Original Research

Effectiveness of Unleashing the Value of Ecological Products for Sustained Income Growth Among Farmers: Evidence from China

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Abstract

Development inequities and environmental pressures are both growing globally. We must actively investigate green development strategies to address the problems of development inequality. First, using RIF regression, we find that releasing the value of ecological products has a considerable beneficial influence on farmers' income. We also utilised quantile regression to find that the effect of income rise was stronger for low-income earners than for high-income earners, confirming the conclusion that the gap might be narrowed. Then, using regressions of moderating effects, we investigate how we can sustain this efficacy and discover that social capital, collective action, and institutional provision can play key positive moderating roles. Finally, we employ heterogeneity analysis to find that the longer the time period, the more effective the income growth, with the northeastern region seeing poor income gains due to intensive industrial development patterns. The findings offer policy suggestions for developing countries to alleviate development inequities.

Keywords: ecological values, income generation, cleaner development, heterogeneity

Introduction

A national soil erosion area of 2,692,700 square kilometers and a desertification area of 2,611,600 square kilometers were approved by the Communique on China's Ecological and Environmental Situation 2021. The average temperature across the country was 10.53ºC, the highest since 1951, and 30.8% of cities reported suffering acid rain. This demonstrates that environmental issues still exist. Prices do not accurately reflect costs since the ecological environment has clear externalities and the private cost of exploiting resources is lower than the social cost [1]. Market players are unwilling to engage in ecological protection behaviors since they do not profit from preserving the environment [2]. In the past, governments have dealt with environmental governance by imposing resource usage restrictions, levies, and subsidies [3]. Later mainstream economists promoted internalizing environmental externalities, recognizing public

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resources as private property rights, and offering incentives to private landowners to manage and conserve resources [4]. Traditional private owners, however, have not been fairly compensated for this, which has had a negative impact on the long-term preservation of the ecosystem [5]. Making sure that everyone benefits financially from environmental protection is essential for strengthening the endogenous motivation for market participants to take part. As a result, releasing ecological values to produce effective and sustainable revenue and to close the gap is a crucial issue that is currently pertinent in managing the environment and reducing development inequities.

The goal of ecological product value realization is to convert natural wealth into economic wealth, and economic wealth into more natural wealth, and so on and so forth, in order to achieve greater overall value in the future; the process of transformation is, in fact, the process of investment [6]. Since the piloting of the ecological product value policy, experience in natural capital accounting and the realization of ecological product values has been gained, which can be broadly divided into four realization models [7]. The first is the industrialized business model. Ecological industrialization management is fundamentally an economic activity process centered on the creation and reproduction of ecological products [8]. Natural ecological products produced and processed by humans condense human labor, making them valuable in use and value [9]. The second is the compensation model for environmental protection. Bind ecological and physical product sales, strengthen green and organic agricultural product certification, and increase the added value of physical ecological products [10]. The goal of ecological compensation is to raise the cost of environmental damage and the benefits of environmental protection while decreasing negative externalities [11]. At present, China's ecological compensation methods include taxing pollution, providing incentives for environmental protection, and using taxes to assume responsibility for environmental repair [12]. The third is the value-added premium model. The essence of ecological value-added premium is to develop ecological agriculture, ecological industry, and ecological tourism in accordance with local conditions through ecological restoration, governance, and comprehensive development to achieve ecological premium [13]. Currently, successful experiences in the remediation and treatment of mines, wetlands, and soils, as well as the development of ecological cultural tourism, have been gained, such as the ecological restoration of coal mining subsidence areas in Pan'an Lake, the ecological restoration of abandoned mines in Caojiafang, and the comprehensive treatment of mountains, forests, fields, lakes, and grasses in Xunwu County. Fourth is the indicator trading model [14]. The goal of ecological indicator trading is to give monetary value to ecological property rights, monetize ecosystem functions, and use market mechanisms to influence people's behavior in order to solve environmental externalities [15]. Rural areas have a large number of idle resources. Farmers' resources

are currently assigned market prices, transactions are conducted on market platforms, and economic benefits are obtained [16].

