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The structure and comparative advantages of China's scientific research - Quantitative and qualitative perspectives

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The Structure and Comparative Advantages of China's Scientific Research - Quantitative and Qualitative Perspectives*

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Abstract

In recent decades there has been a sharp increase in China's scientific output. Behind its fast growth, little is known about China's comparative advantages in different academic disciplines. Meanwhile, despite China's rising position (now in second place worldwide for research output), its research quality has been long in dispute. Based on citation rates, many studies expressed negative opinions on the quality of China's scientific output. This paper argues that citation reflects more social impact than quality. On the other hand, the time lag between being cited and the eventual publication of citing papers masks the real recent situation in developing countries. In particular prior to 2006, almost half of research papers in China were published in Chinese journals, which were not visible (or readable) to people outside of China. Consequently, it is not surprising that citation rates of Chinese researchers were rather low. Given that the publication structure in China has changed tremendously in recent years, evaluation of the quality of Chinese science needs to be carried out according to the latest research output from China. This paper examines the comparative advantages of each academic discipline as well as their shifts over the years. Focusing on the top 5 per cent journals by each discipline, we evaluate the quality of China's scientific output compared to the rest of the world. Different from the criticism stated in previous literature, this paper finds that the quality of China's research in terms of publications in top journals is promising. Since 2006 the growth of scientific publications in China has been driven by papers published in English-language journals. The increasing visibility of Chinese science paves the way for its wider recognition and higher citation rates.

Keywords

Bibliometrics, Scientometric analysis, Revealed comparative advantage, Publications, Scientific output, Publication quality, Citation, High-impact journals

JEL Classification O31, O32, O33, O57

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1 Introduction

Along with its fast economic growth, China has made a series of attempts to increase its science and technology (S&T) capacity. The S&T system has gradually advanced since the 1990s, with the aim of "revitalizing the nation through science and education strategy" (OECD, 2008). Following that, with the introduction of a 15-year "Medium- and Long-Term Programme for Science and Technology Development" in 2006, China shows a clear determination to strengthen indigenous innovation capability at the core of S&T undertakings. The primary goals by 2020 are: that R&D expenditure as a percentage of GDP should increase to 2.5 per cent or above; that the rate of S&T contribution to the economy should reach 60 per cent or above; that the annual number of patents granted with Chinese inventors and the average cited scientific publications of Chinese authors should climb up to the top 5 worldwide.

To meet these targets, R&D expenditure in China has risen steadily over the years, with an annual growth rate of 23 per cent during the 2000s[2]. Various plan actions and funding programmes were carried out in order to strengthen the role of S&T and advance a knowledge-based economy.

Against this background, the scientific output of Chinese researchers skyrocketed from 15th position in 1995 to 2nd position in 2004. By 2013, the share of worldwide total publications reached 17.8 per cent, rising from just 1.2 per cent in 1995. Whether at the aggregate level (Leydesdorff, 2012; Kostoff, 2008; Kostoff, et al. 2007) or at the sectoral level, e.g. pharmacology (Ding, et al. 2013); bioinformatics (Guan and Gao, 2008); nanotechnology (Wang and Notten, 2011; Zhou and Leydesdorff, 2006), China has exhibited an exponential growth with its scientific research output.

Despite the high growth rate, China's scientific research capacity varies greatly across disciplines. The annual research output of the biggest field is 150 times higher than that of the smallest field in China; worldwide it is only 45 times higher. This reveals that research performance across fields in China is widely divergent. This may stem from the government's steering guidelines and research funding. According to the priority list from the government, funding flows first to the top subject categories, chosen on the basis of China's national needs and its scientific potentials (Jiang, 2011; SC-PRC, 2006).

To have a deeper understanding of China's competitiveness in S&T, it is important to clarify China's performance across various academic disciplines, and to measure the comparative

[2] The growth rate is calculated based on the R&D expenditure data from China Statistical Yearbooks on S&T, various issues.

advantages compared with other nations.

Besides the quantity of China's scientific output, the quality has also come to researchers' attention. Different from the impressive quantitative achievements, the quality of Chinese science has long been reviewed negatively. By means of citation analysis, researchers state that the quality and visibility of Chinese research is still at a very low level and Chinese science is still at the periphery of global research (Moiwo and Tao, 2013; Jin and Rousseau, 2004; Guan and Gao, 2008).

We argue that assessing the quality of scientific output based on citation rates entails serious bias against developing countries. On the one hand, citation reflects the impact or recognition of being cited in publications, rather than actual research quality. The high citation rates of famous scholars not only results from the quality of their research but also from their reputation. Another example of the recognition effect is that the higher visibility of a paper can lead to a higher citation rate. Joint publications by distant researchers can be exposed to a wider network environment. Hence internationally co-authored papers receive higher citations than nationally co-authored papers (Nomaler, et al. 2013). This proves that what crucially determines the citation rate is the wide visibility and recognition of being cited in papers, but not necessarily the quality. Given that it takes years or decades to build up their research reputation, which can help lead to higher citations, it is inappropriate to evaluate the quality of scientific output for developing countries by means of citation analysis. Moreover, considering the well-known citation lags between being cited and the publication of citing papers, what citation evaluates was the "past" situation, not the "current". However, the real catch up process for developing countries has occurred in the past decade. Taking China as an example, its S&T took off only around 2004. Of great interest to researchers or policymakers is China's scientific capacity and quality construction after the take-off, not before. In this sense, citation is far insufficient to evaluate China's up-to-date scientific performance.

In our view, publication in highly ranked journals is a more reliable, if not the best, indicator in assessing the quality of science.

