How Forest Subsidies Impact Household Income: The Case from China

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Abstract: (1) Background: It is of great significance to evaluate the impact of forestry subsidies on the income of forest farmers to improve policy and enhance efficiency. (2) Methods: Based on the static panel data of household tracking surveys from 2014 to 2018 in Sichuan, Liaoning, and Zhejiang provinces in China, the impacts of forestry subsidies on forest farmer income and impact paths were systematically verified via parameter estimation with the Fixed-Effect model. (3) Results: Forestry subsidies significantly increased forest farmer income. The impact paths could be summarized as follows: First, from the perspective of operating income, forestry subsidies effectively motivated forestry production and promoted the expenditure on forestry production, and thus increased forest farmer operating income. Second, from the perspective of wage income, forestry subsidy policies played a negative role in releasing the forest farmer labor force for off-farm employment. Third, from the perspective of transfer income as a kind of transferred governmental financial subsidy, forestry subsidies covered a large proportion of transfer income for forest farmers. (4) Conclusions: Forestry subsidies could directly increase the transfer income, effectively improve the forestry production capacity, and increase the income of forest farmers. However, forestry subsidies could also bind forest farmers to forestry production to a certain extent, which was not conducive to the liberation of the labor force.

Keywords: forestry subsidy; forest farmer; income; impact path; China

1. Introduction

Forestry subsidies have been implemented in many countries to improve forestry sustainable development [1–3] because of long forestry production cycles, high early investment, high natural risk, and low profit rates, resulting in a long-term lack of investment attraction [4–7]. During 2009–2010, the Chinese central government successively launched the Afforestation, Forest Insurance Premium, Forest Tending, and the Seeds and Saplings subsidies. The amount of these forestry subsidies increased steadily from USD 0.93 billion in 2011 to USD 2.15 billion in 2018 (USD 1 was equivalent to an average RMB 6.61 in 2018), with an amount of USD 13.01 billion cumulatively and an average increment of 12.70% annually. The Afforestation Subsidy and Forest Tending Subsidy were used to compensate for forest operator costs in artificial afforestation and the restoration of degraded forests, respectively, with an area of not less than 667 m\(^2\). The government offers a one-off grant to forest operators after afforestation and forest tending are completed according to relevant technical standards and a Forest Management Plan. The objects of Afforestation Subsidy and Forest Tending Subsidy include state-owned forest farms, forest farmers, and forestry cooperatives. While the objects of the Seeds and Saplings Subsidy are national key forest seed bases and forest germplasm resource banks, the objective of the Forest Insurance Premium Subsidy is the government’s administrative department paying insurance on
behalf of small-scale forest operators (In China, forest insurance is mainly policy insurance, which is paid by the government on behalf of small-scale operators.). Regarding the proportion of each subsidy in total, the Forest Tending Subsidy accounted for the largest proportion, more than 50% from 2011 to 2018; the proportion of Afforestation Subsidy accounted for about 30%. These two subsidies accounted for more than 80%, while the Seeds and Saplings and Forest Insurance Premium subsidies accounted for less than 5% and 11%-14% of the total, respectively [8]. Due to the objects and proportions, the research object is limited to the Afforestation Subsidy and Forest Tending Subsidy (hereinafter referred to as “forestry subsidies”). The purpose of the forest subsidies was to motivate potential investors, thus promoting ecological construction and increasing forest farmer income [8,9]. During 2009–2018, 52.18 million hectares of afforestation and 61.03 million hectares of forest tending had been completed [10–20]. The national forest coverage rate and forest volume have increased from 21.63% to 22.96% and 15.14 to 17.56 billion m$^3$ according to the Eighth National Forest Inventory (2009–2013) and the Ninth National Forest Inventory (2014–2018) [21,22]. This shows that remarkable achievements have been made in ecological construction. However, changes in forest farmer income have not been fully assessed. In this context, it is of great significance to evaluate the impact on the income of forest farmers (as an important policy objective), in order to improve the policy and enhance the policy efficiency.

