Research on Promoting the Comprehensive Development of the Integrated Transport Industry Based on Subdivision Industries

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Research on Promoting the Comprehensive Development of the Integrated Transport Industry Based on Subdivision Industries

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Abstract. As China’s economic has entered into the New Normal, the development of the integrated transport industry is also stepping into a new stage. Promoting the comprehensive development of the integrated transport industry has direct strategic and global impacts on economic and social development. By defining the integrated transport industry and dividing the subdivision industries, this study intensively analyses the impacts of the related subdivision industries of the integrated transport industry on the economic development by utilizing econometric model. On this basis, this paper puts forward countermeasures and suggestions for promoting the comprehensive development of the integrated transport industry from three aspects: transport equipment manufacturing industry, transport construction industry and transportation industry.

1. Introduction

As a fundamental industry of national economy, transportation exerts a strategic and global effect on the development of economy and society. Devoting to the centenary goal—building a moderately prosperous society in all respects, China has basically built an integrated transportation system adaptive to the development of economy and society on the whole. It powerfully supports China’s important international status as the second largest economy and the biggest trading country in goods in the world. The ambitious goal of building a Transportation Power was put forward in the 19th National Congress of the Communist Party of China. Therefore, it is necessary and crucial to study the general thought and strategic path of promoting the development of integrated transport industry (ITI).

ITI refers to a collection of various transport-related economic activities (including transport equipment, transport infrastructure, and transport services) derived for satisfying comprehensive transportation demands. It is a fundamental industry of national economy, playing a strong leading role and having an extensive scope of influence. To be specific, ITI is mainly composed of transport equipment manufacturing industry, transport construction industry and transportation industry. According to the Industrial Classification Standard of National Economy of China (GB/T 4754-2011) and by selecting transport-related industrial classifications, it can be summarized as follows: transport equipment manufacturing industry is a manufacturing industry providing production techniques and equipment for transportation service. ITI involves general- and special-purpose equipment...
manufacturing industries, transport equipment manufacturing industries related to automobile, railway, ship, aerospace and others, and metalwork, machinery and equipment repairing industry. Transport construction industry belongs to the engineering construction industry for offering infrastructures to transportation service, involving civil engineering construction industry. Transportation industry aims to transfer the spatial positions of goods or passengers to destinations by transportation vehicles, involving railway, road, waterway, air and pipeline transport industries, handling and transport agent industries. ITI contains 12 divisions and hundreds of sections. The sections and divisions are displayed in Table 1.

### Table 1. Involved Industries of ITI

| ITI | Involved industrial sectors | Involved industrial divisions |
|-----|-----------------------------|-------------------------------|
|     | Numbe r | Name | Numbe r | Name |
| Transport equipment manufacturing industry | 34 | General-purpose equipment manufacturing industry |
|     | 35 | Special-purpose equipment manufacturing industry |
|     | 36 | Automobile manufacturing industry |
|     | 37 | Transport equipment manufacturing industries related to railway, ship, aerospace and others |
|     | 43 | Metalwork, machinery and equipment repairing industry |
| Transport construction industry | 48 | Civil engineering construction industry |
| Transportation industry | 53 | Railway transport industry |
|     | 54 | Road transport industry |
|     | 55 | Waterway transport industry |
|     | 56 | Air transport industry |
|     | 57 | Pipeline transport industry |
|     | 58 | Handling and transport agent industries |

The previous empirical analysis on the influence of transport industry on the economy development level generally concentrated on the industry itself. Selecting input or output value of various transportation modes or related technical indexes including mileages of various transportation modes, the influences of transport industry on development of national economy or regional economy were investigated by empirical model [1-7]. Besides, some researches specifically analyzed the influence of industrial structure on the development of transport industry [8]. Since China’s economic development entered into New Normal, supply-side structural reform has become a major means of macro-policy. Each industry is experiencing the transformation and upgrading of industrial structures, including various industries related to transport industry. In terms of the reform and development of transport industry, Rong Chaohe [9], Ge Xiaopeng and Wang Qingyun [10] pointed out that the transport industry needs to be transformed from large-scale constructing to promoting multimodal transportation and improving industrial governance level. In order to realize lean development of transport industry, it is necessary to consider the influence of industries related to ITI on economic development by analyzing the input-output relationship from the perspective of subdivision industries. Investigated the above topic, the deficiencies of current researches are supplemented and pertinent countermeasures and suggestions for promoting the development of ITI are put forward based on the subdivision industries.
2. Methodology