This paper presents a comparison of China's scientific performance with the worldwide trend. In particular, we deconstruct performance in various academic disciplines and provide a detailed overview of China's strengths and weaknesses. Furthermore, this paper evaluates China's research quality by comparing its publications in top journals with the rest the world.

2 Data and methodology

In this study, we employ the publication data from Elsevier's Scopus. The selected publication document type is "articles", which does not include conference papers, editorials, notes, reviews, etc. The time span covers recent 14 years, i.e. 2000 – 2013. Besides the aggregate performance, 27 disciplines are analysed. This paper employs the pre-defined subject categories from Scopus (see Table A1 in the Annex for the academic discipline list).

To assess the quality of Chinese publications, we focus on the top 5 per cent of high-impact journals. First, journals of each scientific discipline are ranked by the average SJR (SCImago Journal Rank) score between 2000 and 2012. Secondly, we count the total journals with SJR indicators in each discipline. Thirdly, we select the top 5 per cent journals with the highest SJR score in each discipline as our target[3]. The total number of source titles and number of top journals are provided in Table A1.

Based on the concept of Revealed Comparative Advantage (RCA), which was proposed by Balassa (1965, 1977) and has been adopted in scientometrics analysis (Chuang, et al. 2010), we calculate the comparative advantage index for each discipline in China.

$$RCA_{ic} = \frac{PUB_{ic} \big/ \sum_{i=1}^{27} PUB_{ic}}{PUB_{iw} \big/ \sum_{i=1}^{27} PUB_{iw}} \qquad i = 1 - 27$$

Where RCA_{ic} is the comparative advantage index for academic discipline i in China. PUB_{ic} is the publication number of field i in China, and PUB_{iw} is the publication number of this field in the rest of the world[4].

We extend this index to measure the quality advantage in each discipline as well. Likewise, the comparative advantage index in publication quality can be expressed as follows:

$$RCAQ_{ic} = \frac{HR_{ic} \big/ \sum_{i=1}^{27} HR_{ic}}{HR_{iw} \big/ \sum_{i=1}^{27} HR_{iw}} \qquad i = 1 - 27$$

Where $RCAQ_{ic}$ is the comparative advantage index for publication quality in discipline i in China. HR_{ic} is the high ranking papers in field i published by Chinese researchers; HR_{iw} is

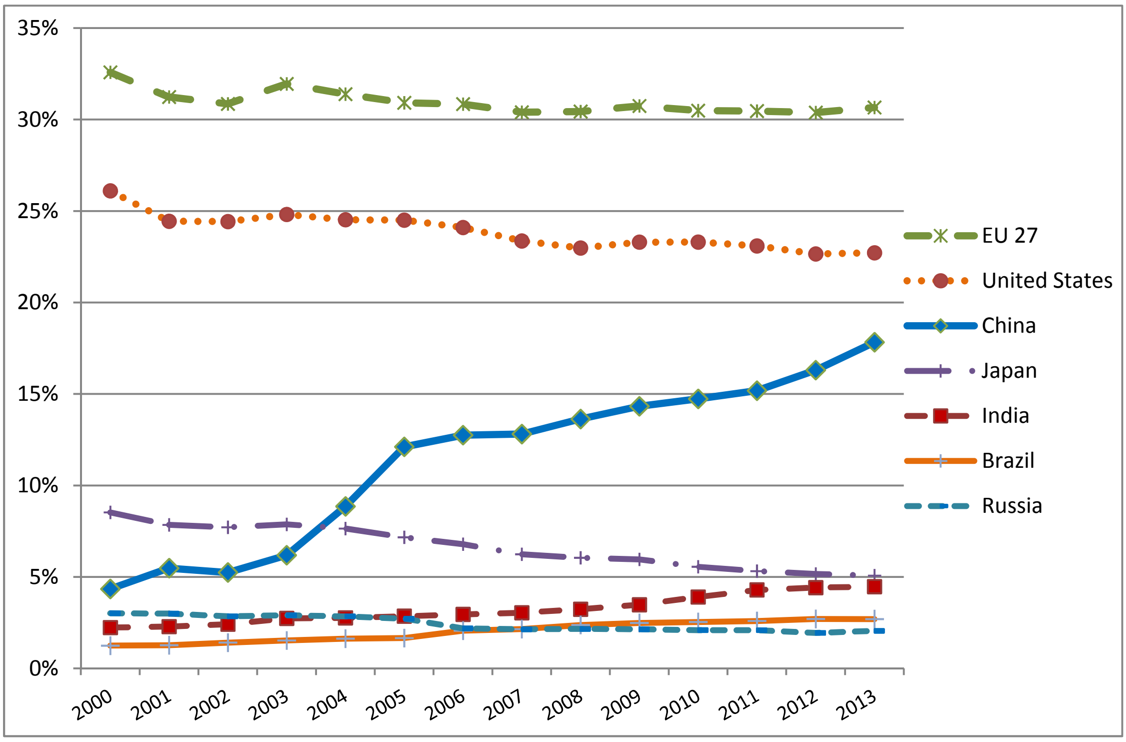
[3] In order to keep the scientific output comparable in different years, we select only the high-impact journals that have existed through the whole 2000-2012 period.
[4] This is calculated by the worldwide total minus China.

the high ranking papers in field i published by researchers outside of China[5].