With the success of local examples, a large number of villages have followed suit leading to similar tourism development projects across the region, which lack market appeal. Not only did they fail to promote regional industry development and consumer spending, but they also wasted resources. First, this is due to slow institutional growth. With ambiguous regulations and unsure policies, the legislation intended to guarantee the realization of the value of ecological products is essentially in limbo [17]. It is challenging to unleash the value of ecological goods in a sustainable manner since the property rights of natural resources are not clearly established, and the rights and obligations of central and local governments are not apparent. Second, there is insufficient social capital engagement. Government financial resources are constrained, and many ecological projects run the risk of being abandoned due to a lack of funding [18]. To achieve industrialized ecological product management, the function of a single government funding source is constrained and it is essential to fully exploit the potential of numerous market participants [19]. In order to finance ecological compensation initiatives, we need to mobilize social capital [20]. Third, this is due to the dilemma of collective action. The process of collaboration is prone to collective action challenges because many participants in the process of environmental governance are rational economic agents who make strategic decisions based on factors intended to maximize their personal interests [21]. Due to widespread free-riding and the absence of regulations, collaborative decision-making, and punitive mechanisms, resources are being used excessively and uncontrollably [22].

In summary, academics have made significant advances in their research on the value of ecological products, but there is still much more to be done. To begin with, the existing literature quantifies ecological value but lacks quantification of the level of realization of ecological value and does not address the current situation of ecological product value realization. Second, while many qualitative studies have focused on the specific path of the realization of the value of ecological products, few quantitative methods have been used to demonstrate what the realization of the value of ecological products can bring to rural residents. What methods are employed to modify this outcome? What are the differences in value realization across time and space?

This study contributes to the existing literature from two aspects. First, we develop a system of applicable indicators based on four models: industrialised operation, ecological protection compensation, value-added premium, and indicator trading, to give standards for measuring the realisation of ecological values in each region. To the best of our knowledge, this is the first attempt to create indicators for the realisation of ecological value. Second, two pieces of evidence are presented in this work. 1) We find that the income enhancement
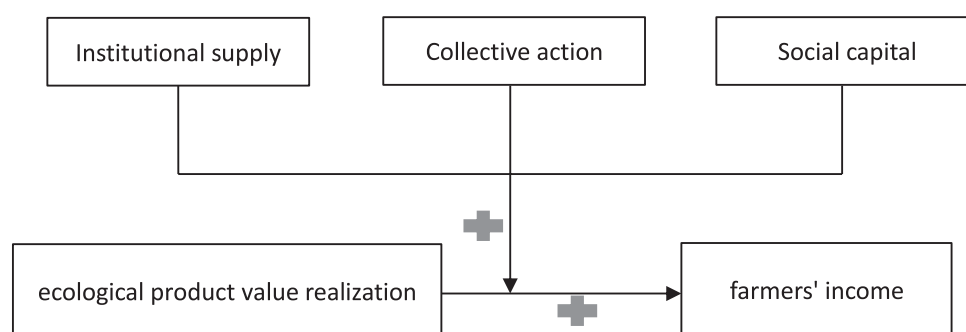
Fig. 1. The impact model of "ecological product value realization" and "sustained income growth".

impact is stronger for low-income groups than for high-income groups using different quantile regressions. This indicates that releasing ecological values can boost farmer revenue and eliminate inequities. 2) Using regressions with a moderating model, we discover that social capital, collective action, and institutional provision all have a significant positive moderating influence. This illustrates that social capital, collective effort, and institutional supply are critical to releasing ecological values that can enhance incomes in a sustainable and effective manner.