Traditional economic growth theory suggests that economic growth is the result of inputs of various production factors on the hypothesis of competitive equilibrium. The output function is determined by diverse factors such as capital, technology and labor force, while the input of production factors is the important factor. By calculating the economic growth, Romer \cite{11} believed that long-term economic growth is attributed to technical growth while short-term economic growth is contributed by inputs of various factors including capital and labor. Moreover, technology, capital and labor are organized together for production in a certain industrial structure. Therefore, different industrial structures can result in different yields. In the research measuring the contributions of industrial structures on economic growth, Liu Wei et al. \cite{12}, scholars in China, supposed that the production function is 

\[ Y = F(X_1, X_2, ..., X_k, A). \]

Where, \( Y \), \( X_i \) (\( i = 1, 2, ..., k \)) and \( A \) separately denote the gross output of a country’s economy, the output of the industry \( i \) in economy and economic system and technological level, respectively. By solving the total differential of the production function \( Y \) and then dividing it by \( Y \), Formula (1) can be obtained:

\[
\frac{dY}{Y} = \frac{X_1}{Y} dX_1 + ... + \frac{X_k}{Y} dX_k + A \frac{dA}{A} = \beta_1 \frac{dX_1}{X_1} + ... + \beta_k \frac{dX_k}{X_k} + \beta_0
\]  

(1)

Where, \( \beta_k = \frac{X_k}{Y} \frac{dY}{dX_k} \) (\( i = 1, 2, ..., k \)) and \( \beta_0 = \frac{A}{Y} \frac{dA}{A} \) represent the output elasticity of the industry \( i \) and the influence of institutional change on the total output, respectively. Thus, the contributions of industries to economic growth can be calculated by using the following econometric model.

\[
\ln Y = \beta_1 \ln X_1 + ... + \beta_k \ln X_k + \beta_0 + \epsilon
\]  

(2)

The independent variable index is selected as the industrial investment of fixed asset to investigate the influence of industrial input on the gross output. In this case, the factors of each item represent industrial input elasticity, namely, the influence of relative change amount of input values on that of gross output of economy. The elasticity can reflect the input-output efficiency of corresponding independent variables to dependent variables. Therefore, by employing the model, the influence of various subdivision industries on gross output of the economy was analyzed by taking 12 divisions related to ITI as indexes.

3. Data Analysis

*Industrial Classification Standard of National Economy* was first released in 1984, successively amended in 1994, 2002, 2011 and 2017. Based on availability of data and complying with the research scope, the investments of fixed assets of 12 divisions in Table 1 are selected as independent variables (namely, general- and special-purpose equipment manufacturing industries, automobile manufacturing industry, transport equipment manufacturing industries related to railway, ship, aerospace and others, metalwork, machinery and equipment repairing industry, civil engineering construction industry, railway, road, waterway, air and pipeline transport industries, handling and transport agent industries) according to Industrial Classification Standard of National Economy of China (GB/T 4754-2011) and refined partition of subdivision industries of ITI. Moreover, the GDP is taken as the dependent variable.

The data of 22 provinces, 5 autonomous regions and 4 municipalities of China in 2012~2015 were utilized. By using cross-section data of various regions, the relationship between the investment in subdivision industries of ITI and the economic growth was explored. It was because that China enters into a new stage of economic development during which industrial adjustment is widely conducted with a short reform time. If the national time series data are applied to carry out the research, the problems of extremely small sample and random appear and the influence of the difference of regional...
industrial structures on economic growth is ignored. By contrast, with the regional sample data, the influence of changes of various subdivision industries with time on economic growth can be taken into account as well as the influence of changes of other industries in the same category with time. Therefore, the influence of industries related to ITI on economic growth is investigated by using the sample data of various regions.

