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Institutional Regime, Off-Farm Employment, and the Interaction Effect: What are the Determinants of Households' Forestland Transfer in China?

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Abstract: The development of the land rental market has been widely attributed to the associated institutional regime and the functioning of the off-farm labor market. However, little is known of the interaction effect of these two factors. To fill this gap, we employ a nationwide representative household dataset to investigate the effects of China's collective forest tenure reform (CFTR) and off-farm employment on forestland transfer in China. Special interest is focused on their potential interaction effect. The Smith-Blundell instrumental variable tobit model is adopted to account for the endogeneity of off-farm employment. The estimation results show that both the tenure reform and off-farm employment significantly influence forestland transactions. However, compared to the positive effect of the reform on both renting in and renting out forestland, the effect of off-farm employment is mixed, that is, its effect is negative when forestland is rented in but positive on rent-out decisions. An important finding is that the CFTR imposes a negative enhancement effect on forestland rent-in through its interaction term with off-farm employment. In contrast, the enhancement effect on rent-out is not statistically significant, which may be due to the neutralization by the endowment effect of the CFTR.

Keywords: collective forest tenure reform; China's forestland transfer; off-farm employment; interaction effect; endogeneity; instrumental variable tobit

1. Introduction

"No country's forest policy has changed more dramatically than China's" [1]. Since the foundation of the People's Republic of China in 1949, tenure institutions of forestland in China have undergone a series of fundamental changes [2]. Given the long rotation period of forests, radical and frequent changes in property rights over a short period of time have undermined farmers' confidence in stable policies and tenure security, and further hampered households' incentives to manage the assigned forestland and conserve the associated forests. This may partly explain the low productivity and low level of growing stock of China's forestland. The stock growing trees per hectare in China is only 89.79 m^3, accounting for 68.54% of the world average [3].

To stimulate farmers' incentives for forest management and to improve efficiency in forestry, a new round of forestland reform has been launched since 2003. This is known as the collective forest tenure reform (CFTR). It is comprised of two steps. The first step, the main-body reform, was featured by clarifying forest property rights, and devolving the use rights of collective forestland to individuals with legal contracts and usufruct certificates. The first-step reform was largely finished by 2012 when 99% of all collective forestlands had been entitled to households [4]. The second stage is called the supplementary or supportive reform, and it grants several important additional rights concerning forestland to households. These include the rights to transfer, inherit, and mortgage the entitled forestland [5]. To some extent, it can be said that the main-body reform is an equity-based change, while the supplementary one is an efficiency- and development-oriented reform. Currently, the second-stage reform is still in progress.

Although being considered a big success, the main-body reform also brought about some undesired consequences. In particular, the allocation of forestland based on the household size has caused the fragmentation of forestland, which can be detrimental to the management incentives and efficiency of forestry [6]. Therefore, forestland transfer is a priority concern in the supplementary reform by the central government. However, the reality contrasts sharply with the policymakers' anticipations, as leasing forestland reportedly occurs on a mere 2% of the contracted forestlands by 2014 (http://www.forestry.gov.cn/Zhuanti/content_lqgg/800410.html). The very low frequency of land rental transactions raises the question as to why the majority households decides not to transfer forestland, and what factors impede households' forestland transfer. Probing into these questions is the motivation of this paper.

The determinants of farmland transfer have been thoroughly investigated in the existing literature [7–9], and in this literature the crucial role of secure tenure arrangements have been found to be an important factor affecting the frequency of farm land transfers. One explanation given in public debate is that without secure property rights, farmers fear that renting out land may be interpreted as a signal that they are not committed to the land entitled to them and that, therefore, the land could be taken away from them [8]. Thus, participation in rental markets is likely to be sub-optimal under insecure property rights. The positive link between tenure security and the land transaction has been widely observed in empirical studies in different countries [9–13]. In China's farmland transfer market, besides the tenure security, the development of parallel factor markets, especially the off-farm labor market, is seen as another crucial determinant of land transfer [7,14–18]. The rationale is that because off-farm activity has become the main source of household income in rural China, off-farm employment carries great weight when farmers allocate labor between farmland cultivation and off-farm work [19].

Although the abovementioned studies emphasize the role of tenure security and off-farm employment, these are investigated separately from each other and their interaction effect on land transfer is neglected. As Deininger et al. [20] argue, secure property rights could encourage migration of rural labor, and a sustained increase in off-farm employment would also foster the importance of secure land tenure. Thus, both the tenure security and off-farm employment would not only have a direct effect, but also an indirect effect on land transfer decisions through their interaction. The test on the statistical significance of the interaction term of off-farm employment and tenure security in land transfer model is the first contribution of this paper.

In contrast to the many studies on farmland transfer, to the best of our knowledge, there are two papers published in English investigating this topic: Xu et al. [21] and Siikamäki et al. [22] (This statement is based on the search results from the Web of Science (https://apps.webofknowledge.com, accessed on 27 September 2017), using TOPIC: (forestland rental) AND TOPIC: (China)). Beyond this, some literature published in Chinese also provides insightful knowledge on China's forestland transfer, such as Xie and Wen [23], Ke et al. [24], Kong and Liao [25], Wang et al. [26], and so forth. However, all these studies are limited to a specific geographic region or a couple of provinces. Moreover, they use cross-section data, which cannot capture the dynamic change of forestland transfer over time. In contrast, the present paper employs an eight-year panel

dataset based on a survey questionnaire. The collection of the data was administered by the Economic Development Research Centre (EDRC) of the State Forestry Administration of China (SFA) from nine provinces (The household survey was research-oriented and was designed to obtain the household data for academic purposes).