Many previous studies have been on forest subsidies, which mainly focused on the impact of forestry subsidies on forest resources [23–27], the relationship between forestry subsidies, and forest farmer production willingness and behavior [28–31]. Compared with the research fields above, research on the impact of forestry subsidies on forest farmers’ income were relatively limited. Nevertheless, research on the impact of forestry subsidies on farmers’ income could be divided into two categories: forestry subsidies had a positive or negative impact on farmers’ income. The positive impacts of forestry subsidies has been recognized via the government policy evaluation [8]. According to the monitoring data on forest farmers issued by the National Forestry and Grassland Administration of China, the average income of subsidized forest farmers in Zhejiang and Hunan provinces were USD 21,907 and USD 11,286 respectively, higher than those of the forest farmers without forestry subsidies, which were, respectively, USD 5118 and USD 4825 in 2013 [8]. On the contrary, some studies have come to the opposite conclusion. For instance, Lei and Luo (2020) [32] analyzed the survey data of Jiangxi Province and found that forestry subsidy policies had no significant influence on the forestry income of households. Zhao et al. (2019) [33] stated that the implementation of the Forest Tending Subsidy policy in state-owned forest regions of Northeast China and Inner Mongolia did not increase the income level of low-income worker families, although they were the target beneficiary group of the policy. Zhu et al. (2018) [34] found that the household income of subsidized households was even lower than that of non-subsidized households in Northeast China and Inner Mongolia. Therefore, the question of whether forestry subsidies can increase farmers’ income is still insufficiently explored, and further research needs to be conducted.

Although many studies stressed the impacts of forestry subsidies on forest farmer income, there are no in-depth studies on the paths of forestry subsidies affecting forest farmer income. According to National Bureau of Statistics of China, household income is divided into wage income, operating income, property income, and transfer income. Wage income refers to the labor remuneration income, which is obtained from labor earnings as employees for certain enterprises and individuals. Property income is obtained from the gain of personal property (such as bank deposits, securities) and real property (such as houses, cars, collectibles, etc.) owned by the family. Operating income is achieved from the regular production and management activities of taxpayers. Transfer income includes various transfer payments made by the state, enterprises, and social organizations to resident families, as well as the income transfer between resident families [35]. Also, in related studies of analyzing the impact of agricultural development projects and farmer cooperatives on income, the path was divided into transfer, operating, property, and wage...
incomes [36–38]. In this sense, it is a relatively mature research approach to classify the household income into operating, property, transfer, and wage incomes and then verify these different paths.

While there is still considerable uncertainty with regard to forestry subsidies’ impact on household income, relevant studies on income path classification in other fields also provide research ideas. Hereby, based on the static panel data of forest farmers’ tracking surveys in Sichuan, Liaoning, and Zhejiang provinces from 2014–2018, the impact of forestry subsidies on forest farmers’ income and income paths are systematically analyzed through Fixed-Effect models. Furthermore, we expect that our work can provide some theoretical guidance and data support for the formulation of forestry subsidy policies.

2. Methods

2.1. Research Framework and Hypotheses

Based on the literature review above, the research framework is designed to answer two questions: Q1 is what is the impact of forestry subsidy policies on forest farmer income; Q2 is in which paths the forestry subsidy policies affect forest farmers’ income.

Q1: what is the impact of forestry subsidy policies on forest farmer income?

The motivation for traditional forestry operations has gradually reduced in the past decades because of lower forest investment attraction and growing off-farm employment opportunities [5,7,39,40]. As a forestry support policy by Chinese central government, forestry subsidies aim to increase the income of forest farmers, and subsequently motivate forestry operations. However, some research argued that the effects of forestry subsidies on forest farmer income were limited [32–34], while others believed that forestry subsidies had a significant positive impact [41–43]. Therefore, regarding Q1, the following research hypothesis was proposed:

Hypothesis 1 (H1). Forestry subsidies may increase the income level of forest farmers.

Q2: In which path does the forestry subsidy policy affect the income of forest farmers?

Based on the income path discussion above, household income could be classified into operating, property, transfer, and wage incomes. However, according to the statistical bulletin issued by China’s National Bureau of Statistics in 2020, per capita rural household income was USD 2592, of which wage income, operating income, property income, and transfer income were USD 1055, 919, 63, and 554, respectively, accounting for 40.71%, 35.47%, 2.45%, and 21.37% of the total income, respectively [44]. These data show that the property income accounts for a fairly small proportion of the total income. The reasons are the slow development of the rural economy, the imperfect rural land circulation mechanism, and the limited investment channels of rural residents [45,46]. Therefore, this study summarized the forestry subsidies affecting forest farmer income as the operating, wage, and transfer income paths, while the property income path was excluded.

From the perspective of operating income path, one of the main purposes of forestry subsidies is to reduce the afforestation cost of forest farmers and motivate forest farmers for forestry production, thus improving the production capacity and increasing the operating income. Therefore, the following hypothesis was proposed:

Hypothesis 2.1 (H2.1). Forestry subsidies may improve the motivation of forestry management, thus increasing their operating income.

From the perspective of the wage income path, forestry subsidies may improve the forestry operating mode of forest farmers, change the traditional “small-scale” production mode, enhance the modernization level of forestry, release the rural labor force, and promote forest farmers to transfer to the secondary and tertiary industries with higher wage levels, thus increasing the wage income. Therefore, the following hypothesis was proposed:
**Hypothesis 2.2 (H2.2).** Forestry subsidies may release the rural labor force and promote the transfer employment to the secondary and tertiary industries, thus increasing wage income.

