

# A Study on Evaluation of University Research Abilities in Three Countries of Japan, China and the United States by Analysis of Network Theory

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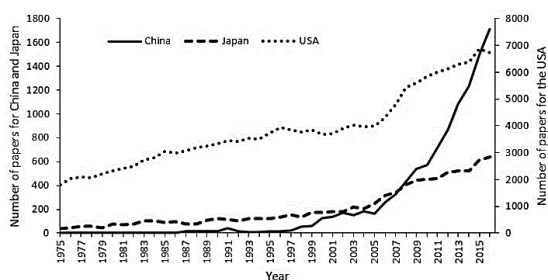
## 1. Introduction

In recent years, it is said that the research ability of China has increased, and it has grown like the United States. On the other hand, it is also said that the research ability of Japan is weakening compared with those countries. A comparison of the number of papers in the economic field is shown in **Figure 1**. The number of articles in China was 128 in 2000 and was lower than Japan. However, it overtaking Japan in 2008, it is rapidly increasing to 1713 in 2016. This means that it would be 13.28 times in 16 years from 2000. However, the USA is 6737 in 2016, and this means that it is 3.93 times as much as China. In other words, for a while, in the Economics field, the number of articles in USA will be bigger than China.

Regarding the increase in the number of articles in China, there is a research by Ueno et al.[1] as a prior study. This article is a case study showing the status of research activities by applying network analysis to bibliographic data, and the aim of this article is to verify some parts of Ueno's claims by comparing and analyzing Economics articles in Japan and China using network theory.

## 2. Conceptual framework

Regarding the increase in the number of articles in China, there is a research by Ueno et al.[1] as a prior study. Ueno et al. pointed out three factors as the factors contributing to the growth in the number of papers in China. The first one is that increase in basic research budget and corporate funding (a). The second



**Figure 1** Number of Articles in the Economic field

one is that recruitment of overseas Chinese researchers (b). The third one is that institutional reform at university.

In this paper, we examine Ueno's arguments (a) and (b) by analysis using bibliographic data at Economics field. Furthermore, we identify important researchers and identify organizations that play a central role in promoting research.

## 3. Research methodology

### 3.1 Data source

In the analysis of this article, we gathered article information was obtained using a bibliographic database of the Institute of Statistical Mathematics. The dataset for this research project was provided by Clarivate Analytics, and it consists of 30 years of data on articles until 2016. We utilized Economics related article data on 2016.

### 3.2 Analysis methods

In the analysis of this article, we gathered articles of the Economics field. Search criteria of the article are documents of 2016 in which the topic is "Economics" and the document type is "Article". In this article, it is desirable to analyze the data of the most recent year, but due to the characteristics of the bibliographic database, it is said that there are many noises, such as data not updated in the last few years. Therefore, in this article, we analyzed 2016 which data is thought to be stable most recently.

**Table 1** Affiliation Country of Author - Top 10

Rank	China	#	[%]	Japan	#	[%]
1	China	15322	59.41	Japan	3622	70.36
2	USA	5165	20.03	USA	375	7.29
3	Taiwan	653	2.53	Australia	309	6.01
4	Australia	649	2.52	UK	245	4.76
5	Canada	616	2.39	China	177	3.44
6	UK	616	2.39	Canada	92	1.79
7	Singapore	354	1.37	South Korea	68	1.33
8	Germany	342	1.33	France	60	1.17
9	Japan	288	1.12	Singapore	38	0.74
10	Netherlands	208	0.81	Uganda	36	0.70
Total		24213	93.89	Total	5022	97.556

China: Total 48 countries and 25790 authors  
Japan: Total 21 countries and 5148 authors

ネットワーク分析による日中米3カ国の大学研究能力の評価に関する一考察

日本大学 楊 晟、 水上 祐治

**Table 2 Number of Articles by Org. - Top 10**

Rank	China	#	Japan	#
1	Peking Univ	115	Univ Tokyo	55
2	Renmin Univ China	99	Kobe Univ	52
3	Southwestern Univ (USA)	79	Hitotsubashi Univ	47
4	Tsinghua Univ	77	Osaka Univ	41
5	Cent Univ Finance & Econ	73	Waseda Univ	39
6	Shanghai Univ Finanve Econ	68	Kyoto Univ	38
7	Hong Kong Univ SCI Technol	65	Keio Univ	34
8	Univ Hong Kong	60	Kyushu Univ	23
9	Chinese Univ Hong Kong	59	Bank Japan	17
10	Xiamen Univ	56	Hiroshima Univ	16
-	Total	751	Total	362

