

# Influencing factors of undergrowth economic growth from the perspective of linear analysis

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**Abstract**—In order to build a comprehensive and systematic management mechanism of forest management, make full use of limited forest land resources, and achieve the goal of sustainable development, this paper summarizes the influencing factors of current undergrowth economic development. Therefore, this paper proposes a linear analysis of the factors affecting the undergrowth economic growth. According to the current situation of economic development under forest, the model structure is designed in the view of linear analysis. In addition, the basic principles involved in the linear analysis are analyzed, and the multiple linear regression model is established to analyze the influencing factors of undergrowth economic growth. The results show that the method is effective and provides technical support for the rapid development of undergrowth economy.

**Keywords**—Economic growth, forest resources, influencing factors, linear analysis, undergrowth economy.

## I. INTRODUCTION

WITH the acceleration of ecological construction, the economic development of state-owned forest areas has been affected. Under the existing conditions, the space of increasing yield per unit area of traditional agricultural and forestry crops becomes very limited. In order to better promote the development of forestry economy, it is necessary to make full use of forestland to open up new planting channels and develop understory economy [1]. And the state-owned forest is the state-owned timber forest base, is the key force to ensure the economic growth, protect the ecological environment. Therefore, this paper studies the current situation of the development of the state-owned undergrowth economy,

determines the relevant factors of the development of the undergrowth economy, and simulates the future development, which has practical and theoretical significance for promoting the development of the state-owned undergrowth economy and the national forestry economy [2]. Forestry is one of the basic industries in China. Total forestry investment from 2011 to 2015 to maintain a stable annual growth rate of about 10%. In 2015, the total investment in forestry reached 20.497 billion yuan, of which 7.178 billion yuan came from the state budget, accounting for 37.61% of the total investment in forestry; And 8.688 billion yuan was raised by the government itself, an increase of 2.435 billion yuan or 38.94% over 2014. According to the content of construction, the investment in ecological construction and protection is 8.345 billion yuan, accounting for 43.92% of the total investment in forestry, 7.611 billion yuan in the development of forestry industry, 661 million yuan in the forestry livelihood project, and 1.601 billion yuan in other funds. By the end of 2015, 1949 million mu of forest land in China's provinces could be reached. The province's forest coverage rate was 59.57 percent, the forest stock volume was 484 million cubic meters, and the total output value of the forestry industry was 279.9 billion yuan. From 2016 to 2020, afforestation projects will cover 21080 hectares, including forestation of 10073 hectares for forestry ecological demonstration projects and afforestation of 11007 hectares for famous economic forests. The total investment of the project was 475.55 million yuan. Of this total, 19.34 million yuan was allocated from the central government budget, 77.34 million yuan from local governments and 204.81 million yuan was raised by project developers themselves. The coexistence of undergrowth economy with traditional forestry and modern agriculture has become a new situation for forestry development. With the change in the form of forestry industry, the state's six key forestry projects have entered a period of "consolidation of achievements", and the reform of the state's

collective forest ownership system has entered a stage of "deepening". Forestry has shifted from wood production to ecological construction, and the form of forestry has shifted from traditional single tree planting to coexisting with modern agriculture, secondary and tertiary industries. The main body of forestry management has expanded from the state and the collective to other enterprises, institutions, forest workers or farmers in the society. Undergrowth economy can further expand the field of forest economy, promote the increase of farmers' income and consolidate the achievements of ecological construction. Therefore, understory economy has a promising prospect in China. How to tap the potential of forest land resources under the premise of ensuring the ecological benefit of forest land, maximize the economic efficiency of forest land resources, enrich forest farmers and serve the construction of new countryside has become the focus of people's attention, and is also one of the new research contents in the field of forestry economy. Due to the late emergence of the undergrowth economy in China, it is still in the early stage of development and needs to be explored and improved. At present, there is still a lack of theoretical research on undergrowth economy, and the influencing factors related to undergrowth economy development need to be further understood. At present, some relevant scholars proposed to use the SWOT-AHP analysis method to set 14 indicators from the advantages, disadvantages, opportunities and challenges of undergrowth economic development, so as to analyze the influencing factors of undergrowth economic development, so as to appropriately choose its development path [3]. Some scholars have also proposed the use of the Probit model, based on the theory of farmers' behavior, and the survey data of 220 households in Sanming City, Fujian Province, to analyze the influencing factors of farmers' willingness to develop forest economy in Fujian province from the micro level [4]. The paper theoretically analyzes the influence mechanism of carbon sequestration afforestation project on county economic development, and estimates the average effect and dynamic effect of carbon sequestration afforestation project on county economic development by using PSM-DID model with the panel data of several counties, and verifies the influence mechanism [5]. Carbon sequestration afforestation projects promote local economic development by optimizing local industrial structure, increasing residents' savings rate and improving local governments' financial revenue and expenditure.

