Article

Assessments of landowners' willingness to accept compensation for participating in forest certification in Shandong China

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Abstract: Achieving sustainable management of forests in China is becoming increasingly important with more awareness and realization of the importance of forests in environmental protection. Forest certification, a market-based instrument to promote sustainable forest management, has been recognized by many countries including China. While landowners' perception and perspective regarding this voluntary program have been well-documented in literature, how to motivate and incentivize landowners to participate in forest certification remained under-studied questions. With the face-to-face survey of landowners in Shandong, China, this study analyzed landowners' willingness to accept compensation for participating in forest certification. Results indicated that landowners average accepted compensation, in terms of increased timber price, was about RMB120 (~$17.2)/m^3 to have their forests certified. Results from multiple regression showed that the level of such compensation required for certification adoption was influenced by ownership size, owners' demographics, certification program requirements, as well as importance placed on timber sale. These findings would inform policy-makers in designing compensation-related polices and establish incentive-based mechanisms to motivate landowners participate in forest certification programs in China.

Keywords: Forest certification; Willingness to accept; Compensation; Landowners; Timber price increase

1. Introduction

Achievement of sustainable forest management for environmental, social and economic benefits is the aim of China's modern (after 1990s) forestry development as natural forests are being depleted because of over-harvesting of timber in the history [1-3]. In China, example practices of sustainable forest management include restoration of degraded landscape and improvement of forest ecology and biodiversity through government initiatives and policies [3]. Forest certification as a market-based mechanism has been recognized in China in the 1990s and the function in promoting forest management level has also been affirmed. Therefore, China began to explore and develop forest certification systems since 2001 based on China's forestry conditions and thus far, China has three major certification programs including Forest Stewardship Council (FSC), Programme for the Endorsement of Forest Certification schemes (PEFC), and China Forest Certification Council (CFCC). Although there are differences in the certify standards and process, they all envision sustainable and responsible management of forest resources.

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China has made a great progressive in forest certification over the past decade such as the certified forests area has experienced a great increase; specifically, the area of certified forests has exceeded 9 million hectares in 2016 [4]. By definition, forest certification is a program established by non-government agencies to promote sustainable forest management and actually, this program also provides an opportunity for landowners to have a formal and independent assessment for their property according to the predefined sustainable management standards [5]. As a result, improve landowners' knowledge and understanding for forest certification and motivate them to participate in this program also plays a significant role for meeting the objective of sustainably and responsibly manage the forest resources globally.

Regarding the research of forest certification among landowners, existing literature mostly focused on the research areas of identifying landowners' concerns and challenges to participate in forest certification as well as investigating their perceptions and attitudes toward certification program. For example, one key concern for landowners to have their property certified was the costs associated with certification [6-17]. To be specific, Tian et al. [16] reported that increased management costs was significantly and negatively associated with landowners' willingness to participate in forest certification. Studies also showed that the stringent requirements of certification program such as requirement of a written management plan [7,9,16,17] was another landowner's concern for seeking forest certification. The last but not the least, lack of price premiums and market preference [8,9,11,16,18] for certified timber was also an important barrier for landowners to adopt forest certification.

In addition, numerous studies have attempted to identify profiles of landowners who are likely to participate in forest certification program. For example, both Tian et al. [17] and Ma et al. [13] stated that landowners who were wealthier and more educated appeared to be more likely to participate in forest certification; in addition, some studies [19, 20, 21] indicated that female landowners were more inclined to engage in environmental-friendly programs including certification program. Moreover, research has shown that landowners' occupation was also an influencing factor for their likelihood of participating in forest certification [22,23,13,16,17]. The explanation was that landowners' familiarity with programs and forestry practices because of their forestry-related occupations might increase their interests in participation. Besides, landowners with larger/more acreage size of forestland and those who intent to harvest timber shortly were more likely to adopt certification than otherwise [13,16,17]. Furthermore, research of Bell et al. [22] and Tian et al. [17] reported that landowners who have a management plan for their forestland were more likely to adopt certification than their counterparts, which was ascribed to landowners' previous experience with forest management positively associated with their willingness to participate forest stewardship programs.