## 4. Results

### 4.1 Grant receipt rate

In China, since 2008 the Grant receipt rate has increased to more than 15%. Since then, it has been stable until 2014, but it has increased sharply and reached 66.14% in 2016. On the other hand, in Japan, In Japan, the Grant receipt rate gradually increased from around 2007, and it was stable at around 6% after 2011. Subsequently, it has increased sharply and reached 55.83% in 2016.

### 4.2 Affiliation country of author

The top 10 Affiliation country of author is shown in **Table 1**. The characteristic of China is that China and USA in the top two countries make up 79.44% of the total. The characteristic of Japan is that Japan accounts for 70.36% of the total. And USA and Australia is over 5%.

### 4.3 Number of articles by organization

The Number of articles by organization is shown in **Table 2**. The characteristic of China is that Southwestern University in the USA is in third place. On the other hand, the characteristic of Japan is that all organizations are in Japan.

### 4.4 Author influence by betweenness centrality

The top 10 affiliation organization of author is shown in **Table 3**. The feature of China is that there are four foreign organizations within 10th place. On the other hand, the characteristic of Japan is that all organizations are in Japan.

### 4.5 Specialized field of author

The research field No.6 is the Economics field. Economics (No.6) accounts for 50.09% of the total, and it is only Chemistry (No.3), Clinical Medicine (No.4), and Engineering (No.7) that exceeds 5%. With Economics field as the center, authors of Chemistry, Clinical Medicine, Engineering fields are active, and the diversity of the field is small. On the other hand, Authors in the fields of chemistry, engineering and economics, especially in the clinical medicine field, are active. Moreover, but the field diversity

**Table 3 Affiliation Org. of Author - Top 10**

Rank	China	BC	Japan	BC
1	Univ Int Business & Econ	0.261	Waseda Univ	0.237
2	Cent Univ Finance & Econ	0.238	Hitotsubashi Univ	0.207
3	Cent Univ Finance & Econ	0.220	Waseda Univ	0.144
4	Univ Calif Berkeley (USA)	0.209	Inst Econ Dev	0.140
5	Univ Macau	0.208	Waseda Univ	0.138
6	Cent Univ Finance & Econ	0.195	Hitotsubashi Univ	0.134
7	Univ Calif Berkeley (USA)	0.170	Keio Univ	0.133
8	Queens Univ (Canada)	0.169	Keio Univ	0.133
9	Queens Univ (Canada)	0.157	Inst Dev Econ	0.126
10	Univ Hong Kong	0.145	Keio Univ	0.110
-	Average	0.197	Average	0.150

BC: Betweenness Centrality

is high.

## 5. Discussion and conclusion

Early 2000's, it is said that the research ability of China has increased, and it has grown like the United States. On the other hand, it is also said that the research ability of Japan is weakening compared with those countries.

In this article we regard Ueno et al.[1] as a major research and analyzed the factors of China's strength at Economics field in 2016. As a result of the analysis, the research activity in China is well supported by Chinese government, has a research grant rate higher than 10% higher than Japan. Moreover, in China, collaborative research with overseas organizations is flourishing compared to Japan. However, there are few collaborative research with researchers with different fields compared with Japan. Furthermore, China is also participating in research that is mainly organized by overseas organizations. As a result, China has higher penetration rate of grants and higher international diversity than Japan, but diversity among research fields is low.

As a future issue of Japan, there are cases where we actively participate in international research. Especially, Japan should participate in research that organized by overseas organizations.

As future research subjects, case analysis of other fields and quantitative analysis methods may be introduced.

## References

- [1] S. Ueno, Y. Yamashita, H. Tomizawa, and M. Kondo, "Increase factor of the number of papers in China and Japan-China co-authorship", Abstract book of annual conference, 20(1), pp.459-462, 2002 (in Japanese)