check for updates

DYNAMIC SHIFT-SHARE ANALYSIS OF FORESTRY INDUSTRY STRUCTURE AND COMPETITIVENESS IN HEILONGJIANG PROVINCE

Pingxia Wu[1+]
Yunliang Jiang[2]

[1]*School of Economics and Finance, Shanghai International Studies University, Shanghai, P. R. China.*
Email: yjiang@shisu.edu.cn

[2]*College of Economics and Management, Northeast Forestry University, Harbin, P. R. China.*

(+ Corresponding author)

ABSTRACT

Since 2014, commercial natural forest cutting is prohibited in state-owned forest areas in Heilongjiang Province, which has affected the traditional forestry economy in Heilongjiang Province. The restructuring and optimization of the forestry industry in Heilongjiang is imminent. Based on the data of forestry output value of Heilongjiang Province from 2002 to 2016, this paper explores the law of forestry economic growth and industrial structure evolution in Heilongjiang Province through the dynamic shift-share analysis method (DSSA).The results show that the economic growth rate of forestry industry in Heilongjiang Province is higher than the national average. The primary industry is still a basic leading industry, the secondary and tertiary industries of forestry are highly dependent on the primary industry. The secondary industry lacks sufficient competitiveness, the technical content of processed products is low, lacking deep processing and fine processing, and the industry needs to be optimized. The tertiary industry accounts for a low proportion, the forest tourism service in Heilongjiang is relatively backward in the country, and it is necessary to further explore the leisure tourism service suitable for Heilongjiang. In order to optimize the industrial structure and promote the economic development of Heilongjiang Province, this paper proposes concrete countermeasures such as extending the industrial chain, developing non-wood forest products, and developing forest tourism and leisure services.

Contribution/Originality: This study is one of very few studies which have investigated the structural evolution and structural optimization of three industries in Heilongjiang Province in recent years and the relationship between Heilongjiang's economic development and forestry's three industrial structures.

1. INTRODUCTION

As one of the indispensable industries in China, forestry not only plays an important role in protecting the ecological environment, but also plays an important role in promoting economic growth. The report of the 19th National Congress pointed out that "Green water and green mountains are golden mountain and silver mountain", which unites the development economy and environmental protection. In the early days of society, the forestry economy relied mainly on cutting down forest trees or acquiring other forest products. With the development of social economy, other functions of forestry continue to expand, such as the development of forestry tourism and leisure services, forestry ecological services, etc., so it is more necessary to study the three industries of forestry. Qiu, et al. [1] used the grey relational analysis method to analyze the correlation between China's forestry industry and the three industries and the correlation between three industries and their internal industries. It is proposed

that the pattern of China's forestry industry will be gradually adjusted and optimized in the future. Xiao, et al. [2] pointed out that the adjustment of the three industrial structures of forestry plays an important role in the development of regional economy. In particular, since April 1, 2014, the key state-owned forest areas in Heilongjiang have begun to implement a comprehensive stop of commercial forest harvesting. This objectively requires the Heilongjiang forestry industry to carry out industrial transformation and upgrading, and promote the efficient development of forestry economy. Zhe [3] used data envelopment analysis (DEA) to evaluate the input and output efficiency of Heilongjiang forestry and identify the key factors affecting the upgrading of forestry industry structure in Heilongjiang Province. Hao, et al. [4] quantitatively measure the transformation degree and transformation tendency of forestry industry structure by using Markov transfer matrix. However, the current analysis of the relationship between Heilongjiang economic development and forestry industry structure is relatively small. Therefore, this paper uses dynamic deviation-share analysis method to analyze Heilongjiang's economic growth, industrial structure change and competitiveness, and explore the evolution law of Heilongjiang three industrial structures. Effective suggestions promote the optimization and adjustment of Heilongjiang's industrial structure and promote the economic development of Heilongjiang.