However, the above methods seldom consider the development of forestry eco-circular economy, and the analysis results are difficult to adapt to the economic development concept of sustainable development. Therefore, from the point of view of ecological construction, the paper puts forward the analysis of the influencing factors of the economic growth under the forest from the perspective of linear analysis. Design the model structure in linear analysis. Expand the analysis of the basic principles involved in the modeling in the linear analysis perspective, establish a multiple linear regression model, and

analyze the influencing factors. To build a forestry economic system with comprehensive and sustainable economic benefits, on the basis of promoting sustainable economic and social development, we should promote the construction of ecological civilization and achieve the goal of building an ecological home. As a new kind of ecological circular economy, the undergrowth economy makes full use of forest land resources, space and unique forest ecological environment, vigorously develops undergrowth and breeding, develops circular economy, increases the economic income of forest farmers, and achieves the goal of sustainable development.

## II. CURRENT SITUATION OF ECONOMIC DEVELOPMENT UNDER FOREST

In order to more intuitively show the development of China's undergrowth economy, the total output value of China's undergrowth economy from 2012 to 2020 is analyzed, and the specific data is shown in Fig. 1.

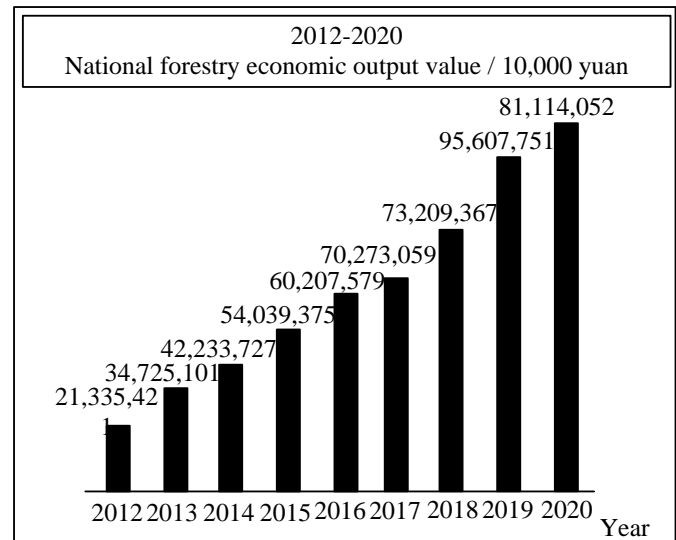


Fig. 1 total output value of national undergrowth economy from 2012 to 2020

Under the guidance of the theory of forestry ecological economy, on the basis of ecological carrying capacity, relying on forest land resources, supported by industrial technology, the undergrowth economy is a compound industry, which makes full use of the land resources and shade space under the forest, planting, breeding and service. We should make full use of the forest resources, change the single forest production mode to the compound management mode of forest birds, forest animals, forest fungi and inter forest planting, so as to enhance the comprehensive performance of forestry and improve the continuity of the economic development of the state-owned forest area. In the new economic system of forestry industry, the unitary wood production is difficult to meet the economic benefit demand. More and more people realize the importance of developing forest economy, which has gradually become a key project in forest management. However, due to the late start of sustainable development of China's forestry industry; There is still a gap with some countries with rich experience abroad. China's undergrowth economic development is still in its

infancy, the resource structure and system have not been reasonably developed and used, the technical means are relatively backward, and the industrial structure is not perfect. To effectively improve the level of forestry economic development, we must attach importance to the forest industry, effectively integrate the management system, and make the development of forestry industry more scientific and comprehensive.

#### A. Forest Resource Level

Forest is our country's precious natural resources and wealth. According to statistics, by 2011, the forest coverage rate in China was 20.36%; The forest land area was 305.9041 million hectares, including 195.4522 million hectares of forest area; the total standing stock was 14912.6819 million cubic meters, including 13720.8036 million cubic meters of forest stock [6]. The abundant forest resources in the forest cover area also provide the development space for the development of the undergrowth economy in China. China's forest areas are distributed all over the country, with various types of landforms, and the natural conditions have their complexity with different regions. The climate, vegetation and soil have both the regularity of spatial distribution and the regularity of vertical distribution, so they are suitable for the growth of a variety of economic crops, and the undergrowth economic model is diverse. For example, the forest economy of Pingjiang County in Hunan Province is developed under the condition of abundant forest resources.

Many forest areas in China have excellent ecological environment, beautiful natural scenery, and many distinctive natural resources and forest resources. The ecological value, social value and economic value of these forest areas have been generally recognized by people. Mountain forest is the city's ecological conservation land and natural barrier, it makes many cities surrounded by mountains, forming a unique charm and unique style of the city, so these forest areas are more and more favored by urban people. For example, Zhejiang, Fujian, Guangdong and other places use suburban forest areas to develop forestry leisure service industry.

