

# Research on the Floating of Railway Container Transport Price under the Condition of Break-Even

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**Abstract:** Multimodal transportation can integrate the advantages of various transportation methods, reduce transportation and logistics costs, and promote reasonable transportation. The development of railway container multimodal transport is of great significance to promote the development of railway modern logistics and to improve the quality and efficiency of the transportation industry. As an important lever in the transportation market, price is one of the important factors that affect customers' choice of cargo transportation. A scientific and reasonable freight rate can significantly improve the competitiveness of the railway container transportation market. In the context of multimodal transport, this article takes China Railway Container Transport Corp, as the object, focusing on determining the fluctuation range of railway container freight rates for different container types under break-even. After calculation and analysis, it is found that under break-even, the fluctuation range of freight rates increases with the increase in transportation mileage decreases, and the price of a 20ft container with the same transportation distance drops more than a 40ft container.

## 1. Introduction

In the context of the increasing importance of railway container transportation, this article considers the use of cost-oriented freight rate floating method, through the analysis of the composition of the payment expenditure of the railway container trains operated by China Railway Container Transport Corp, establishes the relationship model between freight revenue and payment expenditure, and adopts Break-even analysis determines the rate of decline in freight rates for 20ft containers and 40ft containers.

## 2. Construction of Generalized Cost Model for Road and Railway

### 2.1 The Generalized Cost of the Railway Transportation

This paper uses China Railway Group's payment expenditures to approximate operating costs to conduct a break-even analysis. According to the current railway liquidation regulations, China Railway Container Transport Corp's payment expenditures mainly include six fees, including delivery service fee, locomotive towing fee, line usage fee, vehicle service fee, arrival service fee, and comprehensive service fee. In addition, railway construction funds, container handling fees, and highway companies' pickup and delivery fees are also counted as fees for China Railway Container Transport Corp [1]. The above 9 types of costs are represented by the following formula.

$E_{1f}^j$  is the delivery service fee, that is determined as follows:

$$E_{1f}^j = \beta_f \times q_{1x}^j \quad (1)$$

$\beta_f$  is the railway container transportation delivery service fee charging rate(yuan/Unit).

$q_{1x}^j$  is the number of containers transported(Unit)

$E_{1y}^j$  is the locomotive towing fee, that is determined as follows:

$$E_{1y}^j = \beta_y \times q_{1t}^j \times l_{1t} \quad (2)$$

$\beta_y$  is the railway container locomotive towing fee charging rate (yuan/Unit).

$q_1^j$  is the weight of the goods transported (Ton).

$l_{1t}$  is the railway transport mileage (Km).

$E_{1x}^j$  is the Line usage fee, that is determined as follows:

$$E_{1x}^j = \beta_x \times q_{1x}^j \times l_{1t} / 2 \quad (3)$$

$\beta_x$  is the railway container line usage fee rate (yuan/Unit/km).

$E_{1c}^j$  is the vehicle service fee, that is determined as follows:

$$E_{1c}^j = \beta_c \times q_{1x}^j \times l_{1t} / 2 \quad (4)$$

$\beta_c$  is railway container vehicle service charge rate (yuan/Unit/km).

$E_{1d}^j$  is the arrival service fee, that is determined as follows:

$$E_{1d}^j = \beta_d \times q_{1x}^j \quad (5)$$

$\beta_d$  is the railway container transport arrival service fee charge rate (yuan/Unit).

$E_{1z}^j$  is the comprehensive service fee, that is determined as follows:

$$E_{1z}^j = (\beta_{j1} \times q_{1x}^j + \beta_{j2} \times q_{1x}^j \times l_{1t}) \times (1-\rho) \times \beta_z \quad (6)$$

$\beta_{j1}$  is the railway base price 1 (yuan/Unit).

$\beta_{j2}$  is the railway base price 1 (yuan/Unit/km).

$\rho$  is the floating range of freight rate.

$\beta_z$  is the comprehensive service fee rate (yuan/Unit).