In addition, Xu et al. [21] and Siikamäki et al. [22] also neglect the potential endogeneity of off-farm employment. Endogeneity is a theoretically justified assumption as the land transfer and off-farm employment must be simultaneously determined in households' decision-making [27]. This assumption has also gained empirical evidences [16,19,28,29] (For instance, Feng and Heerink [28] and Liu et al. [29] have found that households' land transfer decisions and off-farm employment decisions are closely interrelated. However, their studies focus on the context of farmland transfer with the data from specific regions, while this paper employs nationally representative data to investigate the behavior of forestland transfer). Therefore, the ignoring endogeneity may induce biased and inconsistent estimates. Furthermore, the low occurrence of forestland transactions means that the dependent variable is censored. Therefore, an instrumental variable (IV) tobit estimator is used in this paper, to account for the potential endogeneity and the censoring issues.

The reminder of the paper is organized as follows. Section 2 overviews historical transitions of forestland tenure in China. Section 3 presents the materials and methods, including the data source, the hypotheses, the empirical model and the estimation techniques. Section 4 reports and discusses the estimation results. Section 5 concludes with policy implications.

2. Historical Evolvement of China's Forestland Tenure

Prior to the communist revolution, most of the forestland was owned by landlords and rich peasants. In 1950, the central government initiated the Land Reform Campaign to confiscate all forestlands, some of which were nationalized, while the rest was distributed to households [2] (Herein, the "nationalized" forestlands are also known as the state-owned forestlands, while the "rest" forestlands are the main focus of this paper and is called collective forestlands. Currently, 60% of China's forestlands are collectively owned, which accommodate 71% of China's domestic timber production [3]). From 1956, to organize agricultural production, the cooperative farming system was gradually established in rural China. Farmers were required to surrender forestland as well as other means of production to the advanced cooperatives, which marked a shift from private property rights to collective ownership. Collectivization was strengthened by the Great Leap Forward Campaign around 1958. After the campaign, forestlands were further transferred from advanced cooperatives to the People's commune (The People's commune was a higher level of the advanced cooperative, and was formed through the merging of a number of advanced cooperatives. The communes had governmental, political, and economic functions with further centralized ownership), where collective ownership was the single form of property rights [2]. However, after the famine from 1959 to 1961, the management of communal forestland was readjusted from the higher level of the commune to the lower level of production teams, which can be considered as a signal of decentralization, at least to some extent.

The collective ownership by production teams remained dominant until the early 1980s, when the well-known Three Fixes reform was initiated on collective forestlands, following the implementation of the Household Responsibility System on farmland [30]. Through contracting with households, the Three Fixes reform devolved the use rights of collective forestland and ownership of outputs on the contracted forestland to farmers, which introduced an individualized pattern of tenure on collective forestland. However, an unexpected excessive harvesting and a substantial decline of forest stock was observed. In response, the central government quickly suspended the reform, and some part of the households managed forestland were returned to collectives in 1987, and strict regulations were imposed on forest management [4]. For example, a timber harvesting quota system and a compulsory timber delivery system were introduced. Households had to apply for cutting permits for trees on their contracted forestland, and after cutting, farmers could only sell to the state procurement agency

at low and planned prices set by the government [31]. In addition, high stumpage taxes and fees were collected from households and their communities to fund the reforestation activities [5]. After the Three Fixes reform, about 70% of collective forestland was allocated to households, however, this transfer was somehow ostensible and the control was actually held by collective villages [32]. In the 1990s, the market-oriented reform gradually took place in the forest sector with a gradual devolvement, and more rights concerning forestland were given back to households. The forestland use rights were also allowed to be auctioned off, which was known as the Four Wastelands Auction, or leased out to economic entities [6].

Thus, the frequency of institutional reversals on forestland ownership since 1949 has been high. In addition, the oscillating shift between collective and individual tenure made also the boundaries of the forestland between households unclear, which led to disputations. The insecure and unclear property rights severely dampened households' incentives to invest in forestland, and led to inefficient forestland use (In general, the share of China's natural forests from the total forest area has declined from 95.5% in 1950s to 58.7% in recent years [3,33]. Conversely, the share of the cultivated forests has grown steadily). This situation was further exacerbated due to the heavy tax burden and tight harvesting regulations since the late 1980s. Under these circumstances, a new round reform, the CFTR, was initiated in 2003, as stated in Section 1.

3. Materials and Methods

3.1. Data Source

The dataset used in this paper is collected from a three-wave household survey conducted by the EDRC of the SFA of China. The same households were investigated with a face-to-face interview in 2010, 2012, and 2014, respectively, and the data before (2003) and after the reform (2007–2013) was collected (The first wave was performed in 2010 and the household data of 2003 and 2007–2009 were collected. The last two waves were conducted in 2012 and 2014, respectively, each of which obtained the previous two-year data (2010–2011 and 2012–2013, respectively). During the face-to-face interview, a structured questionnaire was presented to households, which included questions on the tenure reform, household production, demographics, forestland characteristics, and economic attributes. For example, (1) Have you ever rented in or out your forestland? (2) If yes, when did you transfer it? (3) What is the area of the forestland that you have rented in or out? (4) What was the agreed rent fee when you transferred the forestland?). In practice, the stratified random sampling method was used to collect data at household, village and county levels [34]. Nine provinces were selected as the sample area based on the disparities of economic development, forest endowment, geographical distributions and the CFTR implementation, as depicted in Figure 1 (For instance, among these nine provinces, the forest cover is ranged from 16.7% to 66.0%, and the area ratio of collective-owned forestland to total forestland is between 30% and 92% [3]. With regard to the economic development, the annual disposable income of rural household per capita is ranged from 1519.91 to 3391.72 USD (100 USD = 622.84 Yuan) in 2015 [35]. In addition, the starting year of the CFTR in the sample area varies from 2003 to 2009). Among them, Liaoning province and Sichuan province are located in the northeast and the southwest forest region, respectively. Shandong province and Henan province are the representatives of the central forest region, while the remaining five provinces are located in the southern forest region. To some extent, the sample can represent a wide spectrum of different characteristics of China's major collective forest regions. Specifically, the surveys covered two counties from each province, three townships from each county, three villages from each township and, finally, around 15 households from each village. We merged the three-wave surveys into a large dataset and removed the incomplete records and/or those with inconsistent information in the questionnaire, yielding a balanced panel dataset of 1497 households over an eight-year time span.