From the perspective of the transfer income path, this path refers to the direct forestry subsidy revenue of forest farmers. Forestry subsidies have become an important part of the rural transfer payments by the Chinese government. Therefore, the following hypothesis was proposed:

**Hypothesis 2.3 (H2.3).** Forestry subsidies may increase the transfer income.

Based on the above discussion, the logic of the research framework is shown in Figure 1.

![Figure 1. Implementation path of forestry subsidies on the forest farmer income.](image)

**2.2. Data Collection**

This study conducted forestry subsidy tracking surveys (2014–2018) of forest farmers in Zhejiang Province, Liaoning Province, and Sichuan Province, which are respectively located in the southeast, northeast, and southwest of China. The forest coverage rates of Zhejiang Province, Liaoning Province, and Sichuan Province are, respectively, 61.20%, 40.90%, and 36.88%, whose rankings are 5th, 16th, and 17th in the 33 provincial administrative regions of mainland China. These three provinces are typically collectively owned forests areas (China’s forest is mainly divided into collectively owned forest and state-owned forest. The land ownership of collectively owned forest belongs to rural collective economic organizations (i.e., all villagers in rural communities), and forest farmers obtain the forest land management right through the Household Contract Responsibility System. The land ownership of state owned forest belongs to the state, and state owned forest is managed and operated by the natural resources administration entrusted by the State Council. Collectively and state owned forest areas account for 58% and 42% of China’s total forest area, respectively.). The specific tracking survey’s locations were Kaihua County and Jiaxian County in Zhejiang Province, Zhuanghe City, Chaoyang City, and HuanRen County in Liaoning Province, and Nanjiang County, Hanyuan County, and Mianning County in Sichuan Province, as shown in Figure 2.

The farmers investigated in this study were all collectively owned forest farmers and fixed samples; this means that the vast majority of forest farmers have been investigated for five consecutive years. The questionnaire included the following core contents: basic information of family members (gender, age, education level, occupation, and detailed income), resource endowment (forest land area and cultivated land area), forestry subsidies (subsidy standard, subsidy amount, and subsidy form), forestry production and operation behavior (afforestation, forest tending, and logging), and farmers’ cognition of forestry subsidies (policy suggestions and willingness). This core content remained unchanged in the questionnaire over 5 years to ensure systematic research and standardization, and other content was added as appropriate, according to the needs of investigators. In order to ensure the questionnaires were scientifically and accurately obtained, household surveys were conducted through face-to-face interviews of “one investigator to one forest farmer”. The investigators acquired the data by means of filling in the questionnaires on the spot, according to interview content. In total, 2804 questionnaires were obtained from 2014 to 2018, excluding invalid responses, which resulted from incompletion of important...
information (mainly personal information such as the forestry subsidy and income); final valid questionnaires were 2535 copies, including 701 copies per year, with an effective rate of 90.41%.

Panel data of 5 years were used for analysis. Compared with the descriptive statistical analysis and cross-section data commonly used in previous studies, panel data can overcome the disturbance of multicollinearity on time series analysis and provide more information, more variable changes, more freedom degrees, and higher estimation efficiency, thus producing more explicit causal inferences [47].

2.3. Modeling

According to the analysis framework and the research hypothesis, the regression analysis was conducted in two steps to answer Q1 and Q2. The first step was to analyze the impact of forestry subsidies on the total income of forest farmers to determine whether the forestry subsidies of forest farmers had a significant impact on their household income. The second step was to analyze the paths of forestry subsidies affecting forest farmer income and to determine the paths of forestry subsidies promoting the increase of forest farmer income, namely, the operating, wage, and transfer income paths. The model is set as follows:

\[ y_i = \beta_0 + \beta_1 \text{forsubsidy}_i + \beta_i x_i + \epsilon_i, \]  

where, \( y_i \) represents the explained variable; \( \text{forsubsidy}_i \) and \( x_i \) represent explanatory variables, in which \( \text{forsubsidy}_i \) is the core explanatory variable and \( x_i \) is the control variable;
\[ \beta_0 \] represents the constant term; \( \beta_1 \) and \( \beta_i \) represent the coefficients of explanatory variables; and \( \epsilon_i \) is the random disturbance term. The explained and explanatory variables were set according to the abovementioned research hypotheses and explained in detail in Sections 2.3.1 and 2.3.2, respectively.

