

Research Article

Analysis of Market Competitiveness of Container Railway Transportation

Pingbiao Zheng ¹, Shiqi Quan ² and Wenjun Chu²

¹Postgraduate Department, China Academy of Railway Sciences Corporation Limited, Beijing 100081, China

²Transportation and Economics Research Institute, China Academy of Railway Sciences Corporation Limited, Beijing 100081, China

Correspondence should be addressed to Pingbiao Zheng; pbzheng@rails.cn

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With the personalized and diversified development of customer demand in the freight market, road transportation has become a main competitor of railway transportation in container transportation due to its high flexibility, convenience, and low prices. Based on the generalized cost and logit model, this paper constructs a container railway goods transport market competitiveness model including four indicators of economy, timeliness, environmental protection, and safety. Take 20 ft container transportation as an example, the impact of changes in railway goods charge and railway travelling speed on the competitiveness of the railway goods transport market is analysed. Some realistic suggestions, including optimizing the railway tariff system, increasing the travelling speed of railway, innovating container intermodal products, and making full use of policy-oriented advantages are concluded.

1. Introduction

Under the background of transportation structure adjustment in China, the railway is undertaking more and more freight volumes which are shifted from road transportation. In the past three years, the national railway mass freight has increased by 650 million tons, and the average annual growth rate of railway container transportation volume has exceeded 30%. In 2020, the railway container transportation volume accounts for 12.8% of the total railway freight volume, which was only 6.1% in 2017. Containerization is the development direction of railway goods transport. Analysing the market competitiveness of container railway goods transport is of great significance to enhance the volume of railway container transportation, promote the development of multimodal transport, and help deepen the reform of the transport structure.

Many studies have been conducted on the generalized cost and competitiveness model [1–5], among which the generalized cost model is generally formulated as follows:

$$g = p + u_1(w_1) + \dots + u_n(w_n), \quad (1)$$

where g represents the generalized cost and u_n represents the function of converting the n th nonmonetary cost into monetary cost. Some scholars improved the generalized cost model. Wei et al. [5] introduced the safety factor into the model. In their study, the safety factor is considered relatively independent and set to be a multiplier factor in the generalized cost model. When it is better, the transportation mode is the best, so safety and other characteristics should be multiplicative.

In terms of the competitiveness model, the competitiveness of transportation enterprises refers to the ability of enterprises to compete for market resources in the transportation market. The more market shares an enterprise occupies in market competition, the stronger the competitiveness of the enterprise is considered [6], and the common competitiveness analysis model is the logit model. Chen [7] selected five indicators including economy, punctuality, speed, convenience, and safety to analyse the competitiveness of different modes of transportation in the Baiyinhua-Chifeng railway channel; Talebian et al. [8], based on

multiple logit models, analysed the competitive relationship between road, road-rail combined transport, and public-water combined transport.

In many previous studies, the competitiveness of different transport modes under variance of market demand is compared, and the results make significant positive impact on the optimization of railway freight operations. Under the requirements of carbon neutral, the transportation structure of railway goods transport, which is dominated by mass freight, will change. Therefore, this article selects containers that have grown rapidly in recent years for research.

When tendering for conveyance, customers are more concerned about the economy, rapidity, and safety of transportation. At the same time, with the implementation of environmental protection policies in various provinces and cities, the impact of the transportation mode on the environment has gradually been concerned. Therefore, this paper selects four indicators of economy, timeliness, environmental protection, and safety, uses two mature methods of generalized cost and logit model to analyse the market competitiveness of the transportation mode, constructs the railway goods transport market competitiveness model, studies the competition of railway and road container transport under different circumstances, and puts forward optimization suggestions to improve the competitiveness of container railway goods transport.

2. Competitiveness Model of Railway Container Transport Market

2.1. Generalized Cost Function. Freight generalized cost refers to the total cost of freight service in the whole process of transporting goods, including not only the freight cost but also the transportation time and other additional costs brought by freight service.