Figure 1. Spatial distribution of sample area. Note: Counties 1–18 are Mengyin, Laizhou, Wuyang, Shihe, Qingyuan, Benxi, Weiyuan, Danleng, Suichang, Deqing, Shunchang, Shaxian, Pingjiang, Hongjiang, Tonggu, Suichuan, Pingguo, and Huanjiang, respectively.

3.2. Stylized Facts and Hypotheses

In the sight of temporal dynamics, Table 1 shows that the area of forestland transfer increased rapidly after the reform, especially for rent-in. The average rent-in area after the reform is 3.68 times larger than that before the reform. For the whole sample, the mean-comparison *t*-test indicates a significant increase of the rent-in area and rent-out area at the 1% and 10% statistical level, respectively. This is in line with a commonly accepted premise that clearly defined and secure property rights are one of the preconditions of the well-functioning land rental market [10,11]. Based on this, we propose the following hypothesis.

Table 1. Descriptive statistics of household sample by groups. Collective forest tenure reform (CFTR).

	Unit	Expected Signs	Mean, Full Sample	Mean, Pre-CFTR	Mean, Post-CFTR
Explained variables					
Rent-in, overall †	mu		0.54 (13.47)	0.16 (2.35)	0.60 (14.37) ***
Rent-out, overall †	mu		0.07 (2.57)	0.02 (0.78)	0.08 (2.73) *
Rent-in, conditional ‡	mu		79.52 (143.02)	23.70 (17.35)	87.27 (150.99) ***
Rent-out, conditional ‡	mu		21.50 (38.70)	17.00 (18.38)	21.73 (39.58)
Explanatory variables					
CFTR	0/1	+/+	0.87 (0.33)	0.00 (0.00)	1.00 (0.00) ***
Off-farm work	%	−/+	49.80 (34.13)	40.62 (35.64)	51.12 (33.71) ***
Market variables					
Transaction cost	/	−/−	0.22 (0.86)	0.42 (1.32)	0.20 (0.78) ***
Timber price	Yuan/m^3	+/−	427.06 (97.24)	313.65 (54.53)	443.32 (90.98) ***
Wage rate	Yuan/day	−/+	48.97 (19.42)	38.72 (16.63)	50.43 (19.35) ***
Forestland attributes					
Foreland area	mu	±/±	34.91 (66.76)	19.75 (50.87)	37.09 (68.47) ***
Area per plot	mu/plot	+/−	12.28 (21.73)	10.07 (16)	12.50 (22.21) ***
Household attributes					
Age	Years	±/±	51.08 (10.91)	46.03 (10.75)	51.80 (10.74) ***
Education	Years	±/±	7.35 (2.76)	7.36 (2.59)	7.35 (2.78)
Leadership	0/1	±/±	0.25 (0.43)	0.25 (0.44)	0.25 (0.43)

Table 1. *Cont.*

	Unit	Expected Signs	Mean, Full Sample	Mean, Pre-CFTR	Mean, Post-CFTR
Household income	Thousand Yuan/year	±/±	23.18 (30.86)	13.62 (16.48)	24.55 (32.17) ***
Household size	Persons	+/−	3.98 (1.47)	4.11 (1.45)	3.96 (1.47) ***
Village attributes					
Mountain	0/1	+/−	0.56 (0.50)	0.53 (0.50)	0.56 (0.50) **
Road	0/1	−/+	0.72 (0.45)	0.58 (0.49)	0.74 (0.44) ***
County distance	km	+/−	35.14 (30.83)	35.07 (29.74)	35.15 (30.98)
Observations §	/		11,976	1501	10,475

Note: † The mean of transferred area refers to the average value based on the full sample. ‡ The mean is the average value based on the sample with positive observations of forestland transfer. § For the conditional mean of rent-in and rent-out, the observations are 82 and 41, respectively. All price indices have been deflated by the locally rural consumer price index (1994 = 100). The standard deviation is reported in parentheses. The *t*-test is performed to compare the sample mean between pre- and post-CFTR groups. *, **, and *** denote a statistical significance at the 10%, 5%, and 1% levels, respectively. For the expected signs, the sign before the slash mark refers to the rent-in behavior, while the one after the mark is associated with the rent-out case.