2. RESEARCH METHODS AND MODEL CONSTRUCTION

2.1. Research Method

The shift-share method (SSM) was summarized and refined by other scholars such as [5]. Dynamic deviation-share analysis (DSSA) introduces dynamic thinking, taking a regional economic development as a dynamic process, and further subdividing the research time on a yearly basis, taking the upper level of the research object or the national as a reference system for a certain period of time. The economic variables of a particular region are divided into three components: growth share, structural deviation, and competitiveness deviation. Through these three aspects of data evaluation of economic structure and strength and competitiveness, it is possible to analyze the dominant industries in the three industries. The growth of the industry and the optimization of the industrial structure propose specific countermeasures.

2.2. Model Construction

According to the detailed division of China's industry by the National Bureau of Statistics, forestry is divided into primary industry, secondary industry and tertiary industry. Taking the national forestry economic output value as the reference area, and taking the overall forestry economic output value of Heilongjiang as the research area, using the dynamic deviation-share analysis method to deviate from the forestry economic output value of Heilongjiang from 2002 to 2016 for a total of 15 years, trying to evaluate the three industrial structures of Heilongjiang forestry. The advantages and competitiveness are strong, so as to analyze the evolution trend of forestry industry structure in Heilongjiang Province. The total regional increment in the DSSA model of Heilongjiang's forestry economic growth is now broken down as follows:

$$G = \sum G_i^k = N_i + P_i + D_i = \sum_{k=1}^{t} N_i^{(k)} + \sum_{k=1}^{t} P_i^{(k)} + \sum_{k=1}^{t} D_i^{(k)}$$

G represents the total growth of the forestry i-th industry in Heilongjiang Province during the t period:

$$N_i = \sum_{k=1}^{t} N_i^k = \sum_{k=1}^{t} e_i^{(0)} * \frac{E^{(k)} - E^{(k-1)}}{E^{(0)}}$$

N_i representing the growth rate of the regional forestry i-th industry in Heilongjiang Province in the t-time period with the growth rate of the national forestry economic output value, that is, the regional growth share:

$$\text{P}_i = \sum_{k=1}^{t} P_i^{(k)} = \sum_{k=1}^{t} e_i^{(0)} * [\frac{E_i^{(k)} - E_i^{(k-1)}}{E_i^{(0)}} - \frac{E^{(k)} - E^{(k-1)}}{\text{E}^{(0)}}]$$

P_i representing the deviation of the output value of the i-th industry in the regional forestry industry in Heilongjiang Province from the national forestry i-th industry output value growth rate and the national forestry total output value growth rate in t time period, indicating that the i-th industry in Heilongjiang Province deviated from the national forestry i-th industry structure:

$$\text{D}_i = \sum_{k=1}^{t} \text{D}_i^k = \sum_{k=1}^{t} e_i^{(0)} * [\frac{e_i^{(k)} - e_i^{(k-1)}}{e_i^{(0)}} - \frac{E_i^{(k)} - E_i^{(k-1)}}{E_i^{(0)}}]$$

D_i representing the industrial forest industry's i-th industry output value in Heilongjiang Province, the deviation of the growth rate of the i-industry output value of the regional forestry industry in Heilongjiang Province and the growth rate of the i-th industry output value of the national forestry industry, indicating the deviation of the competitiveness of the i-th industry in Heilongjiang Province during the t-time period:

$$(\text{PD})_i = \text{P}_i + \text{D}_i \qquad (\text{PD})_i^t = P_i^t + D_i^t$$

$(\text{PD})_i^t$ represents the total deviation of the i-industry of regional forestry in Heilongjiang Province relative to the development of the i-th industry in the country.

In the above formula, $e_i^{(0)}$ representing the annual output value of the i-th industry base in Heilongjiang Province; $e_i^{(k)}$ representing the final annual output value of the i-th industry in Heilongjiang Province; $\text{E}^{(0)}$ representing the annual gross output value of the national forestry industry; $\text{E}^{(k)}$ representing the final annual output value of the national forestry industry; $\text{E}_i^{(0)}$ representing the annual output value of the national forestry i-based industry; $\text{E}_i^{(k)}$ representing the final annual output value of the national forestry i-th industry.

