

# Research on the Green Logistics Influencing Factors and Optimization Paths under Carbon Peaking and Carbon Neutrality Goals

Peijian Wu<sup>1</sup>, Lanlan Zhu<sup>1</sup>, Si Liu<sup>2</sup>

<sup>1</sup>College of business administration, Anhui University of Finance and Economics, Bengbu, 233000, China

<sup>2</sup>School of Economics, Anhui University of Finance and Economics, Bengbu, 233000, China

**Abstract:** Green logistics is an efficient integration of economy and ecology, and it is a necessary transformation for the high-quality and sustainable development of the logistics industry. The article studies the driving factor that affects China's green logistics based on the LMDI method, and analyzes the impact of the driving factors on the green development of the logistics industry. Finally, on the basis of research, it is targeted at optimizing the green development of China's logistics industry and put forward relevant suggestions for China's low-carbon logistics development.

**Keywords:** Green logistics, Driver factor, Factor decomposition, Optimization path.

## 1. Introduction

In the "Fourteenth Five-Year Plan" outline, it clearly refers to the goal of controlling carbon intensity and achieving carbon neutrality during the occurrence stage, and further promote low-carbon and green transformation in industrial and transportation. As a strategic industry in my country, Essence As a strategic industry in my country, the logistics industry has always been regarded as the main industry of energy consumption consumption. Under the dual target impact of economic growth and energy conservation and emission reduction, the road of logistics industry seeking green development is the realization of upgrading and sustainable development. It is necessary to achieve green transformation of the logistics industry, so that it is an imminent issue at this stage.

At present, the research of the driver's factors of the low-carbon development of the regional logistics industry mainly adopts the LMDI decomposition method. Taoxing Zhu, Yuqing Sa, etc.[1] (2021) using the LMDI decomposition method to break down the influencing factors of low-carbon logistics changes in the provinces, autonomous regions and municipalities across the country from 2014-2018, and analyzed the impact of various factors on green logistics in different regions. DE FREITAS et al. [2] (2011) used LMDI decomposition to analyze the driving factor of Brazilian carbon dioxide emissions, and concluded that there was an absolute decoupling relationship between Brazilian energy carbon emissions and economic activities. Papagiannaki et al. [3] (2009) Based on the LMDI method application time sequence analysis, in-depth analysis of the reasons for carbon dioxide emissions between Greece and Danish passenger vehicles.

## 2. Methodology and Data

### 2.1. Green Logistics Driven Factor Dispensing Model

In order to analyze the driving factor that affects green logistics, Japanese scholar Kaya [4] proposed Kaya constant equal form. The specific expression is as follows:

$$C = \frac{C}{E} \times \frac{E}{G} \times \frac{G}{P} \times P \quad (1)$$

Among them, C is carbon emissions, E is energy consumption, G is GDP, P is the population. C/E represents a carbon emissions coefficient, E/G represents energy strength, G/P represents per capita GDP. Based on the characteristics of green logistics and the research of relevant scholars, this article expands Kaya's constant equation expansion, which breaks down the driver factors that affect the development of green logistics into four factors: energy structure, energy strength, logistics output and the scale of the business. See Table 1 for variables and indicators. The relationship between the construction of each factors is as follows:

$$C^i = \sum_t C_t^i = \sum_t \frac{C_t^i}{E_t^i} * \frac{E_t^i}{G^i} * \frac{G^i}{P^i} * P^i \quad (2)$$

As shown in the (2) formula, t represents energy, i represents the year; C<sup>i</sup> represents the total carbon emissions of the logistics industry in the i year; C<sub>t</sub><sup>i</sup> represents CO2 emissions of the logistics industry based on fuel type t in year i; E<sub>t</sub><sup>i</sup> represents energy consumption of the logistics industry based on fuel type t in year i; E<sup>i</sup> represents the total energy consumption in year i; G<sup>i</sup> represents the output value of the logistics industry in the i year; P<sup>i</sup> represents the number of people in the logistics industry in the i year.

