

Industrial Convergence and Media Industry Performance

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Abstract—This paper exploits the factor analysis and input-output method to test the relationship between industrial convergence and media industry performance. Based on an evaluation model, the comprehensive scores of media industry in different provinces in China are empirically figured out. The results show that in the country-year-level, the convergence between the media industry and information industry has a steadily upward trend during 1995 to 2011. And in the province-year-level, the scores in the east area are relatively higher, which means the east provinces have a relatively competitive media industry. Using the input-output method, this paper measures the convergence degree between the media industry and telecommunication industry, information industry. The results show that the convergence degree of the media industry and information industry are increasing rapidly during 1995 to 2011, while that of media and telecommunication are relatively flat. Based on a production function model embed with convergence factor, we empirically find that there is an “inverted-U” shape relationship between them.

Keywords- industrial convergence; media industry; industry performance; factor analysis; input-output

I. INTRODUCTION

With information technology developing rapidly in the past decades, the phenomena of convergence among different industries becomes more and more common. Theoretically, the industrial convergence can destruct the boundaries between the traditional industries, and then make the convergences possible. Many literatures indicate that the industrial convergence has gradually become the new driving force of the traditional industries and economic growth (Gambardella A, Torrissi S, 1998; Stieglitz N, 2003; Gerum E, Sjurts I, Stieglitz N, 2004; Tian, 2011; Fan Hejun, 2010; McKinsey, 2011; Liya Wang, Chong Wang, 2010; Victor, Kenneth, 2013).

For the industrial convergence and industry performance, a growing literatures show that there is a significant positive relationship between them. Banker, Chang and Majumdar (1998) thinks that industrial convergence can reduce the business operation cost. Gambardella and Torrissi (1998) explore the convergence among computer, service and information industries. They find that the convergence among different industries can improve the industry performance. Also, Gerum E, Sjurts I, Stieglitz N (2004) believe that the industrial convergence

can promote the evolution of the industry (Claudia Loebbecke, 2012; Xiao, 2011).

In recent years, the media industry has made a critical process. From the historical evolution perspective, the media industry has experienced three stages. The first stage is that in the 1930s the media industry mainly focuses on the broadcasting. With the television technology improved, the media industry comes into the second stage in 1950s, and in this period its contents mainly include the newspaper, broadcasting and the TV media. In the past decades, the Internet technology has changed the society critically. With the effect to the media industry increasing, currently the media industry has come into the third stage, where the new media industry grows fast. However, there are few literatures exploring the convergence of media industry. The main challenge for this work is that how to find a proper way to measure the convergence degree of media industry. Also the media industry data available is difficult to obtain.

Comparing with the existing literatures, this paper mainly contributes three strands of the literatures. First, we establish an evaluation system from the economic factors, industry scale factors and the government behavior factors. Using this model, the evaluation scores of media industry in different provinces in China are empirically figured out through the Factor Analysis Method. Second, we find a proper approach to measure the convergence degree between the media industry and telecommunication industry, and also the media industry and information industry. Third, a improved model which embeds the convergence degree factor into the traditional production function is established. And based on the model, this paper tests the relationship between the industrial convergence and the media industry performance.

The rest of the paper is organized as follows. Section 2 shows that the development status of media industry in China. Sections3 describes the empirical analysis of the test of industrial convergence and media industry performance. And the section 4 concludes this paper.

II. THE DEVELOPMENT STATUS OF MEDIA INDUSTRY IN CHINA

A. Analysis from National-Year-Level

Fig.1 shows that from 2008 to 2013, the media industry has experienced a rapid growth. In 2008, the total output of

the media industry is about 436600 million RMB and this figure is doubled in 2013.

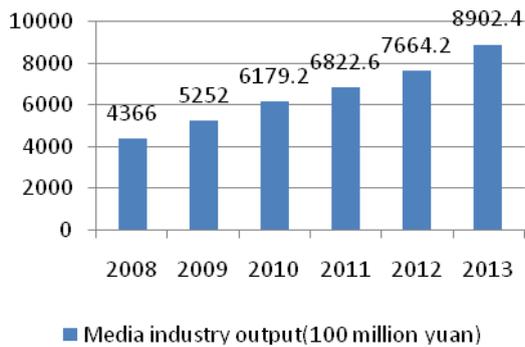


Figure 1. The media industry output during 2008 to 2013(Data source: "Report on development of China's media industry (2014)".)

