Article

Collection of Non-Timber Forest Products in Chinese Giant Panda Reserves: The Effect of Religious Beliefs

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Abstract: Religious belief play an irreplaceable role in the protection of natural resources. This paper explores the influence of religious beliefs on the Non-Timber Forest Products (NTFPs) collection behaviors of farmers, in order to provide new ideas on how to rationally use natural resources for nature reserves. Based on survey data of giant panda reserves in Sichuan and Shaanxi provinces in China, we analyze the differences of NTFPs collection between farmers with or without religious beliefs and those with different religious beliefs. Our results show that: (i) The SUR-Probit method can be used to overcome the endogeneity problem of the model and test the causal effect between religious belief and NTFPs collection; (ii) farmers with religious beliefs collect NTFPs to a lesser extent; and (iii) the collection of NTFPs by farmers with different religious beliefs can be distinguished. The important role of religious belief in the use of natural resources has often been neglected in previous studies. In our research, we find that religious belief can indeed guide the individual choice of resource utilization behavior, to a certain extent, ultimately achieving the mutual co-ordination of ecological protection and economic development, which can also be used as a reference for policy-making.

Keywords: giant panda reserve; religious belief; NTFPs collection; natural resource utilization

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1. Introduction

Nature reserves are core areas of biodiversity conservation. The establishment of a protected area can not only provide a green protection barrier for animals, plants, and farmers in the area surrounding the protected area, but may also promote the construction of an ecological civilization. As of September 2019, China has established 2750 nature reserves, including 474 national nature reserves, with a total area of 147 square kilometers, accounting for about 14.86% of the land area [1]. At present, the number of natural reserves in China has reached 11,029, the area altogether accounting for 18% of its land territory, it also realized the United Nations “Convention on Biological Diversity” goal that the percentage protected area will be reach 17% by 2020. As the giant panda (*Ailuropoda Melanoleuca*) is a typical umbrella-shaped species in nature [2], the protection of its habitats has attracted attention from the international academic community. In China, giant panda habitats are mostly distributed in remote mountainous rural areas, where the surrounding farmers are the most important stakeholders of giant panda protection. However, the establishment of such protected areas and the strengthening of their control has restricted the traditional way of life or farmers residing around the protected area, who are directly dependent on natural resource utilization activities, such as collecting herbs, logging, and hunting, thereby intensifying the contradiction between local community development and ecological protection [3].

There is growing evidence that wild plant collection is critical to the livelihoods of rural populations in developing countries, and it has been recognized that non-agricultural plants are highly valued as a strategy to combat food insecurity, dietary deficiencies,

and poverty alleviation [4–9], suggesting that the extraction of natural resources plays a potentially important role in human lives and traditions. As the main body to promote protection and economic development, the surrounding farmers of the reserves are the most important stakeholders of giant panda protection [10]. Therefore, while protecting the ecological environment, the survival of surrounding farmers is also an important issue that cannot be ignored. Non-timber forest products (NTFPs) collection is an important economic activity for these farmers, as was for their ancestors. The farmers collect the necessary goods for survival through picking, harvesting, and extraction. With the prevalence of migrant workers and the emergence of alternative energy sources, economic production methods have undergone drastic changes; however, NTFPs collection behavior has not been eliminated in history [11,12].

NTFPs collection is also a behavior beyond a range of socio-economic backgrounds, as it involves different individuals entering their surroundings to gather products for their own purposes (i.e., for direct use and consumption). The establishment of reserves has greatly restricted the use of natural resources by local farmers. The farmers in protected areas believe that the need for ecological protection increases their economic cost of living, but does not increase their economic benefits, which may lead to them logging and poaching in illegal manners, in order to meet their social and economic survival needs [13]. Therefore, the relationship between the living habits of farmers and ecological protection needs further adjustment.

Nevertheless, a certain relationship exists between biological diversity and cultural diversity [4]. The natural resources in different regions can be passed down, utilized, and preserved from generation to generation, which can be attributed to their ability to adapt to the unique geographical climate and ecological environment of the local area. In addition, the eating habits of local residents or their preference for food and festive needs may also play a fundamental role in protecting them [5]. Despite the substantial contributions of such studies, accounting for whether religious belief influences NTFPs collection by farmers in econometric model remains challenging.

Combined with previous studies, it has been found that religious belief contributes to the conservation of nature in two main ways: Indirectly, by influencing people's attitudes towards nature, or directly, by strengthening the protection of areas devoted to spiritual worship [14]. It has been found that religious belief plays an important role in ecological environment protection, and individuals or families may have different behaviors of natural resources collection due to different religious beliefs; therefore, it is necessary to understand the influence of religious belief on NTFPs collection of farmers in the reserves, who always seek to balance the relationship between the ecology of the reserves and their household economy.

This study deals with the collection of NTFPs in giant panda reserves, especially focusing on the dimension of the religious beliefs of farmers. To identify how NTFPs collection is influenced by religious beliefs, we took the giant panda reserves in Sichuan and Shaanxi provinces in China and conducted a household survey to explore the following questions: (i) Does religious belief have an effect on the NTFPs collection of farmers in the reserves? (ii) Can religious belief balance the contradiction between economic development and ecological protection in protected areas? We estimated a SUR-Probit model, where the dependent variable indicates whether or not NTFPs were collected by the farmers. Then, we controlled for personal and family characteristics.

Based on a field investigation of giant panda reserves, we could analyze the socioeconomic and environmental contexts of our study regions with more accuracy. Exploring the influence of religious belief on NTFPs collection is very useful for the sustainable development of giant panda reserves.

2. Background

2.1. Religious Beliefs and Ecological View

There is a huge difference between the religions of China and the religions of Western countries. This indicates the significance of studying Chinese religions [15]. The word “religion” can be summarized as follows: “From a broad perspective, religion will be seen as a continuum, from atheistic beliefs that resemble ultimateness and have strong emotional characteristics. To the belief in gods that has ultimate value and is completely supported by the symbolism and worship and organization of supernatural entities”. The main belief form of contemporary Chinese religion has been called diffused religion by Yang [16]. The formation of this phenomenon is mainly due to the following two reasons: First of all, there are deviations in the understanding of religious beliefs. Most Chinese people understand religion based on gods, rather than sects, such that it they find it difficult to classify themselves as belonging to a certain religious sect [17]. Second, multiple religious beliefs may coexist. As the boundaries between some religions are blurry, and as they have the same basic beliefs and core values, there is a situation in Chinese society where a person may easily believe in multiple religions at the same time.