#### B. Extensive Development

In the work of forestry management, most of the forestry in our country is concentrated in the mountainous areas where the economic development is relatively backward. The original structure of forestry economic development is still adopted, the overall operation system is relatively extensive, and there is no clear understanding of the ecological environment. It is easy to cause the poor economic benefits of forestry, the degradation of forest productivity level, and the lack of new technical support, which will also lead to the forest economy. The economic management system is lagging behind [7]. In addition, in the management of forest economic structure, the maintenance of independent intellectual property rights is poor, and the production field of forest products cannot get effective technical support, which seriously affects the sustainable development of economy.

#### C. Unreasonable Industrial Structure

In the forestry industry system, the simplification of economic development and operation mode has always been a "persistent disease", and the unreasonable industrial structure will seriously restrict the sustainable development of forest economy [8]. In most areas, the undergrowth economy still stays in the traditional forestry economic system, paying more attention to the economic benefits of cutting after planting, paying less attention to the work of undergrowth and breeding, and lacking a clear cognition and understanding of the integration of the industrial chain of undergrowth economy.

First, the overall structure is relatively unitary, the development scale is relatively small, and the construction of economic industrial base lags behind, which will seriously restrict the diversified development of the forest economy, making the management process and control mechanism limited.

Second, the undergrowth economy itself is a long-term economic type. In the development process of our country, the industry chain is relatively short and the overall sales path is very narrow, which will cause the imperfection of the service system and institutions. In particular, the lack of an effective R&D and processing platform and the constraints of relevant laws and regulations in the deep processing process of the economic products under the forest will restrict the transformation process of its economic benefits and seriously restrict the enthusiasm of forest farmers.

Third, the process and equipment of undergrowth economic production are backward, lack of effective utilization of resources, and difficult to convert into immediate economic benefits. The main reason is the instability of variety structure, the low development level of new varieties, the lack of seasonal products and products suitable for processing, which will lead to the decline of market competitiveness.

#### D. The Concept of Forestry Sustainable Development Lags Behind

In the process of forest economic development, due to the restriction of relevant economic laws and regulations and the lack of support, the development level of forest economy will be seriously restricted, which leads to the difficulty in the process of forest economic operation and management. If the relevant forest breeders want to develop forest economy, they need to invest a large amount of money, and even face social risks, which to some extent limits the development of forest economy [9].

Taking the road of sustainable development of forestry is the main technical measure of modern forestry construction. The level of forestry production and management can be promoted by adjusting forestry relations and forestry legal system construction. The strategic project of forestry development in the new century is the construction of modern forestry, which will promote the harmonious coexistence of man and nature and the harmonious development of economic society. The research on the construction of modern forestry can provide useful reference for the sustainable development of forestry.

1) Regional problems of modern forestry

In the construction of modern forestry, due to the great difference of different environments, it is necessary to build an appropriate modern forestry system according to different regional characteristics. Different environment determines different ways to deal with problems, which is the case with modern forestry. It plays different roles at any time according to the environment. For example, in areas with poor ecological environment, modern forestry plays a role in improving and optimizing the environment [10]. In the areas with good greening, large forest area, good environment and excellent ecological environment, the principle of ecological priority is adhered to. On this basis, economic benefits are developed. Therefore, we should build modern forestry suitable for local development and construct economic and social ecological environment of modern forestry system according to different regional characteristics.

2) Coordination of modern forestry system

The coordinated development of modern forestry, from the ecological point of view, must adhere to the modern forestry development system based on ecological construction. The effective and healthy development of modern forestry requires the coordinated development of the three aspects of economic, social and ecological. It requires economic stability, social harmony and ecological balance, which is the optimal modern forestry system. On this basis, the development of modern forestry industrialization system and its ecological and cultural system can improve the forestry ecological system, and achieve resource sharing and greater economic benefits.

3) The relationship between forestry ecological construction and social economic development

In the construction of modern forestry, taking ecological construction as the main body and adhering to the strategy of sustainable development of forestry are the basic strategies that must be adhered to all the time. To strengthen ecological construction in an all-round way and provide people with more high-quality ecological products is the basic task of ecological system construction. However, how to realize the dynamic balance between ecological development and economic construction is an urgent problem for the development of modern forestry.

The healthy development of undergrowth economy is an important part of the construction of modern forestry industry system and an important measure to alleviate the economic and social development and ecological construction. Due to the special requirements of modern forestry, the development of under forest economy can achieve the economic benefits without damaging the social and ecological environment. This theory can effectively improve the economic benefits of forest farmers and the destruction of ecological environment, which plays a key role in supporting the development of forest economy.