The value of the economic index mainly considers the total cost of goods transport, including cost of goods transport, loading charges, and miscellaneous charges of different modes of goods transport. The value of the timeliness index mainly considers the time of goods transport, including order acceptance waiting time, transportation time, and loading time of different modes of transportation, unifying the generalized cost measurement standard through the time value of goods. The value of the environmental protection index mainly considers the direct and indirect pollution costs of different transportation modes in the transportation process. The safety index refers to the cargo damage and cargo difference of the railway or road goods transport. The generalized cost functions of different transportation modes are constructed as

$$F_m = \frac{\lambda_1 * C_m + \lambda_2 * VOT * T_m * Q + \lambda_3 * E_m}{S_m}, \quad (2)$$

where F_m is the generalized cost of the m th mode of transportation, yuan, C_m is the transportation cost of the m th mode of transportation, yuan, VOT is the time value of goods, yuan/ $t \cdot h$ or yuan/TEU $\cdot h$, T_m is the transportation time of goods of the m th mode of transportation, h , Q is the volume of goods traffic, t /TEU, E_m is the generalized cost of environmental protection of the m th mode of transportation, yuan, S_m is the safety of the m th mode of transportation, and λ_1 , λ_2 , and λ_3 represent the weight of economy, timeliness, and environmental protection, respectively.

In 2019, the volume of goods traffic of railway and road accounts for 82% of the total freight volume of the society. Therefore, when evaluating the competitiveness of railway container transport market, the research scope is set between railway and road [9]. On this basis, the generalized cost function of railway and road is further refined .

2.1.1. Index Analysis of Railway Generalized Cost Function

- (1) The cost of goods transport C_{rail} :

C_{rail} includes basic cost, railway construction funds, electrification surcharges, pick-up and delivery charge, loading charges, and other miscellaneous charge. The calculation formula is

$$C_{\text{rail}} = C_{\text{rail}}^1 + C_{\text{rail}}^2 + C_{\text{rail}}^3 + C_{\text{rail}}^4 + C_{\text{rail}}^5 + C_{\text{rail}}^6, \quad (3)$$

where C_{rail}^1 represents the basic freight of railway goods transport, which consists of charged weight, tariff kilometrage, goods tariff no, arriving and dispatching goods rate c_{rail}^{11} , and transport goods rate c_{rail}^{12} , C_{rail}^2 represents the railway construction fund, which is jointly determined by the railway construction fund rate c_{rail}^2 and transportation mileage L_{rail} , C_{rail}^3 represents the electrification surcharge, which is jointly determined by the railway electrification surcharge c_{rail}^3 and L_{rail} , C_{rail}^4 represents the charge for receiving and delivering the goods, which is jointly determined by the short distance and the motor freight rate, C_{rail}^5 represents cargo loading charge, and C_{rail}^6 represents container usage charge.

- (2) Cargo transportation time T_{rail} :

Based on the analysis of the whole process of railway goods transport operation, the railway transportation time can be subdivided into order processing time t_{rail}^1 , goods assembly time t_{rail}^2 , goods loading time t_{rail}^3 , departure train inspection time t_{rail}^4 , goods transportation time t_{rail}^5 , freight train arrival train inspection time t_{rail}^6 , and goods unloading time t_{rail}^7 . Then, the goods transportation time can be expressed as follows:

$$T_{\text{rail}} = t_{\text{rail}}^1 + t_{\text{rail}}^2 + t_{\text{rail}}^3 + t_{\text{rail}}^4 + t_{\text{rail}}^5 + t_{\text{rail}}^6 + t_{\text{rail}}^7, \quad (4)$$

where t_{rail}^5 is decided by the travelling speed of railway v_{rail} and L_{rail} . In [10], a homogeneous Poisson process t_{rail}^2 is proposed, and the average assembly time of freight cars at stations is deduced as follows:

$$t_{\text{rail}}^2 = \frac{T}{2N_{ij}}(m_0 - \mu_{ij}), \quad (5)$$

where N_{ij} represents the number of containers arriving at station i and going to the station j in the statistical time period T in which the general value is 24 h, m_0 refers to the number of containers in assembly operation, and μ_{ij} represents the average number of containers sent each time in the statistical time period T .

- (3) Generalized environmental protection cost E_{rail} of railway goods transport:

In the literature [11–15], the calculation method of noise pollution, gas emission pollution, and indirect costs caused by railways is proposed. Among them, the noise cost takes into account the people's willingness to pay to reduce the impact of noise and the diseases that may be caused by noise; the cost of gas emission pollution takes into account factors such as the running distance of diesel locomotives and electric locomotives, weight ratio of freight cars, power loss, and unit price of gas emission costs; railway indirect costs account for 50% of the total external costs.