Methods and Data

Data

The concept of ecological products was first introduced in the State Council's National Plan for Main Function Zones in 2010, and the various databases have been updated to 2020, so the data time in this paper is from 2010 to 2020. Data were gathered from provincial statistical yearbooks, the China Statistical Yearbook, the China Environmental Statistical Yearbook, the China Social Statistical Yearbook, provincial and municipal government work reports, provincial rural property rights trading information service websites, and the EPS Global Database, the WIEGO Database, the China Green Food Development Center Database and the Beida Faber Database. Hong Kong, Macau, Taiwan, Tibet and Hainan were deleted due to serious missing data, and the remaining 29 provinces (cities) were finally selected for analysis in this paper. The number of property rights trading projects transferred and listed projects is obtained from the crawlers of each province's agricultural exchange network, and missing values are filled in using the interpolation method.

Variables and Descriptive Statistics

Explained variables. Farm household income and the urban-rural income gap are the explanatory variables used in this paper. Given that household size varies,

Table 1. System of indicators for realising the value of ecological products.

Target level	Guideline level	Indicator level	Literature Sources
Value realization of ecological products	Industrialization	Ratio of green food base per unit area	[8, 9, 10, 23, 24, 25, 26]
		Per unit of green food production materials certified products	
		Intensity of fertilizer use	[11, 12, 27, 28, 29, 30]
		Intensity of pesticide use	
	Compensation for ecological protection	Expenditure on natural resources, marine meteorology, etc.	
		Agriculture, forestry and water expenditure	
		Energy saving and environmental protection expenditure	
	Value added premium	Area of mine ecological restoration	[13, 14, 31]
		Forestry Engineering Construction	
		Soil erosion control	
	Indicator Trading	Number of items transferred in property transactions	[16, 17, 32, 33, 34]
		Number of listed items for property transactions	

Control variables. As control variables in this study, the indicators of the rural population [35, 36], a number of graduates from higher education institutions [37], the total power of agricultural machinery [38, 39], rural electricity consumption [40], rural minimum subsistence expenditure, primary health care institutions [41], road route mileage [42], and total crop sown area are chosen [43].

the larger the household size, the better the health and education status of the household members, and the higher the statistical household income. As a result, it is more scientific and reasonable to characterize the situation using the per capita disposable income of rural households. Despite the elimination of absolute poverty, relative poverty persists, and the proportion of relatively poor people in rural areas is higher than in urban areas, highlighting the urban-rural divide. As a result, we define the income gap between urban and rural areas by comparing the income levels of urban and rural residents.

Explanatory variable. The explanatory variable used in this paper is "value realization of ecological products". To the best of our knowledge, this is the first time we have developed an indicator system for it. Based on the present four methods for realising the value of ecological products (industrial operation, ecological protection compensation, value-added premium, and index trading), we design a guidance layer. The entropy approach is used to calculate the evaluation value of "value realization of ecological products". The chosen indicators are listed below:

Moderating variables. In this paper, the moderating variables are social capital, collective action, and institutional provision. Because the number of social organizations in large cities is greater than in small cities, social capital is measured in terms of social organizations per 10,000 people [44]. This allows the confounding effects of city size to be avoided. The production and trade of ecological goods is dependent on autonomous organizations, the members of which form a community of interest, and the larger the number

of members, the greater the scope for collective action. As a result, the number of members of autonomous organizations is used to assess collective action [45]. The Beihang University Faber database was used to retrieve the number of local laws and regulations, local government regulations, and local normative documents on environment and ecology in each region from 2010 to 2020, and the institutional supply was calculated accordingly [46].

Descriptive Statistics

Table 2 shows that the minimum value of rural residents' per capita income is RMB 3424.70 and the maximum value is RMB 34,911.30, and the mean value of the ratio between urban and rural residents' income levels is 2.67 and the maximum value is 4.07. This indicates that there is a significant disparity in rural residents' income as well as between urban and rural areas. The mean and maximum values of rural residents' per capita income show that there is still much room for improvement in the income of the majority of rural residents. As a result, the sample chosen is appropriate for researching the academic issue of the impact of realizing the value of ecological products on income.