III. INFLUENCE PRINCIPLE BASED ON LINEAR ANALYSIS

Linear analysis is a statistical analysis method that uses

regression analysis in mathematical statistics to determine the quantitative relationship between two or more variables, which is widely used [11]. The basic principles involved in the analysis model of influencing factors constructed from the perspective of linear analysis mainly include the following:

1) Causality. It is the relationship between the causes and the results. Causality includes positive feedback and negative feedback, indicating that the two variables change in the same or different directions, such as: E increases, I increases; E decreases, I decreases. The negative causality shows that the variables change in the opposite direction, such as: R increases, P decreases; R decreases, P increases.

2) Cause and effect diagram. Causality diagram can be divided into positive and negative causality diagram, which refers to the closed loop diagram formed by the connection of two or more causalities [12]. Causality diagram can qualitatively describe the causality among the variables in the system. The result of the ring graph of positive causality is to strengthen the internal activities in the perspective of linear analysis. The judgment criteria are: If all causal relationships are positive, it is a positive causal relationship diagram; If the number of negative causal relationships is even, it is a positive causal relationship diagram. The result of the negative causality diagram is that the internal activities are gradually weakened in the linear analysis. The judgment criterion is: If all causalities are negative, it is a negative causality diagram; If the number of causalities is negative, it is a negative causality diagram.

3) Model structure from the perspective of linear analysis.

The basic feedback loop of the linear analysis horizon is shown in Fig. 2. The basic principle is shown in Fig. 3 [13].

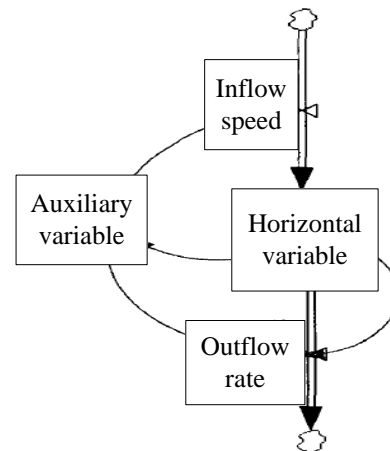


Fig. 2 model structure in linear analysis

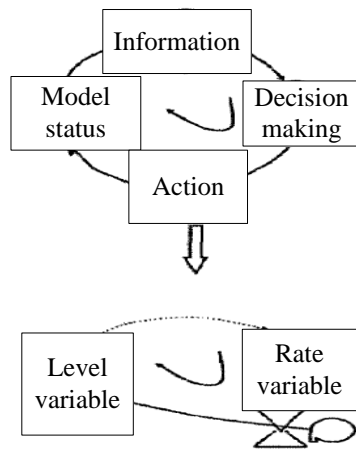


Fig. 3 basic schematic diagram

Under the linear analysis view, the model flow chart can show more linear views and influencing factors of the system, and it is composed of special symbols to show the relationship between various variables in the causality chart. Its main variables include the following:

- 1) Horizontal variable. The most important variables in the model are symbols used to represent the accumulation state of horizontal variables, including input rate, output rate, streamline, variable name and equation code;
- 2) Rate variable. The utility model relates to a controllable variable which controls the change speed of a horizontal variable, including an input information variable, a variable name and an equation code;
- 3) Other variables. Including auxiliary variable, exogenous variable, table function, constant, etc.

#### IV. INFLUENCING FACTORS

##### A. Model Establishment

According to the previous research data, it can be preliminarily analyzed that the undergrowth economy is affected by many factors [14] [15]. Multiple linear regression

can be used to analyze the influence of several explanatory variables on an explanatory variable. Through the estimation of multiple linear regression model, we can get the correlation degree of the influence factors on the economic development under the forest. The influencing factors of forestry economic growth can be divided into two parts: linear and nonlinear. Under the condition of only considering the linear action of various factors on the economy, the influence degree of forestry economy can be quantitatively described by using the multiple linear regression model. Under the condition of considering the nonlinear influence, after linearizing the nonlinear term through variable substitution, the multiple linear regression model can still be used to quantitatively describe the influence degree of each factor on the economy, that is, it is appropriate to apply the multiple linear regression model to quantitatively describe the influence degree of the economic influence factors. Therefore, referring to the relevant research results, this paper expounds the influencing factors of the economic development under the forest from the perspective of developing the economic benefits under the forest, and establishes the multiple linear regression model (1) as follows:

$$W = \alpha_0 + \lambda_1 \alpha_1 + \lambda_2 \alpha_2 + \lambda_3 \alpha_3 + \dots + \lambda_{10} \alpha_{10} + \varphi \quad (1)$$

In (1):  $W$  is the explained variable, which means the income of personnel engaged in forest management (yuan);  $I$  is the explained variable;  $a_0$  is the constant term;  $a_i$  is the regression coefficient of each influencing factor;  $j$  is the random error term, which means the factors that are difficult to quantify and have little influence. The specific variable statistics are shown in Table I.