3 Global position of China's science

The number of scientific publications with Chinese addresses has kept a 17 per cent annual growth rate between 2000 and 2013, increasing from around 41,000 to over 300,000. Despite that the publications in the EU27 and US both keep growing at a speed of 4 per cent per year, their shares in the worldwide total decreased over years, both dropping 2 or 3 per cent – the EU27 from 33 per cent to 31 per cent and the US from 26 per cent to 23 per cent. The share of Japanese publications declined even more, from 9 per cent in 2000 to 5 per cent in 2013. The proportion shrink of these countries is mainly caused by the fast rise of BRIC countries, among which China grew the most, from 4 per cent of the world total in 2000 to 18 per cent in 2013. Other BRIC countries like India and Brazil have increased their shares slightly, by about 2 per cent over the studied 14 years. Russia, however, as the only exception of BRIC, dropped its share by 1 per cent, from 3 per cent to 2 per cent by 2013.

Figure 1: Publication shares in the worldwide total 2000-2013
(EU27, United States, Japan and BRIC countries)



Source: Scopus - SciVerse Elsevier.
Note: Document type is "article" and this does not include conference papers, editorials, notes, reviews, etc.

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[5] This is calculated by the worldwide total minus China.

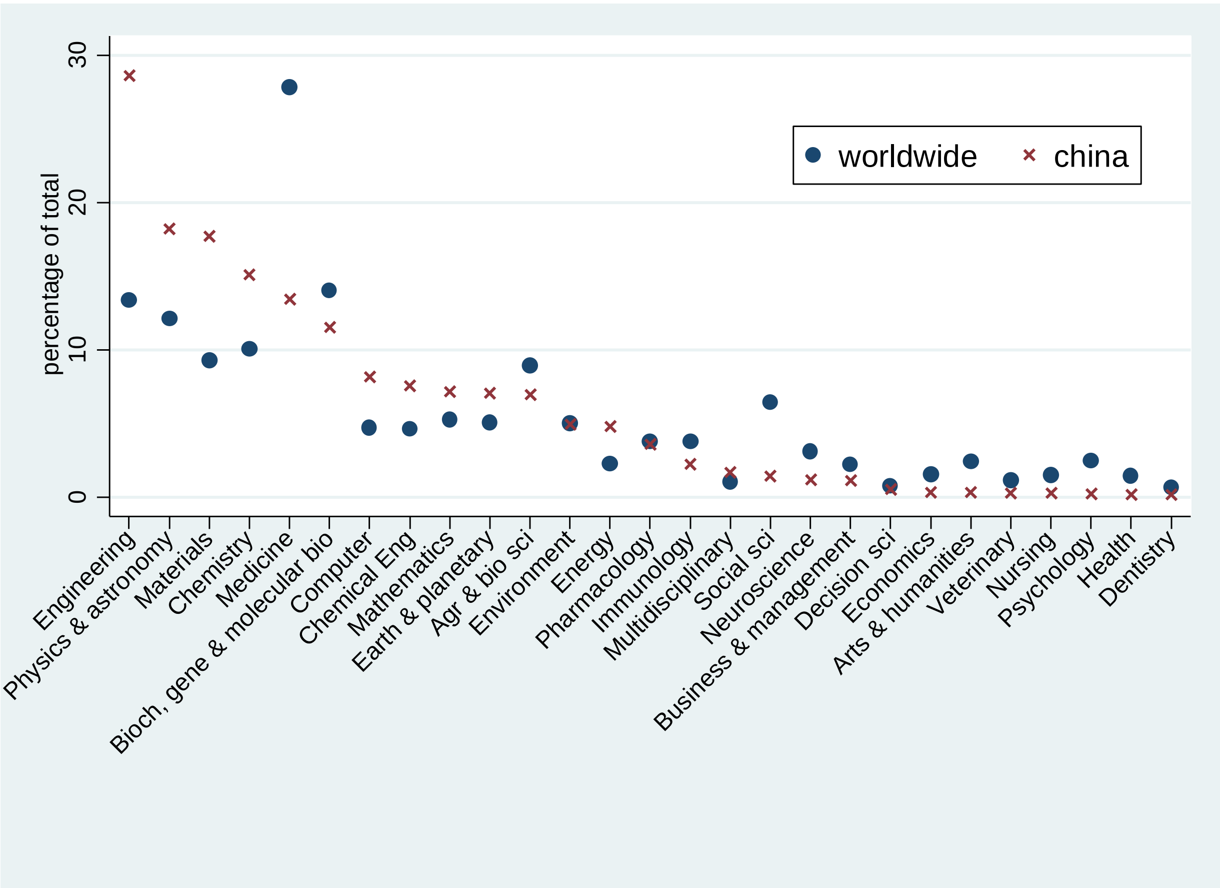
4. Quantitative perspective

4.1 structure of scientific output (China vs. Worldwide)

To shed light on the strengths and weaknesses of the research fields in China, we compare the structure of China's scientific research with global benchmarks.

China's science holds out a different prospect from that of the global total. Over the studied 14 yeas (2000-2013), the aggregate worldwide scientific output is dominated by *Medicine*, which accounts for 28 per cent of the total publications (see Figure 2). The second field is *Biochemistry, genetics and molecular biology*, which is followed by *Engineering* and *Physics and astronomy*. In China, however, the dominant position – which accounts for about 29 per cent of the national total publications – is occupied by *Engineering*. The next three largest fields with the most publications are *Physics and Astronomy*, *Material science*, and *Chemistry*. In general, the major contribution to China's total scientific research output comes from hard science. On the contrary, research in soft science has not developed well in China.