Formula (3) can be further expressed as:

$$C^i = \sum_t f_t^i \times S_t^i \times e^i \times g^i \times P^i \quad (3)$$

**Table 1.** Logistics industry influencing factors variables

Variable	indicators and description	symbols
Energy carbon emissions intensity	Energy carbon emissions coefficient	$f_t^i$
Energy structure	The proportion of energy consumption in total consumption	$S_t^i$
Energy strength	GDP energy consumption of logistics industry institutions	$e^i$
Logistics output	Per capita logistics output	$g^i$
Scales	Number of employees in the logistics industry	$p^i$

This article refers to the LMDI addition method proposed by ANG (2007) [5], so that  $C^0$  is the basis of the carbon emissions of the logistics industry in 2006,  $\Delta C_f$ ,  $\Delta C_s$ ,  $\Delta C_e$ ,  $\Delta C_g$  and  $\Delta C_p$  respectively represent each influencing factors pair. The carbon emissions value of the logistics industry is 10,000 tons. Based on the basis of carbon emissions during the basal period, the increase in the amount of carbon emissions in the  $i$  year is as follows:

$$\begin{aligned} \Delta C &= C^i - C^0 = \sum_t f_t^i \times S_t^i \times e^i \times g^i \times P^i \\ &\quad - \sum_t f_t^0 \times S_t^0 \times e^0 \times g^0 \times P^0 \\ &= \Delta C_f + \Delta C_s + \Delta C_e + \Delta C_g + \Delta C_p \end{aligned} \quad (4)$$

For formula (4), addition and subtraction, number of numbers, etc., the contribution value of various driving factors that affect the development of green logistics to the amount of carbon emissions are as follows:

$$\begin{aligned} \Delta C_f &= \sum_t \frac{C_t^i - C_t^0}{\ln C_t^i - \ln C_t^0} * \ln \frac{f_t^i}{f_t^0} & \Delta C_s &= \sum_t \frac{C_t^i - C_t^0}{\ln C_t^i - \ln C_t^0} * \\ \ln \frac{S_t^i}{S_t^0} & \Delta C_e &= \sum_t \frac{C_t^i - C_t^0}{\ln C_t^i - \ln C_t^0} * \ln \frac{e^i}{e^0} \\ \Delta C_g &= \sum_t \frac{C_t^i - C_t^0}{\ln C_t^i - \ln C_t^0} * \ln \frac{g^i}{g^0} & \Delta C_p &= \\ & \sum_t \frac{C_t^i - C_t^0}{\ln C_t^i - \ln C_t^0} * \ln \frac{P^i}{P^0} \end{aligned} \quad (5)$$

Among them,  $\Delta C$  indicates the change of carbon emissions in the logistics industry,  $C^i$  represents the carbon emissions of the logistics industry in the  $i$  year, and  $C^0$  represents the carbon emissions of the base period logistics industry.  $\Delta C_f$ ,  $\Delta C_s$ ,  $\Delta C_e$ ,  $\Delta C_g$  and  $\Delta C_p$  respectively represent the amount of carbon emission changes of each influential factors. If the contribution value of various factors is greater than zero, it means that the factors will promote the increase in carbon emissions of the logistics industry, that is, this factor will inhibit the development of green logistics; otherwise, it means that the factors will inhibit the increase in carbon emissions of the logistics industry, that is, the factor will promote the promotion The development of green logistics. In addition, because the carbon emissions coefficients of each energy are unchanged, so  $\Delta C_f = 0$ .

## 2.2. Data Illustration

This article mainly studies the analysis of the influencing factors and improvement paths of green logistics in 30 provinces in China from 2006 to 2019. The current statistical

yearbook does not attribute the logistics industry as an industry, and consistent with most of the existing research, with the data of transportation, warehousing, and postal industry in the statistical yearbook as the replacement data of the logistics industry as the replacement data of the logistics industry. conduct statistical analysis. Among them, some data from Hong Kong, Macao and Taiwan, and Tibet are lacking and will not be considered. The energy consumption of the logistics industry required for this article and the standard coal reference coal of various energy discounts have been collected from the Chinese Energy Statistics Yearbook. In terms of quantity, the coefficients of energy carbon emissions are referred to the Guide to the National Greenhouse Gas Eatsurding List (2006). Because the output value of the logistics industry will be affected by price factors, in order to eliminate the fluctuation of price fluctuations, this article is based on the 2006 as the base of the logistics industry.