Literature thus far provides a good perspective on landowners' awareness and perceptions of forest certification and their potential concerns/challenges. What is scarce in certification literature is an estimation of compensation necessary for landowners to certainly participate in certification program. Since landowners considering to enroll in certification may face a small cost of participation (e.g. third-party verification fee, potential harvest reduction, added cost in implementation of best management practices), it may not be financially worthwhile for many without some compensation or increase in timber price. In addition, understanding what specific attributes of forest ownership, landowners demographics, and requirements of certification program schemes impact the necessary compensation is important in designing incentive-based programs. Therefore, the objectives of this study were to 1) investigate landowners' familiarity and attitudes toward forest certification, 2) examine differences in ownership and forestland characteristics among subgroup landowners, and 3) estimate landowners' average willingness to accept compensation for participating in forest certification and identify factors influencing it.

2. Materials and Methods

2.1. Data Collection

Data for this study was collected in 2016 from Shandong province of China using a face-to-face survey of randomly selected landowners. The survey area covered six heavily forested cities which included Taian, Jinan, Linyi, Liaocheng, Jining, and Weifang. The questionnaire was filled by totally 557 landowners and 50 of them did not finish the questions in the survey, so we had 507 usable completed survey. Survey questions primarily included Likert scale items in terms of landowners' familiarity (1 = not familiar at all, 5 = extremely familiar) with forest certification and their level of interest (1 = not interest at all, 5 = very interest) in participating forest certification. We also included an open-ended willingness to accept compensation question asking about landowners' minimum acceptable timber price increase (RMB/m^3) from the average of past 15 years for certainly participating in forest certification program. Specifically, respondents were asked to indicate the percentage increase in stumpage price (relative to current price) for them to consider certainly participating in certification program. Other survey questions mainly included questions regarding ownership and forestland characteristics, requirements of forest certification program, and sociodemographic information about landowners [16,17]. In addition to the survey questions, the secondary data of poplar timber price and timber production per hectare [24] was also collected.

2.2 Empirical Model

Following Lindhjem and Mitani [25] and Beach et al. [26], landowners willingness to accept (WTA) compensation can conceptually be specified as a function of resource conditions (e.g., forestland condition), ownership characteristics, conservative program (e.g., forest certification) requirements, and market drivers (e.g., interest rate, timber price etc.). specifically, the function is expressed as (Eq. 1):

$$WTA = f(FR, OC, PR, MD) \quad (1)$$

Where: FR is a vector of forestland characteristics such as land size, harvesting plan etc., OC includes owners sociodemographic variables such as age, gender, income and education etc. PR denotes a vector of variables associated with certification program design characteristics such as weather required a management plan for participating forest certification etc. MD mainly represents the market driver variables such as timber price and interest rate etc.

The econometric estimation approach employed in this research was multivariate ridge regression, in which dependent variable was landowners acceptable timber price increase (RMB/m^3) for participating in forest certification. Landowners willingness to accept compensation was measured in terms of percentage increase in timber price from the average price of past fifteen years. The other options could have been direct subsidy or payment from government or other entities to participating landowners. However, in the absence of such programs, increase in timber revenue through higher timber price was used instead to elicit willingness to accept value. Respondent indicated percentage increase timber price was multiplied by the average timber price at the time of the survey (RMB660/m^3) to quantify the monetary amount of compensation. Independent variables consisted of variables related to ownership and forestland characteristics (e.g., tenure and land size), owner sociodemographic, as well as program design characteristics. Table 1 presents the description, mean and standard deviation (S.D.) for both dependent and potential influential explanatory variables that were used for empirical analysis. The specific mathematic expression of the model estimated is presented in Equation (2):

Compensation for adopting forest certification = f (Sociodemographic, Ownership size, Tenure, Acquisition Mode, Management Objectives, Harvest history, Owners Familiarly and Interest in Certification Program, Percentage of Return from Forest) (2)

The group of forest resource characteristics (FR) variables mainly included forestland size, management objective of forestland, acquisition mode of forestland, tenure, timber harvest history, and weather have a management plan. The management objective related variables primarily referred to the importance of forestland for recreation (e/g., family gathering, scenic view etc.) and timber