Also in Fig.2, the media industry output growth rate is larger than the GDP growth rate during 2008 to 2013. So we can conclude that in the past few years, the role of media industry in the economic growth is become more and more critical.

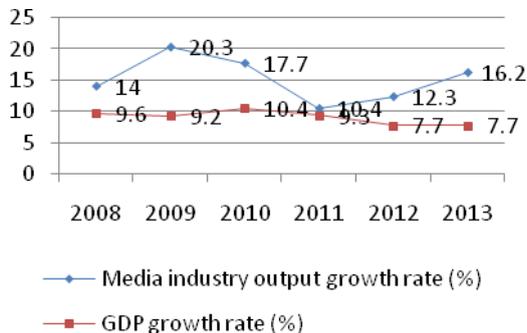


Figure 2. The media industry growth rate and GDP growth rate during 2008 to 2013(Data source: "Report on development of China's media industry (2014)", "China Statistical Yearbook (2014)")

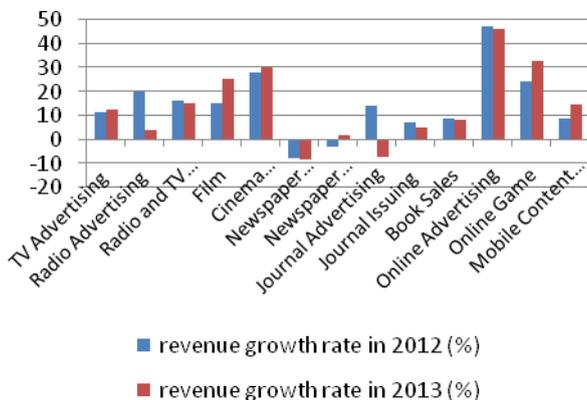


Figure 3. the revenue growth rate of media industry in China during 2012 to 2013(Data source: "Report on development of China's media industry (2014)")

The Fig.3 describes the detail revenues of sub-industries in the media industry. From the bar figure we can see that the revenue shares of traditional businesses in the media industry is significantly smaller than that of the new media industries, like the online advertising, online

games, and mobile content and so on. What's more, some traditional businesses' revenue growth rates are even negative, such as the newspaper advertising, newspaper publishers and the journal advertising.

B. Analysis from Province-Year-Level: Based on the Factor Analysis Method

1) Establishing the Evaluation System of the Media Industry

Using the Factor Analysis Method, we compare the differences of the development of media industry in different provinces. Before this, we establish an evaluation system of the media industry form two level indexes. The level-1 indexes include the economic factors, scale factors and government factors. In the level-2 indexes, the economic factors include the economic scale, economic structure, urbanization and income level. The scale factors include the output value, newspaper publishing, book publishing, journal publishing, broadcasting, broadcast television network trunk, public television programs, and public broadcasting programs. The government factor mainly focus on the government spending on the media industry. The detail variable descriptions are shown in table 1.

TABLE I. THE EVALUATION SYSTEM OF THE MEDIA INDUSTRY

Level-1 indexes	Level-2 indexes	Variable description
Economic factors	Economic scale	GDP
	Economic structure	The proportion of tertiary industry
	Urbanization	The urbanization rate
	Income level	Urban residents' disposable income and the net income of rural residents
Scale factors	Output value	sales output value of publishing and printing enterprises
	newspaper publishing	The total number of newspaper publishing
	book publishing	The total number of book publishing
	journal publishing	The total number of journal publishing
	broadcasting	the covering rate of broadcasting
	broadcast television network trunk	The total length of the broadcast television network trunk
	public television programs	Numbers of public television programs
	public broadcasting programs	Numbers of public broadcasting programs
Government factors	Government media industry spending	The ratio of the media spending in the total government spending

2) The Evaluation Results

Based on the evaluation model in table 1, using the Factor Analysis Method, we figure out the comprehensive evaluation on development of media industry in each province. Table 2 displays the detail results. In the table below, Z is the comprehensive evaluation value. And from the results of the KMO test and Bartlett sphericity test, we

can conclude that this model is suitable for the Factor Analysis Method.