Methods

The RIF regression method proposed by Firpo et al is used in this paper to examine the impact of releasing the value of ecological goods on rural incomes and the urban-rural income gap. [47] In comparison to

Table 2. Results of descriptive statistics.

	Variables	Mean	Standard deviation	Min	Max
Explained variables	Per capita disposable income of rural households (y_1)	12081.86	5679.49	3424.70	34911.30
	Comparison of income levels between urban and rural residents (y_2)	2.67	0.46	1.85	4.07
Explanatory variables	Value realization of ecological products (environment)	0.59	0.12	0.20	0.91
Moderating variables	Social organizations per 10,000 people (C_1)	14.33	10.48	3.19	64.09
	Collective action (C_2)	9.42	6.64	0.90	32.90
	Institutional supply (C_3)	39.82	26.88	2.00	201.00
Control variables	Rural population (X_1)	2024.77	1292.82	212.00	5784.00
	Total power of agricultural machinery (X_2)	3479.63	2922.11	94.00	1335.00
	Rural electricity consumption (X_3)	299.38	423.22	3.80	2011.00
	Total area sown to crops (X_4)	5655.22	3733.05	88.60	14910.10
	Expenditure on rural minimum living standards (X_5)	316154.10	208142.90	11258.30	1084000.00
	Number of graduates from higher education institutions (X_6)	118901.50	65169.16	5784.00	302728.00
	Number of health care facilities (X_7)	31630.65	21013.72	3878.00	83972.00
	Road route mileage (X_8)	153768.60	77527.11	11974.00	394371.10

conventional regression, the recentring impact function regression method can mitigate the endogeneity problem caused by omitted variables. [48] The following is the model design strategy: First, regressions are run to test the impact of realizing the value of ecological goods on rural residents' income and the urban-rural income gap using conditional means. To test the impact of the realization of the value of rural ecological products on the income gap among rural residents, quantile regressions were run on the 10th, 50th, 75th, and 90th quartiles. Second, the same regressions were run with the explanatory variables replaced to test the model's robustness. Finally, the moderating effect model was used to validate the role of social capital, collective action, and institutional supply as moderators.

This paper builds a RIF model based on conditional means to test the impact of releasing the value of ecological products on rural residents' income and the urban-rural income gap.

$$\text{RIF}(y_{1it}; v(F_{y_{1it}})) = \partial_0 + \partial_1 environment_{it} + \mu_1 X_{it} + \varepsilon_{1it} \quad (4)$$

$$\text{RIF}(y_{2it}; v(F_{y_{2it}})) = \beta_0 + \beta_1 environment_{it} + \mu_2 X_{it} + \varepsilon_{2it} \quad (5)$$

y_{1it} is the per capita disposable income of rural households, y_{2it} is the comparison of income levels of urban and rural residents, $v(F_{y_{1it}})$ is the mean value of income, $v(F_{y_{2it}})$ is the mean value of the comparison of income levels of urban and rural residents, $environment_{it}$ is the value realization of ecological products, x_{it} is a series of control variables, and ε_{it} is a random disturbance term.

This paper chooses regressions at the 10th, 50th, 75th, and 90th quartiles to test the effect of releasing the value of ecological products on income gap within the rural population;

$$Q_{y_{1it}}(\tau|environment_{it}) = \alpha_0 + \alpha_1(\tau) + \alpha_2(\tau)environment_{it} + \mu_3 X_{it} + \varepsilon_{3it}$$
$$(6)$$

$Q_{y_{1it}}(\tau|environment_{it})$ is the conditional quantile of disposable income per rural household in the above equation, and the coefficient in equation (6) will change as the quantile changes.