The counterpart of diffused religion is institutional religion. The religions in Western countries are mainly independent religions, which are more manifested in a more stable state of religion, with not only independent concepts and theories, but also complete organizational systems and members.

According to the classification method of Rongping Ruan [18], religious beliefs can be divided into native religions and foreign religions, based on religious beliefs. In China, the native religions are Buddhism, Taoism, and folk beliefs, while the rest are classified as foreign religions; namely, Christianity, and Islam.

Through field research in Chinese giant panda reserves, we found many types of religions in such areas, mainly including Buddhism, Taoism, folk beliefs, and Christianity. Many Chinese giant panda reserves are located in areas inhabited by ethnic minorities, with the major ethnic minorities being the Tibetan, Qiang, and Yi. Ethnicity and religion are related to each other, but there are differences. First, the ethnicity that an individual belongs to is determined by the ethnic identity of their parents. Individuals cannot choose and change their ethnic identity at will. They are relatively fixed, while religious beliefs can be freely chosen and transformed. Secondly, religious believers are stratified within the organization, but ethnic members do not have different levels, due to descent and other reasons, and there is no unified organization [19]. Moreover, there is a certain degree of exclusivity between different religions, while there is basically no natural conflict between ethnic groups. These ethnic minorities have traditional natural worship and beliefs, such as “sacred mountains”, “sacred forests”, “sacred rivers”, and so on, which is a manifestation of folk belief [20].

Different religious beliefs have different ecological concepts and behaviors. For example, Buddhism not only promotes respect for the environment and the avoidance of material desires, but also the well-being of others and guides behavior. Those with strong religious beliefs tend to focus more on practice than those who are not religious, making it easier for them to produce protective behaviors [21]. Native religions do not have the characteristics of exclusivity. The ecological view pursued by native religions is mainly the equality between man and nature, or the harmonious co-existence between man and nature, where a state of equilibrium is achieved by taking from nature and giving back to nature. The ecological view of foreign religious beliefs can be expressed as all things being created by God and human beings have no arbitrary power to control nature [22–26].

As part of the cultural phenomenon, these religions and beliefs differ, in terms of concepts and resource use behaviors, but have played active roles in the protection of the ecological environment and biodiversity.

2.2. The Relationship between Religious Belief and NTFPs Collection

Religion can play an important role in shaping the formation of an individual's social identity. According to Social Identity Theory, an individual's self-concept is partly formed through the subjective identity of a series of social groups [27]. A person's social identity is defined as "knowing that he belongs to a certain social group and the emotional and value meanings of members of this group to him" [28].

Due to differences in religious beliefs, NTFPs collection differs between individuals [29]. The Rational Choice Theory of Religion, as one of the basic theories to study the relationship between religion and behavior, believes that an individual's choice of religious belief is a rational choice behavior after balancing the cost and reward [30]. First of all, religion—as a cultural expression of a country—can have an impact on people's beliefs in ecological protection which, in turn, affects the decision-making, behavior, and performance of people with respect to natural resource collection [31,32]; on the other hand, as religions conduct regular religious activities, whether or not they believe that religious believers may affect people's resource allocation, social capital, and the restraint mechanism of religious organizations. This will also affect the collection behavior of individuals [33].

Early humans respected nature and developed natural resources sustainably to meet their minimum needs. These beliefs answer a basic question—how and where people originated, and how they should treat their environment. With the advent of modern industrial society, the rejection and substitution of traditional customs has undoubtedly changed the social atmosphere from protection to the development and utilization of nature. Nevertheless, certain religious taboos and social customs still exist in hunter-gatherers, herders, and even certain parts of modern society. Through this interaction of social culture and religion, a rich tradition of environmental protection has gradually formed. All these factors drew our attention to the key role of religious belief in resource utilization.

3. Materials and Methods

3.1. Study Area

According to The Fourth National Survey on giant panda released by the National Forestry and Grassland Administration of China, the China giant panda nature reserve involved 196 townships of 49 counties (county level cities and districts) of 17 cities in Sichuan, Shaanxi, and Gansu provinces, with the area of giant panda habitats covering nearly 1.39 million hectares. So far, 67 giant panda nature reserves have been set up across the country, such that 53.8 percent of giant panda habitats and 66.8 percent of wild giant panda populations have been effectively protected in nature reserves, which are mainly distributed in the Qinling, Minshan, Qionglai, Daxiangling, XiaoXiangling, and Liangshan Mountains.

Giant panda habitats are mostly distributed in underdeveloped rural remote mountains areas, which are highly overlapping with minority areas. In the long process of evolution and development, religion has gradually merged with the traditional culture and customs of China's ethnic minorities, thus affecting the behaviors of farmer.

Our study was conducted in the giant panda reserves of Sichuan and Shaanxi provinces, as the giant panda reserves are mainly distributed in Sichuan and Shaanxi provinces, with less in Gansu province. According to the household survey in Sichuan and Shaanxi giant panda reserves in China, we found that 83.07% of the farmers still collected NTFPs from forests inside or around the reserves. The energy dependence of farmers on natural resources was 25.2%, where fuelwood collection accounted for 14% of the total energy expenditure; this still constitutes a large proportion of the household energy consumption. The collection of Wild Harvestable Flora (WHF), including the collection of wild vegetables, medicinal herbs, fruits, berries, nuts, and mushrooms, is also related to the collection habits and location of local community residents [34–36]. The farmers who operated a homestay to provide catering and accommodation for tourists collected most of their provisions from the mountains by themselves, but some of them were sourced from other local farmers or markets. In all the samples, the closest mountain wild vegetable collection place was 0.5 km

away, while the furthest was 45 km. In terms of forest land types, 52.66% of the surveyed farmers mainly collected wild herbs in nature reserves, while 25.53% and 15.96% of the farmers collected wild herbs in their own forest land and collective forest land, respectively. And because the farmers in the reserves may suffer losses in farming, forestry activities, business, etc., which resulting in a negative total household income (see Table 1).