Hypothesis 1. *China's CFTR is expected to have a positive effect on forestland transactions between households in both rent-in and rent-out actions.*

Figure 2 depicts the correlation between the off-farm employment and forestland transfer across different provinces, where the off-farm employment is measured by the ratio of off-farm income to household total income. It can be found that China's forestland rental market is still at an infant stage, as shown in Figure 2. By 2013, only about 8.75% (131/1497) and 4.28% (64/1497) of households have transferred in and out their forestland in our sample (The household survey included a question of "when did you transfer your forestland". The answers show there are 49 and 32 households that transferred their forestland in and out from 2004 to 2006, respectively. It should be noted that our dataset has a gap without information from 2004 to 2006. Hence, we just know the households transferred their forestland during that time, but we cannot utilize the transfer information to conduct regression since other information is unavailable for that period. That is why, herein, the transaction frequency is reported to be 131 and 64, respectively, while the counterparts are 82 and 41 in the Note of Table 1, respectively). Basically, the provinces with more off-farm employment are associated with lower occurrence of forestland rent-in. For instance, Zhejiang province and Fujian province have the highest rates of off-farm income, which is 70.29% and 63.79%, respectively. However, the incidences of forestland rent-in for these two provinces are very low, as shown in Figure 2. Conversely, in Henan province, the rent-in frequency is the highest among these nine provinces, while the share of off-farm income in this province is relatively low at only 54.85%. Compared with the rent-in case, the shape of the rent-out line generally displays a parallel trend with the off-farm work. That is, households in provinces with a larger portion of income from off-farm work, such as Zhejiang and Fujian, are more inclined to transfer out their forestland, and vice versa. The analogous phenomenon is also found in the context of farmland transfer and off-farm employment [15,16]. Theoretically, off-farm employment and forestland cultivation can compete for household labor, inducing a so-called lost-labor effect [36]. This effect, combined with the observed phenomenon in Figure 2, leads to the following hypothesis.

Hypothesis 2. *Off-farm employment is anticipated to play a negative role in forestland rent-in, while the effect is expected to be positive in the rent-out case.*

A striking finding in Table 1 is that the share of off-farm income has experienced a considerable growth from 40.62% before the reform to 51.12% after the reform, which is significant at the 1% risk level. This growth provides a preliminary evidence that households' off-farm activities might be correlated with the CFTR. At least to some extent, the CFTR can eliminate the risk of land expropriation, which is argued to be a major impediment to off-farm employment and migration [37]. Given the

potentially positive correlation between the CFTR and off-farm work, an enhancement effect can be summarized as follows.

Hypothesis 3. *There exists an interaction effect between the CFTR and off-farm employment. In addition to the direct effect, the CFTR can impose an indirect effect on forestland transfer through the channel of off-farm work. In addition, the CFTR would further strengthen the negative effect and positive effect of off-farm employment on forestland rent-in and rent-out, respectively.*

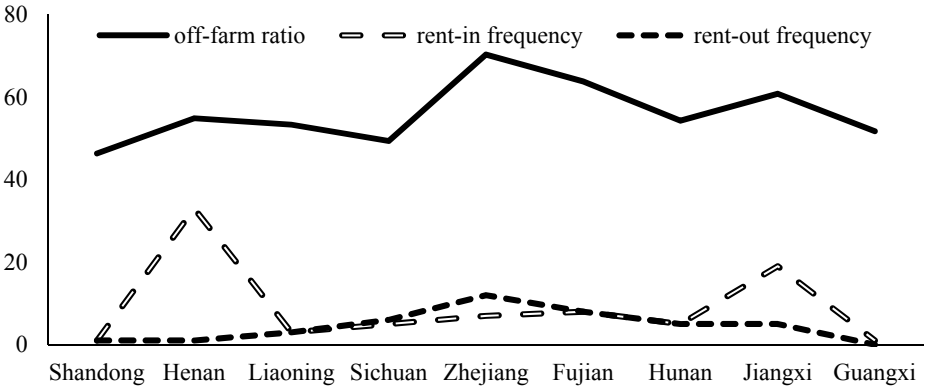

Figure 2. Forestland transfer activities and off-farm employment by provinces in China. Note: The ratio and frequency are measured in % and the number of times, respectively. The off-farm ratio is calculated on the data of 2013, while the frequency refers to whether households had transferred forestland by 2013.

3.3. Model Specification

To verify the above-mentioned three hypotheses, we need to establish an empirical model to investigate the relevant effects. Both forestland transfer and off-farm work are determined jointly in households' decision-making process. The simultaneous causality leads to an endogeneity of off-farm employment, which can bias the estimation results [16,19,27–29]. Meanwhile, the fact that most of the sample households choose not to transfer their forestland implies that the dependent variable is censored. To resolve the endogeneity and censoring, an IV tobit model is adopted as follows:

$$\begin{aligned} A_i^* &= \beta_0 + \beta_1 OF_i + \beta_2 R_i + \beta_3 OF_i \times R_i + X'\eta + \varepsilon_i \\ A_i &= \max(A_i^*, 0) \end{aligned} \tag{1}$$

$$OF_i = \alpha_0 + \alpha_1 IV_i + \alpha_2 R_i + X'\theta + e_i \tag{2}$$

where A_i^* indicates the latent area that household i desires to transfer in or out, while A_i is the observed transferred area. OF and R denote off-farm employment and the CFTR, respectively. The former is represented by the ratio of off-farm income to household total income. Following Lin [38], the institutional reform is denoted by a dummy variable, which is equal to one if the CFTR has been implemented. Otherwise, it is equal to zero. To test Hypothesis 3, we introduce an interaction term between OF and R. Hypotheses 2 and 3 indicate $\beta_1 < 0$ and $\beta_3 < 0$ for the rent-in equation, while $\beta_1 > 0$ and $\beta_3 > 0$ for the rent-out equation. According to Hypothesis 1, the estimated coefficient β_2 is expected to be positive both in rent-in and rent-out equations.