In this study, the Fixed-Effect model was used for parameter estimation. In statistics, the Fixed-Effect model is a statistical model that represents the observed quantities in terms of explanatory variables, which are treated as if the quantities were non-random. In panel data analysis, the term fixed effects estimator (also known as the within estimator) is used to refer to an estimator for the coefficients in the regression model. The Hausman test was used to test the possibility of random factors. If the \( p \) value of Hausman test were below 0, the Fixed-Effect model was consistent and could be used for parameter estimation [36,47].

2.3.1. Explained Variable

Explained variable \( y_i \) can be respectively set as the following parameter, according to the above-mentioned research hypotheses:

- H1: Total income of forest farmer.
- H2.1: Operating income and forestry production expenditure of the forest farmer.
- H2.2: Wage income and cumulative off-farm working time of the forest farmer.
- H2.3: Transfer income of the forest farmer.

In H2.1, variables of forestry production expenditure were introduced. The forestry production expenditure includes the expenditure on seedlings, fertilizers, mechanical work, and the labor force in forestry production and operation activities. In H2.2, variables of cumulative off-farm working time were introduced. The cumulative off-farm working time refers to the total number of months that the family members work outside the county in one civil year. Through the analysis of the two variables above, the production and operation behaviors of forest farmers could be defined more precisely, thus verifying the impacts of the production and operation behaviors on the operating and wage income of forest farmers.

2.3.2. Explanatory Variable

The core explanatory variable is set as \( \text{forsubsidy}_i \), which refers to the sum of the Afforestation and Forest Tending subsidies obtained by forest farmers.

In addition to the core explanatory variable (i.e., forestry subsidies), some control variables may have a significant impact on household income based on the literature [26,27,30,33,34,39,43,48–51], including household population composition and resource endowment. The household population composition includes the household population, the average age of family members, and the education level of family members. The household resource endowment includes the areas of cultivated farmland and forestland. Therefore, \( x_i \) is set as the control variable, including the household population, the average age, the average years of schooling, the cumulative off-farm working time, the cultivated farmland area, and the forestland area of family members. \( \beta_i \) is a coefficient to be estimated; \( \epsilon_i \) is the random disturbance term.

2.4. Endogeneity Analysis

The reasons for endogeneity could be summarized following three aspects: the omission of variables, mutual causality between explanatory and explained variables, and sample selection bias.

For the mutual causal relationship between explanatory and explained variables, since forestry subsidy is a typical exogenous variable with strong policy nature, the subsidy standards are uniformly formulated according to the actual situation of the local government, and the conditions of granting subsidy are not affected by income level. That means that there is no causal relationship between the core explanatory variable (forestry subsidy) and the explained variable (income). For omitted variables and sample selection bias, the Fixed-Effect model allows the disturbance term to be correlated with a certain
explanatory variable, thereby eliminating endogeneity problems caused by the factors that do not change with time. In addition, this paper selected the continuous tracking data of eight counties (cities) in three provinces from 2014 to 2018, with a sample size of 2535; the explained variable does not change significantly with time and has strong representativeness.

Therefore, the regression strategies and model settings in this study could effectively avoid the problem of endogeneity and obtain unbiased estimates.

3. Results
3.1. Descriptive Analysis

The family characteristics of the sample forest farmers are shown in Table 1. Among the sample forest farmers, the average family population is 3.91, the average labor force is 2.58, the average age of the family population is 43.34, and the average years of schooling is 7.32 years. While, according to the results of the Seventh National Census (2020), the average family population of rural residents in China is 3.9, and the average labor force of rural residents is 2.8. The family population aged 15–64 accounts for 74.5% of the total population [52]. According to the results of a sampling survey (2020) conducted by the National Bureau of Statistics of China, the proportion of residents with primary, junior, and senior secondary education in China are 29%, 37.29%, and 17.74%, respectively [44]. Through the comparison between the sample forest farmers in this study and the official statistics of the National Bureau of statistics, we conclude that the sample forest farmers in this study could represent the common household characteristics phenomenon in rural regions of China. The average income of the sample forest farmers is USD 15,117, of which the proportion of operating, wage, and transfer income are 37.00%, 55.94%, and 7.06%, respectively.

