

Grey Relational Analysis of the Correlation between the Road Transportation and the National Economy

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Abstract. In order to reveal the correlation between the road transportation industry and national economy in China from 1985 to 2013, the grey relational analysis method is chose to calculate the gray correlation degree between GDP as main performance index in national economy system and other four factors,such as passenger capacity,passenger person-kilometers, freight traffic,rotation freight ton-kilometers,as performance indexes in road transportation industry system. The result of calculation shows the correlation between road transportation industry and national economy in China has maintained at a high level and each factors in road transportation industry conforms the level of national economy development. The order of the correlation degree are easily illustrated by FT,PC,PPKs and RFTKs.It means FT is closer interactive with national economy than other factors in the period.

Introduction

The road transportation is the most widely used in the comprehensive transportation system, in which the road transportation features in its widest service scope, most carrying capacity, most flexible organizing methods, most various carrying products and most employees, and becomes one of most important pillars of national economic and social development. From the middle 80's of the last century, China's road transport industry began to carry out the industry reform. Until now the road transport industry has achieved a leap forward development, which results in the "bottleneck" of the national economy caused by road transportation industry having been almost eliminated and giving a strong support for the rapid development of economic society.

Many scholars, in the past decades, have made a qualitative and quantitative analysis on the relationship between transportation and national economic development.Chirenouzhu had qualitatively studied the relationships between transportation national economy in 2002[1], Chuan_xu Wang had made a comprehensive evaluation of the coordinative effect of transportation and economy by the comprehensive weighted method. On such basis, a sensitivity analysis of the target weight and target value is given[2].

As a subindustry of transportation industry, the study on the relationship between the road transport industry and the national economy had been conducted by many professional researchers in past years. Lei Chen had analyzed the interactive relationship between the roadtransportation and the national economic development with panel data from Zhejiang province[3].Lifang Wang had established the evaluation index system and the evaluating model and conducted a analysis of adaptability of road transportation to the development of national economy based on road transportation supply-and-demand-balance coefficient, factors analysis and DEA model with Jilin province panel data[4].

This paper attempts to quantitatively analyze the relationship between the road transport industry and the whole national economy. By establishing index system of performance in road transportation industry and in national economic development, the grey relational analysis model is used to calculate in the paper. The results of calculation can provide the accurate data about interactive relationship between Road transportation industry system and national economy system. On the basis of those figures, paper further researches the reasons behind the performance and put forth a series of corresponding suggestions.

Calculation model and selection of performance indexes in two systems

In this paper, the gray correlation analysis method is chose for the model of calculation. This method considers the "the gray correlation degree" which is based on the similarity or dissimilarity degree of development trend among factors is a measure of the degree of correlation between the two different systems. This method can be easily performed by SPSS software package.

The performance indexes in two different systems, road transportation industry and national economy, are selected as follows. Gross domestic production (GDP) is main performance index in national economy system and passenger capacity (PC), passenger person-kilometres (PPKs), Freight Traffic (FT), rotation volume of freight transport kilometres (RFTKs) are the performance indexes in road transportation industry.

Collection of original data

In order to better reveal the correlation between road transportation industry and national economy system, the paper collects the original data from year of 1985 to 2013. The period of data collection is nearly 30 years in order to lead to a thorough analysis. These original data which are presented in table 1 is originated from China Statistical Yearbook published by the China National Bureau of statistics[5].

Table 1 the original data from year of 1985 to 2013.