Table 1. The source of income and natural resource dependence of farmers.

Variables	Mean	Standard Error	Min	Max
Per capita crop income	820.5	5497	−68,600	157,500
Per capita aquaculture income	9962	178,751	−81,667	4,000,000
Per capita forestry income	1855	9181	−4050	187,500
Per capita collection income	580.5	4747	0	133,500
Per capita self-employment income	17,024	545,109	−60,000	20,000,000
Per capita transfer income	1327	2508	0	29,945
Per capita property income	631.6	3728	0	58,500
Per capita total income	54,973	741,697	−174,113	20,000,000
Per capita fuelwood collection amount	237.7	351.2	0	7000
Per capita straw collection amount	3.243	33.20	0	1800
Per capita energy consumption expenditure	1709	3395	0	75,200
Energy dependence	0.252	0.258	0	1

Most farmers in giant panda reserves maintained their habits of collection, mainly collecting Wild Harvestable Flora (WHF) for food and fuelwood for heating. Figure 1 shows WHF and fuelwood collection examples in rural households.

Figure 1. (a) Medicinal herbs collected by the household; (b) Fuelwood collected by the household.

3.2. Data Sources and Processing

The data in this paper were derived from a questionnaire conducted by the research group from July 2018 to May 2019, forming the basic sectional data. For this part of the questionnaire survey data, we randomly selected 12 reserves in Sichuan (including 5 at the national level, 6 at the provincial level, and 1 at the municipal level) and five giant panda reserves in Shaanxi (including 3 at the national level and 2 at the provincial level). A total of about 60 farmer households in four villages were selected in each reserve for investigation, as well as attempting to follow two villages inside and outside the reserve for comparison. The investigators were all selected as masters, doctors, and team members with strong research interest and certain research experience. At the same time, the quality of data collection was improved through systematic training of investigators.

The questionnaire interviews were conducted in a face-to-face manner. In minority areas, the questionnaire interviews were conducted with the help of local staff, in order to solve language communication barriers. The head of the household was the main target of the interview. In the absence of the head of the household, the research team investigated his spouse or other adults over 18 years old. After the survey, the members of the survey team ensured the quality of the survey data by cross-checking the questionnaire. In the end, a total of 943 questionnaire survey data of peasant households were formed during this stage of research, which provided the basis for the research. The specific research area and sample distribution are shown in Table 2.

Table 2. Study area and sample distribution.

Province	Reserves	Survey Sample Size
Shaanxi	Huangguan Mountain Reserve; Huangbaiyuan Reserve; Niuwei River Reserve; Taibai Mountain Reserve; Changqing Reserve	256
	Qianfo Mountain Reserve	38
Sichuan	Fengtongzhai Reserve; Tangjia River Reserve	123
	Anzi River Reserve; Heishui River Reserve; Laohegou Reserve; Xiaohogou Reserve; Longxi-Hongkou Reserve; Wolong Reserve	370
	Daxiangling Reserve; Wawu Mountain Reserve; Yele Reserve	156
Total	17	943

For the purpose of better research on the influence of the religious beliefs of farmers living around the reserve on their NTFPs collection, we vertically combined the samples from previous surveys, from July 2018 to May 2019, in the data processing. First of all, in the survey questionnaires, the households were uniquely coded according to the initial letter and number of the province, city or region, county, township or town, and village, in order to obtain the household code. Then, we coded the population of each household numerically, obtaining a new code for each person. Each part of the questionnaire was combined horizontally by household code and person code. Eventually, 943 complete household data samples and 4395 personal data samples were obtained.

3.3. Data Analysis

It is a binary choice problem whether farmers collected NTFPs or not. There are three main econometric models which are applicable to such binary choice problems; namely, the Linear Probability Model (LPM), the Probit model, and the Logit model. In general, although the Linear Probability Model is easy to calculate, it can only be used as a rough reference. Compared with Probit and Logit models, the linear probability model may incur heteroscedasticity and the predicted value is not between 0 and 1. The Probit model is similar to the Logit model, with the main difference being the assumptions about the population distribution: The Logit model assumes that the population follows a Logistic distribution, while the Probit model assumes that the population follows a cumulative normal probability distribution. In the specific data analysis, the Probit model was used for estimating the results.

In order to test the influence of religious belief on NTFPs collection, the following model was established:

$$\Pr(\text{gather}_{is} = 1) = G(\alpha + \beta \text{reli}_{is} + \gamma X_{is} + \delta R_{is} + \vartheta \text{cohort}_{it} + \zeta \text{district}_{is} + \varepsilon_{is} > 0), \quad (1)$$

where gather_{is} denotes whether the individual collected NTFPs; reli_{is} represents the religious belief of individual i who lives in region s ; X_{is} is the control variable matrix, which specifically includes gender, age, ethnicity, education, job type, and other personal characteristics [37]; R_{is} includes family size, total family income, and other family characteristics variables; and the regional fixed effects district_{is} and birth year fixed effects cohort_{it} are considered in the regression, in order to control for unobservable heterogeneity.

Religious beliefs tend to affect many unobservable individual traits that also influence economic behaviors, such as risk appetite, thrift attitude, income redistribution attitude, successful attribution attitude, and so on [32]. In this regard, referring to the practices of Pan Li et al. and Liu Li et al. [15,38], we used the level of religious participation and religious atmosphere at the regional macro level as instrumental variables to amend existing endogenetic problems and to identify causal effects, rather than simple correlations, in the model. Specifically, the instrumental variable was obtained by calculating the proportion of religious belief and participation in religious activities in the sample of each county administrative unit in the survey. In addition, as the endogenous explanatory variable is whether the individual has religious beliefs or not—which is a binary variable with the value of 0 or 1, rather than a continuous variable—in the estimation method, the traditional “two-step method” (i.e., the instrumental variable Probit; IV-Probit) cannot be used for regression. This is because, in the first stage, the OLS method is used instead for the regression, to obtain the residual estimate value, which will cause a large error in the result. Thus, the Seemingly Unrelated Bivariate Probit (SUR-Probit) method was used to estimate the model.