The moderating effect model is used to test the moderating effects of social capital, collective action, and institutional supply. The moderating variable is C_{it}. If the coefficients γ_0 and γ_1, δ_0 and δ_1, are in the same direction, the moderating variable has a positive moderating effect and vice versa.

$$\text{RIF}\left(y_{1it}; v(F_{y_{1it}})\right) = \text{cons}_1 + \gamma_0 environment_{it} + \gamma_1 environment_{it} * C_{it} + \mu_4 X_{it} + \varepsilon_{4it} \quad (7)$$

$$\text{RIF}\left(y_{2it}; v(F_{y_{1it}})\right) = \text{cons}_2 + \delta_0 environment_{it} + \delta_1 environment_{it} * C_{it} + \mu_5 X_{it} + \varepsilon_{5it} \quad (8)$$

Results and Discussion

RIF Regression

The regressions in columns (1) and (3) of Table 3 are both significantly positive at 1%, with rural residents' per capita disposable household income as the explanatory variable and the inclusion of all and some control variables, respectively. This suggests that releasing the value of ecological products can increase rural residents' income. Columns (2) and (4) use a comparison of income levels among urban and rural residents as explanatory variables, and include all and some of the control variables, respectively, with the regression results being significantly negative. This suggests that releasing the value of ecological products can help to close the income gap between urban and rural areas.

Quantile Regression

To examine the effect of releasing the value of ecological goods on the income gap within rural residents, we selected regressions at the 10th, 50th, 75th and 90th quartiles. The results of the quantile regression with disposable income per rural household as the explanatory variable are shown in Table 4. Impact coefficients of 0.317 and 0.332 for quintile 10 and 50 are greater than those of 0.238 and 0.237 for quintile 75 and 90. As the quantile rises, the impact factor decreases. This suggests that releasing the value of ecological products has a greater driving effect on the low-income group of rural residents than the high-income group.

Robustness Tests

While the use of RIF benchmark regression in this paper mitigates the problems caused by omitted variables, the model may still have the following two issues. One, there may be an inappropriate selection of explanatory variables and the income indicator may be subject to short-term fluctuations, resulting in an inaccurate model. Second, there may be an endogeneity issue of reverse causality between the explanatory variables. The robustness testing strategy is as follows: First, considering that consumption is less volatile relative to income, it also better reflects the welfare status of farm households. As a result, in this paper, the explanatory variables are replaced with rural residents' consumption expenditure and a comparison of consumption levels of urban and rural residents in a RIF regression. Second, this paper selects general public service expenditure to measure the level of public services as an instrumental variable. The rationality lies in the fact that the higher the level of local public services, the smoother the transformation of the production, exchange and consumption links of ecological products, and the more efficient the realization of the value of ecological and ecological products, but the level of local public services

Table 3. RIF regression results.

Variables	(1)	(2)	(3)	(4)
Environment	0.578***	-0.078**	0.521***	-1.316***
	(8.43)	(-2.17)	(10.45)	(-6.21)
X_1	-0.075	0.255***		
	(-0.59)	(3.77)		
X_2	0.393***	-0.079*		
	(4.44)	(-1.70)		
X_3	0.154***	0.002		
	(3.11)	(0.07)		
X_4	-0.092	-0.187***	0.125*	-0.243***
	(-1.03)	(-4.00)	(1.84)	(-6.91)
X_5	-0.032	0.110***	0.017	0.158***
	(-0.46)	(3.00)	(0.26)	(4.74)
X_6	0.674***	-0.361***	0.819***	-0.348***
	(11.05)	(-11.25)	(17.12)	(-14.04)
X_7	-0.275***	-0.040	-0.140**	0.046
	(-2.82)	(-0.78)	(-2.28)	(1.44)
X_8	-0.332***	0.157***	-0.537***	0.218***
	(-3.50)	(3.14)	(-6.01)	(4.70)
cons	0.000	2.672***	0.000	3.449***
	(0.00)	(148.40)	(0.00)	(27.26)

Note: *p<0.1, **p<0.05, ***p<0.01.

does not act directly on income. Therefore, the choice of public service level meets the requirements of relevance and exogeneity of the instrumental variable. The results all passed the test.