year	GDP(100million)	PC(10Thousand)	PPKs(100million person_kilometers)	FT(10thousand ton)	RFTKs(100million ton_kilometers)
1985	9016	476486	1724.88	538062	1903.2
1986	10275.2	544259	1981.74	620113	2117.99
1987	12058.6	593682	2190.43	711424	2660.39
1988	15042.8	650473	2528.24	732315	3220.39
1989	16992.3	644508	2662.11	733781	3374.8
1990	18667.8	648085	2620.32	724040	3358.1
1991	21781.5	682681	2871.74	733907	3428
1992	26923.5	731774	3192.64	780941	3755.39
1993	35333.9	860719	3700.7	840256	4070.5
1994	48197.9	953940	4220.3	894914	4486.3
1995	60793.7	1040810	4603.1	940387	4694.9
1996	71176.6	1122110	4908.79	983860	5011.2
1997	78973	1204583	5541.4	976536	5271.5
1998	84402	1257332	5942.81	976004	5483.38
1999	89677.1	1269004	6199.2	990444	5724.3
2000	99214.6	1347392	6657.4	1038813	6129.4
2001	109655.2	1402786	7207.1	1056312	6330.4
2002	120332.7	1475257	7805.8	1116324	6782.5
2003	135822.8	1464335	7695.6	1159957	7099.5
2004	159878.3	1624526	8748.4	1244990	7840.9
2005	184937.4	1697381	9292.1	1341778	8693.2
2006	216314.4	1860487	10130.8	1466347	9754.2476
2007	265810.3	2050680	11506.8	1639432	11354.6872
2008	314045.4	2682114	12476.1	1916759	32868.1861
2009	340902.8	2779081	13511.4	2127834	37188.8205
2010	401512.8	3052738	15020.8	2448052	43389.6721

2011	473104	3286220	16760.2	2820100	51374.7406
2012	519470.1	3557010	18467.5	3188475	59534.9
2013	56845.2	1853463	11250.9	3076648	55738.1

The progress of analysis

The progress of analysis is divided into the following steps: nondimensionalization, the calculation of correlation coefficient and the calculation of the gray correlation degree. Whole original data mentioned in table 1 are nondimensionalized with z-score standard in the paper. Dimensionless data are showed in table 2.

Table 2 Dimensionless data

Year	GDP	PC	PPKs	FT	RFTKs
1985	-0.8960	-1.1230	-1.1498	-1.0388	-0.6505
1986	-0.8875	-1.0459	-1.0953	-0.9175	-0.6372
1987	-0.8753	-0.9896	-1.0511	-0.7826	-0.6036
1988	-0.8550	-0.9249	-0.9795	-0.7517	-0.5688
1989	-0.8418	-0.9317	-0.9511	-0.7495	-0.5592
1990	-0.8304	-0.9276	-0.9600	-0.7639	-0.5603
1991	-0.8092	-0.8883	-0.9067	-0.7493	-0.5559
1992	-0.7742	-0.8324	-0.8386	-0.6798	-0.5356
1993	-0.7170	-0.6856	-0.7309	-0.5921	-0.5161
1994	-0.6295	-0.5794	-0.6208	-0.5113	-0.4903
1995	-0.5438	-0.4805	-0.5396	-0.4441	-0.4773
1996	-0.4732	-0.3880	-0.4748	-0.3798	-0.4577
1997	-0.4201	-0.2941	-0.3407	-0.3906	-0.4416
1998	-0.3832	-0.2340	-0.2557	-0.3914	-0.4284
1999	-0.3473	-0.2207	-0.2013	-0.3701	-0.4135
2000	-0.2824	-0.1315	-0.1042	-0.2986	-0.3883
2001	-0.2114	-0.0684	0.0123	-0.2727	-0.3759
2002	-0.1387	0.0141	0.1393	-0.1840	-0.3478
2003	-0.0334	0.0017	0.1159	-0.1195	-0.3282
2004	0.1303	0.1840	0.3391	0.0062	-0.2822
2005	0.3008	0.2670	0.4543	0.1493	-0.2293
2006	0.5142	0.4527	0.6321	0.3334	-0.1635
2007	0.8510	0.6692	0.9238	0.5893	-0.0642
2008	1.1791	1.3881	1.1293	0.9993	1.2704
2009	1.3618	1.4985	1.3487	1.3113	1.5385
2010	1.7742	1.8101	1.6687	1.7847	1.9232
2011	2.2612	2.0759	2.0374	2.3347	2.4185
2012	2.5767	2.3842	2.3993	2.8792	2.9248

With SPSS, all correlation coefficients are calculated and showed in table 3.