$$\begin{cases} \text{gather}_{is} = 1 \ (\alpha + \beta \text{reli}_{is} + \pi X_{is} + \lambda R_{is} + \omega \text{cohort}_{it} + \zeta \text{district}_{is} + \varepsilon_{is} > 0) \\ \text{reli}_{is} = 1 \ (\sigma + \gamma X_{is} + \delta R_{is} + \sum_{t=1,2} \theta_t \text{iv}_{ts} + \vartheta \text{cohort}_{it} + \eta \text{district}_{is} + \mu_{is} > 0) \end{cases} \quad (2)$$

$$(\varepsilon_{is}, \mu_{is} | X_{is}, R_{is}, \text{iv}_{ts}) \sim N(0, 0, \delta_1^2, \delta_2^2, \rho) \quad (4)$$

Equation (4) is the joint distribution of the disturbance $(\varepsilon_{is}, \mu_{is})$ of Equations (2) and (3).

As the coefficients of the Probit model only have the reference meaning of symbolic direction and significance, more information cannot be obtained from it. As the endogenous variables of the model are not continuous, we calculate the Discrete Marginal Effects of the Probit model to obtain the economic significance of each explained variable. Concrete is defined as when the exogenous variables $X = \bar{x}$ satisfy:

$$\Delta \text{Prob} = \text{Prob}(\text{gather} = 1 | \text{reli} = 1, X = \bar{x}) - \text{Prob}(\text{gather} = 1 | \text{reli} = 0, X = \bar{x}) \quad (5)$$

that is, Δ with respect to $\text{reli} = 1$ and exogenous variables are in the average $X = \bar{x}$ situation under the condition of acquisition for 1, $\text{gather} = 1$ probability, and $\text{reli} = 0$ and exogenous variables are in average $X = \bar{x}$ situation under the condition of acquisition for 1, $\text{gather} = 1$ the difference of the probability.

By the method described above, the Household survey data were analyzed by descriptive statistics and the Probit/SUR-Probit model using the STATA (Version 15) software.

3.4. Variables Defined

We extensively reviewed the independent variables used in the previous literature in this field, where the major independent variables included personal characteristics and family characteristics such as income, age, health, work, family size, education level, number of adult labor force, location of residence, and so on [39–44].

In the original questionnaire, the gender variable gender was divided into men and women, where the value for men is 1, while the value for women was 0. The national variable nation of ethnicity was merged to 1, for the Han nationality it was 0 and, for minorities, it was 1 for virtual variables. The main type of work was marked in the questionnaire as work; the value for not working was 0, the value for only farming work was 1, the value for only engaged in non-agricultural work was 2, and the value for both agricultural and non-agricultural work was 3. The number of family members in each household generated the family size variable scale; in each household, children under 14 years old and elderly people over 65 years old accounted for a proportion of the total household population, which was used to generate the family burden ratio variable burden, in order to measure the objective standard of living of farmers. The proportion of non-agricultural employment and development in the family, Non_agri was generated using the production and operation situation of the family, including planting, breeding, forestry, while the production situation was comprehensively calculated by the collection of their

per capita incomes as income. The question “relationship with head of household” in the questionnaire was used to calculate the intergenerational number of households in which the respondents lived together, generating the family intergenerational variable, generation, which reflected the living unit size of the respondent’s family after separation. The energy use part of the questionnaire involved calculating the energy uses of the family, including fuelwood, straw, electricity, gas, coal, and gasoline costs, as well as their total energy consumption, to obtain the total energy consumption and variable energy. Considering a part of the household energy use came from natural resources, compared with the total energy expenditure, the natural resource dependence was calculated as dependency. To this end, the amount of fuelwood and straw gathered by family members for household energy consumption was converted into cash equivalent, according to the local fuelwood and straw prices, which were recorded during the survey (Table 3).

Table 3. Description of the independent variables specified in the Probit/SUR-Probit model.

Variables	Description	Type of Measure
Personal characteristics		
Gender	Gender of each person in the household	1 if male, 0 if female
Age	Age of each person in the household	Years
Education	Years of formal education for each person in the household	Years
Health degree	Health degree of each person in the household	1 if healthy, 2 if general, 3 if chronic disease, 4 if serious disease, 5 if disabled
Ethnic group	Nationality of each person in the household	1 if Ethnic minority, 0 if Han
Work	Work category of each person in the household	0 if not working, 1 if only farming, 2 if only engaged in non-agricultural work, 3 if working in both the agricultural and non-agricultural sectors
Family characteristics		
Income	Per capita income for the household	Numbers
Scale	Number of family members in each generation	Numbers
Non_agri	The proportion of non-agricultural employment and development in the family	Numbers
Burden	The proportion of children under the age of 14 and elderly people aged 65 and over in the family population	Numbers
Distance from town market	The distance from the homestead to the town market	Meters
Distance from cement road	The distance from the homestead to a cement road	Meters
Location of residence	Located in the core area, experimental area, or buffer zone of the reserve, or outside the reserve	1 if inside the core area, 2 if inside the buffer zone, 3 if inside the experimental area, 4 if outside the reserve
Energy	Fuel wood, straw, electricity, gas, coal, and gasoline costs, the total energy consumption	Numbers
Dependency	The part of the household energy use coming from natural resources compared with the total energy expenditure	Numbers
Mean collection distance	The average distance from the farmer’s house to a collection place	Meters

4. Results

4.1. The Contrast of Personal and Family Characteristics for the Samples Having Religious Beliefs or Not

In the sample of 4395 personal data generated from the 943 farmer household questionnaires, it was found that 86% of individuals collected NTFPs. There were no significant differences in gender, education, and health degree between individuals with or without

religious beliefs. The average age of the sampled individuals was 39 years. The individuals who had religious beliefs were more likely to be ethnic minorities and there were more categories of work for their family members. In terms of family characteristics, families without religious beliefs were more dependent on the use of natural resources (Table 4).

Table 4. Descriptive statistics of the main variables.