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production, as well as in protecting nature and biodiversity. Acquisition mode of forestland mainly included purchase, inherit, and trade/rent those three options. Timber harvest history consisted of variables of whether landowners harvested timber in the previous five years and weather they intent/plan to harvest timber in the coming five years. The sociodemographic variables (OC) collected in this study primarily consisted of age, gender, education, income, and occupation. Besides, we also considered the effect of landowners living area which included metropolitan area/suburb area, town/county, and rural/village area, as well as their return from forestland which was measured as the percentage of annual household income from forestland. The specific description for those variables were included in Table 1. The third category of program design characteristics (PR) included different variables in terms of certification program requirements. Specifically, whether certification program required landowners to have a management plan for participation, whether required a periodical on-site inspection and use a professional forester to manage and harvest timber, as well as whether required landowners to be involved in some part of certification process. In addition, we also considered variables related to landowners familiar and interest degree for forest certification (Table 1).

Table 1. Explanatory variables used to explain landowners accepted compensation for adopting forest certification

Variable	Mean (S.D.)	Description
Dependent variable		
PRICEINC	153.50 (81.91)	Minimum increase in timber price required for respondents to surely participate in forest certification (RMB/m^3)
Independent variables		
Forest resource characteristics		
SIZE	139.9 (91.20)	Hectares of forestland being owned by landowners
IMPBIO	3.55 (1.27)	Importance of forestland in protecting nature and biodiversity (1 = not important, 5 = extremely important)
IMPREC	2.71 (1.08)	Importance of forestland for recreation (1 = not important, 5 = extremely important)
ACQIZ	2.92 (1.30)	Acquisition mode of forestland (1 = purchase, 2 = inherited, 3 = rent/traded)
TENURE	21.89 (20.48)	Number of years forestland has been owned by landowners
FUHAR	0.92 (0.85)	Dummy variable, whether landowners intend to harvest timber in the near future (1 = Yes, 0 = No)
MANAPLAN	0.52 (0.50)	Dummy variable, whether landowners have a management plan (1 = Yes, 0 = No)
Certification program design characteristics		
RMNP	0.70 (0.58)	Dummy variable, whether required to have management plan (1 = Yes, 0 = No) for participation
ROPI	0.31 (0.32)	Dummy variable, whether required a periodical on-site inspection (1 = Yes, 0 = No)
RPFMH	0.65 (0.28)	Dummy variable, whether required to use a profession forester to manage and harvest forestland (1 = Yes, 0 = No)
RICP	0.63 (0.45)	Dummy variable, whether required to be involved in some part of certification process (1 = Yes, 0 = No)
RIRP	0.48 (0.47)	Dummy variable, whether make inspection summary results to the public (1 = Yes, 0 = No)
Sociodemographic variables		
AGE	37.81 (8.77)	Age of landowners (years)
GENDER	1.29 (0.45)	Gender of landowners (1 = male, 2 = female)
EDU	2.21 (1.28)	Highest grade of school that landowners completed (1 = High school degree/vocational training, 2 = Did not complete high school, 3 = Bachelor/higher)

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INCOME	2.30 (0.85)	Annual income level of landowners (1 = Less than RMB 20,000, 2 = RMB 20,000-50,000, 3 = RMB 50,000-75,000, 4 = >RMB 75,000)
OCCU	3.97 (1.82)	Occupation of landowners (1 = Forester/loggers/miner, 2 = Professional manager, 3 = Government employee, 4 = Farmer, 5 = Retired/businessman/others)
LIVAREA	2.49 (1.30)	Landowners living community (1 = Metropolitan area/suburb area, 2 = town/county, 3 = rural area/village)
DEPFOR	39.97 (28.73)	Percentage of household income come from their forestland (%)
Market Drivers		
IMPTIM	3.62 (1.29)	Economic importance of forestland for timber sale (1 = not important, 5 = extremely important)
Others		
FAMI	2.47 (1.08)	Landowners familiarity with forest certification (1 = not familiar at all, 5 = very familiar)
INTERE	3.33 (1.02)	Landowners interest in adopting forest certification (1 = not interested at all, 5 = very interested)

3. Results

3.1. Landowners' knowledge and attitudes toward forest certification

Familiarity with forest certification among landowners was very low. Almost 38% of the respondents reported that they had never heard of the concept (not familiar at all) before receiving the survey; and about 20% of the respondents indicated that even they heard forest certification before (slightly familiar), but did not understand its meaning. About 22% of the respondents indicated that they had at least a minimal understanding of forest certification (very familiar), and only 2% of the respondents said that they had an extensive understanding of forest certification (extremely familiar).