From the table, we can find that the cities like Beijing, Guangdong, Jiangsu, Zhejiang, Shandong and Shanghai

have relatively higher Z-scores in the model. Consequently, we can draw the conclusion that, the development of the media industry in the east area is better than the other areas.

TABLE II. THE EVALUATION RESULTS ON MEDIA INDUSTRY IN EVERY PROVINCE DURING 2010 TO 2013

	2010		2011		2012		2013	
	Z	rank	Z	rank	Z	rank	Z	rank
Beijing	1.40	2	1.79	1	0.85	5	0.97	5
Tianjing	-0.36	24	0.64	6	-0.34	22	-0.33	23
Hebei	0.19	8	0.00	11	0.22	9	0.34	8
Shanxi	-0.19	19	-0.39	23	-0.08	15	-0.01	15
Inner Mongolia	-0.10	16	-0.17	16	-0.17	18	-0.07	16
Liaoning	0.08	11	0.18	9	0.08	11	0.12	10
Jilin	-0.27	20	-0.07	13	-0.17	19	-0.17	19
Heilongjiang	-0.15	17	-0.10	14	-0.24	20	-0.26	21
Shanghai	0.14	9	1.37	2	0.42	6	0.37	7
Jiangsu	0.95	3	0.92	5	1.30	2	1.31	1
Zhejiang	0.87	4	1.02	3	1.28	3	1.28	2
Anhui	-0.07	14	-0.22	18	-0.13	16	-0.11	18
Fujian	-0.06	13	0.23	8	-0.01	13	-0.01	14
Shanxi	-0.28	21	-0.27	20	-0.31	21	-0.24	20
Shandong	0.86	5	0.48	7	1.17	4	1.17	4
Henan	0.22	6	-0.15	15	0.21	10	0.22	9
Hubei	0.10	10	0.07	10	0.24	8	0.12	11
Hunan	-0.01	12	-0.27	19	0.01	12	-0.10	17
Guangdong	1.76	1	1.01	4	1.46	1	1.21	3
Guangxi	-0.35	22	-0.44	24	-0.38	24	-0.41	24
Hainan	-0.64	28	-0.30	21	-0.71	27	-0.74	27
Chongqing	-0.49	27	-0.05	12	-0.53	26	-0.59	26
Sichuan	0.20	7	-0.22	17	0.41	7	0.55	6
Guizhou	-0.68	29	-0.88	31	-0.75	28	-0.94	29
Yunnan	-0.36	23	-0.49	25	-0.37	23	-0.45	25
Xizang	-0.73	30	-0.82	30	-0.85	29	-1.00	31
Shanxi	-0.09	15	-0.31	22	-0.01	14	0.04	12
Gansu	-0.39	25	-0.72	28	-0.44	25	-0.33	22
Qinghai	-0.90	31	-0.73	29	-1.11	31	-1.00	30
Ningxia	-0.49	26	-0.51	26	-0.92	30	-0.92	28
Xinjiang	-0.16	18	-0.63	27	-0.15	17	0.00	13
KMO-test	0.72		0.7		0.75		0.75	
Bartlett sphericity test	0.00		0.00		0.00		0.00	

III. EMPIRICAL ANALYSIS

A. Sample Selection

In this section, we will set a model to figure out the convergence degree between media industry and information technology industry. Also we want to find out some differences between China and other countries. So we set our sample countries as shown in the table below.