Variables	All Samples		No Religious Belief		Have Religious Belief		Mean (Proportion) Difference
	Mean (Proportion)	SD	Mean (Proportion)	SD	Mean (Proportion)	SD	
Personal characteristics							
Have NTFPs collection behavior or not	0.86	0.35	0.87	0.34	0.84	0.37	0.03 **
Have fuelwood collection behavior or not	0.79	0.41	0.80	0.39	0.73	0.44	0.07 ***
Have WHF collection behavior or not	0.27	0.44	0.24	0.43	0.36	0.48	−0.12 ***
Gender	0.53	0.50	0.53	0.50	0.51	0.50	0.02
Age	38.96	21.48	38.49	21.65	40.25	20.95	−1.76 **
Education	7.05	4.58	7.07	4.65	6.99	4.36	0.08
Health degree	1.32	0.77	1.32	0.75	1.33	0.79	0.01
Ethnic group	0.17	0.38	0.12	0.33	0.32	0.47	−0.20 ***
Work							
Work0	0.17	0.37	0.18	0.38	0.14	0.35	0.04 ***
Work1	0.31	0.46	0.30	0.46	0.33	0.47	−0.03 **
Work2	0.29	0.46	0.29	0.46	0.29	0.46	0
Work3	0.23	0.42	0.23	0.41	0.23	0.42	0
Family characteristics							
Income	61,823.57	799,247.30	59,133.89	857,531.87	69,152.51	613,274.42	−10,018.62
Scale	5.08	1.86	5.08	1.87	5.07	1.82	0.01
Non-agri	0.54	0.30	0.53	0.30	0.57	0.29	−0.04 ***
Burden	0.29	0.22	0.29	0.21	0.29	0.23	0
Distance from town market	9856.03	13,154.21	9920.67	13,341.84	9679.87	12,634.12	240.80
Distance from cement road	109.47	883.01	140.87	1028.16	23.90	118.63	116.97 ***
Location of residence							
Location of residence 1	0.003	0.06	0.005	0.07	0	0	0.005 **
Location of residence 2	0.16	0.37	0.19	0.39	0.07	0.25	0.12 ***
Location of residence 3	0.25	0.43	0.27	0.44	0.19	0.39	0.08 ***
Location of residence 4	0.58	0.49	0.53	0.49	0.74	0.43	−0.21 ***
Energy	8135.07	14,125.33	8180.75	15,562.05	8010.62	9133.32	170.13
Dependency	0.25	0.26	0.26	0.26	0.21	0.24	0.05 ***
Mean collection distance	2465.96	11,960.93	2233.89	12,585.64	3107.34	10,012.78	−873.45 *

Note: One-way ANOVA was used to test the mean difference and proportion difference of individual characteristics under different groups with the mean difference and proportion difference reported between groups, and the significance of the differences between groups were also reported. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively. Work0–Work3 denote the dummy variables describing No work, Agricultural work, Non-agricultural work, Concurrent business; Location of residence1–Location of residence4 denote the dummy variables describing Households' residence located inside core zone, Households' residence located inside buffer zone, Households' residence located inside experimental zone, Households' residence located outside the reserve.

4.2. Whether Having Religious Beliefs Correlates NTFPs Collection

4.2.1. Whether Religious Beliefs Affect NTFPs Collection (Comparison of Total Samples)

Based on the conclusion shown in Table 5, it can be seen that the probability of collecting NTFPs increased in respondents with religious beliefs. Considering that the estimation results of the benchmark model may face endogeneity problems caused by missing variables, we suspect that the estimation results of the benchmark model may be biased and unreliable.

Table 5. The baseline regression for religious belief and NTFPs collection behavior.

—	Have NTFPs Collection Behavior or Not (Base)	Have NTFPs Collection Behavior or Not (Marginal Effect)
Whether have religious belief	0.172 *** (0.0620)	0.0393 *** (0.0141)
Gender	−0.0359 (0.0503)	−0.00820 (0.0115)
Age	0.000799 (0.00909)	0.000182 (0.00207)
Education	−0.0230 *** (0.00810)	−0.00525 *** (0.00185)
Health degree	0.0769 ** (0.0385)	0.0175 ** (0.00878)
Ethnic group	−0.139 ** (0.0689)	−0.0317 ** (0.0157)
Work	0.0718 ** (0.0323)	0.0164 ** (0.00737)
Income	−0.00915 (0.0133)	−0.00209 (0.00302)
Scale	0.110 *** (0.0390)	0.0251 *** (0.00889)
Non_agri	−0.515 *** (0.106)	−0.117 *** (0.0240)
Burden	−0.275 * (0.140)	−0.0627 * (0.0320)
Distance from town market	0.0810 *** (0.0144)	0.0185 *** (0.00328)
Distance from cement road	0.134 *** (0.0144)	0.0305 *** (0.00320)
Location of residence	0.00454 (0.0349)	0.00104 (0.00795)
Constant	−0.427 (0.911)	
Regional fixed effects	Control	Control
Birth year fixed effects	Control	Control
Pseudo R ²	0.0682	
Observations	3926	3926

Note: *** indicates a significance level of 1%, ** a significance level of 5%, and * a significance level of 10%. Values in brackets are standard deviations.

In the two-stage regression, after adding the instrumental variable to correct endogenous errors, the endogenous variable $relis$ coefficient, compared to the benchmark, returned from positive significance to negative significance, suggesting that if we ignored the endogenous problems of personal religious beliefs, simply using the Probit model to estimate the impact of religious beliefs on the NTFPs collection behavior would lead to its wrong estimation as a positive correlation. At the same time, from the two-stage decision-making equation of NTFPs collection behaviors, we found that female interviewees had a significantly positive influence on NTFPs collection behaviors, that being a minority had a significantly positive influence on NTFPs collection behavior, and that the poorer self-rated health status of interviewees also had a positive influence on NTFPs collection behaviors. Additionally, among the family characteristic variables, the higher the number of generations of the family (i.e., the families living together for multiple generations) and the families farther away from the town market and the cement road also had a significantly positive impact on NTFPs collection behaviors, while the families with a higher proportion of off-farm employment had a significantly negative impact on NTFPs collection behaviors. Among the variables, ρ_{12} represents correlation coefficient between the error term of one-stage equation and two-stage equation. If it significantly rejected the 0 hypothesis, it means there was endogeneity problem in the equation system. The joint significance of the

instrumental variables was also reported. If the first-stage F is greater than 10, no weak instrumental variable problem exists in the equation system [45]. Amemiya-Lee-Newey (ALN) test *p*-value was calculated to test overidentifying restrictions. The null hypothesis of ALN test was that all the instrumental variables were exogenous variables, so the instruments be deemed exogenous if the *p*-value accepted the null hypothesis. (Table 6).