Figure 2: share of academic disciplines, China vs. Worldwide

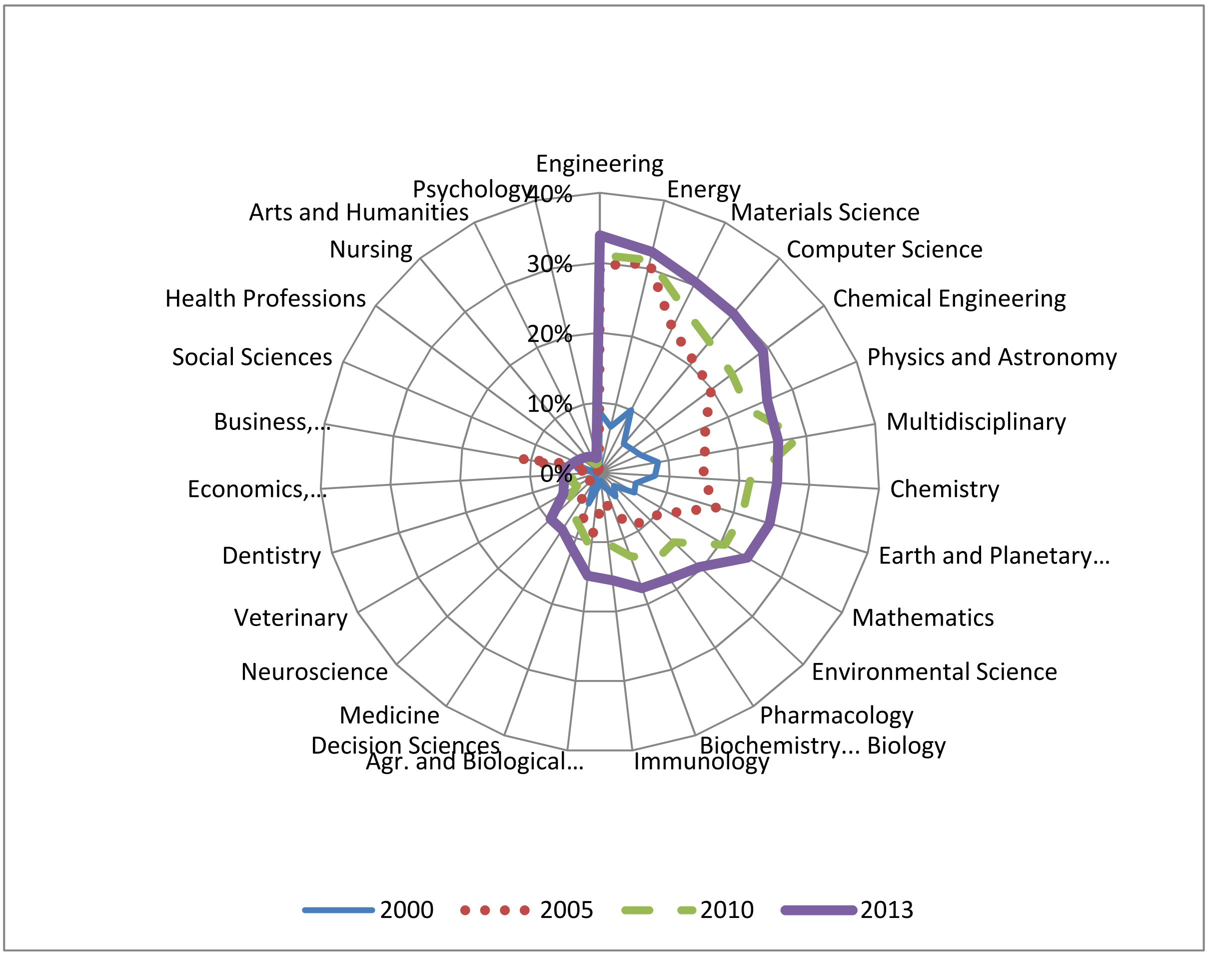


Source: Scopus - SciVerse Elsevier.

Note: This is calculated on the basis of total publications between 2000 and 2013.

Figure 3 provides the shares of Chinese publications in the global total.

Figure 3: Weight of Chinese academic output (as percentage of worldwide total), 2000-2013



Note: Fields are ranked by their percentage values in 2013.

As shown in Figure 3, the research fields in China vary considerably in output. Taking 2013 as an example, the publications in the *Engineering*, *Energy*, *Materials science*, *Computer science* and *Chemical engineering*, accounted for respectively 34 per cent, 32 per cent, 30 per cent, 30 per cent and 29 per cent of the global total. However, the global shares of China's *Psychology*, *Arts and Humanities*, *Nursing*, *Health professions* and *Social science* were only between 2 per cent and 4 per cent.

Comparing Figure 2 and Figure 3, an interesting observation is that a great contribution to the worldwide total does not necessarily come from large fields in China. For example, almost one third of the worldwide total publications in *Energy* originate from China, yet this field contributed only 5.4 per cent of China's total publications in 2013. On the contrary, *Physics and astronomy*, being the second largest field in China, accounted for only 26 per cent of the worldwide total in 2013.