Based on the above research results, the generalized environmental protection cost of railway freight transportation includes four parts: ① pollution cost caused by NO_x , SO_2 , HC, PM, and other polluting gases emitted during transportation; ② climate change cost caused by the impact of carbon dioxide emitted during transportation on climate; ③ noise pollution cost; ④ indirect pollution cost caused by the manufacturing and distribution activities of power, fuel, and other energy to ensure its transportation. The specific cost of railway is shown in Table 1.

The generalized cost of railway environmental protection E_{rail} can be expressed as follows:

$$E_{\text{rail}} = 0.01454 * Q * L_{\text{rail}}, \quad (6)$$

where L_{rail} represents the distance of railway freight transportation.

- (4) Safety of railway goods transport S_{rail} :

The safety of railway goods transport is very important, so the safety attribute value of railway goods transport is 0.97 [16].

2.1.2. Index Analysis of Road Generalized Cost Function

- (1) Cost of goods transport C_{road} :

C_{road} includes basic freight charge C_{road}^1 and other transportation C_{road}^2 . C_{road}^1 can be divided into ton cost c_{road}^{11} and transportation cost c_{road}^{12} . C_{road}^2 includes

bridge charge and loading charge. The calculation formula is as follows:

$$C_{\text{rail}} = C_{\text{road}}^1 + C_{\text{road}}^2. \quad (7)$$

- (2) Cargo transportation time T_{road} :

Based on the analysis of the whole process of road goods transport, the time of road goods transport can be divided into order processing time t_{road}^1 , goods loading time t_{road}^2 , delivery time of transport documents t_{road}^3 , goods transportation time t_{road}^4 , and goods unloading time t_{road}^5 , where t_{road}^4 is jointly determined by road travel speed v_{road} and L_{road} .

T_{road} can be expressed as follows:

$$T_{\text{road}} = t_{\text{road}}^1 + t_{\text{road}}^2 + t_{\text{road}}^3 + t_{\text{road}}^4 + t_{\text{road}}^5. \quad (8)$$

- (3) Generalized cost of environmental protection in road goods transport E_{road} :

Similar to the broad environmental protection cost of railway goods transport, the specific cost of road is shown in Table 2.

The generalized cost of road environmental protection E_{road} can be expressed as follows:

$$E_{\text{road}} = 0.0441 * Q * L_{\text{road}}, \quad (9)$$

where L_{road} refers to the distance of road goods transport.

- (4) Safety of road goods transport S_{road} :

The safety of road goods transport is relatively lower than that of railway goods transport, and the value of road goods transport safety attribute is 0.92.

2.1.3. Index Weight Setting. There are many studies on index weight setting. The commonly used weight determination methods include principal component analysis method, analytic hierarchy process (AHP), entropy weight method, fuzzy comprehensive evaluation method, and multiattribute decision-making evaluation method. Because using a single method to determine the index may lead to a large deviation of different index weights, based on the principle of minimum information entropy, this paper uses AHP and entropy weight method to obtain the weights of the three indicators of economy, timeliness, and environmental protection. Formula (10) is used for solving the combined weights, and the final results are shown in Table 3:

$$W(i) = \frac{\sqrt{A(i)B(i)}}{\sum_{i=1}^n \sqrt{A(i)B(i)}}, \quad (10)$$

where $A(i)$ represents the weight of the AHP and $B(i)$ represents the weight of the entropy.

2.2. Competitiveness Model of Railway Freight Market. Based on the logit model, the competitiveness model of container railway goods transport market is constructed. The general form of the logit model is as follows:

TABLE 1: Generalized cost of environmental protection indicators for railway goods transport.

	Pollution fee	Climate change fee	Noise pollution fee	Indirect pollution fee	Total
Generalized unit cost of environmental protection (yuan/t km)	0.00543	0.00116	0.00053	0.00742	0.01454

TABLE 2: Generalized cost of environmental protection indicators for road goods transport.

	Pollution fee	Climate change fee	Noise pollution fee	Indirect pollution charge	Total
Generalized unit cost of environmental protection (yuan/t km)	0.02	0.007	0.0096	0.0075	0.0441

TABLE 3: Index weights of generalized cost function.