3. DATA PROCESSING AND RESULT ANALYSIS

3.1. Data Processing

The output value of the forestry industry comes from the China Forestry Publishing House, the China Forestry Statistical Yearbook compiled by the State Forestry Administration, and the total output value of the forestry industry from 2002 to 2016. Find out the total output value of China's forestry, the output value of China's first, second and third industries, and the total output value of forestry in Heilongjiang Province and the output value of the first, second and third industries.

3.2. Heilongjiang Forestry Economic Output Value is on the Rise

Heilongjiang Province is rich in forestry resources and is a large forestry province with a large state-owned forest area and the largest timber production base in China. In the five-year forest census data from 2009 to 2013, the forestry land area was 21.84 million square kilometers, the total standing timber volume was 1.65 billion cubic meters, and the forest coverage rate was as high as 42.39%. The resources of various forest products were also abundant. At the same time, the total forest area and standing stock in Heilongjiang Province accounted for 7% and 11% of the national total, respectively, but the proportion of Heilongjiang forestry output from 2002 to 2016 accounted for only 3.1%-5.6% of the total national forestry output value. In the meantime, it can be seen that the forestry industry in Heilongjiang has yet to be optimized and adjusted.

It can be seen from Table 1 that the total forestry output value of Heilongjiang in 2002-2016 is on the rise, from 26.115 billion yuan in 2002 to 203.481 billion yuan in 2016. It has increased nearly eight times in just 15 years, with an average annual growth. The growth rate is 14.67%. After the ban on logging in Heilongjiang in 2014, the growth rate of total forestry output was only about 2.14%. It can be seen that the growth rate of total forestry output value of Heilongjiang after the ban is reduced, and the growth rate is decreasing.

Table-1. National and Heilongjiang Province total forestry output value and three industrial output value / 100 million yuan.

years	Total forestry output value		Primary industry output value		Secondary industry output value		Tertiary industry output value	
	National	Heilongjiang	National	Heilongjiang	National	Heilongjiang	National	Heilongjiang
2002	4634.24	261.15	2911.72	75.66	1485.69	144.09	236.83	41.41
2003	5860.33	329.71	3518.08	145.08	2007.43	125.12	334.81	59.5
2004	6892.21	367.43	3887.54	167.32	2561.12	135.38	443.55	64.73
2005	8458.74	399.17	4355.56	184.17	3486.54	142.59	616.64	72.42
2006	10652.22	535.76	4708.82	217.35	5198.4	229.65	745	86.76
2007	12533.42	657.91	5546.21	274.78	6033.92	280.06	953.3	102.15
2008	14406.41	744.29	6358.82	309.78	6838.25	312.15	1209.34	123.41
2009	17493.73	877.21	7225.26	331.84	8717.92	394.87	1550.56	150.51
2010	22779.02	1037.39	8895.21	399.42	11876.95	457.42	2006.86	180.46
2011	30596.73	1206.46	11056.19	495.54	16688.4	571.52	2852.14	239.4
2012	39450.91	1534.83	13748.52	581.85	20898.3	685.26	4804.09	268.16
2013	47315.44	1776.64	16373.79	701.41	24976.16	760.83	5965.48	314.41
2014	54032.94	1859.3	18559.46	723.95	28088.04	774.21	7385.44	361.14
2015	59362.71	1939.89	20207.32	760.98	29893.34	766.26	9262.06	412.66
2016	64886.04	2034.81	21619.44	773.71	32080.67	775.86	11185.94	485.24

Source: China forestry statistics yearbook.