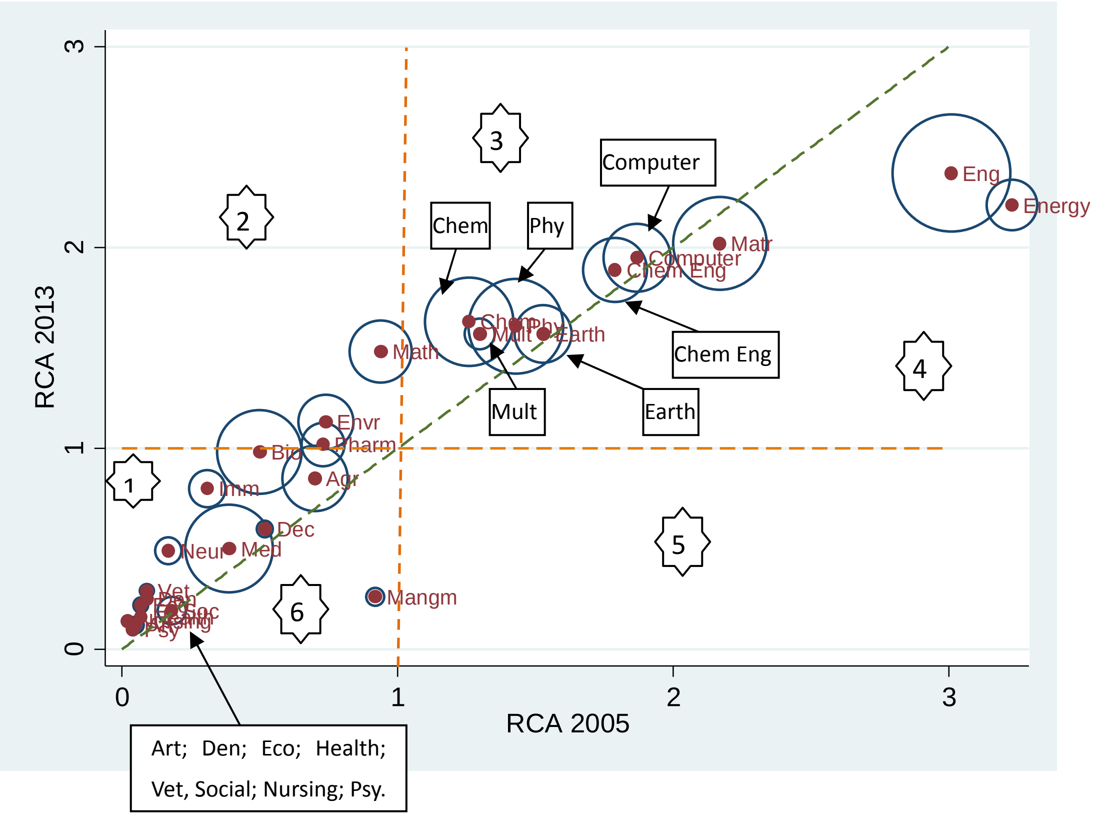
4.2 Revealed Comparative Advantage

Using the RCA (Revealed Comparative Advantage) index proposed by Balassa (1965, 1977), we evaluate China's comparative advantages and trace their dynamic shifts over the years. The comparative advantage score of one subject field is calculated by the proportion of this field in China divided by the proportion of this field in the rest of the world. The RCA scores by field reveal the strengths and weaknesses of research capabilities in China.

Figure 4 presents the shifts of RCA scores in different academic disciplines over the years[6]. The sizes of the circles represent the weights of their national shares in China in 2013. The larger the circle is, the greater its share in China. Based on the value combinations of the *x* and *y* coordinate axes, the figure can be divided into six areas. Areas 1 - 3 lie above the diagonal, demonstrating that the RCA values increased over the years (from 2005 to 2010), while Areas 4 - 6 lie below the diagonal indicating that RCA values decreased over years. Areas 1, 3, 4 and 6 are the 'mildly changing' areas, while Areas 2 and 5 are 'dramatically changing' areas. When a discipline falls in Area 2, this indicates that this field changed from a disadvantageous field (lower than worldwide average) in 2005 to an advantageous one (higher than the worldwide average) in 2013, vice versa in Area 5. Generally, academic disciplines in Areas 4 and 5 are those in which China has advantages, but those in Areas 1 and 6 are those in which China has comparative disadvantages.

[6] We choose 2005 and 2013 as the two comparable years in the RCA figures. As will be explained in a later section, 2005 is the changing point after which the language structure of China's publications has greatly changed. Therefore, for the RCA quality index we would like to take 2005 as one reference year. In order to be consistent, we use 2005 for RCA quantity index as well. Data and figures for other years are available upon request.

Figure 4: Revealed comparative advantage of scientific field in China (2005 & 2013)



Note: 1) China's comparative advantage is compared with the rest of the world.

2) The sizes of the circles represent the share weights of those fields in China in 2013.

3) The acronyms are as follows: Agr - Agricultural and Biological Sciences; Art - Arts and Humanities; Bio - Biochemistry, Genetics and Molecular Biology; Mangm - Business, Management and Accounting; Chem eng - Chemical Engineering; Chem – Chemistry; Computer - Computer Science; Dec - Decision Sciences; Den – Dentistry; Earth - Earth and Planetary Sciences; Eco - Economics, Econometrics and Finance; Energy – Energy; Eng – Engineering; Envr - Environmental Science; Health - Health Professions; Imm - Immunology and Microbiology; Matr - Materials Science; Math –Mathematics; Med – Medicine; Mult – Multidisciplinary; Neur – Neuroscience; Nursing – Nursing; Pharm - Pharmacology, Toxicology and Pharmaceutics; Phy - Physics and Astronomy; Psy – Psychology; Soc - Social Sciences; Vet – Veterinary.

Figure 4 shows that most academic disciplines are located in Areas 1, 3 and 4. Areas 3 and 4 include the disciplines in which China has advantages in both beginning (2005) and ending year (2013), namely their RCA values are greater than 1 in both years. The comparative advantages of *Computer science (Computer)*, *Chemical engineering (Chem Eng)*, *Chemistry (Chem)*, *Physics (Phy)*, *Multidisciplinary(Mult)* and *Earth and planetary sciences* (*Earth)* kept rising (in Area 3), while those of *Engineering (Eng)*, *Materials science (Matr)* and *Energy* declined slightly (in Area 4), albeit their RCA values are still rather high in 2013, with Engineering at 1.9, Energy at 1.82, and Materials science at 1.71. These fields in Area 3 and 4 continue to be at the advantageous positions.