	λ_1	λ_2	λ_3
Weight	0.25	0.39	0.36

$$P_m = \frac{\exp(-\theta F_m)}{\sum \exp(-\theta F_m)} \quad (11)$$

where P_m represents the market share of the m th mode of transportation and θ indicates the parameters to be calibrated.

The generalized cost values of different transportation modes are quite different. In order to avoid the problem of result deviation caused by excessive generalized cost, the above model is improved as follows:

$$P_m = \frac{\exp(-\theta F_m / F_{ave})}{\sum \exp(-\theta F_m / F_{ave})} \quad (12)$$

where F_{ave} represents the average value of generalized cost in different modes of freight transportation.

3. Analysis on the Competitiveness of Railway Container Transport Market

3.1. Parameter Calibration. According to the survey on the relevant parameters of container railway and road goods transport in the market, the parameters of the railway goods transport market competitiveness model are calibrated in Table 4.

3.2. The Influence of Different Factors on the Competition of Railway Container Transport Market. According to the model constructed in Section 2.1, the generalized cost is directly related to the market competitiveness of railway goods transport [18]. Two factors that have a greater impact, namely, cost of railway goods transport and railway travelling speed, are selected to analyse the impact of their fluctuations on the competitiveness of railway goods transport market.

3.2.1. Cost of Railway Goods Transport. The influence degree of railway goods transport competitiveness is shown in Figure 1 when other parameters remain unchanged, the

trunk transportation distance is calculated in the range of 100–2500 km, and the variation range of railway goods transport rates is between –60% and 60%.

It can be seen from the above figure that the market competitiveness of railway goods transport increases with the decrease of cost of railway goods transport. When the cost of railway goods transport increase or decrease in the same proportion, the decrease of railway cost of railway goods transport has a greater impact on the market competitiveness of railway goods transport within the range of 100–1000 km. The increase of cost of railway goods transport has a greater impact on the market competitiveness of railway goods transport within the range of 1000–2500 km. For example, the railway goods transport market competitiveness changes by 23.7%, 14.6%, –13.5%, and –21.0%, respectively, when the railway goods transport transportation distance is 800 km and the cost of railway goods transport changes by –50%, –30%, 30%, and 50%. The railway goods transport market competitiveness changes by 17.6%, 11.5%, –12.8%, and –21.1%, respectively, when the railway freight transportation distance is 1500 km and the cost of railway goods transport changes by –50%, –30%, 30%, and 50%.

From the perspective of impact degree, the reduction of cost of railway goods transport has a greater impact on the market share of railway goods transport within the range of 500–700 km. With the increase of railway goods transport distance, the market competitiveness of railway goods transport gradually increases, but the impact degree gradually decreases. For example, when the cost of railway goods transport is reduced by 30% and the railway goods transport distance is 300 km, 600 km, 2000 km, and 2500 km, the market competitiveness of railway goods transport increased by 12.0%, 15.3%, 10.2%, and 9.3%, respectively.

The increase of cost of railway goods transport has a great impact on the market share of railway goods transport within the range of 800–1100 km. With the increase of railway goods transport distance, the market competitiveness of railway goods transport is gradually reduced, but the impact degree gradually decreases. For example, when the cost of railway

TABLE 4: Parameter calibration list of container railway and road goods transport.

Parameter	Meaning	Value	Unit
c_{rail}^{11}	Dispatching goods rate	440	yuan/TEU
c_{rail}^{12}	Transport goods rate	3.185	yuan/ (case*km)
c_{rail}^2	Railway construction fund	0.528	yuan/ (case*km)
c_{rail}^3	Railway electrification surcharge	0.192	yuan/ (case*km)
C_{rail}^4	Taking-out and placing-in of cars fee	450 yuan/case within 10 km; 24 yuan/case more than 10 km	yuan/ (case*km)
C_{rail}^5	Railway loading charge	290	yuan/case
C_{rail}^6	Container usage charge	Within 250 km, 35 yuan/case; thereafter, 6 yuan/case per 100 km	yuan/case
t_{rail}^1	Railway order processing time	24	h
t_{rail}^2	Railway assembly time	3	h
$t_{rail}^3 + t_{rail}^4 + t_{rail}^5$ $+ t_{rail}^6 + t_{rail}^7$	Railway goods transport operation time other than railway order processing time, assembly time, and transportation time	12	h
v_{rail}	Railway travelling time	40	km/h
c_{road}^{11}	Ton cost of road goods transport	60	yuan/TEU
c_{road}^{12}	Road transport goods rate	6	yuan/ (case*km)
C_{road}^2	Road loading charge	130	yuan/TEU
C_{road}^2	Tolls for vehicle transition, bridge crossing, and tunnel crossing	1.866	yuan/ (case*km)
t_{road}^1	Road order processing time	10	H
$t_{road}^2 + t_{road}^3 +$ $t_{road}^4 + t_{road}^5$	Road goods transport operation time except road order processing time and transportation time	6	H
v_{road}	Road travelling speed	70	km/h
VOT	Time value of container freight [17]	40	yuan/TEU-h
θ	Competitiveness model parameters	3.5	