For the instrument variable IV_i, a commonly adopted strategy is to use the lagged values of the endogenous variables [39,40]. Hence, we introduce the share of off-farm income in last period and denote it by IV_i. An instrument is valid under two conditions. The first is the exclusion restriction. For the transfer decision in a given year, the lagged share of off-farm income is predetermined, thereby satisfies the first condition. The second condition is that the instrument must be strongly correlated

with the endogenous explanatory variables. Generally, households who engage in off-farm work in last year would also participate in off-farm employment in the following years. This time-continuity or path-dependent feature implies the strong correlation condition should be satisfied. Formal statistical tests will be presented in Section 4.

The disturbances of ε_i and e_i have the multivariate normal distribution due to the endogeneity of off-farm employment. The vector X includes other variables that potentially influence households' decisions on forestland transfer. As listed in Table 1, it consists of four categories: market-based variables; forestland attributes; household characteristics, and; village characteristics. Following Kimura et al. [41], the transaction cost is approximated by the reciprocal of the average forestland area per household in that village (The rationale is intuitive: If the village-averaged land size per household is small, then many households would be involved to transfer a certain amount of forestland, which induces a high search and negotiation costs [41]. It should be noted that a higher village-averaged land size per household indicates a lower transaction cost, i.e., they are logically opposite. In practice, we take a reciprocal operator on the index to make it logically consistent. The reciprocal index is further taken logarithm to keep the magnitude of the estimated coefficient unchanged, i.e., $\ln(1/x) = -\ln x$). The timber price and wage rate refer to the average level in the local county. The t-test shows that after the CFTR, the transaction cost has experienced a significant decline at the 1% risk level, which might be due to the reform. Conversely, the timber price and wage rate have a rising trend. With regard to the forestland attributes, the forestland area refers to the area before transfer, while the area per plot is introduced to measure the fragmentation level [42]. For the household characteristics, the age and the education variables refer to the information of the household head. The leadership variable is equal to one if household members hold a cadre position in local governments or in the village committee. Likewise, if the village is located in mountainous regions and the roads in the local village are paved with a hard smooth surface, the mountain and road dummy variables are equal to one. Otherwise, the above three dummies are equal to zero. The county distance variable indicates the distance from the village to the closest county.

The expected signs of the estimated coefficients are also presented in Table 1. For most of the household characteristic variables, the signs can only be empirically determined. For instance, the existence of the life cycle effect makes the expected sign of the age variable ambiguous. Similarly, the potential of the economies of scale renders the estimated sign of the forestland area variable uncertain.

3.4. Estimation Method

In practice, the IV tobit model is estimated with a two-step estimator, proposed by Smith and Blundell [43]. In the first step, Equation (2) is estimated to obtain the consistent estimates of unknown parameters. Then the residuals are calculated. In the second step, the first-step residuals are inserted into the right-hand side of Equation (1) as an additional variable, and the equation is estimated using standard tobit model. As stated by Smith and Blundell [43], this procedure will yield consistent estimates of Equation (1), and is commonly adopted to address the censoring with endogenous explanatory variables [35]. If, in the second step, the estimated coefficient of the residual term is significantly different from zero, then the off-farm employment can be deemed endogenous. Otherwise, it is weakly exogenous [43]. Considering that the data used in this paper are the panel data, in the first step, the fixed effects (FE) estimator is employed on Equation (2), while in the second step, village dummies and year dummies are added to the right-hand side of Equation (1) to capture the unobservable heterogeneities and year-specific effects, at least to some extent (It should be noted that the FE estimator and the least squares dummy variables (LSDV) estimator will generate the same estimates. However, the coefficient of determination, denoted R^2, of LSDV is generally higher than that of FE, since the LSDV estimator estimates the individual-specific effects, which are eliminated during the estimation of FE. Thus, the residuals of Equation (2) are different under these two estimators. In the case of this paper, the R^2 of LSDV is 0.56, while it is 0.34 with FE (Table 2). This implies the

LSDV fits the model much better. Therefore, we take the residuals associated with LSDV into the second step of Smith-Blundell estimator, instead of that associated with FE. In addition, we did not adopt the FE estimator in the second step, since the FE tobit estimator will lead to an incidental parameters problem [44]). Before estimating the model, the explained and explanatory variables, except for dummy variables, are converted into the logarithmic form, and the variance-covariance matrix is estimated using the Huber-White robust estimator.

Table 2. Smith-Blundell estimates of household's decision on forestland transfer. Average partial effects (APE); fixed effects (FE); least squares dummy variables (LSDV).