Table I. Descriptive statistics of variables

Variable	Variable specification	Mean Value	Standard Deviation
Number of family labor force ( $I_1$ ) / person	Continuous variable	2.1	0.78
Operating area ( $I_2$ ) / hm <sup>2</sup>	Continuous variable	128.04	346.06
Family wage income ( $I_3$ ) / yuan	Continuous variables of operation of Forestry Bureau, enterprises and institutions, part-time or part-time jobs, and individual industry and Commerce	33723.63	25544.52
Subsidy from Forestry Bureau ( $I_4$ )	0 = No, 1 = Yes, Dummy variable	0.27	0.44
Attention to forestry technology ( $I_5$ )	1 = Never, 2 = Sometimes, 3 = Always, Dummy variable	2.53	0.58
Whether to join the cooperative ( $I_6$ )	0 = No, 1 = Yes, Dummy variable	0.24	0.43

Smoothness of capital source ( / <sub>7</sub> )	1 = Unsmooth, 2 = Normal, 3 = Smooth, Dummy variable	1.85	0.83
Lack of production technology ( / <sub>8</sub> )	0 = No, 1 = Yes, Dummy variable	0.64	0.41
Supply of means of production ( / <sub>9</sub> )	0 = None, 1 = Yes, Dummy variable	0.25	0.45
Whether the product unsalable ( / <sub>10</sub> )	0 = No, 2 = Yes, Dummy variable	0.44	0.48
Family income from undergrowth ( W ) / yuan	Continuous variable	0.69	0.46

Note: The operation of individual industry and commerce is included in the family wage income, which is to better reflect the impact of other labor income on the development of forest economy besides the operation of forest economy.

Other influencing factors, such as productive assets and social services of developing forest economy, will also have an impact on developing forest economy. However, due to the difficulty of quantitative expression, these variables cannot be well reflected in the model. Secondly, the development of undergrowth economy of undergrowth households is mostly primary products, and seldom involves processing factors, so this factor is not considered in the model.

### B. Linear Regression Analysis

Linear regression analysis is a regression analysis with one or more independent variables. The principle of this method is simple, the basic data needed is less, the prediction precision is higher, and it is more scientific. The principles and models of linear regression analysis are as follows.

For convenience of research, the variables that play the role of cause are called independent variables, and the variables that play the role of result are called dependent variables. The change of independent variable will cause corresponding change of dependent variable. The relationship between dependent and independent variables can be recorded as

follows:

$$Y = X + e \quad (2)$$

where, when  $X = f(x)$ , the mean value of dependent variable

$Y$  is:

$$f(x) = E(Y|X = x) \quad (3)$$

Call  $f(x)$  the regression function of  $Y$  with respect to  $X$ , and  $e$  the bias of  $Y$  with respect to  $f(x)$ , which is a random variable.

The basic model of linear regression analysis is as follows:

$$Y = b_0 + b_1x_1 + b_2x_2 + \dots + b_mx_m + e \quad (4)$$

where,  $b_0, b_1, \dots, b_m$  is the regression coefficient to be estimated unrelated to  $x_1, x_2, \dots, x_m$ . After the above estimated regression coefficients are obtained, regression analysis and prediction can be made.

According to the valid data provided by the questionnaire, SPSS software was used for multiple linear regression analysis, and the results are shown in Table II.

Table II. Estimation results of regression model of undergrowth economic factors

Variable	Correlation coefficient	Standard error
(Constant)	-2284.59	16778.89
Number of family labor force ( / <sub>1</sub> )	4004.83***	3950.29
Operating area ( / <sub>2</sub> )	115.46***	10.25
Family wage income ( / <sub>3</sub> )	0.08***	0,12
Subsidy from Forestry Bureau ( / <sub>4</sub> )	27896.55***	6431.96
Attention to forestry technology ( / <sub>5</sub> )	9228.11***	5140.38
Whether to join the cooperative ( / <sub>6</sub> )	-4279,62	7501.84
Smoothness of capital source ( / <sub>7</sub> )	-4879.62	7501.84
Lack of production technology ( / <sub>8</sub> )	-4940.91	6301.98
Supply of means of production ( / <sub>9</sub> )	-13867.53*	6609.03
Whether the product unsalable ( / <sub>10</sub> )	-8803.07*	5852.91

$R^2$ value	0.73
$F$ value	22.54

SPSS regression analysis results show that  $R^2 = 0.732$ , indicating that the regression model has a high degree of fit; Variance analysis shows that  $F$  value is 27.542, and the significance is 0.000, which can judge that all explanatory variables have a significant linear impact on the explained variable  $W$ .

