Transportation and quantitative analysis of socio-economic development of relations

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Abstract: Transportation has a close relationship with socio-economic. This article selects the indicators which can measure the development of transportation and socio-economic, using the method of correlation analysis, regression analysis, intensity of transportation analysis and transport elastic analysis, to analyze the relationship between them quantitatively, so that it has the fact guiding sense in the national development planning for the future.

1. Introduction
In the process of China's modernization, development of transport have a close correlation with socio-economic development. Qualitative analysis is that transportation link social production, distribution, consumption and other aspects of organic together, plays an important role in the realization of the rational distribution of productive forces, the development of resources, strengthen the horizontal joint, connecting urban and rural areas and other social economy, That is, it is a sufficient condition for ensuring the normal conduct and development of socio-economic activities.

However, in the quantitative analysis of the quantitative relationship between transportation and economic development, many scholars at home and abroad also have relevant research. Yizhong Ding (2002) constructed the Transportation-Economy Model, putted the Concept of Traffic Reactions, and analyze quantitative the Nonlinear Relationship between Transportation and Economy; Jianguo Liu (2002) constructed an evaluation of the relationship between transportation and social economy, verified the long-term equilibrium relationship between freight volume and GDP. Weidong Li (2007) constructed an index system to evaluate the adaptability of highway traffic and socio-economic development, nonlinear weighted evaluation method was used to evaluate the adaptability between them. Shudan Cui (2007) analyzed the only relationship between the freight price, the freight turnover and GDP, and have the conclusion that the Granger reason for the price of transportation is GDP, the Granger reason for GDP and transportation price is the freight turnover. Kveiborg (2007) Using the exponential decomposition method to study the relationship between Danish road freight weight + transfer and economic growth. Haicheng Xu (2007) studies the coordination of road traffic and economic development, and concludes that there is no Granger causality and long-term equilibrium development between them in 1978-1991, and there is a two-way causality and co-integration relationship in 1992 - 1991. Li Jing (2008) Aimed at the development of transportation corridor and urban economy, selected the quantitative index, established economic impact model based on the space economic gravity model, and analyzed empirically the Chengdu-Chongqing transportation channel.

The analysis of the existing literature, the study of the relationship between transportation and social economy, mostly from the perspective of the macroeconomic time series to analyze the
relationship between the two, and more emphasis on the transport of goods, passenger transport involves less. Based on the relevant research results at home and abroad, this paper chooses the indicators to measure the development of transportation and social economy, and uses the correlation analysis, regression analysis and other methods to explore quantitatively relationship between the passenger transport, cargo transport and socio-economic development. Through this analysis and discussion, it is clear that the closely relationship and influences of each other between transportation and social economy, the development trend of transportation is clearly grasped.

2. Indicators Selected

There are more important quantitative indicators to reflect the development of transportation. The common indicators are traffic infrastructure investment, line mileage and so on. Passenger index have passenger transport volume, passenger turnover, freight index have cargo volume, freight turnover, especially the last four indicators are particularly important.

Passenger (cargo) volume refers to that in a certain period of time, a variety of transport vehicles actually transport the number of passengers (goods). It is a quantitative indicator to reflect the transport industry for people's lives and socio-economic life, and an important indicator to study the scale and speed of transport development, development and inspection of transport production plan.

Passenger (cargo) turnover refers to that the sum of the number of passengers (goods) delivered by various means of transport and their corresponding transport distance over a period of time. It is an important indicator to reflect the total output of the transport industry. It is also the main basic information for compiling and checking the transportation production plan, calculating the transportation efficiency, labor productivity and accounting for the cost of the transport unit. The formula is:

\[ \text{passenger (cargo) turnover} = \sum \text{passenger(cargo)transport volume} \times \text{transport distance} \]

China's economy continues to grow rapidly, and transportation is also developing rapidly by leaps and bounds, especially the turnover. Traffic volume and turnover are subordinate to economic development. In short, economic development is a prerequisite for the development of transport. Under the effect of the funds provided by economy, the volume and turnover have a substantial increasing. Therefore, this article assumes that the social economy is in a relatively stable state, and selects the passenger volume, passenger turnover, cargo volume and cargo turnover to quantitative analyze transportation. Table 1 for China's 2004 - 2013 related specific data.