Variables	First Step	APE of the Second Step	
		Rent-In	Rent-Out
Off-farm employment		−0.018 (0.012)	0.057 (0.014) ***
IV	3.864 (0.123) ***		
CFTR	0.502 (0.154) ***	3.865 (1.125) ***	2.852 (0.976) ***
Off-farm × CFTR		−0.033 (0.016) **	−0.021 (0.014)
Transaction cost	−0.076 (0.041) *	−0.394 (0.143) ***	−0.156 (0.082) *
Timber price	0.113 (0.239)	1.414 (0.401) ***	−0.657 (0.206) ***
Wage rate	0.419 (0.205) **	−0.581 (0.148) ***	0.242 (0.09) ***
Foreland area	−0.008 (0.038)	−0.037 (0.007) ***	0.109 (0.046) **
Area per plot	−0.001 (0.039)	0.058 (0.021) ***	−0.039 (0.008) ***
Age	2.946 (1.03) ***	−1.892 (0.512) ***	−13.424 (4.362) ***
Age square		0.135 (0.041) ***	1.718 (0.563) ***
Education	−0.028 (0.031)	0.054 (0.036)	−0.029 (0.005) ***
Leadership	−0.033 (0.131)	0.088 (0.06)	0.168 (0.088) *
Household income	0.377 (0.055) ***	0.162 (0.05) ***	−0.028 (0.004) ***
Household size	−0.338 (0.158) **	0.195 (0.089) **	−0.224 (0.041) ***
Mountain †		−3.308 (0.872) ***	0.248 (0.124) **
Road	−0.03 (0.115)	−0.107 (0.022) ***	−0.354 (0.077) ***
County distance †		4.573 (1.277) ***	−0.09 (0.026) ***
Village dummies	No	Yes	Yes
Year dummies	No	Yes	Yes
Constant	−21.528 (3.585) ***		
R^2, FE/LSDV	0.340/0.563		
Pseudo R^2		0.203	0.240
Observations/Censored	10,479	10,479/69	10,479/38
Exogeneity test			
Residual term, *t*-test		0.036 (0.012) ***	−0.067 (0.026) ***
Wald test		28.28 ***	77.04 ***
Hausman test	400.27 ***		
Instrument validation tests			
Kleibergen-Papp *LM*	738.97 ***		
Kleibergen-Papp Wald	835.89 ‡		
Cragg-Donald Wald	1429.98 ‡		

Note: The average partial effects are calculated based on the data of households with positive observations of the dependent variable. The standard error is reported in parentheses. *, ** and *** denote a statistical significance at the 10%, 5% and 1% levels, respectively. For the sake of brevity, the coefficients of year dummies and village dummies are not reported, but available upon requests from authors. † The variables of mountain and county distance are dropped in the first-step regression since there is no within-group difference for these two variables. ‡ The critical value of the Stock-Yogo test (10% maximal IV size) is 16.38.

4. Results and Discussion

4.1. Instrument Variable Justification

The first-step estimation of Smith-Blundell procedure is displayed in Table 2. It shows that households' behavior with regard to off-farm employment is strongly correlated with the lagged share of off-farm income, whose coefficient is the largest among all explanatory variables and is highly

significant at the 1% statistical level. As expected, the positive effect implies that households who have engaged in off-farm work in the last period are inclined to keep working on the off-farm sector in the next period. The strong correlation and high significance provide evidence that the second condition for an appropriate instrument is satisfied. Formally, both the Kleibergen-Papp and the Cragg-Donald Wald F statistics are much higher than the Stock-Yogo critical value of 10% maximal IV size, which strongly rejects the null hypothesis of the weak instrument. Furthermore, the Kleibergen-Papp LM (Lagrange multiplier) statistic suggests that the instrument passes the under-identification test at the 1% risk level. These results indicate our instrument is valid.

In the second-step estimation, the first-step residuals are included as an additional regressor. As argued by Smith and Blundell [43], this serves to test the null hypothesis that the off-farm employment can be treated as exogenous. Table 2 shows that both t-tests and Wald tests reject the hypothesis at the 1% significance level, no matter what directions of transfer. These results confirm that the off-farm employment cannot be deemed as an exogenous variable.

4.2. The CFTR Effects

Columns 3 and 4 of Table 2 present the estimation results of the forestland transfer behavior. The coefficients refer to the average partial effects (APE) on conditional means ($E[A|OF, R, X; A > 0]$). According to the results, the CFTR has a positive and significant effect on both the rent-in and rent-out behavior at the 1% risk. That is, Hypothesis 2 is supported by our empirical evidence. Compared to the case before the reform, the area of forestland rented in and rented out have increased by 3.87 and 2.85 times after the reform, respectively (Row 3 in Table 2). These empirical results are consistent with the descriptive statistics in Table 1, according to which the rent-in and rent-out experienced a significant increase after the reform. The positive effects are also consistent with the practical actions of the CFTR. For instance, with the implementation of the CFTR, forestland transfer is encouraged and promoted by central and local governments. In addition, public transaction platforms or forestland-based asset evaluation agencies have been established. All these actions would facilitate forestland transactions [4,5].

Table 3 reports the estimation results of the standard Tobit model (not addressing endogeneity), a standard linear IV model with panel data (not addressing censoring), and a standard linear model with panel data (neither addressing endogeneity nor censoring). A direct comparison suggests that some of estimated coefficients from these models are unreasonable and difficult to explain. For instance, except for the case of IV-FE, the estimated signs of the CFTR effect are always negative. In addition, the effect of off-farm employment on rent-in is positive with the FE and tobit model. The differences between standard tobit model and IV-tobit model results indicate the bias due to endogeneity. It is clear that our heavily censored dependent variable forecloses the use of linear models, as also suggested by the results reported in Table 3 for these specifications.

Table 3. Comparison of estimation results from different model specification.