4. Result and Discussion

According to the investments of fixed assets of 12 divisions in various regions and sample observations of GDP, the econometric model (2) is solved by Eviews 9.0 software and the results is in Table 2.

| Index of divisions                                      | 2012  | 2013  | 2014  | 2015  |
|--------------------------------------------------------|-------|-------|-------|-------|
| General-purpose equipment manufacturing industry (X1)  | 0.0980| 0.2915| 0.0551| 0.2173|
| Special-purpose equipment manufacturing industry (X2)  | 0.2618| 0.0026| 0.2657| 0.2034|
| Automobile manufacturing industry (X3)                  | 0.0567| 0.1725| 0.1337| 0.0386|
| Transport equipment manufacturing industries related to railway, ship, aerospace and others (X4) | 0.0147| -0.0627| 0.0304| 0.0330|
| Metalwork, machinery and equipment repairing industry (X5) | -0.1520| -0.0014| -0.2134| 0.0033|
| Transport construction industry (X6)                    | -0.0971| 0.0324| 0.0438| -0.0094|
| Railway transport industry (X7)                         | -0.0574| -0.0628| 0.0395| 0.0278|
| Road transport industry (X8)                            | 0.0613| 0.1741| 0.1285| 0.2305|
| Waterway transport industry (X9)                        | 0.0006| -0.0270| 0.0314| 0.0335|
| Air transport industry (X10)                            | 0.1617| 0.2460| 0.2071| 0.1762|
| Pipeline transport industry (X11)                       | 0.1288| 0.0456| 0.0838| -0.0298|
| Handling and transport agent industries (X12)           | 0.1589| -0.0634| 0.0017| -0.1930|
| Factors such as institution (A)                          | 10.2634| 8.4624| 7.4167| 8.1603|
| Coefficient of determination (R^2)                      | 0.9461| 0.9575| 0.9443| 0.9325|
| Adjusted coefficient of determination (R^2)             | 0.9102| 0.9292| 0.9072| 0.8874|
| Significance level of F-statistics (P)                  | 0.0000| 0.0000| 0.0000| 0.0000|

By analyzing the test result of level of significance of the model, the coefficient of determination and the adjusted coefficient of determination were both basically larger than 0.9. Moreover, the significance level of F-statistics was significantly lower than 0.01. All these implied that the model had great regression effect and therefore it was deserved to be further analyzed. Afterwards, the results of coefficients of industrial indexes every year were analyzed to thus further observe the changes of some key industries in time series.

According to the sorting results of elasticity coefficients of industrial inputs influencing economic growth, the industries ranked the first three and last three in terms of the influences on economic growth every year were successively displayed, as shown in Table 3.
It can be seen from Table 3 that the industries related to ITI contributed a lot in promoting economic growth. The industries which have an insignificant contribution and even a negative effect in promoting economic growth involve transport equipment manufacturing industries related to railway, ship, aerospace and others, metalwork, machinery and equipment repairing industry, civil engineering construction industry, railway and pipeline transport industries, and handling and transport agent industries.