## 3. Analysis of Influencing Factors of Green Logistics in China

This article uses the LMDI model to decompose the green logistics driving factors of various provinces and cities across the country to obtain the cumulative contribution value of each driving factors on the degree of influence of green logistics. The specific results are shown in Table 2.

Energy structure factors. Energy structure effectiveness has no significant suppression or promotion of the development of green logistics. From the perspective of provincial and cities, The contribution value of the energy structure effect of Shandong, Tianjin, Jilin, Liaoning and other places is negative, which will suppress the increase in carbon emissions; the energy structure effect of Hunan Province is a positive value, and the effect of inhibiting low-carbon logistics is the best; Henan, Zhejiang, Jiangsu and other places have a greater contribution value and will also promote the increase in carbon emissions. This is because most parts of China mainly promote the economic development of the logistics industry with oil and diesel energy consumption. Although the proportion of clean energy is increasing each year. Therefore Adjust the energy structure to achieve the purpose of promoting green logistics.

Energy strength factors. From the perspective of provinces, the energy strength effects of Guangdong and Hubei Province have the best effect to promote the development of green logistics. The energy intensity effects of each region show an increasing trend year by year, indicating that the growth of carbon emissions in the logistics industry is slow year by year, and the better the effect of energy intensity promotes low - carbon logistics.

**Table 2.** The LMDI decomposition results at province level(2006-2019)

province	$\Delta C_s$	$\Delta C_e$	$\Delta C_g$	$\Delta C_p$
Liaoning	6.33	-415.75	603.49	51.87
Jilin	5.28	-59.63	177.51	1.42
Heilongjiang	7.94	-40.26	202.12	18.48
Beijing	1.72	-129.80	201.67	164.38
Tianjin	-0.78	-152.13	124.52	71.55
Hebei	-0.24	-250.53	331.00	20.07
Shandong	0.23	-654.69	457.93	393.34
Shanghai	-42.78	-293.16	11.56	582.24
Jiangsu	0.56	-292.15	534.35	190.59
Zhejiang	-14.65	-344.98	335.82	275.17
Fujian	8.90	-82.62	196.62	134.09
Guangdong	9.06	-701.36	655.48	560.03
Hainan	3.53	-44.15	78.69	35.61
Shaanxi	3.29	-159.91	248.68	69.77
Shanxi	-7.62	-40.35	249.53	38.54
Henan	0.69	-87.38	286.13	92.62
Inner Mongolia	7.83	-285.52	367.80	127.80
Hubei	8.06	-556.06	697.01	122.55
Hunan	6.38	-176.83	343.92	77.94
Jiangxi	0.32	-112.00	200.86	43.60
Anhui	1.54	-18.77	171.50	101.21
Yunnan	3.11	-173.17	266.59	99.66
Guizhou	1.38	-237.09	346.12	67.84
Sichuan	3.47	-202.67	269.00	157.66
Chongqing	0.98	-106.44	157.18	130.59
Guangxi	1.94	-265.46	350.57	56.75
Gansu	0.02	-36.50	98.21	17.64
Qinghai	1.79	8.97	34.83	10.72
Ningxia	0.94	-91.73	96.25	18.89
Xinjiang	-4.18	-200.80	249.23	114.71

Logistics output factors. Logistics output effect is the main factor that hinders the development of green logistics. In terms of provinces, the effect of logistics output in Hubei and Guangdong is the best effect. This also shows that the economic development of the logistics industry in various places mainly depends on the consumption of energy. Therefore, with the rapid development of the logistics industry, the carbon emissions of the logistics industry will increase year by year.

Factors of employment. The scale factors show a negative effect on the development of green logistics. The contribution of the scale of employment in Guangdong, Shanghai, Jiangsu and other places is far more than other provinces. This is because the logistics industry in economic developed areas has developed rapidly, and the number of employees in the logistics industry has continued to increase.