	Rent-In			**Rent-Out**		
	FE	**IV-FE**	**Tobit**	**FE**	**IV-FE**	**Tobit**
Off-farm employment	0.01 (0.01)	−0.09 (0.14)	0.01 (0.01)	−0.00 (0.00)	−0.00 (0.10)	1.06 *** (0.32)
CFTR	−0.06 (0.05)	0.36 (0.59)	−0.02 (0.04)	−0.01 (0.03)	−0.01 (0.42)	−0.39 *** (0.08)
Off-farm × CFTR	−0.01 (0.01)	0.08 (0.14)	−0.03 ** (0.01)	−0.00 (0.00)	−0.00 (0.10)	−1.06 *** (0.33)
Transaction cost	−0.01 (0.00)	−0.01 (0.01)	−0.18 ** (0.08)	0.00 (0.00)	−0.00 (0.01)	−0.08 (0.05)
Timber price	0.17 *** (0.06)	0.20 *** (0.07)	1.36 *** (0.34)	−0.02 (0.04)	0.01 (0.05)	−0.79 *** (0.24)
Wage rate	−0.08 (0.05)	−0.05 (0.06)	−0.73 *** (0.17)	0.04 (0.04)	0.03 (0.04)	0.35 *** (0.12)
Foreland area	0.01 (0.03)	−0.02 (0.03)	−0.41 *** (0.13)	−0.01 (0.02)	−0.03 (0.02)	0.11 ** (0.04)
Area per plot	−0.00 (0.04)	0.03 (0.03)	0.06 *** (0.02)	0.01 (0.02)	0.03 (0.02)	−0.04 *** (0.01)
Age	1.04 (1.59)	−3.72 (3.60)	7.34 *** (1.82)	0.62 (1.32)	5.43 ** (2.70)	−12.18 *** (3.76)
Age square	−0.13 (0.22)	0.47 (0.47)	−1.08 *** (0.26)	−0.06 (0.17)	−0.68 * (0.35)	1.56 *** (0.49)
Education	0.01 (0.00)	0.01 (0.00)	0.08 ** (0.04)	0.01 (0.01)	0.01 (0.01)	−0.03 *** (0.01)
Leadership	0.00 (0.04)	−0.01 (0.05)	0.13 ** (0.07)	0.04 (0.03)	0.04 (0.03)	0.16 ** (0.08)
Household income	−0.03 * (0.01)	0.01 (0.01)	−0.05 *** (0.01)	0.00 (0.00)	0.00 (0.01)	−0.01 *** (0.00)

Table 3. *Cont.*

	Rent-In			Rent-Out		
	FE	**IV-FE**	**Tobit**	**FE**	**IV-FE**	**Tobit**
Household size	0.03 ** (0.04)	0.01 (0.04)	0.41 *** (0.13)	0.02 (0.04)	0.02 (0.04)	−0.21 *** (0.04)
Mountain	/	/	−1.44 *** (0.31)	/	/	0.76 *** (0.27)
Road	−0.04 (0.03)	−0.05 (0.03)	−0.15 *** (0.02)	0.01 (0.03)	0.01 (0.03)	0.26 ** (0.12)
County distance	/	/	1.72 *** (0.43)	/	/	−1.16 *** (0.36)
Observations	11,976	10,479	11,976	11,976	10,479	11,976

Note: The coefficients of the tobit model refer to the APE, which are calculated based on positive observations of the dependent variable. The robust standard error is reported in parentheses. *, ** and *** denote a statistical significance at the 10%, 5% and 1% levels, respectively. The variables of mountain and county distance are dropped in the FE and IV-FE regression since there is no within-group difference for these two variables.

4.3. The Off-Farm Employment and Interaction Effects

With regard to forestland rent-in, as expected, the estimated coefficient of off-farm employment is negative but is not significantly different from zero. It is worth noting that the model setup of containing an interaction term means that the coefficient of off-farm employment only represents its effect on forestland transfer before the CFTR, thus, the insignificance of the off-farm employment variable does not necessarily indicate that off-farm work has no significant effect on forestland rent-in. To examine the overall effect of off-farm employment, we re-estimated the forestland transfer equation without the interaction term. The results showed that the off-farm employment indeed imposes a significantly negative effect on forestland rent-in at the 1% statistical level. The APE suggests that a 1% increase in the share of off-farm income from total income would reduce the area of forestland rent-in by 5.09% (The regressions without the interaction term are conducted for both rent-in and rent-out behavior. For the sake of brevity, the estimation results are not reported in this paper, but are available upon requests from the authors).

An intriguing finding is that the interaction term is negative and significant at the 5% risk level in the rent-in equation, which supports the assertion in Hypothesis 3 that an enhancement effect of the CFTR exists in forestland rent-in behavior. As shown in the first-step regression (Column 2 in Table 2), the CFTR plays a positive and significant effect on off-farm work at the 1% level. That is, households engage in more off-farm work after the CFTR, which makes households' propensity to rent-in forestland to decline. This indicates that, besides the direct negative effect, the CFTR can indirectly reduce forestland rent-in through increasing off-farm employment.

It is worth noting that the effect of off-farm employment has experienced a shift from being statistically insignificant before the reform to being significant after the reform. For the pre-CFTR case, the legalized transaction market was not established, therefore, it was difficult for households with low off-farm employment to find forestland to transfer in. This may be a reasonable explanation for the insignificance the off-farm effect before the reform. By contrast, with the implementation of the CFTR, it has become much easier for the households to search transaction information and transfer in forestland. To some extent, this may reflect the fact that the CFTR can facilitate the effective functioning of the forestland rental market.

For the rent-out behavior, off-farm employment has a positive effect before the CFTR, which is also significant at the 1% statistical level. This is in line with the trade-off in allocating labor between forestland management and off-farm employment [35]. However, the *t*-test on the interaction term fails to reject the null hypothesis that the corresponding coefficient is zero. That is, the enhancement effect in case of rent-out is not warranted by our empirical evidence. Additionally, although statistically insignificant, the negative sign of the estimated coefficient of the interaction term is somewhat difficult to interpret. Given the positive effect of the CFTR on off-farm employment, the question remains as to why households do not transfer out more forestland when they work more on off-farm activities after the reform. We conjecture that this might result from a special mental illusion, which is called the endowment effect by Thaler [45], specifically, that individuals generally demand much more compensation to give up a good than they would be willing to pay to acquire

it. Psychologically, this effect is a reflection of the loss aversion in the evaluation of prospects and trades [46], and implies that the measures of willingness to accept would exceed measures of willingness to pay [47]. Hence, a price discrepancy is generated between owners and potential buyers, thus the transaction set would be reduced correspondingly [48].