Table 6. The baseline regression for religious belief and NTFPs collection behavior.

Variables	SUR-Probit	
	One-Stage Regression	Two-Stage Regression
	Whether Have Religious Beliefs	Whether Have NTFPs Collection Behavior
Whether have religious belief		−0.9338 *** (0.2661)
Mean value of religious belief	3.444 *** (0.1656)	
Average value of religious belief activities	−1.6160 *** (0.6449)	
Personal characteristics	Control	Control
Family characteristics	Control	Control
Regional fixed effects	Control	Control
Birth year fixed effects	Control	Control
Constant	−3.858 *** (1.355)	0.296 (0.873)
ρ_{12}		0.696 *** (0.221)
Instrumental variable F value	269.87	
Overidentification test <i>p</i> -value		0.437
Observations	4227	4227

Note: *** indicates a significance level of 1%. Values in brackets are standard deviations.

4.2.2. Whether Religious Beliefs Affect Different NTFPs Collection Behaviors

In order to further understand the influence of religious beliefs on NTFPs collection behaviors, the influence of religious beliefs on the collection of fuelwood and “Wild Harvestable Flora” (WHF; including wild herbs, Chinese medicinal materials, wild fungi and mushrooms, and so on) were examined, as discussed in the following part.

As shown in Table 7, whether an individual has religious beliefs had differentiated effects on the collection of fuelwood and WHF. Among them, the effect of rel_{is} on fuelwood collection was negative, while that on WHF collection was significantly positive.

According to the discrete marginal effect of religious belief on NTFPs collection behaviors, the probability of NTFPs collection behaviors decreased by 27.1% if the individuals had religious beliefs, where the probability of collecting fuelwood was reduced by 30.8% and WHF collection behavior was increased by 47.8%. Considering the results of Table 8, there was a difference in the direction between the probability of fuelwood collection behaviors and WHF collection behaviors, which may be due to the heterogeneity of relevant religious beliefs and the differences in traditional lifestyles which rely on local natural resources [8].

Table 7. The baseline regression for religious beliefs and different NTFPs collection behaviors.

Variables	SUR-Probit		SUR-Probit	
	One-Stage Regression	Two-Stage Regression	One-stage Regression	Two-Stage Regression
	Whether Have Religious Belief	Whether Collect Fuelwood	Whether Have Religious Belief	Whether Collect WHF
Whether have religious belief		−0.957 *** (0.289)		1.335 *** (0.190)
Mean value of religious belief	3.448 *** (0.165)		3.471 *** (0.165)	
Average value of religious belief activities	−0.153 ** (0.063)		−0.208 *** (0.0628)	
Personal characteristics	Control	Control	Control	Control
Family characteristics	Control	Control	Control	Control
Regional fixed effects	Control	Control	Control	Control
Birth year fixed effects	Control	Control	Control	Control
Constant	−3.492 ** (1.361)	−0.220 (0.854)	−3.633 *** (1.313)	−0.896 (0.791)
ρ_{-12}		0.568 ** (0.224)		−0.819 *** (0.215)
Instrumental variable F value	272.96		281.7	
Overidentification test <i>p</i> -value		0.432		0.833
Observations	4227	4227	4227	4227

Note: *** indicates a significance level of 1%, ** a significance level of 5%. Values in brackets are standard deviations.

Table 8. The discrete marginal effect of religious belief on collection behavior.

Collection Behavior (Probability)	Have Religious Belief	No religious Belief	Marginal Effect Difference Δ
NTFPs collection	0.623 ***	0.894 ***	−0.271
Fuelwood collection	0.555 ***	0.863 ***	−0.308
WHF collection	0.648 ***	0.170 ***	0.478
Other control variables	Control	Control	
Regional fixed effects	Control	Control	
Birth year fixed effects	Control	Control	
Observations	4227	4227	

Note: *** indicates a significance level of 1%. Values in brackets are standard deviations.

4.3. Effect of Different Religious Beliefs on NTFPs Collection Behavior

4.3.1. Effect of Different Religious Beliefs on NTFPs Collection Behavior (Comparison of Total Samples)

Due to cultural differences in religious beliefs, it is necessary to consider not only mixed religions in China, but also independent religions in western countries when classifying religious beliefs. Therefore, according to the classification method of Rongping Ruan [18], religious beliefs were classified according to individuals who believed in native religions and individuals who believed in foreign religions (Table 9).

The influence of believing in a native religion on NTFPs collection behaviors was negative at the 1% significance level, indicating that individuals with belief in native religions were less inclined to gather. However, the influence of foreign religion on NTFPs collection behaviors was positive at the 1% significance level, which means that individuals who believed in foreign religions were more inclined to gather.

4.3.2. Effects of Different Religious Beliefs on Different NTFPs Collection Behaviors

Consistent with the previous content, the NTFPs collection behavior was further divided into fuelwood collection and WHF collection (Table 10).

Table 9. Baseline regression for native and foreign religious beliefs and NTFPs collection behavior.

Variables	SUR-Probit		SUR-Probit	
	One-Stage Regression	Two-Stage Regression	One-Stage Regression	Two-Stage Regression
	Native Religious Belief	Whether Have NTFPs Collection Behavior	Foreign Religious Belief	Whether Have NTFPs Collection Behavior
Native religious belief/Foreign religious belief		−1.412 *** (0.104)		1.363 *** (0.510)
Mean value of religious belief	3.182 *** (0.186)		0.491 (0.315)	
Average value of religious belief activities	−0.167 ** (0.0720)		0.369 ** (0.161)	
Personal characteristics	Control	Control	Control	Control
Family characteristics	Control	Control	Control	Control
Regional fixed effects	Control	Control	Control	Control
Birth year fixed effects	Control	Control	Control	Control
Constant	−3.478 *** (0.304)	1.194 (0.779)	−5.305 *** (0.784)	1.269 (0.901)
ρ_{12}		0.847 *** (0.0433)		−0.574 ** (0.288)
Instrumental variable F value	304.62		10.54	
Overidentification test <i>p</i> -value		0.556		0.597
Observations	4227	4227	4227	4227

Note: *** indicates a significance level of 1%, ** a significance level of 5%. Values in brackets are standard deviations.