Different explanatory variables have different effects on  $W$  (Income of personnel engaged in undergrowth). From Table II, it can be seen that the number of family labor force, operating area, family wage income, attention to forestry technology and subsidies of forestry bureau have a significant impact on family undergrowth business income, which are all positive correlation. Among them, the operating area has the greatest impact. The larger the operating area is, the more the output of forest products will be, and the operating area will reach a certain degree. The large-scale business can be carried out, which can correspondingly reduce the input of some costs such as manpower, time, etc., and also help to improve the output and quality of forest products, thus increasing the income of forest economy.

The second significant factor is family wage income. The wage income of forest workers is relatively low. In order to increase their income, they usually choose to use the advantages of forest areas to develop the forest economy. When the family wage income becomes more, more money will be invested in the forest economic production, and then increase the income of the forest economy.

The number of family labor has a significant positive correlation with the economic income under the forest, which is consistent with the initial expectation of the study. With the increase of labor input, the management level and output of forest products will naturally be improved, and the economic income under the forest will increase. The attention degree of forestry technology can reflect a family's attention degree to the development of forest economy. Families who often pay attention to forestry related technology can learn advanced technology faster, so that they can invest in forest management and promote the development of forest economy.

The factor of Forestry Bureau subsidy is related to the government's support for the development of forest economy, increasing the amount or types of subsidies for forest products, which has a positive impact on the development of forest economy. The supply of means of production and whether the products will be unsalable also have a strong significant impact on the family's operating income under the forest, which are negatively correlated. The smaller the problem of the supply of means of production is, the less unsalable the products are, and the more the income from under forest operation will be.

From the regression results, we can see that whether to join the cooperative, whether the capital source is unobstructed, whether the production technology is lack or not these factors have no significant impact on the family's income from under forest management. Generally speaking, joining cooperatives

has a positive impact on the development of the forest economy. However, the number of cooperatives in the current forest area is small, the establishment mechanism is not perfect, and the number of families joining cooperatives in the survey sample is small. At the same time, some families don't think it is necessary to join the cooperative, so the cooperative situation has no significant impact on the development of forest economy. Generally speaking, the unobstructed degree of capital sources also has a positive impact on the development of the forest economy, but the analysis results show that the impact is not significant, mainly because the capital sources of the staff family to develop the forest economy are mostly their own funds, and less external funds are involved. Because the scale of developing forest economy is relatively small, most of its own funds can meet the investment needs of forest economy. The reason why the lack of production technology has no significant impact on the development of forest economy is that many families of workers and staff have not developed forest economy for a long time, are not large in scale, and are in the first link of production. The technical requirements for primary product production are relatively low, so the demand for and dependence on production technology are not large. Although the results of regression model analysis have errors and need to be improved, the results of regression model analysis in this paper can be consistent with the experience of most people.

## V. CASE VERIFICATION AND ANALYSIS

In order to verify the rationality of the analysis of the influencing factors of the economic growth under the forest from the perspective of linear analysis, a case study was carried out.

### C. Instance Object

In order to study the development of undergrowth economy better and more deeply, we need to understand its current development situation first. Taking the state-owned forest economy of Heilongjiang Province as the research object, analyzing the development situation of undergrowth economy is helpful to formulate relevant sustainable development policies. The particularity of the state-owned forest region determines the complexity of the undergrowth economy, which includes the relationship of multiple repetition and miscellaneous, the relationship between man and nature, and the relationship of development on the basis of ecological environment.

The state-owned forest area of Heilongjiang Province is vast, with a total management area of 10.098 million hectares, accounting for 22% of the total land area of Heilongjiang Province; the total forest area is 8.46 million hectares, accounting for 11.7% of the national state-owned forest area; Meanwhile, the forest coverage rate is 83.9%. Most of them are distributed in the dense forests of Xiaoxing'an Mountains, Wanda Mountains, Laoye Mountains, Zhanguangcai Mountains and other mountain systems. This rich resource is the

natural ecological barrier of the big granary in the northeast, and also the main birthplace and conservation forest of the six major water systems (Heilongjiang River, Songhua River, Wusuli River, Mudanjiang, Nenjiang River, Suifen River). The ecological status is particularly important.

The state-owned forest areas in Heilongjiang Province have made great contributions to the country from three aspects. On the one hand, in terms of ecological construction, we should adhere to the principle of forest management and vigorously carry out afforestation, with an area of 2.938 million hectares; On the other hand, in terms of economic development, the timber output continued to grow, accounting for 33.5% of the national output at the highest time, accounting for 21% of the national output; At the same time, we should pay 11.9 billion yuan in profits and taxes. Third, in terms of social development, in the past, small towns were built in primitive forests with

inconvenient transportation and nearly zero infrastructure. After more than 60 years of hard work, it has formed a relatively complete system of forestry ecology, a relatively developed system of forestry industry and a relatively complete system of forest communities.

2012 is the key year of forestry development and reform. The State Forestry Administration and forestry departments at all levels take the construction of ecological civilization as the goal, accelerate the development of modern forestry, strengthen the ecological construction and protection. The forestry industry also grows rapidly. Heilongjiang Province actively responds to the call of the government, and has achieved better benefits in the growth of forestry economy. See Table III for the forestry development of Heilongjiang state-owned forest region.