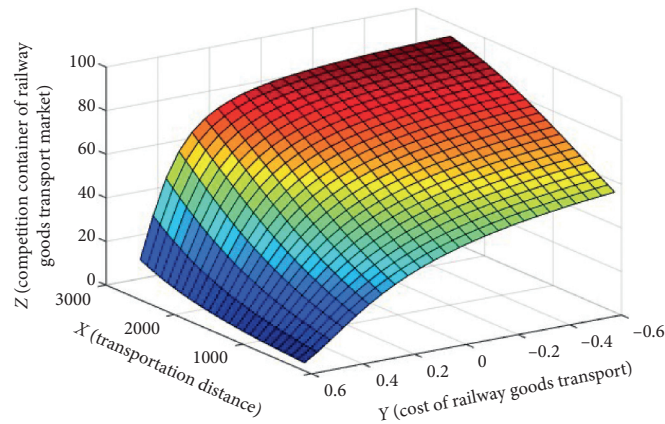


FIGURE 1: The impact of changes in cost of railway goods transport on the competitiveness of railway goods transport.

goods transport is increased by 30% and the railway goods transport distance is 300 km, 1000 km, 2000 km, and 2500 km, the market competitiveness of railway goods transport is decreased by 7.8%, 13.5%, 12.0%, and 11.4% respectively.

3.2.2. Railway Travelling Speed. The influence degree of railway goods transport competitiveness is shown in Figure 2 when other parameters are kept unchanged, the

calculated trunk line transport distance is in the range of 100–2500 km, and the variation range of railway travelling speed is between –60% and 60%.

It can be seen from Figure 2 that the market competitiveness of railway goods transport increases with the growth of railway travelling speed, and the decrease of travelling speed has a greater impact on the market competitiveness of railway goods transport than its growth. For example, when the transport distance is 800 km, the railway travelling speed

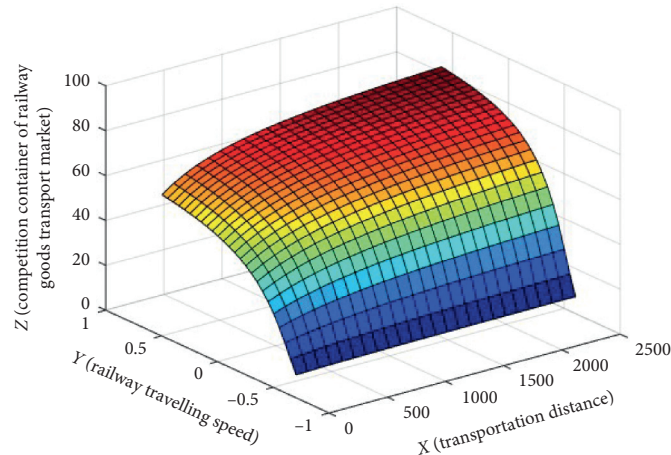


FIGURE 2: The impact of railway travelling speed on railway goods transport competitiveness.

changes by -50% , -30% , 30% , and 50% , and the market competitiveness of railway goods transport changes by -11.1% , -4.9% , 2.7% , and 4.0% , respectively.

From the perspective of impact degree, the reduction of railway travelling speed has a greater impact on the market competitiveness of railway goods transport with the transport distance between 1500 km and 2000 km. With the increase of transport distance, the impact degree shrinks, but the change range is small and basically stable. For example, when the railway travelling speed is reduced by 30%, the transport distance is 300 km, 800 km, 1500 km, and 2500 km, and the market competitiveness of railway goods transport decreased by 2.0%, 4.9%, 5.4%, and 5.2%, respectively.