There are three fields, *Mathematics (Math)*; *Environmental science (Envr)*; and *Pharmacology (Pharm*), located in Area 2. This indicates that these three fields have improved their comparative advantages from under to above the worldwide level. The empty Area 5 implies that there are no opposite changes from above to under the worldwide average.

A number of fields are located in Area 1 and 6, indicating that China does not have comparative advantages in these fields. However, a clear majority of these fields lie above the diagonal, which demonstrates the improvement of their RCA scores over the years. *Biochemistry, Genetics and Molecular Biology (Bio); Agricultural and Biological Sciences (Agr); Immunology and microbiology (Imm); and Neuroscience (Neur); Decision sciences (Dec)* and *Medicine (Med)* are the fields that have improved their RCA scores significantly. The only field whose comparative advantage has declined significantly is *Business, Management and Accounting (Mangm)*, with a RCA score dropping from 0.93 to 0.30.

Congested at the left corner of this figure are eight fields in which China does not have comparative advantages and in which publication numbers are very low. They are *Psychology (Psy)*; *Arts and humanities (Art)*; *Nursing*; *Health professions (Health)*; *Social science (Social)*; *Economics, econometrics and finance (Eco)*; *Dentistry (Den);* and *Veterinary (Vet)*.

5. Quality of scientific output

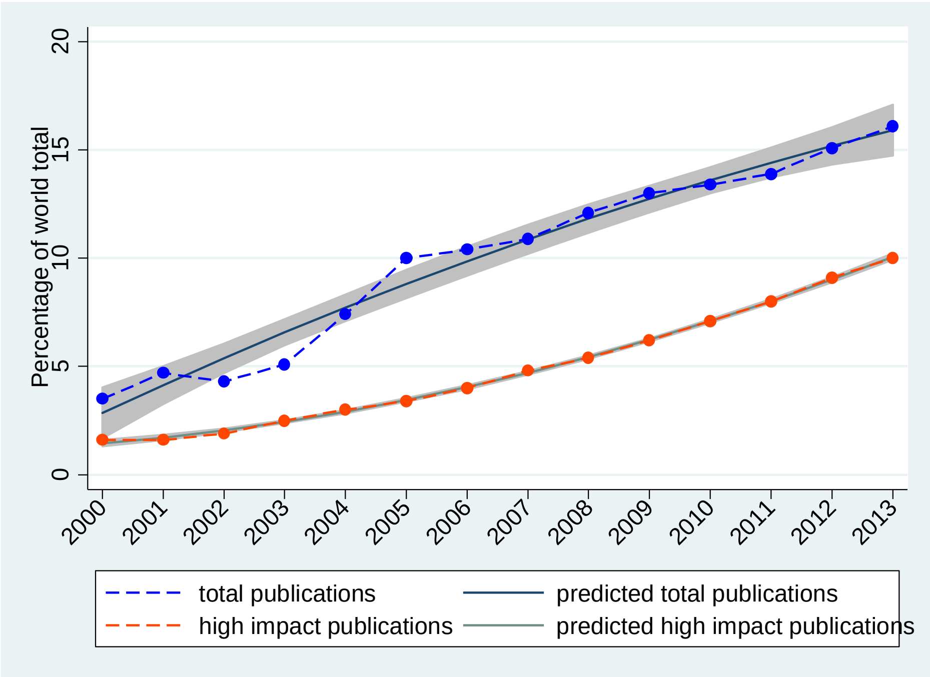
A good understanding of China's scientific performance requires evaluations not only in quantity but also in quality. The quality of scientific research can be assessed by two indicators: citation rate and number of publications in top journals. We prefer the latter to the former for the following two reasons. First, citation embodies more recognition and impact than quality. In this regard, authors' reputation affects the citation rate in the future. Using this method will create bias against less developed countries that do not possess historical advantages. Secondly, there is a significant time lag between the citing and being cited ones. Given that in developing counties, e.g. China, tremendous research activities were carried out in recently years, for which citation analysis is unable to provide us valuable information.

In this section, the high-quality publications are defined as the papers published in the top 5 per cent high-ranking journals by each academic discipline.