Table III. Growth of forestry output value of Heilongjiang Province and China in 2012

Index	Growth rate of Heilongjiang Province (%)	Total amount of China (billion yuan)	Growth rate of China (%)	Total amount of Heilongjiang Province (billion yuan)
GDP	10	519 322	7.8	13691.6
Output value of primary industry	20.5	13 748	24.3	413.1
Output value of secondary industry	7.8	4 804	68.4	163
Forestry output value	14.3	39 451	28.9	134.5

Data source: China Statistical Yearbook, China forestry yearbook.

Fig. 4 shows the specific distribution of forest related industries in China.

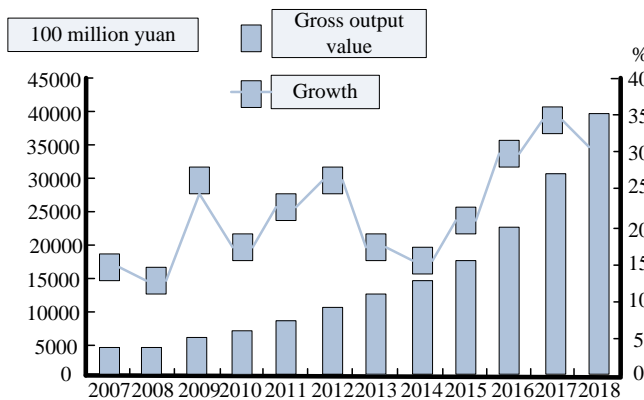


Fig. 4 total output value and growth rate of national forestry in 2007-2018

The forest related industries of the first industry in Heilongjiang Province are shown in Fig. 5.

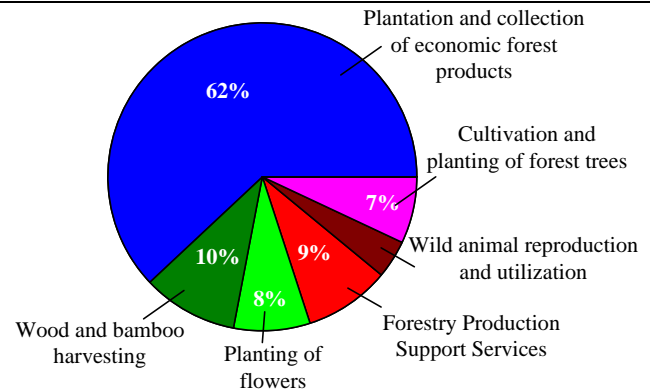


Fig. 5 forest related industries of primary industry in Heilongjiang Province

In order to better realize the construction of ecological forestry, the national afforestation work has been carried out steadily. The increase of afforestation area can effectively improve the richness of forest resources and enrich species. Afforestation pays attention to the ecological efficiency from the structural type, and plays a more prominent role in water conservation, windbreak and sand fixation, and soil and water conservation.

#### D. Comparison of Case Analysis Results

Analyze the forestry related data of Heilongjiang Province from 2007 to 2018 of the above example samples, and use SWOT-AHP analysis method [3] and linear analysis method to analyze the effect of influencing factors of undergrowth economy. The results are shown in Fig. 6.



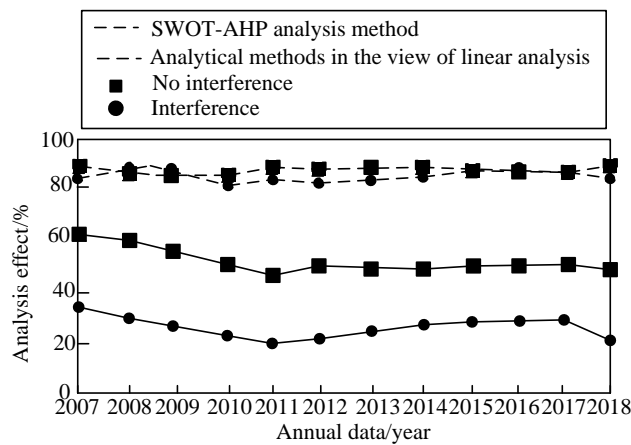


Fig. 6 comparison of analysis results of two methods

It can be seen from Fig. 6 that under the condition of no interference, the SWOT-AHP analysis method has the best data analysis effect in 2007, reaching 60%. From 2010 to 2012, the data analysis effect is the worst, reaching 45%; With interference, the data analysis effect in 2007 is the best, reaching 35%. The data analysis effect from 2010 to 2012 is the worst, reaching 20%.