Moderation Mechanisms Tests

This research develops a moderating effects model based on previous theoretical work to investigate the moderating processes of social capital, collective action, and institutional provision. Columns (1) and (5) in Table 6 have been validated by the baseline regressions in the previous paper. Columns (2), (3), and (4), which use rural residents' income as the explanatory variable and include the interaction terms of collective action, social capital, and institutional supply in turn, show that at the 1% level, the realization of the value of ecological goods is significantly positive, and each interaction term is also significantly positive. This suggests that collective activity, social capital, and institutional supply can mitigate the income-generating effect of unleashing the value of natural products. Columns (6), (7) and (8) use the urban-rural income gap as the explanatory variable, and add the interaction terms of collective action, social capital and institutional supply in turn. The results

show that the ecological product value realisation has a significant negative relationship, and each interaction term is also significantly negative. This indicates that collective action, social capital and institutional supply have a positive moderating effect on the effect of ecological product value realisation in reducing the urban-rural gap.

Regional Heterogeneity Tests

As demonstrated in the preceding section, releasing the value of ecological products can help to increase incomes and reduce inequities; however, the regression findings vary greatly across geographical samples. Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan are classed as the east, Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu Qinghai, and Ningxia as the west, and Liaoning, Jilin, and Heilongjiang as the northeast. Table 7 shows that, first, there is an income-generating effect of releasing the value of ecological products in the east, center, west, and northeast. The northeast has the smallest income-generating effect of any. Second, releasing the value of ecological products helps to close the deficit in the

Table 4. Quantile regression results.

Variables	q10	q50	q75	q90
Environment	0.317***	0.332***	0.238***	0.237***
	(8.22)	(4.91)	(3.32)	(2.83)
X_1	-0.271**	-0.471***	-0.566***	-0.566***
	(-2.47)	(-6.65)	(-4.66)	(-4.83)
X_2	0.282***	0.437***	0.408***	0.416***
	(9.21)	(4.82)	(5.35)	(4.85)
X_3	0.051	0.180***	0.248***	0.224***
	(0.65)	(2.69)	(3.81)	(4.05)
X_4	-0.004	0.004	-0.067	-0.110*
	(-0.04)	(0.06)	(-0.99)	(-1.84)
X_5	-0.019	-0.053	0.038	-0.022
	(-0.39)	(-0.79)	(0.43)	(-0.37)
X_6	0.514***	0.435***	0.385***	0.420***
	(8.21)	(6.43)	(5.14)	(8.73)
X_7	-0.159***	-0.091**	-0.052	-0.093
	(-3.46)	(-2.03)	(-0.66)	(-1.21)
X_8	0.073	0.159***	0.173***	0.199***
	(0.99)	(3.54)	(3.74)	(4.00)
cons	-0.400**	-0.036	0.098	0.258**
	(-2.42)	(-0.39)	(1.07)	(2.09)

Note: *p<0.1, **p<0.05, ***p<0.01.

eastern and western regions, but not in the central and northeastern regions. The reason for this is that the industrial structure of the central and northeastern regions is skewed towards heavy industry, making it difficult to avoid waste and pollutant emissions and posing serious challenges to realizing the value of ecological products, weakening the effect of closing the income gap.

Table 5. Rusults of robustness tests and endogeneity test.

Variables	Robustness tests				Endogeneity test			
					Stage 1	Stage 2	Stage 1	Stage 2
	y_1	y_2	y_1	y_2	Environment	y_1	Environment	y_2
Environment	0.652***	-0.229***	0.613***	-0.326***		2.453***		-0.064***
	(9.84)	(-5.16)	(12.64)	(-10.19)		(3.38)		(-3.07)
General public service expenditure					0.226***		0.623***	
					(3.12)		(6.02)	
Control variables	Control	Control	Non-control	Non-control	Control	Control	Control	Control
cons	-0.000	2.417***	-0.000	2.417***	-0.000	-0.000	1.188***	0.875***
	(-0.00)	(109.24)	(-0.00)	(105.65)	(-0.00)	(-0.00)	(4.76)	(25.51)

Note: *p<0.1, **p<0.05, ***p<0.01.