Among the three forestry industries in Heilongjiang Province, the output value of the primary industry and the secondary industry accounts for a large proportion of the total forestry output value of Heilongjiang, and the tertiary industry accounts for a relatively small proportion. From 2002 to 2016, the output value of the primary industry accounted for a general decline in the proportion of Heilongjiang's total output value, from 46.14% to 38.02%. The proportion of the secondary industry is also large. It can be seen that the secondary forestry industry in Heilongjiang Province is also an important source of forestry economy in Heilongjiang Province. The proportion of the tertiary industry's output value to Heilongjiang's total output value has increased, from 18.57% to 23.84%, especially after the ban on logging in 2014, the first breakthrough of 20% reached 21.27%. Although the proportion of output value of the tertiary industry has increased, the proportion is still relatively small, which is still far lower than that of the secondary and tertiary industries, indicating that there is still room for development in the tertiary industry.

3.3. Analysis on the Overall Deviation of Forestry Economy in Heilongjiang Province

The dynamic deviation-share analysis of the forestry industry in Heilongjiang Province from 2002 to 2016 is shown in Table 2. First of all, the total deviation of the three industries in Heilongjiang can be 1773.65, far greater than 0, indicating that the growth rate of the forestry industry in Heilongjiang Province is higher than the average growth rate of the national forestry industry. Among them, the overall structure deviation of the three industries is 1972.38, indicating that the forestry structure of Heilongjiang Province is better. The deviation of the competitiveness of the three industries is -3,594.19, indicating that the overall competitiveness of forestry in Heilongjiang Province is weak. The total deviation is better at 269.16 between 2010 and 2011, and the worst is only 31.7 in 2004-2005. It can be seen that the total deviation value is also relatively large.

Table-2. Deviation of forestry economic dynamics in Heilongjiang Province/100 million yuan.

t	Primary industry			Secondary industry			Tertiary Industry		
	N_1^t	P_1^t	D_1^t	N_2^t	P_2^t	D_2^t	N_3^t	P_3^t	D_3^t
2002-2003	20.02	-4.26	53.66	38.12	12.48	-69.57	0.96	6.18	0.96
2003-2004	16.85	-7.25	12.64	32.08	21.62	-43.44	9.22	9.79	-13.78
2004-2005	25.58	-13.41	4.69	48.71	41.04	-82.54	14.00	16.27	-22.57
2005-2006	35.81	-26.63	24.00	68.20	97.82	-78.97	19.60	2.84	-8.10
2006-2007	30.71	-8.95	35.67	58.49	22.54	-30.62	16.81	19.61	-21.03
2007-2008	30.58	-9.46	13.88	58.24	19.77	-45.92	16.74	28.03	-23.51
2008-2009	50.40	-27.89	-0.45	95.99	86.31	-99.58	27.59	32.08	-32.56
2009-2010	86.29	-42.90	24.19	164.33	142.05	-243.83	47.23	32.56	-49.83
2010-2011	127.63	-71.48	39.97	243.07	223.57	-352.54	69.86	77.94	-88.86
2011-2012	144.56	-74.60	16.35	275.30	133.00	-294.56	79.12	262.18	-312.54
2012-2013	128.40	-60.18	51.34	244.53	150.96	-319.92	70.27	132.80	-156.82
2013-2014	109.67	-52.88	-34.25	208.86	92.94	-288.43	60.03	188.26	-201.55
2014-2015	87.02	-44.20	-5.79	165.72	9.37	-183.04	47.63	280.50	-276.61
2015-2016	90.18	-53.48	-23.96	171.73	40.40	-202.54	49.35	287.04	-263.81
Total	983.69	-497.58	211.94	1873.38	1093.88	-2335.49	538.39	1376.07	-1470.63

Source: China forestry statistics yearbook.