Under the condition of no interference, the data analysis effect of 2017-2018 is the best, reaching 91% by using the linear analysis method. The data analysis effect from 2009 to 2010 is the worst, reaching 85%; under the condition of interference, the data analysis effect from 2008 to 2009 is the best, reaching 89%. The data analysis effect from 2010 to 2012 was the worst, reaching 81%.

Therefore, under the condition of interference or not, the effect of linear analysis is better.

### E. Discussion

In this study, in order to improve the forest management mechanism and optimize the utilization of forest land resources, this paper makes a linear analysis of the factors affecting economic growth in underdeveloped areas. According to the growth of forestry output value in Heilongjiang Province and China in 2012, we can see that the development of forestry in state-owned forest areas in Heilongjiang Province is good, which has a certain impact on the economy. From 2007 to 2018, the national total output value and growth rate of forestry presented an upward trend. Based on the above real data and investigation, a comparative experiment is designed to verify the effectiveness of the proposed method. Experimental results show that under the condition of no interference, under the linear analysis method, the data analysis effect of 2017-2018 can reach 91%. Under the condition of interference, the data analysis effect of 2008-2009 is the best, reaching 89%, and the data analysis effect of 2010 is the worst, reaching 85%. The analysis of data from 2010 to 2012 was 81 per cent effective. The above experimental data show that the linear analysis results of the factors affecting the economic growth of forest land are effective and provide technical support for the rapid development of forestry economy.

Although this study has made some contributions in

exploration, it still has some shortcomings. This paper only studies the data of total forestry output value in China, and does not consider the output situation of a certain region separately, nor does it study the commonality and difference of forestry output value in each region. Therefore, in the subsequent research, we can try to find the similarities and differences by fitting and comparing the time series models of the forest output data of different regions. The deficiencies of the above research will be further discussed by deepening and expanding the theoretical framework in the future research.

## VI. CONCLUSIONS AND SUGGESTIONS

According to the results of the analysis of the factors affecting the undergrowth economy, we can see that the development of the forest economy has achieved initial results, but there are still some problems that cannot be ignored. First, the plots used by many families to develop the undergrowth economy are small and scattered, which has not reached a certain scale; Second, the number of forest product cooperatives in the forest area is small, and the willingness of employees to participate in the cooperatives is not strong; Third, the product sales channels are single, which is prone to the situation of unsalable products; Fourth, the subsidies of the forestry bureau are not enough, and the wage income of the employees is relatively low, which makes the families of the employees unable to develop the undergrowth economy. Based on the above descriptive statistics and multiple regression analysis results, the following suggestions are proposed:

1) Centralize land and use it reasonably to achieve scale management. The government should improve the relevant land laws and policies, simplify the procedures of land transfer, actively promote the circulation of forestry land, promote the concentration of land plots, and solve the problem of forest land fragmentation. At the same time, the family should make full and reasonable use of forest land resources, master certain management methods, so as to ensure the large-scale operation of forest economy.

2) Increase the number of cooperatives and the enthusiasm of employees to participate. First of all, the government should guide the establishment of under forest economic cooperatives, improve their operation and management mechanism, make the cooperatives give full play to the scale effect, unify the purchase of good varieties, fertilizers and other means of production, and unify the sale of forest products, which can not only solve the problem of the supply of means of production, but also expand the sales market and reduce the unsalable situation of products. In addition, according to the production varieties or other related links, the forest economy developed by forest workers can be gathered to form a base, so as to enhance the ability to deal with market risks.

3) Expand sales channels and increase technical input to solve the problem of unsalable products. We can use the Internet to develop e-commerce and establish an online sales platform to expand the sales channels of forest products; We can also collect market information from various aspects through

the network and other developed communication facilities, pay attention to the market dynamics, and prevent products from being difficult to sell in the market. Scientific research institutions and relevant technology promotion institutions shall provide forestry technical support in time to help employees master advanced technology. Meanwhile, employees shall also strengthen their attention to technology, apply advanced technology to the production and operation under the forest, improve the added value of forest products, and reduce the possibility of unsalable products.

4) Increase economic subsidies and wages for undergrowth employees. The government should issue relevant policies to provide guarantee for the development of forest economy. At the same time, it can increase the amount and varieties of subsidies to increase the intensity of economic subsidies, so as to promote the enthusiasm of employees in developing forest economy. Secondly, the forestry bureau and relevant enterprise units should also appropriately increase the wages of the staff according to the current consumption level, so that while improving the quality of life of the staff in the forest area, more disposable funds can be invested in the development of the under forest economy, forming a virtuous cycle of developing the under forest economy to promote the increase of the staff's income, which in turn promotes the development of the under forest economy.

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## **Contribution of individual authors to the creation of a scientific article (ghostwriting policy)**

### **Author Contributions:**

**Chao Wang is responsible for the whole paper writing; Jiehua Lv is responsible for the framework of the paper and guidance of the paper writing; Qiumin Zhao is responsible for the data collection.**