TABLE III. SAMPLE COUNTRIES

Developed countries	Developing countries	Data source
AUS, USA, CAN, GBR, JPN, KOR	CHN, RUS, IND, BRA,	WIOT Database

B. *Measuring the Convergence between Media Industry and Information Technology Industry: Based on the Input-output Analysis Method*

It is critical to figure out the convergence degree for the research on the relationship between media industry convergence and industry performance. A growing literature tries to find a proper approach to realize this. There are three possible methods which are Correlation Coefficient Method, Herfindahl Index, Entropy Method and Input-output Method (Fai, Tunzelmann, 2001; Gambardella, Torrisi, 1998; Xing W, Ye X, Kui L, 2011).

1) *Correlation Coefficient Method*

For the Correlation Coefficient Method, after figuring out both the positive and negative coefficient of technology convergence between two industries, the correlation coefficient between the two coefficients is taken as the industrial convergence degree.

2) *Herfindahl Index*

The equation of the Herfindahl Index Method is shown as follows.

$$HHI = \sum \left(\frac{m_i}{M} \right)^2 \quad (1)$$

In the equation above, m_i is the number of the patents in industry i , and M is the total number of the patents. The HHI value is smaller, the convergence degree is larger.

3) *Entropy Method Herfindahl Index*

The equation of this method is displayed as follows.

$$entropy = \sum p_i \ln(1 / p_i) \quad (2)$$

p_i is the proportion of the firm's income to the industry's income.

4) *Input-output Method*

The equation of the input-output method is as follows.

$$convergence = input_{i,j} / output_i \quad (3)$$

In the equation above, the $input_{i,j}$ is the input of industry j in the production of industry i . And $output_i$ is the total output of industry i .

Among all the possible methods, we choose the input-output method, for its advantages on the research on the penetration and convergence between different industries. And the data required for this method is available in the WIOT database.

The input-output analysis method is used to measure the convergence degree between the media industry and other industries. In this paper, we focus on exploring the convergence among the media industry, telecommunication industry and the information industry. The detail results are shown as follows.

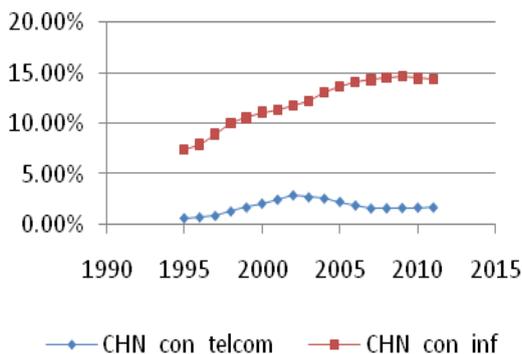


Figure 4. the convergence degrees between media industry and telecommunications industry and media industry and information industry during 1995 to 2011

Fig.4 draws the trend of the convergence degrees between media industry and telecommunications industry and media industry and information industry during 1995 to 2011. In the figure, “CHN_con_telcom” means the convergence degree between the media and telecommunication in China, and “CHN_con_telcom” means the convergence degree between the media and the information. From the figure, we can see that there are both an upward trend for the convergence degree of the media and telecommunication, also the media and information. Especially for the convergence between the media and information industry, the convergence degree is 7% in 1995, while this figure has been doubled in 2011.

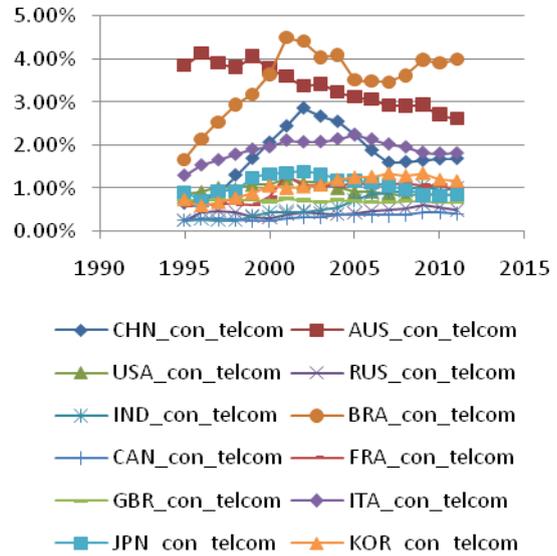


Figure 5. the convergence degree between media industry and telecommunications in different countries during 1995 to 2011

Fig.5 shows the comparison results of the convergence between media and telecommunication. We can find that the convergence degree is relatively higher in Australia and Brazil. But the trend in most countries is flat.