Even landowners had a low familiarity with forest certification, after giving them a brief description and introduction for forest certification such as the associated benefits for adopting forest certification and the purpose of certification etc., about 63% of the respondents expressed some of interests in participating in forest certification. To test the hypothesis that landowners might be more interested in adopting forest certification if they were more aware of this concept, we used Kendall's rank correlation tau to examine their correlation. The correlation result ($p = 0.22$) suggested that there was no significant correlation between them, so the premise was incorrect.

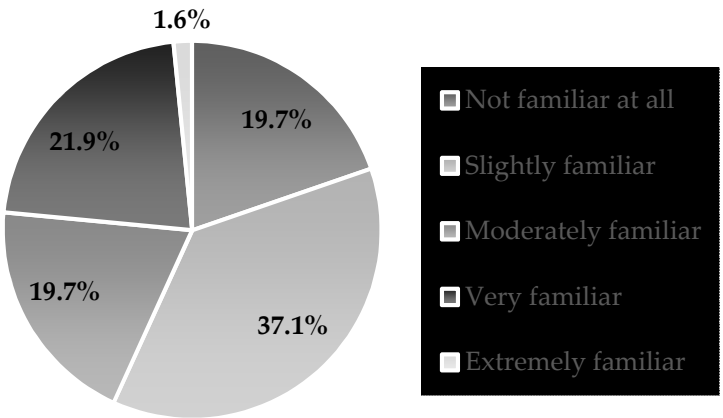

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Figure 1. Familiarity with forest certification among respondents

3.2. Characteristics of subgroup landowners

We classified the respondents into different subgroups according to their familiarity with forest certification program (Table 2). Respondents in the familiar group (n = 117) were those who reported that they understood the basic concepts or general certify process or have involved in the certify process before. By contrast, the respondents in the not familiar group (n = 388) were those who never heard the concept before or have heard it but did not know/understand what it means before receiving our survey. Results of ANOVA tests indicated that there were typological differences in terms of respondents' socio-demographics and their forestland characteristics between those two subgroups. No significant difference was found in the average age between those two subgroups, but marked distinction was found in their education level, income level, as well as occupation. Specifically, the percentage of respondents in the familiar group who gained a bachelor/higher degree (76.9%) was significantly higher than not familiar group (56.2%), while percentage of who did not complete high school in this group (1.7%) was much lower than not familiar group (14.9%). In terms of income level, 17% of respondents in the familiar group had an annual income level greater than RMB 75,000 whereas this number was only 6% in not familiar group. By examining the respondents' occupation, results suggested that over half of the respondents (57.3%) in familiar group were professional managers while almost half of the respondents in not familiar group were farmers (49.7%). In addition, the forestland characteristics were also examined for those two subgroups and no substantial difference was found for tenure, importance of timber production, and weather to harvest timber in the near future (Table 2). Landowners in both groups put high importance in timber production and they both intent to harvest timber in the near future. The average forestland size was about 125 hectares in not familiar group and it was around 192 hectares in familiar group. In terms of weather have a management plan for their forestland, a relatively higher percent of respondents in the familiar group (62%) had a management plan than those in not familiar group (49%). Regarding landowners' future plan of forestland, most of respondents in both groups would continue to self-manage it, whereas 16% of respondents in not familiar group planned to sell/rent out, but only 6% in familiar group.

Table 2. Demographics and ownership characteristics among forest owner subgroups.