Table 1. Family characteristics of the sample forest farmers.

| Variables                      | Unit          | Mean | S.D. | Max | Min |
|--------------------------------|---------------|------|------|-----|-----|
| Family population              | Capita        | 3.9  | 1.5  | 9   | 1   |
| Average age of family members  | age           | 43.3 | 13.7 | 243.2 | 1.3 |
| Average years of schooling     | Year          | 7.3  | 12.2 | 403.8 | 0   |
| Cumulative off-farm working time| Months per year| 15.4 | 153.5 | 7000 | 0   |
| Cultivated farmland area       | ha            | 0.4  | 1.0  | 34.7 | 0   |
| Forestland area                | ha            | 5.4  | 31.9 | 1333.3 | 0  |
| Total income                   | USD           | 15,117 | 147,580 | 7,267,927 | 15,117 |
| Operating income               | USD           | 5593 | 3347 | 72,617 | 5593 |
| Wage income                    | USD           | 8457 | 9111 | 184,932 | 8457 |
| Transfer income                | USD           | 1067 | 1572 | 2245 | 1067 |

From the perspective of subsidy standards, the central financial standards of the Afforestation Subsidy were unified (453.86 USD/ha). However, due to the different regional financial supports, the Afforestation Subsidy standards in the survey of forest farmers in this study ranged from 453.86 to 907.72 USD/ha. Meanwhile, the central financial standard was implemented for the Forest Tending Subsidy in all regions, which was 215.58 USD/ha from 2014 to 2018. From the perspective of forest subsidies obtained by forest farmers, the proportion of forest farmers who received an Afforestation Subsidy in the tracking survey in 2014–2018 was 18.83%, 42.80%, 31.38%, 34.24%, and 38.23%, respectively; The proportion of forest farmers who received a Tending Subsidy was 18.83%, 45.65%, 23.97%, 45.65%, and 37.66%, respectively, which indicated that the coverage of forest subsidies was very large, and nearly half of the forest farmers had been covered in some years. From the actual amount obtained by forest farmers, the average forestry subsidy for each household was USD 593, of which the highest amount was USD 72,617. The average Afforestation Subsidy per household in 2014, 2015, and 2018 was higher than that of the Forest Tending Subsidy; this was the opposite in 2016 and 2017, which also reflected the changes of forest
management behavior from 2014 to 2018. In forestry production and operations, the average forestry production expenditure was USD 1815, and the average forestry operating income was USD 1180. The main reason why the expenditure was greater than the income was that China had implemented the policy of banning commercial logging of natural forests in recent years, which had a significant impact on forest farmers’ income from forest harvesting. The subsidy standard and actual amount obtained by forest farmers from 2014 to 2018 are shown in Figure 3.

![Figure 3](image_url)

Figure 3. Subsidy standard and actual amount obtained by forest farmers.

### 3.2. Estimated Results of Models

The Fixed-Effect model was used for parameter estimation of Equation (1) by the statistical software STATA15; the data were mostly larger in absolute value and some values were 0. The values of income and expenditure were processed by adding 1 and then taken the logarithm for processing. Although taking the logarithm compresses the scale of values, the processed data would be more stable, without changing the correlation, and the olinearity and heteroscedasticity of the model would be smaller [53]. By calculation of Equation (1), the $p$ values of the Hausman test were determined to be below 0.05, indicating that the Fixed-Effect model used in this study was suitable for data analysis.

#### 3.2.1. Hypothesis Testing for the Impact of Forestry Subsidies on Forest Farmer Income

As per the results presented in Table 2, from the perspective of the core explanatory variable (forestry subsidies), the coefficient of forestry subsidies was positive (0.13) and passed the test at the significance level of 0.01, indicating that forestry subsidies have a significant positive impact on forest farmer income. Therefore, we conclude that forestry subsidies significantly improved the income of forest farmers.

In addition, from the perspective of control variables, the coefficients of the household population, average years of schooling of family members, the cumulative off-farm working time, and the forestland area were positive and passed the test at the significance level of 0.01, indicating that larger household population, higher average education level of family members, more time of off-farm working, and larger forestland area generated higher income for forest farmers. By contrast, cultivated farmland area had no significant influence on the income of forest farmers. Thus, Hypothesis H1 was supported.
Table 2. Impact of forestry subsidies on forest farmer income.

| Variable Name            | Coefficient | T-Statistics | p-Statistics |
|--------------------------|-------------|--------------|--------------|
| Forestry subsidies       | 0.13        | 11.03        | p < 0.01     |
| Household population     | 0.16        | 5.89         | p < 0.01     |
| Average age of family members | 0.00   | 0.80         |              |
| Average years of schooling | 0.08   | 6.27         | p < 0.01     |
| Cumulative off-farm working time | 0.05 | 14.99        | p < 0.01     |
| Cultivated farmland area | 0.01        | 1.22         |              |
| Forestland area          | 0.00        | 6.47         | p < 0.01     |
| Constant term            | 7.72        | 31.51        | p < 0.01     |
| χ² value of Hausman test | 150.20      |              |              |
| p value of Hausman test  | 0.00        |              |              |
| Sample size              | 2535        |              |              |
| R-squared                | 0.68        |              |              |

3.2.2. Hypothesis Testing for the Impact Paths of Forestry Subsidies on Forest Farmer Income

Based on the above analysis, forestry subsidies had a significant positive impact on forest farmer income. However, the impact mechanism of forestry subsidies on forest farmer income still cannot be explained. According to the above theoretical framework analysis, the impact path of forestry subsidies on affecting forest farmers’ income could be summarized into transfer, operating, and wage income paths. Subsequently, it needs to be determined via which path forestry subsidies may promote the increase of forest farmer income. To further explore the path of forestry subsidies to promote the increase of forest farmer income, Hypothesis H2.1–2.3 were verified.