## 4. Optimization Path for The Development of Green Logistics in China

### 4.1. Optimization of Energy Structure

On the whole, we must continuously improve the structure of the energy consumption of the logistics industry, excavate the emission reduction effect of the energy structure, and relieve the energy consumption of oil energy through the price control of high energy use of carbon emission coefficients; continuously improve the relevant policies and encouragement measures of energy use, Improve the energy structure, ensure the full use of oil and other energy, and introduce high-tech clean energy technology to increase investment and use of natural gas and electricity and other clean energy, and promote diversified energy supply; Green

environmental logistics transportation equipment, accelerate the elimination of old-fashioned high-energy consumption equipment, improve infrastructure construction, and give full play to the logistics emission reduction effect of the energy structure.

### 4.2. Improvement of Energy Efficiency

On the one hand, we must attach importance to technological innovation, strengthen the reasonable allocation of logistics industry resources, use high-tech to promote low-carbon logistics green development, use technology to help reduction work, give full play to the role of energy intensity on promoting green logistics development, while optimizing the energy structure of the energy structure Improve energy intensity, rely on advanced technology to drive the improvement of energy efficiency; on the other hand, we must improve the carbon emission reduction mechanism of the logistics industry, vigorously promote the reasonable allocation of the logistics industry resources, encourage the development of multi-type transportation, and promote various logistics and transportation methods to coordinate low-carbon development. , Reduce logistics energy consumption and carbon emissions, thereby improving the energy efficiency of the logistics industry.

### 4.3. Adjustment of Industrial Structure

The economic development of the logistics industry is a very important part of China's economic development. All regions across the country should reasonably adjust the economic development structure according to the economic development of their logistics industry, and take the goal of low-carbon development to make the logistics industry develop in the direction of energy conservation. In addition, China needs to strengthen the integration and development of

the Internet and logistics industry, thereby realizing the conversion of new and old kinetic energy, and striving to achieve the cooperation between the economic growth of the logistics industry and the development of low-carbon development.

## 5. Conclusion

China's carbon emissions still show a continuous growth trend, but the overall growth rate is not large. From the perspective of energy composition, it is still mainly based on the consumption of oil and diesel and other oil energy. The proportion of clean energy shows the increasing trend of each year. In the future, it is necessary to increase the research and development and use of clean energy to promote the improvement of green logistics.

It can be seen from the influencing factors of green logistics development that the energy strength effect will promote the development of green logistics. Logistics output and population scale effect will inhibit the development of green logistics. Therefore, the logistics industry should continuously optimize the industrial structure and adopt multi-type transportation and other methods to improve the efficiency of logistics operation.

## Acknowledgment

[Fund Project] Anhui University of Finance and Economics Graduate Scientific Research Innovation Fund Project 'Research on the Green Logistics Influencing Factors and Optimization Paths under carbon peaking and carbon

neutrality goals' (ACYC2021133).

## References

- [1] Zhu Taoxing, Sa Yuqing, British Sturgeon. Analysis of the development characteristics and efficiency of regional logistics-analysis based on carbon emissions and LMDI methods [J]. Research on technology, economy and management, 2021 (06): 104-108.
- [2] De Freitas L C, Kaneko S. Decomposing the decoupling of CO<sub>2</sub> emissions and economic growth in Brazil [J]. Ecological Economics, 2011, 70 (8): 1459-1469.
- [3] Papagiannaki K, Diakoulaki D. Decomposition analysis of CO<sub>2</sub> emissions from passenger cars: The cases of Greece and Denmark[J]. Energy Policy, 2009, 37(8): 3259-3267.
- [4] Kaya Y. Impact of carbon dioxide emission control on GNP growth: interpretation of proposed scenarios[R]. Paris: Presentation to the Energy and Industry Subgroup, Response Strategies Working Group, IPCC, 1989.
- [5] ANG B W, LIU N. Handling zero values in the logarithmic mean division index decomposition approach [J]. Energy Policy, 2007, 35(1): 238-246.
- [6] Gu Z, Malik H A, Chupradit S, et al. Green supply chain management with sustainable economic growth by CS-ARDL technique: perspective to blockchain technology[J]. Frontiers in Public Health, 2022, 9: 2391-2391.
- [7] Lin B, Tan R. Sustainable development of China's energy intensive industries: From the aspect of carbon dioxide emissions reduction[J]. Renewable & Sustainable Energy Reviews, 2017, 77: 386-394.