$E_{1q}^j$  is the fees for collection and delivery by highway companies, that is determined as follows:

$$E_{1q}^j = l_{1g} \times \beta_g \times q_i^j \quad (7)$$

$\beta_g$  is the railway container transportation delivery service fee charging rate(yuan/Unit).

$l_{1g}$  the highway transport mileage (Km).

$E_{1z}^j$  is the miscellaneous expenses, that is determined as follows:

$$E_{1z}^j = \beta_b \times q_{ix}^j \times (1-\rho) \quad (8)$$

$\beta_b$  is the railway container transportation delivery service fee charging rate(yuan/Unit).

$E_{1j}^j$  is the railway construction fund, that is determined as follows:

$$E_{1j}^j = \beta_j \times l \times q_i^j \times (1-\rho) \quad (9)$$

$\beta_j$  is the railway construction fund rate (yuan/Unit/km).

$C_t$  is China Railway Container Transport Corp's cost of operating railway container trains, that is determined as follows:

$$C_t = \beta_x \times q_{1x}^j \times l_{1t} + \beta_c \times q_{1x}^j \times l_{1t} + \beta_y \times q_{1x}^j \times l_1 + \beta_f \times q_{1x}^j + \beta_g \times l_{1g} \times q_1^j + \beta_d \times q_1^j \quad (10)$$

$$+ (\beta_j \times l_{1t} \times q_i^j + \beta_b \times q_{ix}^j) \times (1-\rho) + (\beta_{j1} \times q_{1x}^j + \beta_{j2} \times q_{1x}^j \times l_{1t}) \times (1-\rho) \times \beta_z$$

## 2.2 The Generalized Cost of the Truck-Only Transportation

Assuming that the railway-sea express line business is carried out between two cities A and B, this article takes the transportation fee charged by the single vehicle to the cargo owner as the railway-sea express line business revenue, and the revenue from operating railway container trains of China Railway Container Transport Corp corporation mainly includes the freight income, freight and miscellaneous income and extended service income of the container train, of which 20ft containers are calculated based on 2 containers per vehicle. Then, between two points, the revenue from a single

vehicle of the Rail-Sea Express line = freight revenue + transportation and miscellaneous fee revenue + extended service revenue.  $Y$  is the revenue from operating railway container trains of China Railway Container Transport Corp corporation, that is determined as follows:

$$Y = (\beta_{j1} \times q_{lx}^j + \beta_{j2} \times q_{lx}^j \times l_{lr} + (\beta_s + \beta_b) \times q_{lx}^j + \beta_q \times q_{lx}^j + \beta_j \times l_{lr} \times q_{lx}^j) \times (1 - \rho) \quad (10)$$

### 3. Calculation Model of the Advantageous Railway Distance

Set up the profit of the railway container trains operated by China Railway Container Transport Corp is a function of the transportation mileage and the floating range of the freight rate under different standard container types. Establish the functional relationship between transportation mileage, standard container type, cargo density and the floating range of freight rate, that can be determined as follows:

$$F(l_{lr}, \rho) = Y - C_t \quad (12)$$

When  $F(l_{lr}, \rho)$  is equal to 0, the break-even state is reached.

## 4. Case Analysis

### 4.1 Parameter Value Analysis

Based on the information that is shown on website and actual investigation, the parameters of the cost should value as shown in Table 1, the parameters of the revenue should value as shown in Table 2 [2].

Table 1 the Parameters List of the Cost

parameter	the value	unit
$\beta_f$	150.71	yuan/ Unit
$\beta_x$	1.872	yuan/ Unit /km
$\beta_c$	0.96	yuan/ Unit /km
$\beta_y$	0.0245	yuan/ Ton/km
$\beta_z$	7.25%	--
$\beta_d$	150.71	yuan/ Unit
$\beta_g$	0.213	yuan/ Ton/km

Table 2 the Parameters List of the Revenue

parameter		20ft	40ft	unit
$\beta_{j1}$		440	532	yuan/ Unit
$\beta_{j2}$		3.185	3.918	yuan/ Unit/km
$\beta_s$	within 500 kilometers	130	260	yuan/ Unit
	501-2000 kilometers will be charged for every additional 100 kilometers	13	26	yuan/ Unit
	2001-3000 kilometers will be charged for every additional 100 kilometers	6.5	13	yuan/ Unit
	more than 3001 kilometers	390	780	yuan/ Unit
$\beta_b$		375	592.5	yuan/ Unit
$\beta_q$		690	1035	yuan/ Unit
$\beta_j$		0.528	1.122	yuan/ Unit/km