(1) The impact on the operating income

As per the results presented in Table 3, from the perspective of the core explanatory variable of forestry subsidies, in the Fixed-Effect model of forestry production expenditure and household operating income, the coefficients of the core explanatory variable (forestry subsidies) were both positive, and the core explanatory variable (forestry subsidies) passed the test at the significance level of 0.01, indicating that forestry subsidies significantly impact forestry production expenditure and household operating income. Based on this, we conclude that forestry subsidies significantly increased the forestry production expenditure of forest farmers and then significantly increased the household operating income. Thus, Hypothesis H2.1 was supported.

Table 3. Impact of forestry subsidies on the operating income of forest farmers.

| Variable Name            | Coefficient | T-Statistics | p-Statistics | Coefficient | T-Statistics | p-Statistics |
|--------------------------|-------------|--------------|--------------|-------------|--------------|--------------|
| Forestry subsidies       | 0.04        | 4.84         | p < 0.01     | 0.13        | 4.08         | p < 0.01     |
| Household population     | 0.12        | 7.19         | p < 0.01     | 0.33        | 4.62         | p < 0.01     |
| Average age of family members | −0.01  | −3.94        | p < 0.01     | −0.01       | 1.32         |              |
| Average years of schooling | 0.07   | 8.50         | p < 0.01     | 0.11        | 3.31         | p < 0.01     |
| Cumulative off-farm working time | 0.01  | 3.22         | p < 0.01     | −0.05       | 6.30         | p < 0.01     |
| Cultivated farmland area | 0.01        | 1.58         |              | 0.13        | 6.48         | p < 0.01     |
| Forestland area          | 0.00        | 13.20        | p < 0.01     | 0.00        | 2.82         | p < 0.01     |
| Constant term            | 9.42        | 61.48        | p < 0.01     | 4.66        | 7.04         | p < 0.01     |
| χ² value of Hausman test | 281.80      |              |              | 22.89       |              |              |
| p value of Hausman test  | 0.00        |              |              | 0.00        |              |              |
| Sample size              | 2535        |              |              | 2535        |              |              |
| R-squared                | 0.76        |              |              | 0.63        |              |              |

From the perspective of control variables, in the Fixed-Effect models of forestry production expenditure and household operating income, the coefficients of the household population, average years of schooling of family members, and forestland area were
positive, passing the test at the significance level of 0.01, indicating that larger household population, higher average education level, and larger forestland area could lead to higher forestry production costs and higher household operating income. In addition, the average age of family members passed the test at the significance level of 0.01 in the Fixed-Effect model of forestry production expenditure, and the coefficient was negative, indicating that the average age of family members only has an impact on the forestry production expenditure but not on the household operating income. The cultivated farmland area passed the test at the significance level of 0.01 in the Fixed-Effect model of household operating income, and the coefficient was positive, indicating that the cultivated farmland area has an impact on the household operating income but not on the forestry production expenditure. In the Fixed-Effect models of forestry production expenditure and household operating income, the cumulative off-farm working time passed the test at the significance level of 0.01, but its impacts on forestry production expenditure and household operating income showed the opposite pattern. Longer off-farm working time would increase the forestry production expenditure but decrease the household operating income.

(2) The impact on the wage income

As per the results presented in Table 4, from the perspective of the core explanatory variable of forestry subsidies, in the Fixed-Effect model for the cumulative off-farm working time, forestry subsidy passed the test at the significance level of 0.01, but the coefficient was negative, indicating that forestry subsidies have a significant negative impact on the off-farm working time. However, in the Fixed-Effect model for wage income, the coefficient of forestry subsidy did not pass the significance test, indicating that forestry subsidies have no significant impact on the wage income of forest farmers. However, according to the mechanism of the forestry subsidy policy, the subsidy policy would motivate forest farmers for forestry operation and production, but weaken their willingness to off-farm working for a wage income, at least to a certain extent. Thus, the Hypothesis H2.2 was rejected.