Table 6. Regression results for moderating mechanisms.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Environment	0.578***	0.383***	0.359***	0.754***	-0.078**	-0.144***	-0.047**	-0.072***
	(8.43)	(3.04)	(6.08)	(7.59)	(-2.17)	(-4.61)	(-2.60)	(-3.42)
Environment *C_2		0.329***				-0.333***		
		(3.57)				(-4.07)		
Environment *C_1			0.393***				-0.016**	
			(12.32)				(-2.53)	
Environment *C_3				0.083**				-0.016**
				(2.15)				(-2.34)
Control variables	Control	Control	Control	Control	Control	Control	Control	Control
Cons	0.000	0.705***	-0.176***	0.135*	2.672***	2.188***	0.733***	0.674***
	(0.00)	(2.85)	(-5.59)	(1.77)	(148.40)	(22.83)	(15.64)	(15.43)

Note: *p<0.1, **p<0.05, ***p<0.01.

Table 7. Regression results for regional heterogeneity tests.

Variables	y_1				y_2			
	East	Central	West	Northeast	East	Central	West	Northeast
Environment	0.577***	0.638***	0.772***	0.195*	-0.388*	-1.188	-0.352***	-0.556
	(3.05)	(6.08)	(6.13)	(1.74)	(-1.70)	(-1.89)	(-5.84)	(-0.32)
Control variables	Control	Control	Control	Control	Control	Control	Control	Control
Cons	-0.000	-0.000	0.000	0.000	2.160***	1.532	3.102***	-2.714
	(-0.00)	(-0.00)	(0.00)	(0.00)	(17.06)	(2.18)	(110.44)	(-1.05)

Note: *p<0.1, **p<0.05, ***p<0.01.

Table 8. Regression results for temporal heterogeneity tests.

Variables	y_1			y_2		
	(1)	(2)	(3)	(4)	(5)	(6)
	2016-2020	2013-2015	2010-2012	2016-2020	2013-2015	2010-2012
Environment	0.476***	0.419***	0.333**	-0.916***	-0.833**	-0.509*
	(5.21)	(3.29)	(2.00)	(-7.07)	(-2.45)	(-2.01)
Control variables	Control	Control	Control	Control	Control	Control
Cons	-0.000	-0.000	-0.000	1.141***	2.034*	1.044***
	(-0.00)	(-0.00)	(-0.00)	(14.33)	(2.10)	(7.17)

Note: *p<0.1, **p<0.05, ***p<0.01.

Temporal Heterogeneity Tests

The time period is divided into three sections in this paper: 2010-2012, 2013-2015, and 2016-2020. While ecological policies are gradually created, the influence of releasing the value of ecological products on farmer income and disparities is investigated. Table 8 columns (1) to (3) regress each of the three stages using rural household disposable income per capita as the explanatory variable, and the results show that the value realization of ecological products is consistently and significantly positive as time migrates, with a gradual

upward trend in the coefficient. This suggests that as the value realization of ecological products grows, the income-generating effect will gradually increase. Columns (4) to (6) demonstrate that the value realization of ecological products is always notably negative over time, with the absolute value of the coefficient increasingly increasing. This suggests that as the value realization of ecological products grows, the significance of bridging the urban-rural income gap becomes more apparent.