	Familiarity with forest certification	
	Not Familiar	Familiar
Average age	38[a]	39[a]
Education		
--High school degree/vocational training (%)	28.9[a]	21.4[a]
--Did not complete high school (%)	14.9[a]	1.7[b]
--Bachelor/higher (%)	56.2[a]	76.9[b]
Income		
--< RMB 20,000 (%)	14.9[a]	12.0[a]
--RMB 20,000-50,000 (%)	53.9a	44.4[ab]
--RMB 50,000-75,000 (%)	25.3[a]	26.5[a]
-->RMB 75,000 (%)	5.9[a]	17.1[b]

Occupation		
--Forester/loggers/miner (%)	2.6[a]	2.6[a]
--Professional manager (%)	26.0[a]	57.3[b]
--Government employee (%)	5.7[a]	10.3[a]
--Farmer (%)	49.7[a]	9.4[b]
--Retired/businessman/others (%)	16.0[a]	20.5[a]
Average ownership size (hectares)	124.8[a]	192.4[b]
Tenure (year)	23.4[a]	17[a]
Have a forest management plan (%)	49.2[a]	61.5[b]
Importance of timber production (5 scales)	3.57[a]	3.80[a]
Intend to harvest timber in the near future	58.8[a]	59.8[a]
Future plan of forestland		
--continue to self-manage it (%)	66.5[a]	72.6[a]
--sell/rent it (%)	15.7[a]	6.0[b]
--pass it to family (%)	17.8[a]	21.4[a]

3.3. Landowners' accepted compensation and affecting factors

To get a ballpark estimation for landowners accepted compensation to certify their forestland, the average timber production of 100.3 m^3/ha with a general 10 years' rotation was gathered from Tian and Lu [24]. Results of survey data revealed that landowners accepted minimum timber price increase was averaged 18% from current timber price for respondents to certainly have their forestland certified. Also, the calculated expected/average poplar timber price was around RMB 660/m^3 based on past 15 years' price (2005-2020) (Figure 2); as a result, the accepted timber price increase for respondents to participate in forest certification was around RMB120/m^3. Using the timber production data and price increase data, the minimum accepted compensation for respondents to participate in forest certification was estimated at RMB1200/ha.

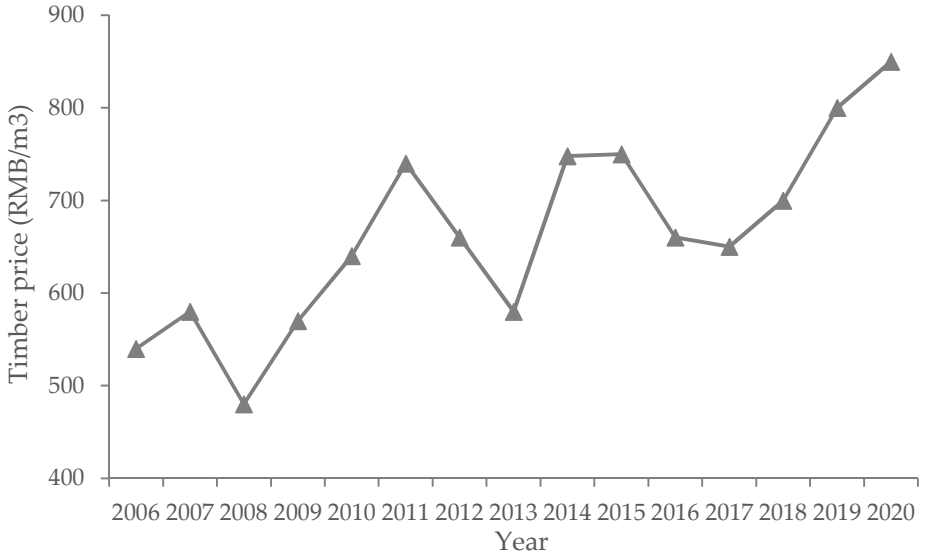

Figure 2. Poplar timber price, 2005-2020 (RMB/m^3)

Multicollinearity was examined by calculating the index of variance inflation factors (VIF) among all independent variables (Table 3) and results showed that they were less than critical threshold of 10 [27], indicating that multicollinearity was not a concern in this model. Regression results were summarized in Table 3. The results revealed that variables in the sociodemographic group, both age and gender variables were not significantly related to respondents' WTA compensation for participating in forest certification; similar results were found for income and

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education variables. As expected, the percentage of landowners' annual household income depending on forests ($p < 0.01$) had a significant and positive association with respondents acceptable compensation. This positive coefficient indicated that the greater landowners' annual household income depended on forests, the more compensation was demanded for them to adopt forest certification. Similarly, the positive coefficient before living area ($p < 0.05$) suggested that respondents who lived in rural/village area demanded a greater WTA compensation to have their forestland certified.