Table 4. Impact of forestry subsidies on the wage income of forest farmers.

| Variable Name          | Cumulative Off-Farm Working Time | Wage Income |
|------------------------|---------------------------------|-------------|
|                        | Coefficient | T-Statistics | p-Statistics | Coefficient | T-Statistics | p-Statistics |
| Forestry subsidies     | -0.30       | -3.62        | p < 0.01     | -0.01       | -0.15        |
| Household population   | 2.69        | 15.48        | p < 0.01     | 0.61        | 7.26         | p < 0.01     |
| Average age of family members | -0.02     | -0.73        | p < 0.01     | -0.04       | -3.69        | p < 0.01     |
| Average years of schooling | 0.98       | 11.62        | p < 0.01     | 0.42        | 10.19        | p < 0.01     |
| Cultivated farmland area | -0.11      | -2.14        | 0.01 < p < 0.05 | -0.03       | -1.24        | p < 0.01     |
| Forestland area        | 0.00        | -2.94        | p < 0.01     | 0.00        | -2.83        | 0.01 < p < 0.05 |
| Constant term          | -3.67       | -5.16        | 0.01 < p < 0.05 | 3.52        | 4.25         | p < 0.01     |
| $\chi^2$ value of Hausman test | 53.38     | 7.90         | p < 0.01     | 2535        | 2535         |
| p value of Hausman test | 0.00        |              |              | 0.00        |              |
| Sample size            | 2535        |              |              | 2535        |              |
| R-squared              | 0.71        |              |              | 0.02        |              |

From the perspective of control variables, in the Fixed-Effect models for cumulative off-farm working time and wage income, the coefficients of household population, average years of schooling of family members, and forestland area were positive, passing the test at the significance level of 0.01, indicating that a larger household population, a higher average education level, and a larger forestland area could lead to longer off-farm working time and a higher wage income. In addition, the average age of family members passed the test at the significance level of 0.01 in the wage income model, and the coefficient was negative, indicating that a lower average age of family members could lead to a higher wage income. However, the cultivated farmland area passed the test at the significance level of 0.05 in the model for the cumulative off-farm working time, and the coefficient was negative, indicating that a larger cultivated farmland area could reduce the off-farm working time.
(3) The impact on the transfer income

As per the results presented in Table 5, from the perspective of the core explanatory variable (forestry subsidies), the coefficient of forestry subsidies was positive and passed the test at the significance level of 0.01, indicating that forestry subsidies have a significant positive impact on transfer income. Based on this, we conclude that forestry subsidies significantly improved the transfer income of forest farmers. Thus, Hypothesis H2.3 was supported.

Table 5. Impact of forestry subsidies on the transfer income of forest farmers.

| Variable Name                  | Coefficient | T-Statistics | p-Statistics |
|-------------------------------|-------------|--------------|--------------|
| Forestry subsidies            | 0.57        | 34.55        | p < 0.01     |
| Household population          | 0.21        | 5.84         | p < 0.01     |
| Average age of family members | 0.04        | 9.43         | p < 0.01     |
| Average years of schooling    | −0.01       | −0.62        |              |
| Cumulative off-farm working time | −0.01     | −1.16        |              |
| Cultivated farmland area      | 0.02        | 2.18         | 0.01 < p < 0.05 |
| Forestland area               | 0.00        | 0.91         |              |
| Constant term                 | 1.22        | 3.58         | p < 0.01     |
| $\chi^2$ value of Hausman test|             |              | 16.64        |
| $p$ value of Hausman test      |             |              | 0.02         |
| Sample size                   |             |              | 2335         |
| R-squared                     |             |              | 0.44         |

In addition, from the perspective of control variables, the coefficients of the household population, average age of family members, and cultivated farmland area were positive. The household population and the average age of family members passed the test at the significance level of 0.01, and the cultivated farmland area passed the test at the significance level of 0.05, indicating that a larger household population, a higher average age of family members, and a larger cultivated farmland area could increase the transfer income. By contrast, the average years of schooling of family members and the forestland area had no significant impacts on transfer income.

4. Discussion

According to the research results, forestry subsidies had a significant positive impact on the income of forest farmers. The result was consistent with the research of Liu and Lin (2011), Dong et al. (2017), and Yu and Qi (2018) [41–43], which demonstrated that the forestry subsidy policy had produced good economic effects by improving the economic benefits to forest farmers. Furthermore, the impact of forestry subsidies on forest farmer income could be realized through the operating and transfer income paths.