Table 3 correlation coefficients

year	PC	PPKs	FT	RFTKs
1985	0.6709	0.6457	0.7650	0.6532
1986	0.7456	0.6902	0.9418	0.6488
1987	0.8032	0.7252	0.8345	0.6297
1988	0.8707	0.7891	0.8187	0.6175
1989	0.8388	0.8102	0.8353	0.6205

1990	0.8278	0.7822	0.8764	0.6311
1991	0.8558	0.8275	0.8876	0.6461
1992	0.8905	0.8798	0.8320	0.6597
1993	0.9392	0.9740	0.7885	0.6974
1994	0.9047	0.9850	0.7977	0.7696
1995	0.8818	0.9947	0.8241	0.8764
1996	0.8462	1.0000	0.8337	0.9709
1997	0.7869	0.8553	0.9430	0.9587
1998	0.7569	0.7849	0.9859	0.9134
1999	0.7862	0.7609	0.9561	0.8769
2000	0.7548	0.7223	0.9694	0.8150
2001	0.7648	0.6741	0.8851	0.7383
2002	0.7524	0.6244	0.9134	0.6889
2003	0.9323	0.7568	0.8447	0.6104
2004	0.8982	0.6892	0.7896	0.5279
2005	0.9347	0.7515	0.7541	0.4650
2006	0.8847	0.7981	0.7194	0.4045
2007	0.7184	0.8659	0.6385	0.3346
2008	0.6890	0.9051	0.7205	0.8367
2009	0.7729	0.9757	0.9039	0.7242
2010	0.9307	0.8156	0.9812	0.7572
2011	0.7144	0.6740	0.8649	0.7469
2012	0.7065	0.7233	0.6042	0.5701

In order to thoroughly analyze the interactive relationship between road transportation industry and National economy, the correlation coefficients in table 3 are visually diagrammed in figure 1. In the figure 1, the trend of each factor are clearly showed.

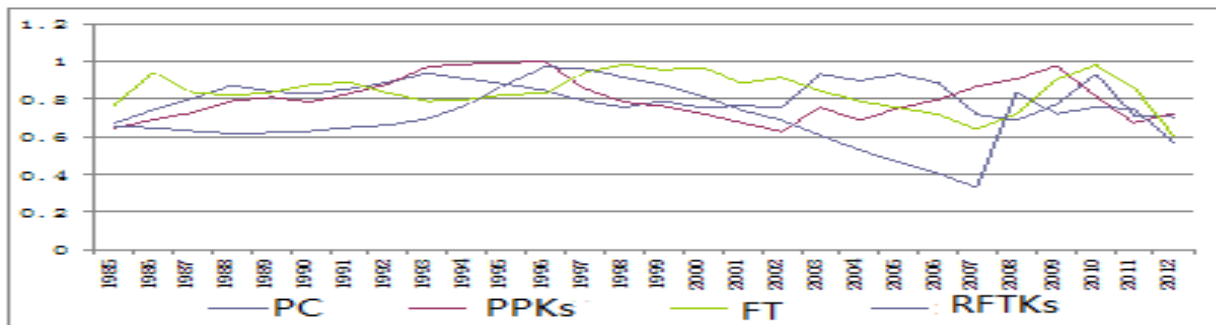


Fig. 1 the trend of each factor

Finally, on the basis of all Correlation Coefficients being calculated, the gray correlation degree between GDP and other factors, such as PC, PPKs, FT, RFTKs, are computed and listed in table 4.

Table 4 the gray correlation degree between GDP and other factors

	PC	PPKs	FT	RFTKs
the gray correlation degree	0.8164	0.8029	0.8396	0.6925

Conclusions

The result from the result of calculation shows the correlation between road transportation industry and national economy in China, from 1985 to 2013, has maintained at a high level and each factors in road transportation industry conforms the level of national economy development. The order of the

correlation degree are easily illustrated by FT,PC,PPKs and RFTKs.It means FT is closer interactive with national economy than other factors in this period.

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