5.1 structure of high-quality publications

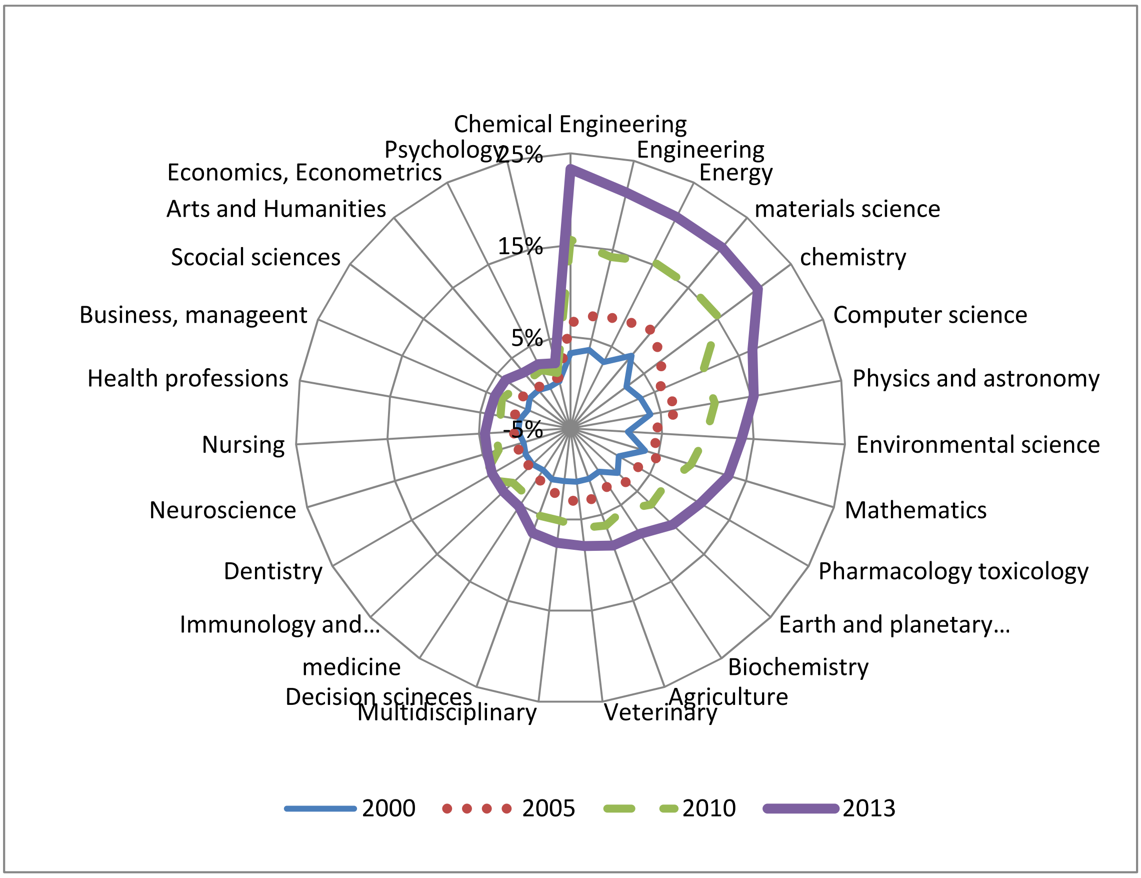
Figure 5 compares the growth trends between China's total publications and high-quality papers, as a share of worldwide total. In the beginning year of our studied period, China's total publication accounted for 3.5 per cent of the worldwide total and the high-quality publications accounted for 1.6 per cent, the latter being less than half of the former. Afterwards total publications in China experienced a downturn in 2002 and 2003, but a sharp rise in 2004 and 2005. However, high-quality publications in China kept a steady growth over all the years. The gap between the total and high-quality publications was at its widest during 2004 and 2006, but this gap was narrowed down after 2010. In the end of our studied years, i.e. 2013, China's publication share in global total increased to 16 per cent while its high-quality share reached 10 per cent, the latter being as much higher than half of the former, compared with the beginning point in 2000.

Figure 5: comparison of total and high-impact publications in China



Similar to the quantitative analysis in the earlier section, Figure 6 illustrates the shares of Chinese high-quality publications in the global total. The ranking of academic disciplines is slightly different from that in Figure 3. *Chemical engineering* is the top discipline in China, contributing the most to the high-quality output in the worldwide share. Following that are *Engineering*, *Energy*, *Materials science* and *Chemistry*. Compared with the total output structure in Figure 3, a very different view provided in Figure 6 is that all fields are less divergent in the publication quality picture.

Figure 6: Weight of Chinese high-impact output (as percentage of worldwide total)



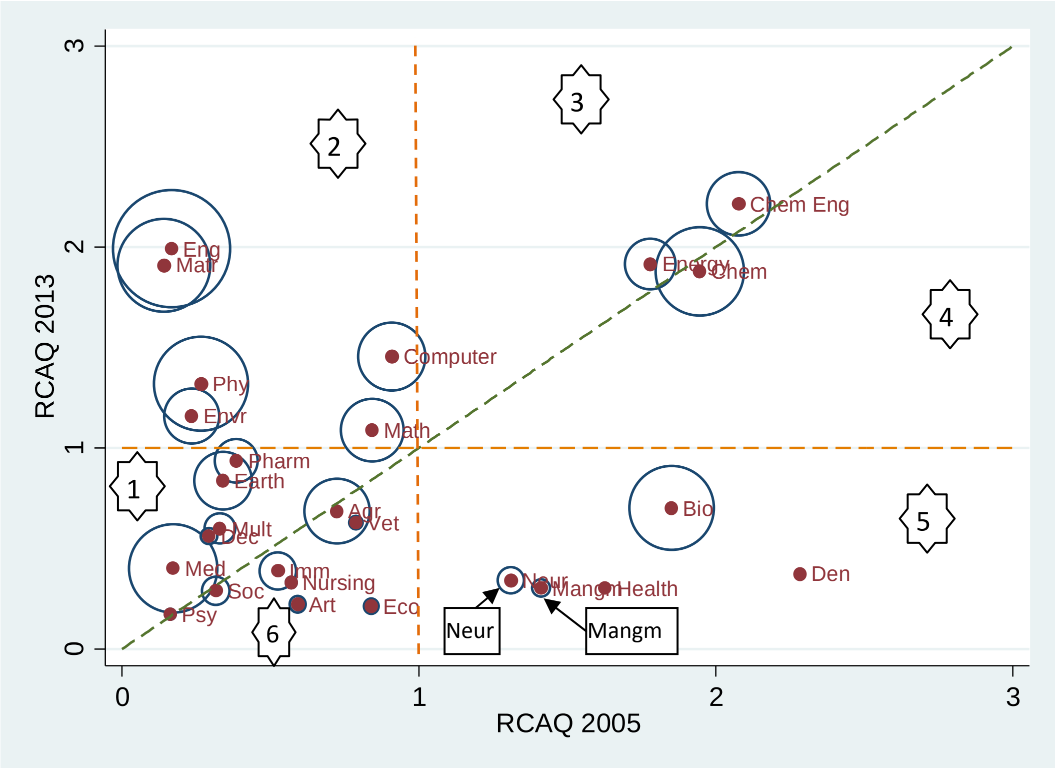
Note: Fields are ranked by their percentage values in 2013.