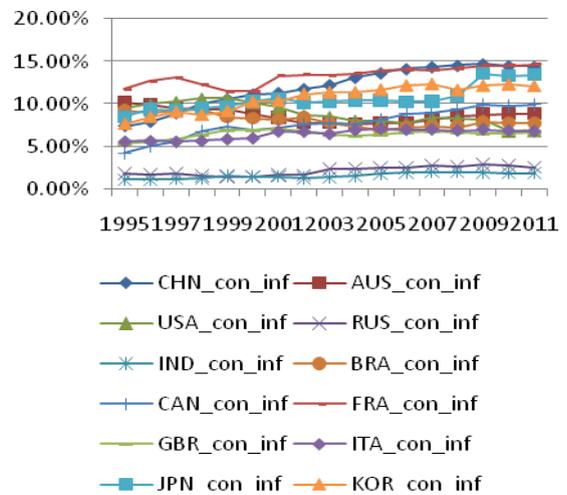


Figure 6. the convergence degree between media industry and information industry in different countries during 1995 to 2011

Fig.6 describes the trend of the convergence degree between media industry and information industry in different countries during 1995 to 2011. We can find that the convergence degree of China is relatively lower in 1995. While from 1995 to 2011, the convergence between the media industry and information industry has a significant upward trend. Actually, starting from 2005, the convergence degree in China is almost the top one in the selected sample countries.

C. *The Econometric Analysis of the Industrial Convergence and the Performance of the Media Industry*

1) *The Econometric Model*

From the analysis above, we can find that in the past decades, the convergence on media industry in China has made a great process. But the question is whether the convergence is promoting this industry performance. In order to figure out this question, we embed the convergence factor into the traditional production function.

$$Y_i = L_i^{\alpha} * K_i^{1-\alpha} * \varepsilon_i \quad (4)$$

$$Y_i = Convergence_i * L_i^{\alpha} * K_i^{1-\alpha} * \varepsilon_i \quad (5)$$

In order to establish a linear model, we do the logarithmic process on the above equation. Then we can get the equation as follows.

$$\ln Y_i = Convergence_i + \alpha_i \ln L_i + \beta_i \ln K_i + \varepsilon_i \quad (6)$$

In the equation, Y is the output, convergence is the convergence degree, and L is labor input and K is the capital input.

We get our data from 2003 to 2011 from the China Statistical Yearbook. Before solving the model, we standardize the data. Then the regression results are shown in the table 4. The unit root test results show that all the variables are first-order stationary, while the convergence between media and telecommunication is second-order stationary. So we get L.tel in our model.

2) *The Results*

In table 4, we can see that in the model (1), the coefficient of inf is significant positive and the coefficient if inf2 is significant negative. Also, we can get the same information for L.tel and L.tel2. The results mean that there is an “inverted- U” relationship between the convergence and media industry. Consequently, as the degree of the convergence increasing, the effect on the media industry performance could be positive at the beginning, and then be negative.

TABLE IV. THE REGRESSION RESULTS

Variables	(1)	(2)
inf	583.9044*	
inf2	-2373.293*	
L.tel		6.851406*
L.tel2		-25.69185*
L	15.03767**	2.952152
K	1.421971	-0.0893338
gov	-1.94912	0.434775
constant	-37.54815	-0.7195701
R-squared	0.9836	0.9983

Notes: * means the coefficients pass the significant test under the 10% confidential level. inf2 is the square of inf and tel2 is the square of tel.

IV. CONCLUSIONS

Our paper establishes an evaluation system and empirically figures out the evaluation scores of media industry in different provinces in China, using the Factor Analysis Method. Also, we use the input-output method to measure the convergence degree between the media industry and telecommunication industry, and also the media industry and information industry. From 1995 to 2011, the convergence between the media industry and information industry has a significant upward trend. Based on the econometric model, we test the relationship between the convergence and the industry performance, and results show that the relationship is an “inverted-U” shape.

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