According to the definition of the elasticity coefficient of industrial input influencing economic growth, it represents the change of gross output of the economy induced by changing industrial input. For example, the elasticity coefficient of road transport industry was 0.2305 in 2015, which represents that the GDP will increase by 0.2305% once the input in road transport industry rises by 1%. A positive elasticity coefficient implies that the input-output efficiency of the industry is high and industrial development effectively promotes economic growth. On the contrary, a negative elasticity coefficient indicates that the input-output efficiency of the industry is low and therefore the industrial development environment remains to be improved and governed. Otherwise, extensive management probably restricts economic development. On this basis, by analyzing the results in Table 3, as the average annual growth rate of China’s GDP fell to that below 10% and economic development enters into New Normal in 2012~2015, the promotion effect of ITI on economic growth lies in equipment and automobile manufacturing industries in transport equipment manufacturing industry and the air and road transport industries in transportation industry. However, the industries with a low development efficiency and even restricting economic growth mainly involve metalwork, machinery and equipment repairing industry in transport equipment manufacturing industry and civil engineering construction industry in transport construction industry as well as railway transport industry, handling and transport agent industries in transportation industry. The elasticity coefficients of the industries which significantly push the economic growth are basically larger than 0.2%, showing a great promotion effect. By contrast, the elasticity coefficients of the lower-ranked industries are basically larger than -0.1%, having an insignificant inhibition effect on economic growth. Therefore, in terms of
the influence of ITI on economic development based on subdivision industries, ITI should concentrate on industrial upgrading based on giving priority to efficiency. The first task is to allocate resources to some advantaged industries which have a large promotion effect on economic growth, for example equipment manufacturing industry, automobile manufacturing industry, road and air transport industries. Afterwards, it is necessary to optimize the resource allocation in various industries including transport equipment manufacturing industry related to railway, ship, aerospace and others, metalwork, machinery and equipment repairing industry, civil engineering construction industry, railway transport and pipeline transport industries, and handling and transport agent industries. In this way, industrial governance level and development efficiency can be improved to thus further structural transformation and upgrading of ITI. Based on the basic framework, pertinent countermeasures and suggestions are put forward for involved key sectors.

5. CONCLUSION AND SUGGESTIONS

5.1. Transport Equipment Manufacturing Industry
The focus in development plan of transport equipment manufacturing industry is to constantly maintain and enhance the advantages for the development of transport equipment and automobile manufacturing industries. Meanwhile, more attention should be pay to improving the development quality of transport equipment manufacturing industries related to railway, ship, aerospace and others.

Firstly, targeting at new demand of the transportation market, the Chinese government needs to prioritize manufacturing industries of all kinds of general- and special-purpose equipment based on the foundation and the advantages of equipment manufacturing industry. In addition, it is necessary to build a transport equipment manufacturing industrial chain integrating design, research and development (R&D), manufacturing, and marketing to form a new boom of the high level transport equipment manufacturing industry in time.

Secondly, it is necessary to seize the huge market demand of automobile to increase the input in the automobile manufacturing industry taking numerous opportunities brought about by new technologies including artificial intelligence, automatic drive, and new energies. In addition, the mixed ownership reform of stated-owned enterprises in the automobile industry should be promoted and much attention needs to be paid to cultivate and assist industry leaders such as First Auto Work, Dongfeng Motor Co., Ltd, SAIC Motor, and Chang’an Auto. The government is suggested to encourage automobile enterprises to reorganize and merge on a national scale to improve the industry concentration, increase R&D input in automobile industry, and build world-class brands.

Thirdly, the government needs to facilitate the transformation and upgrading of transport equipment manufacturing industry related to railway, ship, aerospace and others. The system integration capability of electromechanical equipment in rail transport is expected to be strengthened led by the manufacturing of whole railway vehicles with the support of the production of key parts. In addition, it is necessary to consummate the technical standards and build industrial clusters of one hundred billion yuan. Moreover, the government should highlight innovative development and industrial upgrading and focus on mainstream ship products and key parts. It is suggested to vigorously support outstanding enterprises and rapidly strengthen their capacity in R&D, design and manufacturing through the deep integration of manufacturing and information technologies. Based on major projects, whole aircraft manufacturing, aviation related manufacturing, and space equipment manufacturing should speed up to realize leap development by insisting on technology import and industry cooperation and making breakthroughs in manufacturing of large aircrafts, utility aircrafts, and unmanned aerial vehicles. On this basis, aerospace industry of one hundred billion yuan is expected to be built with high competitiveness and a leading position. Striving to make breakthroughs in transportation related engineering machinery and equipment with high performance, high added value, and large market demand. These industries are suggested to enhance their technological cooperation with leading international enterprises to develop local productivity as soon as possible.