The growth of railway travelling speed has a greater impact on the market competitiveness of railway goods transport with a transport distance of 1000–1200 km, and it is generally stable. For example, when the increase of railway travelling speed is 30%, the transport distance is 300 km, 800 km, 1200 km, and 2500 km, and the market competitiveness of railway goods transport increases by 1.1%, 2.7%, 2.9%, and 2.6%, respectively.

3.3. Suggestions on Improving the Competitiveness of Container Railway Goods Transport Market. Based on the above analysis, it can be obtained that the falling cost of railway goods transport and the increase of travelling speed have positive effects on container railway goods transport to varying degrees. In order to promote the increase of railway goods transport revenue, it is necessary to supplement the corresponding supporting measures to optimize the railway tariff system and increase travelling speed. In addition, since the introduction of the “Road to Railway” policy, it has played a significant role in railway goods transport. Therefore, it is necessary to give full play to the policy-oriented advantages to accelerate the increase of railway containers. Specific optimization suggestions are as follows.

3.3.1. Optimizing the Railway Tariff System [19]. On the whole, cost of railway goods transport change has great influence on the competitiveness of railway freight market, and the

reduction of cost of railway goods transport has a positive impact on enhancing the competitiveness of railway goods transport market. From the above theoretical calculation results, in the range of 500–700 km, the change of cost of railway goods transport has a high sensitivity to the impact of railway goods transport market competitiveness. Strengthen the monitoring of the road freight rate of goods transportation within this range, and give customers certain price concessions when the transportation capacity allows, as far as possible to improve the proportion of railway goods transport of such goods. However, excessive use of the way of winning at low price will lead to the reduction of the revenue rate of tariff per ton-kilometre. Within the transportation distance of more than 1500 km, the cost of railway goods transport increases by 10~20%, and the railway goods transport still has more than 60% of the market share, maintaining a certain competitive advantage.

Therefore, in order to achieve the effect of increasing transportation and income at the same time, the railway goods transport marketing decision-making department can combine the seasonal fluctuation law of suitable container goods, comprehensively consider the factors such as transportation distance and transportation capacity, formulate a stepped and flexible railway freight tariff system, promote the competitiveness of railway goods transport market, and ensure the increase of railway goods transport income.

3.3.2. Increase the Travelling Speed of Railway Goods Transport. From the above theoretical analysis, the reduction of railway travelling speed is more sensitive to the impact of railway goods transport market competitiveness of long-distance container transportation. The improvement of railway travelling speed is more sensitive to the impact of railway goods transport market competitiveness of medium- and long-distance container transportation. In view of the above two characteristics, the following optimization suggestions for increasing the travelling speed of container railway goods transport are proposed.

First, optimize the layout of container assembly centres. The average transportation distance of railway container goods has decreased from 1851 km in 2014 to 987 km in

January to October 2020, with a significant decrease. This paper suggests analysing the sources of railway medium- and long-distance container goods, selecting container assembly centres that adapt to market changes, reducing the assembly time of medium- and long-distance container goods at stations, and improving the travelling speed of container railway goods transport. Second, increase the proportion of medium- and long-distance direct container trains. Through strengthening the research on the cross bureau freight source of the origination and the arriving, expanding the suitable container freight source, operating the multimodal container freight train products, improving the operation proportion of the through train, and ensuring the stability of the goods transportation time, so as to form the “passenger train” transportation mode and improve the travelling speed. Third, innovate the transportation organization mode. This paper suggests promoting the close cooperation between goods transport and dispatching departments, formulating the whole process plan of goods transport, improving the close cooperation among goods transport, locomotive, vehicle, loading and unloading equipment, and train inspection operation groups, optimizing the operation process of transportation organization, and improving the freight turnover rate. Fourth, improve the informatization level of railway goods transport. Based on the advantages of electronic freight bills, this paper suggests improving the transportation dispatching management system, focusing on improving the quality of daily and shift traffic plans preparation and fulfilment, dynamically grasping the main fulcrum station in station traffic flow and expected arrival traffic flow, reducing the detention time of freight technical station as the optimization goal, strengthening process control, realizing the efficient connection of traffic flow between main fulcrum stations, and improving the overall travelling speed of the freight train. Fifth, play the role of the assessment mechanism. Based on the goal of improving speed and efficiency, according to the capacity of different stages, based on adhering to the centralized and unified command of dispatching, the dynamic adjustment of transportation differentiation assessment method can improve the competitiveness of railway goods transport.