Discussion

In general, releasing the value of ecological products is indeed effective in increasing income. However, three facets of the idea that releasing the value of eco-products can be useful in boosting income in a sustainable way are reflected. First, there is sufficient social capital to participate. Rural acquaintance "society"'s potential trust and relationship network plays a significant part in the process of realising the value of ecological goods by facilitating the integration of rural ecological and social resources. Environmental management and protection are subject to "free-riding" because they are a common good. The normative component of social capital promotes self-control, self-regulation, and self-management in farmers. The government's absence of two-way environmental management can be compensated for by the introduction of social capital in the process of realising the value of ecological products. It can also create a system for coordinating environmental interests between the government and villages. Second, to avoid collective dilemma. Farmers' interest groups improve the efficiency of resource use, integrate information, capital, and other factors, and increase the capacity to mitigate market risks by centralising the management of dispersed individual and ecological resources. The group's foundation is founded on the pursuit of similar interests, and the value of rural ecological products is realised via a shared desire to safeguard the natural world. Group organisations gather individual information and vote collectively to ensure that individual rationality and collective interests coincide in the decision of realising the value of ecological products. This is done because individual rationality and collective interests of participants sometimes do not coincide, and the phenomenon of "free-riding" may easily occur, causing a collective action dilemma. Third, there are reasonable institutional arrangements. The establishment of production standards for ecological goods, the ability to set appropriate punishments and rewards, and the smooth operation of market exchanges for indicators and goods are all made possible by institutional arrangements related to ecological governance. Power rent-seeking and the loss of plentiful natural resource assets can be stopped by effective institutional provision. In addition to stabilising farmers' income expectations, more secure ecological resource property rights can help

lessen uncertainty in business dealings between various parties. The more standardised the behaviour of the subject and the object, the more explicit the definition of property rights, the more clear the power and duty of the subject, and the lower the transaction costs. In addition, we further explore the impact of releasing the value of ecological products on income growth in terms of regional and temporal heterogeneity. The northeastern region of China, which has a heavier industrial development pattern and more traditional sectors, performs the lowest in terms of revenue creation performance, according to our findings. When we examine the history of how policies have been implemented, we can observe that as time goes on, the impact on revenue generation gets more obvious. This demonstrates once further that promoting the value of environmentally friendly items does genuinely work to boost income.

Conclusion

The indicators of "value realization of ecological products" developed in this paper are based on four existing practise models in China. This serves as a baseline for gauging the level of "ecological product value realisation" at this point. This paper uses panel data from 2010-2020 to provide evidence of the effectiveness of releasing the value of ecological products to increase farm household income. Effectiveness becomes more evident over time, but is not evident in the Northeast because of the heavy industrial development pattern. We used a variety of robustness tests and endogeneity debates to verify the paper's conclusions.Further research evidence suggests that social capital, collective action, and institutional provision play a key role in order to sustain the effectiveness of income generation. We should construct an evaluation system for social organisations' participation in ecological protection, and grant commensurate preferences for financial and ecological services based on social organisations' high ratings, to encourage their active participation. We can employ village collective organisations to combine resources and unify planning in order to promote resource efficiency and market risk prevention. Ecological value cannot be realised without market transactions, and we must do a good job of supplying the system and clearly defining the attribution of rights and obligations for ecological product transfer, assignment, lease, mortgage, and stock ownership.

Currently, the success of rural eco-projects in some parts of China has led to a scramble to follow suit, which is a concerning issue. Each location has a unique development model, and simply copying ecological projects from other locations may result in a waste of resources rather than an improvement in farmer income. There is an urgent need to investigate the conditions that will allow the ecological value of the rural to achieve sustained revenue growth. While most

scholars are studying what specific ecological projects, we are studying what conditions are built for ecological projects. This research concludes that there are three factors to establishing sustainable and successful revenue production using a moderating effects model. First, we must create a system in which resources can be sold and market obstacles may be removed. Second, because government financing is limited, we must actively engage social organisations. Third, we must harness the force of China's specific village collective organisations to strengthen collective action unity. This paper is a study of the Chinese issue, and more research in other countries is needed to deepen our understanding of transition conditions.

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Conflict of Interest

The authors declare no conflict of interest.

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