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5.2. Transport Equipment Manufacturing Industry
In the new era, the transport construction industry should improve the quality and benefit of industry investment and development by underlining optimization of supply structure, selection of engineering increment, and vitalization of engineering stock. The government should cultivate local leading enterprises with international competitiveness and enlarge the market share of high-end transport engineering by taking great opportunities brought about by the construction of the integrated transport and making breakthroughs in fields including large-scale bridge, tunnel, and rail engineering. It also needs to guide leading enterprises to expand business in high value-added fields such as project financing, construction management, construction, and subsequent operation and maintenance, and support large-scale, well-positioned design and construction enterprises to transform to engineering general contracting ones. In addition, new organization modes in transport engineering construction need to be created. The transport construction industry is suggested to popularize the mode combining agent construction and supervision to promote the integrated development of construction, management, and maintenance of transport engineering and facilitate the transformation of construction-oriented enterprises to comprehensive service-oriented ones. The government is also suggested to build demonstration pilots applying PPP+EPC mode for transport engineering and supports eligible local enterprises to take part in construction of high-end transportation buildings in test lines and test sections to solve difficulties in qualification and performance examination.

5.3. Transportation Industry
The focus in the development plan of transportation industry is maintaining the development efficiency of road and air transport industries and improving the governance of railway transport industry.

Firstly, it is necessary to stick to the integrative development of transport with Internet plus. New industrial modes need further cultivation and development, including e-commerce logistics, urban and rural distribution and shared transportation to build a nationwide benchmark for the transformation and innovation of road transport. In this way, a personalized, customized road transport industry is expected to be built with characteristics of innovative industrial conditions.

Secondly, the integration of all airport resources should be speeded up. It is advised to build a nation of strong civil aviation, highlighting the development of air passenger service and striving to cultivate aviation logistics industry. In addition, the government should promote the status and functions of rail transport both in passages and cargo systems.

Thirdly, the government requires promoting the operation management of local railways, inter-city railways, urban railways, and large comprehensive transportation junctions and facilitating the formulation of service standard for the operation of rail transport. Besides, it should also study the standard scheme for the new rail transport, build operation management brands and expand overseas market. Moreover, it is necessary to promote the reform of railway operation mechanism by referring to advanced railway management and operation experience in China and abroad. The government needs to speed up the construction of specific maintenance bases for bullet trains and of maintenance and support bases for new standard rail transport equipment including modern tramcars.

6. CONCLUSIONS
The ITI refers to a collection of all kinds of transport-related economic activities including transport equipment manufacturing, transport infrastructure, and transport services derived to meet the demand for comprehensive transportation. It is a fundamental industry in the national economy. Vigorously developing the ITI is of important practical significance to facilitating the development of New Normal, speeding up fostering new driving force for economic growth, and building new nationwide benchmarks and samples. By defining the ITI and dividing the subdivision industries, we analyze the influences of subdivision industries of the ITI on the economic development using the econometric model and propose pertinent countermeasures and suggestions. The following conclusions are obtained: in the background of New Normal, the promoting function of the ITI on economic growth is
mainly contributed by equipment and automobile manufacturing industries in transport equipment manufacturing industry, as well as air and road transport industries in the transportation industry. While the metalwork, machinery and equipment repairing industry in the transport equipment manufacturing industry, civil engineering construction industry in the transport construction industry, and railway transport, handling, and transport agent industries in the transportation industry present low development efficiency and even restrict economic growth. By comprehensively considering the promotion effects of various industries on economic growth, the development of the ITI in future should put emphases on industrial upgrading on the premise of giving priority to efficiency: The top priority is to concentrate resources in advantaged industries showing larger promotion effects on economic growth; then, the resource allocation of other industries needs to be optimized and the governance level and development efficiency of industries should be improved to facilitate the structural transformation and upgrading of the ITI.

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