Table 10. Baseline regression for native religious belief and different NTFPs collection behaviors.

Variables	SUR-Probit		SUR-Probit	
	One-Stage Regression	Two-Stage Regression	One-Stage Regression	Two-Stage Regression
	Native Religious Belief	Whether Have Collection Fuelwood	Native Religious Belief	Whether Have Collection WHF
Native religious belief		−1.368 *** (0.136)		0.741 * (0.386)
Mean value of religious belief	3.238 *** (0.189)		3.218 *** (0.190)	
Average value of religious belief activities	−0.229 *** (0.0720)		−0.255 *** (0.0733)	
Personal characteristics	Control	Control	Control	Control
Family characteristics	Control	Control	Control	Control
Regional fixed effects	Control	Control	Control	Control
Birth year fixed effects	Control	Control	Control	Control
Constant	−3.276 *** (0.303)	−0.270 (0.782)	−3.257 *** (0.303)	−1.034 (0.810)
ρ_{12}		0.737 *** (0.0715)		−0.314 (0.228)
Instrumental variable F value	301.65		293.10	
Overidentification test <i>p</i> -value		0.675		
Observations	4227	4227	4227	4227

Note: *** indicates a significance level of 1%, and * a significance level of 10%. Values in brackets are standard deviations.

For individuals who believed in native religions, fuelwood collection behaviors were negative at 1% significance level, indicating that individuals with belief in native religions were less inclined to gather fuelwood. Nevertheless, WHF collection behaviors were positive at 10% significance level, indicating that individuals who believed in native religions were more inclined to gather WHF.

Obviously, Table 11 showed that individuals who believed in foreign religions were less inclined to gather WHF, while there was no significant difference in the fuelwood collection behaviors of individuals without religious beliefs (including individuals who had religious beliefs but did not believe in foreign religions and non-religious individuals).

Table 11. Baseline Regression for Foreign Religious Belief and Different NTFPs Collection Behaviors.

Variables	SUR-Probit		SUR-Probit	
	One-Stage Regression	Two-Stage Regression	One-Stage Regression	Two-Stage Regression
	Foreign Religious Belief	Whether Have Collection Fuelwood	Foreign Religious Belief	Whether Have Collection WHF
Foreign religious belief		0.418 (0.811)		−1.928 *** (0.0725)
Mean value of religious belief	0.398 (0.311)		−0.327 (0.250)	
Average value of religious belief activities	0.416 ** (0.164)		0.495 *** (0.148)	
Personal characteristics	Control	Control	Control	Control
Family characteristics	Control	Control	Control	Control
Regional fixed effects	Control	Control	Control	Control
Birth year fixed effects	Control	Control	Control	Control
Constant	−5.674 *** (0.817)	−0.0968 (0.887)	−5.644 *** (0.625)	−1.313 * (0.714)
ρ_{12}		−0.0632 (0.369)		0.656 *** (2.56×10^{-9})
Instrumental variable F value	9.78		11.25	
Overidentification test p-value		0.643		0.257
Observations	4227	4227	4227	4227

Note: *** indicates a significance level of 1%, ** a significance level of 5%, and * a significance level of 10%. Values in brackets are standard deviations.

From the marginal effects reported in Table 12, it can be seen that, when the interviewed individual had native religious beliefs, the probability of NTFPs collection behaviors decreased by 43.6%, the probability of collecting fuelwood decreased by 47.6%, and the probability of collecting WHF increased by 33.7%.

From the marginal effects reported in Table 13, it can be seen that, when the interviewed individual had foreign religious beliefs, the probability of NTFPs collection behaviors dropped by 14.1%, the probability of collecting fuelwood dropped by 9.1%, and the probability of collecting WHF dropped by 26.3%. Comparing the results in Table 12 with those of Table 13, when the interviewed individual believed in a native religion, their NTFPs collection behavior and fuelwood collection decreased more, but their WHF collection behavior increased; meanwhile, individuals who believed in foreign religions reduced all collection behaviors, but the probability of reduction was not large. This result echoes the base regression result.

Table 12. The discrete marginal effect of native religious belief on collection behavior.

Collection Behavior (Probability)	Have Native Religious Belief	Not Have Native Religious Belief	Marginal Difference Δ
NTFPs collection behavior	0.457 *** (0.0452)	0.893 *** (0.005032)	−0.436
Fuelwood collection behavior	0.391 *** (0.00584)	0.867 *** (0.0468)	−0.476
WHF collection behavior	0.528 *** (0.0143)	0.191 *** (0.09706)	0.337
Other control variables	Control	Control	
Regional fixed effects	Control	Control	
Birth year fixed effects	Control	Control	
Observations	4227	4227	

Note: *** indicates a significance level of 1%. Values in brackets are standard deviations.

Table 13. The discrete marginal effect of foreign religious belief on collection behavior.

Collection Behavior (Probability)	Have Foreign Religious Belief	Not Have Foreign Religious Belief	Marginal Difference Δ
NTFPs collection behavior	0.851 *** (0.00991)	0.992 *** (0.01062)	−0.141
Fuelwood collection behavior	0.814 *** (0.009085)	0.905 *** (0.133)	−0.091
WHF collection behavior	0.00551 *** (0.00113)	0.269 *** (0.00711)	−0.263
Other control variables	Control	Control	
Regional fixed effects	Control	Control	
Birth year fixed effects	Control	Control	
Observations	4227	4227	

Note: *** indicates a significance level of 1%. Values in brackets are standard deviations.