| Index         | Years | Passenger traffic (million) | Passenger turnover (100 million kilometers) | Freight (ten thousand tons) | Cargo turnover (100 million km) |
|---------------|-------|----------------------------|---------------------------------------------|-----------------------------|---------------------------------|
| Years         | 2015  | 1943271.00                 | 30059.00                                   | 4175886.00                  | 178356.00                       |
|               | 2014  | 2032218.00                 | 28647.00                                   | 4167296.00                  | 181668.00                       |
|               | 2013  | 2122991.55                 | 27571.64                                   | 4102495.00                  | 168164.76                       |
|               | 2012  | 3804034.90                 | 33383.09                                   | 4100436.00                  | 173804.46                       |
|               | 2011  | 3526318.73                 | 30984.03                                   | 3696961.00                  | 159323.62                       |
|               | 2010  | 3269508.17                 | 27894.26                                   | 3241807.00                  | 141837.42                       |
|               | 2009  | 2976897.83                 | 24834.94                                   | 2825222.00                  | 122133.31                       |
|               | 2008  | 2867892.00                 | 23196.70                                   | 2585937.00                  | 110300.49                       |
|               | 2007  | 2227761.00                 | 21592.58                                   | 2275822.00                  | 101418.81                       |
|               | 2006  | 2024158.00                 | 19197.21                                   | 2037060.00                  | 88839.85                        |
|               | 2005  | 1847018.00                 | 17466.74                                   | 1862066.00                  | 80258.13                        |
|               | 2004  | 1767453.00                 | 16309.10                                   | 1706412.00                  | 69445.09                        |

Source: China Statistical Yearbook

The important quantitative indicators that reflect the socioeconomic status are GDP, GNP, price
index, per capita income, wage level, personal disposable income, employment rate, fiscal revenue, population size, etc. They are able to measure the degree of social and economic development from a different perspective. China's GDP in 2004-2015 specific data in Table 2.

| Years | GDP (billion yuan) | Per capita GDP (yuan) | Years | GDP (billion yuan) | Per capita GDP (yuan) |
|-------|-------------------|-----------------------|-------|-------------------|-----------------------|
| 2015  | 689052.10         | 50251.00              | 2009  | 340319.95         | 25607.53              |
| 2014  | 636463.00         | 46652.00              | 2008  | 316030.34         | 23707.71              |
| 2013  | 566130.18         | 41907.59              | 2007  | 266422.00         | 20169.46              |
| 2012  | 518214.75         | 38459.47              | 2006  | 183617.37         | 14185.36              |
| 2011  | 468562.38         | 35197.79              | 2005  | 16499.70          | 12355.58              |
| 2010  | 399759.54         | 30015.05              | 2004  | 159453.60         | 12355.58              |

Source: China Statistical Yearbook

3. Analysis of the Number of Transportation and Social Economy

The relationship between transportation and social economy is very strong. First, transport demand is derived from social and economic activities, and the economic benefits that it brings are realized by investment in traffic construction. Therefore, So this part of the indirect, hidden the contribution is contained in the owner of the object. The quantitative analysis between transportation and social economy is discussed in detail from the following aspects.

3.1 Correlation Analysis

The correlation analysis specifically refers to analyze two or more relevant variable elements, to study whether is a certain dependency between the variables and to study the direction and degree of correlation between the variables, so as to measure the degree of close relationship between variable factors, which is applicable to the study whether exist some dependency between variables or phenomena. A typical expression of relevance is that a variable changes with another variable. In the following analysis, the per capita GDP is used as the Dependent variable (Y), the independent variable is the passenger volume (X1), the passenger turnover (X2), the cargo volume (X3) and the cargo turnover (X4). Using SPSS software for its correlation analysis, from Table 1, Table 2, the data in Table 3 obtained by regression.

| Correlation | Per capita GDP | Passenger traffic (million) | Passenger turnover (100 million kilometers) | Freight (ten thousand tons) | Cargo turnover (100 million km km) |
|-------------|----------------|-----------------------------|---------------------------------------------|----------------------------|-----------------------------------|
| Per capita GDP | Pearson correlation | .666*                        | .931**                                       | .996**                      | .990**                            |
|               | Significant (bilateral) | .035                         | .000                                        | .000                        | .000                              |
| Passenger traffic (million) | Pearson correlation | .666*                        | 1                                           | .709*                       | .748**                            |
|               | Significant (bilateral) | .035                         | .001                                        | .022                        | .013                              |
| Passenger turnover (100 million kilometers) | Pearson correlation | .931**                       | .882**                                      | 1                           | .952**                            |
|               | Significant (bilateral) | .000                         | .001                                        | .000                        | .000                              |
| Freight (ten thousand tons) | Pearson correlation | .996**                       | .709*                                       | .952**                      | 1                                 |
|               | Significant (bilateral) | .000                         | .022                                        | .000                        | .000                              |
| Cargo turnover (100 million km km) | Pearson correlation | .990**                       | .748**                                      | .970**                      | 1                                 |
|               | Significant (bilateral) | .000                         | .013                                        | .000                        | .000                              |