### 4.2 The Analysis of the Advantageous Railway Distance and Sensitivity

It can be seen from Figure 1 that the floating range of freight rate of 40ft containers under breakeven is significantly lower than that of 20ft containers. Under breakeven, the floating range of

freight rate can show its profitability. It can be seen that the profitability of 20ft containers is significantly better than that of 40ft containers. The reason is that the suitable source of cargo for 20ft containers is different from that of 40ft containers. 40ft containers have a lower load capacity utilization rate than 20ft containers, they occupy more transportation capacity, and the freight rate is also higher [3]. Under the breakeven situation, the floating range of freight rate shows a decreasing trend with the increase of the transport mileage. The revenue of ton-kilometers of cargo transportation decreases with the increase of the transport mileage, and the change of the ton-kilometer payment is small. The lower the floating range of freight rate will be under break-even [5].

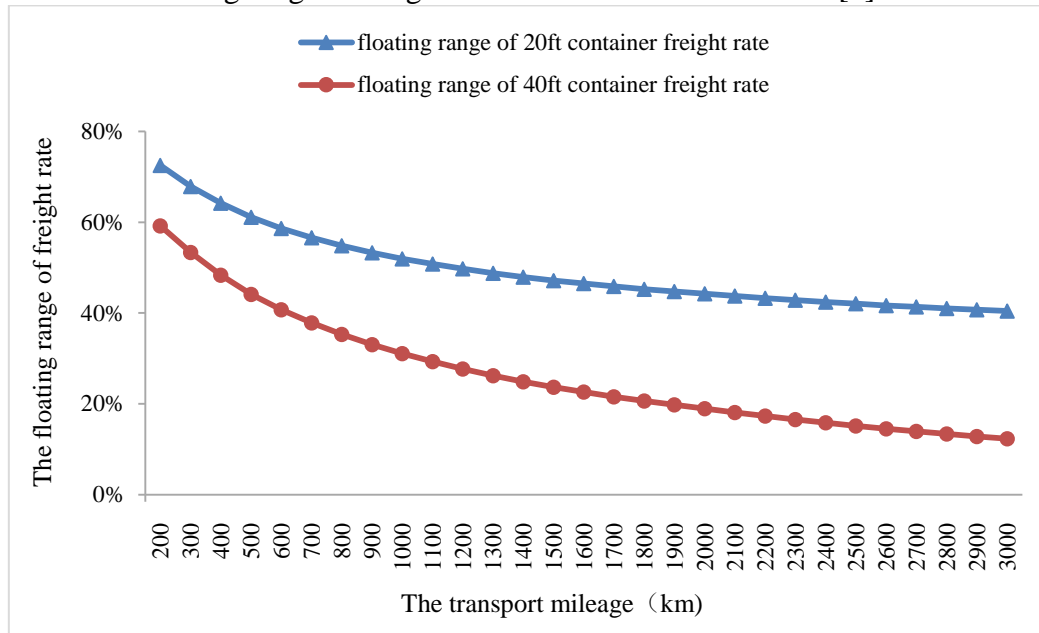


Fig.1 Rail-Sea Express Train Fluctuation of 20ft Container Freight Price and 40ft Container Freight Price with Distances for Break-Even

## 5. Conclusion

We found that under break-even, the fluctuation range of freight rates increases with the increase in transportation mileage decreases, and the price of a 20ft container with the same transportation distance drops more than a 40ft container. This paper selects the calculation parameters of the price of road freight and the cost of railway container trains operated by China Railway Container Transport Corp Since the data obtained is only relatively static data [5], the actual cost of China Railway Container Transport Corp's operation is difficult to measure and obtain, and there are certain values. For the limitations and deficiencies of, future research can conduct more detailed, extensive and in-depth research on parameter values.

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