3.3.3. Innovative Medium- and Long-Distance Container Intermodal Transportation Products. It can be seen from the above analysis that changes in railway travelling speed and freight rates have a greater impact on the 800–1000 km railway goods transport market competitiveness, and the longer the distance, the more obvious the advantage of railway goods transport. In the context of the continuous shortening of the overall distance of railway goods transport, we must actively innovate transport products to ensure the competitiveness of the railway medium- and long-distance transportation market.

At this stage, due to a stronger sense of competition among transportation modes, it is possible to consider promoting the integration of various modes, optimizing the division of roles of each mode of transportation in the field of freight, and taking advantage of the medium-and long-distance railway

goods transport. In the stage when railways vigorously develop the container launching business, the complementary attributes of the transportation modes can be used to form a competition and cooperation situation. The whole process of container intermodal transportation can be designed to collect and dredge the port transportation by railway, and the water transportation is unblocked along the coast and along the river, and the road dredges the “capillary” transportation. Products, with the help of inland dry port logistics nodes, develop “pendulum cycle” and “triangular cycle” container train products [20], at the same time, strengthen the brand marketing concept, and use the China-Europe train brand management as a template to promote road-rail-water container intermodal products to enhance its influence.

3.3.4. Making Full Use of the Advantages of Policy Orientation. In the past three years, under the guidance of the central government’s policy on adjusting the transport structure and increasing the volume of railway goods traffic, the China railway has been actively docking with various ministries and commissions, provincial and municipal government departments, and key enterprises, realizing the rapid development of railway containers from the four aspects of sea-rail combined transport, international combined transport, riverside trains, and inland areas. In the case of rapid development, we should also see the shortcomings that restrict the development of container. For example, first, affected by the epidemic, China Railway Express has grown against the trend, but restricted by the factors such as gage change and infrastructure lag, and the capacity of ports is tight, which makes China Railway Express congestion become normal. Second, in terms of multimodal transport, the construction of dedicated lines, capacity expansion and transformation projects in ports, logistics parks, and other places is slow, which restricts the incremental space. In addition, the application scope of mobile equipment such as rail/road dual-purpose trailer, rail/road roll on roll off transport equipment, and humpback transport flat car required by rail/road combined transport is small, which restricts the improvement of multimodal transport convenience and has an impact on the increment of container multimodal transport.

Container transportation is an important method to reduce social logistics costs, promote the adjustment of transportation structure, and help build a new development pattern of international and domestic dual cycle. Under the new situation, with the help of national policy dividends, the railway container transportation facilities and equipment are optimized and upgraded to enhance its market competitiveness. The first is to transform port facilities and equipment, improve the clearance capacity of international channels, and ensure the timeliness and reliability of international container transportation. The second is to accelerate the construction of special lines and the expansion and reconstruction of old lines, so as to solve the shortage of “last one kilometre” connection and improve the container transportation capacity. The third is to actively promote the development and application of advanced equipment such as variable gauge bogies and rail/road trailers, improve the

adaptability of container transportation under different standards, and ensure its flexible operation.

4. Conclusions

In the face of the complex freight market environment, this article analyses the competitiveness of the railway goods transport market under the conditions of different transportation distances, cost of railway goods transport, and travelling speeds of containerized goods through the comprehensive use of generalized cost and logit models, which is of great significance to winning the battle for incremental freight. In view of the fierce competition of road and railway goods transport, quantify the market share of railways between road and railway goods transport and propose the degree of influence of different factors on the competitiveness of railway goods transport market under different haul distances and the law of change, which is the decision-making level of railway transportation enterprises. Understand the transportation market situation, focus on optimizing daily freight marketing and transportation production organization, promote “revolution to rail” transportation, and formulate high-quality development promotion plans for railway goods transport to provide theoretical support.

However, this article only conducts research from the perspective of railways. As the national comprehensive transportation system is becoming increasingly mature, containers, as a standardized means of delivery between different modes of transportation, have more market growth potential and can also compete for the development of rail and other modes of transport in the market. Make further analysis to promote the integration and development of various modes of transportation.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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