From 2002 to 2016, the total deviation of the primary industry in Heilongjiang Province was 698.05, the total structural deviation was -497.58, and the competitiveness deviation was 211.94. It shows that the growth rate of the output value of the first industry in Heilongjiang Province is higher than the national average, but the structural quality of the primary industry is lower than the national average. The development of the primary industry has developed better in the three industries, and the primary industry still has certain competitive advantages. The competitiveness of Heilongjiang's secondary and tertiary industries is negative and does not have a competitive advantage.

The share of the three industrial growth shares in Heilongjiang Province has been increasing from 2002 to

2012, reaching peaks in 2012, respectively, at 128.40, 244.33 and 70.27. After 2012, there is a downward trend. The competitive advantage of the primary industry was positive in 2002-2012 except for 2008, and it was negative from 2013 to 2016. From 2013, the competitive advantage of Heilongjiang's primary industry was not available.

The industrial growth component of Heilongjiang Province is positive in all three industries, and the growth rate is higher than the national average. The structural deviations of the secondary industry and the tertiary industry are both positive, and their structural quality is better than the national average. The competitiveness of the secondary and tertiary industries is lower than the national average. It can be seen that Heilongjiang Province is rich in forestry resources and is a large forestry country, but it is not a forestry power. The forestry industry needs further optimization.

3.4. Analysis and Interpretation of Research Results

The above theoretical and empirical analysis of the overall economic deviation of the forestry industry in Heilongjiang Province, the paper analyzes and explains the following results:

i.   The Primary Industry is the Basis for the Development of the Forestry Industry

Forest resources play a fundamental and indispensable role in the forestry industry and are crucial to the development of the forestry industry. Heilongjiang Province is rich in forest resources, taking into account the protection and development of the forestry primary industry is the basis for the development of the second and third industries. Under the background of the prohibition of commercial harvesting of natural forests in Heilongjiang Province, the forest industry has developed rapidly, so the output value of the forestry primary industry has only slightly decreased. At present, Heilongjiang Province is transforming its development direction, increasing capital investment, promoting the development of forestry industry, cultivating forest trees, and developing forestry products to ensure that the forestry output value of Heilongjiang Province is not affected by the ban.

ii.   The Policy of Ban on Logging in Heilongjiang Province Promotes the Development of the Secondary and Tertiary Industries

At present, Heilongjiang Province is increasing the construction of an ecological civilization system and promoting the sustainable development of forestry. Therefore, the development of industries dominated by log harvesting will be restricted, and it is necessary to take a different approach to promote the development of forest products processing industry and develop non-wood forest products. At the same time, the development of forestry tertiary industry is the focus of future forestry development in Heilongjiang Province. Heilongjiang Province is rich in forest resources and beautiful natural scenery, and the development of leisure tourism has great potential. Therefore, Heilongjiang Province should increase the infrastructure of the tourism industry, protect the ecological environment, and continuously explore the potential of ecotourism and services in Heilongjiang Province.

4. CONCLUSION AND SUGGESTION

4.1. Conclusion

This paper uses the dynamic shift-share analysis method to study the development of the three industrial output values of Heilongjiang Province in 2002-2016 based on the national forestry industry output value. The conclusions of the study are as follows: First, the forestry primary industry in Heilongjiang Province is still a basic leading industry. Although the proportion of the output value of the first forestry industry in Heilongjiang Province has a downward trend, the growth rate and competitiveness of the output value of the primary industry are much higher than the average level of the national forestry industry. The secondary and tertiary industries of forestry are highly dependent on the primary industry, so the forestry primary industry in Heilongjiang Province

still has a large advantage. Secondly, Heilongjiang Province's forestry secondary industry accounts for a large proportion, with rapid growth, but lacks competitiveness. The total output value of the second industry in Heilongjiang forestry is higher than 30% in the total forestry output value, and the growth rate is much higher than the national average. The industrial structure is excellent. However, for Heilongjiang Province, the secondary industry processed products have low technical content, lack of deep processing and fine processing, and the industry needs to be optimized. Finally, the proportion of the tertiary industry in Heilongjiang Province is low, and industrial development is lagging behind. The proportion of the tertiary industry in Heilongjiang Province has shown an increasing trend every year since 2002-2016, but the growth is relatively slow. At present, the proportion of the tertiary industry is still low. As a whole, the forest tourism services in Heilongjiang are relatively backward nationwide. Need to pay attention to further explore the leisure travel services suitable for Heilongjiang.