The results of the forestland and ownership characteristics group indicated that tenure was significantly ($p < 0.001$) and positively related to a respondent's WTA compensation for certifying their forestland. A similar result was observed for the acquisition mode of forestland ($p < 0.05$), indicating that if a landowner rented/traded for his/her current managed forestland, he/she needed a higher WTA amount than those who inherited it. As expected, forest land size was significantly ($p < 0.01$) and negatively associated with respondents' WTA for certification adoption, which suggested that landowners who indicated to have a smaller size forestland demanded a relatively higher WTA compensation to enroll in forest certification. The dummy variable representing whether the respondents' intent/plan to harvest timber in the coming five years had a positive and significant ($p < 0.01$) relationship with WTA, suggesting that if a landowner plans to harvest timber in the near future request a higher WTA than their counterparts. Regarding the forestland management objective variables such as the importance of managing forestland for recreation and protecting biodiversity, both of them was significantly and positively ($p < 0.01$) related to respondents' WTA.

The certification program design characteristics category included different requirements of certification program after participating, specifically, requirements of having a management plan, on-site inspection, having a professional forester to manage and harvest forestland, as well as involvement of certification process and publishing summary inspection results to the public. Among those variables, results indicated that there was a significantly positive ($p < 0.001$) association between requirement of having a management plan with respondents accepted compensation for adopting forest certification. A similar result was found for requirement of using professional forester/loggers ($p < 0.001$) to harvest forestland; both results suggested that if certification program requires landowners to have a management plan and hire trained foresters/loggers to harvest timber after certifying, they would demand higher compensation amount for participating in certification program.

Regarding the variable in the group of market drivers, results suggested that the economic importance of timber sales was significantly and positively ($p < 0.05$) associated with respondents' WTA. The positive coefficient was expected and indicated that if a landowner places a high importance in the economic benefits of timber production, he/she would request a greater WTA for certifying their forestland. Regarding the variables describing respondents' familiarity and interests in forest certification, results in this research revealed that there was no significant association between them with respondents' WTA.

Table 3. Results of ridge regression affecting factors for landowners WTA compensation to have their forestland certified

Significant variables	Coefficient	S.E.	VIF
DEPFOR	0.06	34.57**	1.49
LIVAREA	6.59	2.91*	1.17
TENURE	0.72	0.22***	1.62
ACQIZ	10.36	2.92*	1.15
SIZE	-0.02	0.009**	1.23
FUHAR	14.46	6.85**	1.69
IMPBIO	7.44	3.71**	1.73
IMPREC	7.67	4.22**	1.54
RPFMH	18.50	4.83***	2.96

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RMNP	23.45	5.89***	2.49
IMPTIM	6.84	3.92*	2.07

*** p = 0.001; ** p = 0.01; and * p = 0.05. VIF: variance inflation factors.

4. Discussion

The survey results of this study indicated that landowners in Shandong province have a generally low familiarity with forest certification, which was consistent with the previous associated studies [28,14,16,17]. The study of Chen et al. [28] found that, in China, wood products manufactures were not familiar with forest certification either. The correlation results suggested that there was no significant association between landowners' familiarity with forest certification and their willingness to participate in this program. This was not in lines with studies of Mercker and Hodges [29] and Sun et al. [30], who reported that there was a positive association between landowners' knowledge of forest certification and their likelihood of participating.

Significant differences were found in landowners' demographics between familiar and not familiar group. In terms of education and household income, familiar group landowners were more educated and had a higher income level than those in not familiar group, which was consistent with He et al. [15], who stated that education was positively associated with landowners familiarity with forest conservation programs. In addition, results indicated that occupation was associated with landowners familiarity with forest certification since almost two thirds of landowners in familiar group worked as a forester/logger or professional managers. Regarding ownership variables, we found a significant difference in ownership size between these two subgroups, suggesting a positive association between ownership size with a landowner's familiarity with forest certification. Between two subgroups, a significant difference was found in the availability of a written forest management plan, which implied a positive correlation between weather have a management plan and landowners familiarly with forest certification.