5. Discussion

5.1. NTFPs Collection in Reserves

Farmers living in reserves have diverse ways of using natural resources. For example, although NTFPs are the main source of income for some households, other households may rely mainly on agriculture for their livelihoods. Therefore, the factors that affect household participation in NTFPs collection has become a related issue. In previous studies, scholars have summarized many factors that affect collection behaviors, including the perception of reserve management and other related organizations, the level of welfare, the manner of using natural resources, the impact of wild animals on crops and livestock, the cost of protecting the environment, their dependence on natural resources, and awareness of the code of conduct in the protected area and socio-economic factors related to the family and individual's village, among other, which originate mainly from the conflict between people and the protected areas [46–53].

Due to the advantageous rich natural conditions, local farmers living around the giant panda nature reserve are dependent on the utilization of natural resources and, in our investigation, we found that more than 80% of farmers still collected NTFPs. Among the ways of living, the NTFPs collection behaviors have gradually changed from the original traditional living habits into a livelihood strategy. The NTFPs are used by rural communities for energy, food, medicine, household equipment materials, building materials, and materials for agricultural activities. Compared with other forest activities, such as logging, the rural population's adoption of wild plants from the forest may have less interference with conservation work. Despite this, NTFPs collection is a time-consuming activity and, so, if families have other sources of income to support their livelihoods, they may reduce their dependence on forest resources. This leads us to think that, in addition to the factors

summarized in previous studies, there may be other factors that affect NTFPs collection in reserves.

5.2. Religious Beliefs and NTFPs Collection

The values of farmers in such protected areas determine some of their attitudes. There exists a certain relationship between biological diversity and cultural diversity [3]. Many scholars have found that ecological protection based on cultural and religious values is often more conducive to sustainable development than protection based only on laws or regulations [54–58]; in particular, the doctrines and rules related to religious beliefs play a vital role in protecting the environment and biodiversity [59]. Combined with previous studies, it was found that religious belief contributes to the conservation of nature in two main ways: Indirectly, by influencing attitudes towards nature, or directly, by strengthening the protection of areas devoted to spiritual worship [14]. Obviously, in this study, we put emphasis on the former.

Religion is one aspect which shapes people's values and, thus, influences the behavior of individuals in society. Moreover, social phenomena in the community can be understood by observing individual behaviors. Religion ties people in the community together, promoting the accumulation of trust, customs, and norms, therefore introducing a mechanism to enforce ideal behaviors [60]. There is ample evidence, from our regression results, that different doctrines and norms of religious beliefs do have different effects on the NTFPs collection behaviors of individuals. "Social identity becomes a meaningful self-definition precisely because of its content" [61]. We considered the differences between religious beliefs by using Social Identity Theory, which is the most influential theory providing insight into the definition of self-identity and the relationship between social groups to which it belongs [27].

As the demand for NTFPs from farmers in the reserves can be basically summarized as energy dependence and livelihood maintenance [62,63], the NTFPs were divided into fuelwood and WHF for comparison in the analysis. Farmers with religious beliefs had lower probability of collecting fuelwood for non-profit making purposes, but were more likely to collect WHF as a livelihood strategy; except for farmers with belief in foreign religions. This was consistent with what we summarized before: Farmers with foreign religions have the belief that they do not have the right to control nature at will and, so, they tend to exercise restraint in the use of natural resources. However, farmers with native religious beliefs were more inclined towards the concept of harmonious coexistence between man and nature. WHF is basically composed of herbaceous plants, the collection of which does little damage to the environment. Therefore, they were more willing to collect WHF in order to maintain their livelihood.

5.3. Religious Belief and the Conservation of Natural Resources

In general, having religious beliefs restrained the exploitation of natural resources. Religion is a powerful promoter of the evolution of prosocial behavior in human society [64]. For example, most people with faith do not use chemical fertilizers in ecological production, paying more attention to ecological production; while farmers without religious belief pay more attention to ecological consumption [65]. This view was further verified in this study. The doctrines and regulations associated with religious beliefs, as well as the care and enthusiasm for nature and environment advocated for a long time, serve to protect the sustainable development of forest areas, aquatic organisms, and various species [66], while the idea of supporting ecological protection in religious belief is of great significance for achieving conservation goals [67]. In future research, the role of traditional ecological consciousness in environmental protection can be further explored, and the ecological concept of local people can be actively brought into play, in order to achieve the goal of sustainable use of natural resources.

5.4. Limitations of the Study

While we believe that this study represents a useful analysis of the impacts of religious beliefs on NTFPs collection, this is a new perspective and we are aware of the limitations of our study. In terms of data collection, due to the randomness of reserve selection, it was impossible to fully study the religious beliefs of farmers throughout the entirety of the reserves. Further, in the analysis, there was no further discussion relating to the collection quantity, with only the probability of the collection behavior being discussed; thus, the associated implications can be further explored. Finally, the use of cross-sectional data limited us in capturing the changes in NTFPs collection and, so, future studies should use panel data to complement our results.

6. Conclusions

In this study, we analyzed the causal relationships between religious beliefs and NTFPs collection in Chinese Giant panda reserves, comparing the differences in the NTFPs collection of farmers with or without religious beliefs and having different religious beliefs. As a result, the influence of religious beliefs on the NTFPs collection behavior was generally inhibiting, which is inseparable from the role played by traditional culture.

Despite considering religious belief as a form of expression of people's values and intentions, which cannot be ignored with respect to the use of natural resources, few relevant studies have focused on this aspect, instead paying more attention to its direct impact on the use of natural resources. This study may provide a new perspective for regulating the natural resource utilization behaviors of farmers in such reserves. First, through the restriction of religious belief on the collection behavior of farmers, local farmers can voluntarily restrain their natural resource utilization behaviors. Second, knowledge of traditional resource utilization can be popularized in religious teachings, thus improving the recognition of NTFPs by local farmer. Third, some supportive policies can be adopted, in order to alleviate the contradiction between ecological protection and the economic development of farmers. For example, with the development of ecological tourism, farmhouses can be used to provide catering, accommodation, and characteristic NTFPs cultivation projects to visitors. Through these approaches, the overutilization of wild NTFPs can be improved, while enriching the diversity of the livelihoods of local farmers.

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