4.2. Suggestion

1. Promote the optimization and upgrading of industrial structure and extend the industrial chain. In 2014, the state-owned forest area was completely banned, and the traditional forest economy with timber utilization was inevitably impacted. The development of the forestry primary industry will be restricted, the development space will be limited, and the economic growth mode that relies solely on the production of logs has already not applicable, the optimization and upgrading of the forestry industry structure is imminent. Therefore, it is necessary to give play to the functions of forest resources and promote the integration and development of the three industries of forestry. It is necessary to increase the construction of forestry supporting infrastructure in Heilongjiang Province to provide guarantee for the development of the primary industry. At the same time, pay attention to the deep processing and fine processing of forest products, improve the quality of forest products, increase the added value of forest products, and enable the effective allocation of forest resources. Promote the coordinated development of the entire industrial chain of the three industries in Heilongjiang and bring out the greatest economic and social benefits.

2. Promote the development of non-wood forest products industry and achieve sustainable development. The ban on logging in Heilongjiang has provided new ideas and directions for the economic development of Heilongjiang Province. Non-wood forest products span three industries in the forestry industry. The primary industry includes the cultivation and collection of understory products and flowers, as well as the breeding and utilization of wild animals; the secondary industry includes the processing of non-wood forest products and the manufacture of forestry chemicals; the production and tourism of forestry in the tertiary industry, technology, management and other services. Pay attention to the industrial development of non-wood forest products, increase its economic benefits, transform production methods, and realize the source of income while protecting the environment and responding to the call for policies to achieve sustainable development.

3. Bring into play the functions of forest tourism and leisure, and take advantage of the environmental resources of forest areas. It can be seen from the conclusion that the development of the tertiary industry in Heilongjiang Province has yet to be optimized and improved. The development of tourism and leisure services in the forest areas will be able to shift the focus of the forestry industry to the tertiary industry. On the basis of the overall ecological environment, we will develop leisure tourism, holiday vacation, skiing, forestry, forest oxygen bar, cultural tourism and other forestry-specific tourism projects. Integrate the concept of ecological civilization with the cultural connotation of forests, and establish a brand of forest tourism and leisure industry with connotation, quality and individuality. On the basis of abundant natural resources and excellent forest ecological environment, the potential of ecotourism in forest areas will be developed to the maximum extent, and a new pattern of ecotourism in Heilongjiang Province forest areas will be formed.

REFERENCES

[1]   J. Qiu, S. Chen, and R. Zhao, "Correlation analysis and future development forecast of China's forestry industry," *Forestry Economy*, vol. 40, pp. 11-15, 2018.

[2]   X. Xiao, Y. Peng, and L. Shaolin, "China's optimal industrial structure: Theoretical model and quantitative measurement," *Economics (Quarterly)*, vol. 11, pp. 135-162, 2012.

[3]   Y. Zhe, "The trend of forestry industry change and DEA efficiency measurement in Heilongjiang province," *Forestry Science and Technology*, vol. 42, pp. 58-62, 2017.

[4]   L. Hao, B. Zhang, and L. Jiehua, "Study on the transformation trend of forestry industry structure based on markov transfer matrix——taking Heilongjiang province as an example," *Forestry Economics*, vol. 39, pp. 26-32, 2017.

[5]   E. S. Dunn, "A statistical and analytical technique for regional analysis," *Papers in Regional Science*, vol. 6, pp. 97-112, 1960. Available at: https://doi.org/10.1111/j.1435-5597.1960.tb01705.x.