Regression results of this study displayed that a landowner's minimum accepted compensation for participating in forest certification was influenced by a series of ownership and forestland characteristics. Among the sociodemographic variables, a positive and signification coefficient was found for the variable of income dependence on forests, which implies that if a landowner's household livelihood is depending more on forestry-associated activities such as timber harvesting, he/she would demand a higher compensation for participating in forest certification. Similarly, those who lived in a rural/village area requested more compensation for them to have their forestland certified, which possibly because landowners in this area are more financially reasoned to own forestland. In addition, variables of education and income were both not significantly associated with landowners' requested compensation to seek forest certification. This finding was in lines with Kline et al. [19], who stated that willingness to accept compensation for landowners to participate in forest conservation program was quite consistent among different income categories.

Landowners who owned large acreage size of forestland required less compensation to surely have their forestland certified. This observation was not particularly surprising considering that average per unit certification cost would be lower for large forestland size than small size of forestland, and this result was consistent with studies Kilgore et al. [18] and Bateman et al. [31]. As expected, forest owners who indicated high importance of their forestland in protecting nature and biodiversity as well as high importance in providing recreation values demanded a higher compensation to enroll in forest certification. Landowners would expect a higher compensation amount to pay off their benefits reduction from timber activities for providing the public benefits such as protecting the biodiversity. In terms of landowners' tenure of forestland, results showed a positive and significate relationship with their WTA compensation, which indicated that landowners who owned forest land a longer time period would request a higher compensation. It is possible that landowners with a longer tenure would be more inclined to keep their forests in current conditions instead of changing based on standards/requirements of other programs such as certification program. Study of Poudyal et al. [32] stated that tenure had a negative association with landowner intentions to convert forestlands. Therefore, landowners who owned forests for a longer period of

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time would demand a higher WTA to participate in forest certification. Regarding landowners' future harvesting plan, we found a positive association with the requested compensation, which suggested that a higher WTA was expected for adopting certification if they intend to harvest timber in the near future.

Positive and significant association was found between different requirements of forest certification program and landowners WTA compensation for adoption. Specially, if the certification program request landowners to use a profession forester to manage and harvest their forestland after certifying, landowners would demand a higher WTA compensation than otherwise. Moreover, landowners indicated a higher WTA if the certification program require them to have a written management plan after participation. The possible reason behind those two observations was that hiring a professional forester or having a written management plan might indirectly increase their management costs. In addition, landowners who highly valued the economic benefits of timber sale from their forestland demanded high willingness to accepted compensation for participating in forest certification.

5. Conclusions

Overall, this study sheds some light on the analysis of landowners' preference and willingness to accepted compensation for adopting forest certification in China. Compensation needed for landowners, in terms of increased timber revenue, to consider participate in certification program was estimated at RMB120/m^3 to have their forestland certified. In other words, it may be the case that landowners might not find it financially worth participating unless the timber price increases by this amount. This finding may be helpful to government agencies and non-government institutions that are currently considering designing incentive mechanisms to encourage landowners' participation. Moreover, this compensation amount was influenced by a group of ownership and forestland characteristics. For example, to encourage/motivate landowners participating in forest certification, a greater/higher compensation might be required for those whose annual household income was heavily depending on forest-related returns. On the contrary, lower compensation might be enough for landowners with larger acreage size.

In addition, a few caveats of this study should be noted. First, landowners willingness to accepted compensation was computed by averaging 15 years' poplar timber price which actually is changeable and uncertainty with market condition. Second, a future study of identifying landowners desirability to learn about forest certification and their preferred and accepted learning methods (e.g., workshop, webinar, or video conference etc.) would be needed to improve landowners awareness and familiarity with forest certification in China. Third, establishment of incentive-based mechanisms might be necessary and essential to increase landowners' likelihood to participate in certification program.

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