* Significant correlations at 0.05 level (bilateral).
** Significant correlations at 0.01 level (bilateral).
[0.0,0.09], indicating no correlation; [0.1,0.3] is weakly correlated, [0.3,0.5] is moderately correlated; [0.5,1.0] is highly correlated. Transportation and social economy as a social science subject, will be affected by many complex factors. And from the chart we can see that the Pearson correlation coefficient between per capita GDP and passenger volume, passenger turnover, cargo volume, cargo turnover is 0.666, 0.931, 0.996, 0.990. So the per capita GDP is highly correlated with the apparent level of 0.01. In addition, in addition to the double-tailed test probability P value of per capita GDP and passenger volume is 0.035 > 0.1, the two-tailed test probability P value of the per capita GDP and the remaining indicators are 0.000 < 0.01, which shows that per capita GDP and passenger turnover, freight, cargo turnover have a strong correlation, in short, transport and socio-economic has a strong relevance.

3.2 Linear Regression Analysis
Based on the correlation analysis, SPSS software was used to analyze the linear regression model between the dependent variable and the different independent variables, and the corresponding form is shown in Table 4.

| Equation   | R²      | F    | df1 | df2 | Sig. | C      | b1      | b2      |
|------------|---------|------|-----|-----|------|--------|---------|---------|
| Linear     | .444    | 6.391| 1   | 8   | .035 | 1114.708| .009    |
| Logarithm  | .449    | 6.528| 1   | 8   | .034 | -339167.514| 24740.346|
| Twice      | .444    | 2.799| 2   | 7   | .128 | -2174.640| .012    | -4.705E-10|
| Index      | .532    | 9.112| 1   | 8   | .017 | 7872.622| 4.197E-7 |

Dependent variable: per capita GDP; independent variable: freight turnover

| Equation   | R²      | F    | df1 | df2 | Sig. | C      | b1      | b2      |
|------------|---------|------|-----|-----|------|--------|---------|---------|
| Linear     | .866    | 51.869| 1   | 8   | .000 | -14913.569| 1.680    |
| Logarithm  | .874    | 55.367| 1   | 8   | .000 | -376876.360| 39988.695|
| Twice      | .877    | 24.984| 2   | 7   | .001 | -36690.345| 3.544    | -3.792E-5 |
| Index      | .900    | 72.268| 1   | 8   | .000 | 4347.374| 7.026E-5 |

Dependent variable: per capita GDP; independent variable: freight volume

| Equation   | R²      | F    | df1 | df2 | Sig. | C      | b1      | b2      |
|------------|---------|------|-----|-----|------|--------|---------|---------|
| Linear     | .992    | 963.088| 1   | 8   | .000 | -6636.724| .272    |
| Logarithm  | .984    | 487.503| 1   | 8   | .000 | -444233.671| 31729.585|
| Twice      | .992    | 441.538| 2   | 7   | .000 | -9399.097| .013    | -3.478E-10|
| Index      | .961    | 196.864| 1   | 8   | .000 | 6439.511| 4.609E-7 |

Dependent variable: per capita GDP; independent variable: turnover of goods

| Equation   | R²      | F    | df1 | df2 | Sig. | C      | b1      | b2      |
|------------|---------|------|-----|-----|------|--------|---------|---------|
| Linear     | .981    | 408.510| 1   | 8   | .000 | -7284.402| .272    |
From Table 4, we can see that there is a strong fit degree of between the independent variable and the dependent variable. From the data in Table 4, we can analyze the index curve fitting degree between the per capita GDP and passenger volume, passenger turnover is better. The fitting equation is

\[ Y = 7872.622 + 4.197 \times 10^{-7} X \]  

(1)

\[ Y = 4347.374 + 7.026 \times 10^{-5} X \]  

(2)

The quadratic curve fitting degree between per capita GDP and freight volume, freight turnover are excellent, and the fitting equation is

\[ Y = -9399.097 + 0.13 X - 3.48 \times 10^{-10} X^2 \]  

(3)

\[ Y = -4041.685 + 0.215 X - 2.231 \times 10^{-7} X^2 \]  

(4)

These data and equations further illustrate the significant impact on per capita GDP by changes in transportation. Namely, there is a close association between transportation and socio-economic development.

4. **Summary**

The relationship between transportation and social economy is extremely complex. On the whole, transportation supports the development of social economy, and the social economy drives the development of transportation at a certain level. In this paper, through the correlation analysis, regression analysis, transport intensity and transport elasticity analysis, The relationship between the two is quantitatively analyzed. Transportation and social economy has a strong correlation, they promote each other, the socio-economic development trend is basically synchronized with the development trend of transport. Based on the close relationship between them, from the perspective of long-term development of the country, we should increase the support and focus on transportation in the future development plan, in order to achieve better economic and social benefits, which will be on positive role in promoting the transportation, the socio-economic, the national living standards.

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