From the perspective of the operating income path, the forestry subsidy policy is a kind of forestry support policy, invested in by the Chinese central government, to motivate forest farmers to operate forests. According to the incentive theory in behavioral science, the behavior motivation of forest farmers, as a rational economic means, comes from the need for family benefit maximization and greatly impacts the attitudes and choice of operating behaviors of forest farmers. When the forest farmers receive more forestry subsidies, which tend to increase their forestry investment motives, they accordingly increase their forestry investment [49,51]. The result is also consistent with other studies [26,48,54–56]. Hu et al. (2019) [48] demonstrated that forestry subsidy policies significantly increased the forest farmers’ investment. Yu et al. (2017) [55] found that forestry subsidies stimulated forest farmers to increase forestry management input. Jiang et al. (2017) [26] stated that forestry subsidies stimulated households to expand the planting scale, which was more conducive to applying new technologies and equipment. Due to the above changes in forestry production and management behavior, forest farmers achieved a higher operating income. Yin and Xu (2002) [54] demonstrated that forest farmers received a higher operating income...
directly from selling timber, by employing more laborers. Therefore, we conclude that forestry subsidies would reduce the afforestation cost of forest farmers and motivate forest farmers for forestry production, thus improving the production capacity, and increasing the operating income of forest farmers.

As a transfer financial subsidy, forestry subsidies themselves are a part of the transfer income for forest farmers. From the perspective of transfer income itself, with the growth of the Chinese central government budget, transfer payments to low-income groups, such as rural households, steadily increased, and the transfer income also occupies an important share among rural household income. According to the statistical bulletin issued by China’s National Bureau of Statistics in 2020, transfer income accounted for 21.37% of rural household total income [44]. Moreover, according to the situation of the samples in our tracking surveys, forestry subsidies accounted for 55.58% of the transfer income, which is a very high proportion. Also, nearly half of the forest farmers had been covered by the policy in some years, and the highest amount obtained by forest farmers was USD 72,617, which is a very considerable income. Therefore, we conclude that forestry subsidies would directly increase the transfer income of forest farmers, thus increasing total family income.

However, from the perspective of the wage income path, the hypothesis was rejected, which showed the forestry subsidy policies did not release the labor force of forest farmers but restricted their off-farm work. This result is inconsistent with some studies, some research stated that forestry subsidy policy had positive impacts on the off-farm employment of forest farmers. On the one hand, forestry subsidies contributed to large-scale production and modern forestry management, and provided potential employment opportunities for local forest farmers, thus increasing the income from employment [57–59]. On the other hand, the enhancement of the production efficiency releases the rural labor force and promotes the transfer of forest farmers to secondary and tertiary industries with higher wage levels. For instance, Carlos Bopp et al. (2020) [60] analyzed the forest plantation subsidies’ effect on off-farm income in Chile and indicated that the beneficiaries of the subsidy have a marginal increase in off-farm income. However, our result may be explained from another perspective; with the development of urbanization in China, wage income from off-farm employment in cities has become the main source of income for rural households, surpassing the operating income from traditional agricultural and forestry production. According to the statistical bulletin issued by China’s National Bureau of Statistics in 2020, wage income accounted for 40.71% of rural household total income [44]. Due to this large proportion of wage income, the impact of forestry subsidies was not enough to cause statistically significant changes. In addition, with the slowdown of China’s economic growth in recent years, the demand for off-farm workers has been decreasing, and the labor force released from forestry production may enter the planting industry. According to the research of Yang and Zhai (2016) [31], the peasants are more willing to return to cultivation since the agricultural income was higher than the forestry income in certain periods. Therefore, we conclude that forestry subsidies failed to release the rural labor force, and promoted forest farmers to transfer to the secondary and tertiary industries with higher wage levels, thus increasing wage income.

5. Conclusions

Based on the survey data of forest farmers in Sichuan, Liaoning, and Zhejiang provinces from 2014 to 2018, we established static panel models and used the Fixed-Effect model to systematically analyze the impact of forestry subsidies on forest farmer income. Our research showed that forestry subsidies had a significant positive impact on the income of forest farmers, and the impact of forestry subsidies on forest farmer income could be realized through increasing operating and transfer income.

Based on the research results and discussion, and considering the current situation of the implementation of forestry subsidy policies, forestry subsidies have increased the income of forest farmers by supporting forest operation and management; the farmers received direct transfer payments from the government. However, with the market subject
status of forest farmers for economic benefits consolidated, and the responsibility of governments for protecting the ecological environment enhanced, forestry subsidies should be modified in a timely way by fully considering the strategic mission of forestry development, thus releasing more policy signals and having more powerful policy effects. This study puts forward policy suggestions based on the above discussion. First, forestry subsidy policy should be changed from traditional forestry production to ecological construction, such as setting up subsidies to improve forest biodiversity. Second, the adjustment of forestry subsidies should consider the social equity of forest farmers, and should not let them bear the loss of economic interests in order to protect the environment. Third, it is necessary to increase the amount of forestry subsidies and to ensure the income of forest farmers, thus guiding forest farmers to carry out forestry operation activities and consolidating the achievements of forestry projects.

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