In the case of this paper, through allocating collective forestland to individuals, the collective forestland has, de facto, become part of the households' endowment. As discussed above, the existence of endowment effect may mean that the compensation that households desire to obtain from transferring out forestland would exceed the rent that the tenants are willing to pay. Therefore, the CFTR imposes an endowment effect, which is negative, on households' forestland rent-out decision. That is, the positive enhancement effect of the CFTR on forestland rent-out through off-farm employment might be neutralized by the negative endowment effect of the CFTR on forestland rent-out through entitling forestland to households as endowments. This makes households not transfer out more forestland after the reform even though they participate more off-farm work, which explains the insignificance of the interaction term.

Analogous to the rent-in case, we also performed a regression without the interaction term in order to test the overall effect of off-farm employment on forestland rent-out. The results showed that off-farm work plays a significantly positive effect on forestland rent-out at the 1% risk level, and a 1% increase in the share of off-farm income would stimulate a rise of forestland area of rent-out by 3.64% (The regressions without the interaction term are conducted for both rent-in and rent-out behavior. For the sake of brevity, the estimation results are not reported in this paper, but are available upon requests from the authors). Combined with the case of rent-in, it can be found that Hypothesis 1 is verified by our empirical evidences.

4.4. Other Determinants of Forestland Transaction

Table 2 shows that the transaction cost plays a negative role in both rent-in and rent-out behavior, and the effect is significant at the 1% and 10% statistical level, respectively. A striking finding is that forestland area and household size impose a significantly negative and positive effect on forestland rent-in, respectively. That is, forestland is transferred from households with more arable land and fewer labor to the land-poor and labor-ample ones, which strongly supports a factor equalization effect of land rentals [8,15]. This adjustment of the labor-forestland ratio among households also provides a preliminary evidence that forestland transfer would improve the allocative efficiency and promote forestland productivity. For other variables, the estimation results are generally consistent with theoretical anticipations.

5. Conclusions

Using the case of China's CFTR, we have examined the effects of policy-induced institutional change and off-farm employment on forestland transfer. Particular interest was focused on the plausible interaction effect between the CFTR and off-farm employment. The Smith-Blundell IV-tobit estimator was used to control the potential endogeneity of off-farm employment. The results show that the CFTR indeed promotes forestland transfer significantly, as desired by policymakers. With regard to off-farm employment, it imposes a negative and positive effect on forestland rent-in and rent-out, respectively, and is significant at the 1% statistical level. It is worth noting that rent-in and rent-out denote the demand side and the supply side of the land rental market, respectively, and a well-functioning land market requires the mutual development of both the demand and the supply sides. Hence, the opposite signs of the off-farm employment effect suggest a dilemma of policy intervention: If policymakers desire to promote forestland transfer through off-farm employment, they have to face a trade-off between the impediment on the demand of forestland transfer and the promotion on the supply of forestland transfer. The overall effect depends on the intensities of these two contradictory effects. At least for our sample, the APE illustrates that the negative effect on the demand side (−5.09, Section 4.3) dominates the positive effect on the supply side (3.64, Section 4.3),

that is, off-farm employment might not be a desirable means to stimulate the development of forestland rental market.

Furthermore, we also find the CFTR has a significantly positive effect (Row 3 in Table 2) on off-farm employment. That is, besides the positive effect on forestland transfer, an additional benefit of the CFTR is to promote more farmers to engage in off-farm activities, which can be expected to improve households' income and livelihood in the long term. However, it should be noticed that these benefits might come along with a risk of cost. Specifically, as discussed above, more off-farm employment would impose a net negative effect on forestland rental, at least based on our estimates. More interestingly, the interaction effect is verified for forestland rent-in, namely, the CFTR imposes an enhancement effect on forestland rent-in through influencing the behavior of off-farm employment. However, the counterpart for rent-out is not statistically supported. That is, the effect of off-farm employment on forestland rent-out does not exhibit statistical differences between pre- and post-CFTR, even though households engage in more off-farm work after the reform. A possible explanation is that the positive enhancement effect of the CFTR on rent-out through off-farm employment is dominated by the negative endowment effect of the CFTR.

On the whole, the development of forestland rental market is influenced by the tenure system and the functioning of the parallel labor markets. However, the effect of off-farm employment is a double-edged sword, which has the contradictory effects on the demand and supply sides of forestland transactions. This paradox should be recognized by policymakers, especially for the negative effect on forestland rent-in. Compared to the off-farm employment, institutional reform may be a more feasible and effective tool to activate forestland transfer. After all, the CFTR is found to significantly promote the occurrences of rent-in and rent-out simultaneously. Presently, although the property rights of forestland have been clarified, there are still several institutional constraints to hinder households' behavior on forestland cultivation, including, for example, harvesting quota system and timber circulatory system. In the next step of the CFTR, removing these institutional restrictions and deepening the CFTR might be beneficial to forestland transfer. In addition, as a special psychological response in the process of forestland rent-out, the endowment effect should be paid more attention. Currently, the information on households' willingness to accept when transferring out forestland is still very limited. Academic measurements of this effect should take top priority.

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