5.2 Revealed Comparative Advantage

To reveal the comparative advantage of each discipline from the qualitative perspective, this section provides the comparative advantage index for publication quality by discipline in China ($RCAQ_{ic}$).

Figure 7 presents the changes of comparative advantages in publication quality ($RCAQ_{ic}$). Similar to Figure 4, above the diagonal are the areas where $RCAQ_{ic}$ scores have increased over the years, while under the diagonal are the areas where $RCAQ_{ic}$ scores have decreased.

Figure 7: Revealed comparative advantage of high-impact publications in China (2005 & 2013)



Note: 1) China's comparative advantage is compared with the rest of the world.

2) The sizes of the circles represent the share weights of those fields in China in 2013.

3) The acronyms are as follows: Agr - Agricultural and Biological Sciences; Art - Arts and Humanities; Bio - Biochemistry, Genetics and Molecular Biology; Mangm - Business, Management and Accounting; Chem eng - Chemical Engineering; Chem – Chemistry; Computer - Computer Science; Dec - Decision Sciences; Den – Dentistry; Earth - Earth and Planetary Sciences; Eco - Economics, Econometrics and Finance; Energy – Energy; Eng – Engineering; Envr - Environmental Science; Health - Health Professions; Imm - Immunology and Microbiology; Matr - Materials Science; Math –Mathematics; Med – Medicine; Mult – Multidisciplinary; Neur – Neuroscience; Nursing – Nursing; Pharm - Pharmacology, Toxicology and Pharmaceutics; Phy - Physics and Astronomy; Psy – Psychology; Soc - Social Sciences; Vet – Veterinary.

Most fields lie above the diagonal, in particular in Area 1 and 2, suggesting an improvement in publication quality over the years. Area 2 includes the fields that have advanced their comparative advantages in quality greatly, from under to above the worldwide level. For instance, *Engineering (Eng)* and *Material Sciences (Matr)* have increased their $RCAQ_{ic}$ scores from 0.17 and 0.15 in 2005 to 1.78 and 1.72 in 2013, respectively. *Physics (Phy)* and *Environmental science (Envr)* both increased from around 0.25 in 2005 to 1.14 and 1.27 in 2013 respectively. *Computer science (Computer)* and *Mathematics (Math)* have also improved their comparative advantages in quality, being higher than 1 in 2013.

Area 1 includes the fields that have improved their comparative advantages in quality but with a level still lower than the worldwide average. These are *Pharmacology, toxicology and pharmaceutics (Pharm)*; *Earth and planetary (Earth)*; *Multidisciplinary (Mult)*; *Decision sciences (Dec)* and *Medicine (Med)*. Fields in Area 6 are those that have somewhat degraded their $RCAQ_{ic}$, being at the disadvantageous position in the whole studied period.

Contrary to Area 2, Area 5 captures the fields that have greatly decreased their comparative advantages in quality from 2005 to 2013.

The three fields in which China has the highest comparative advantages are, *Chemical engineering (Chem Eng)*, *Chemistry (Chem)* and *Energy*, with $RCAQ_{ic}$ scores at around about 2 in both years.

In sum, Figure 7 delivers two pieces of important information. One is that most fields have improved their quality index from 2005 to 2013 (see Areas 1 and 2). The other one is that, taking the size of fields into consideration, large academic fields with higher national weights have mostly all improved their quality over the studied years. *Biochemistry, genetics and molecular biology (Bio)* is the only large field which has high publication numbers in China but has decreased its comparative advantage in quality.

5.3 Language composition

Language composition is an important aspect to reflect the visibility of research publications. This study examines publications in both English and Chinese, which are the two major languages for Chinese researchers to present their academic output.

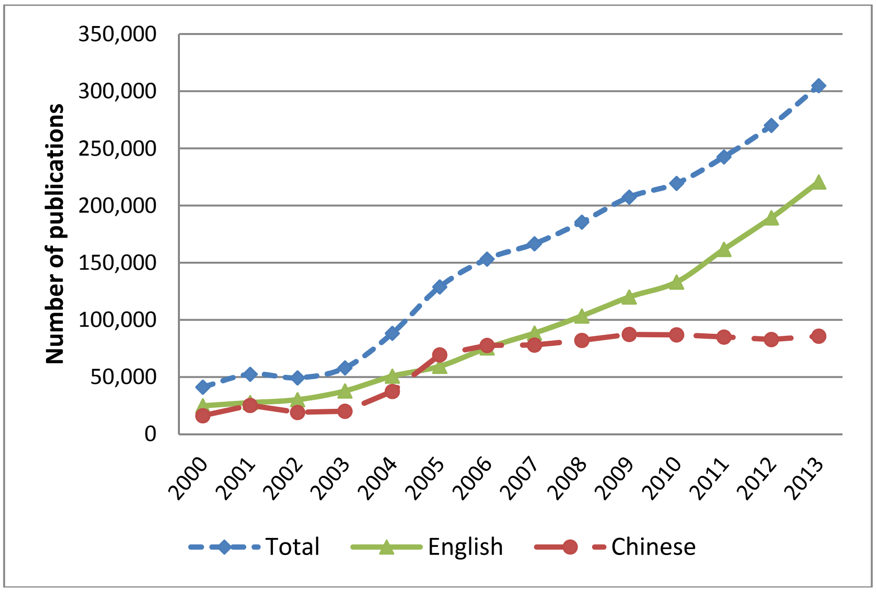
Figure 8 provides the growth trends of publications in both languages, as well as the aggregate total[7]. In 2005 and 2006, articles published in Chinese accounted for more than half of the total output. This shows that the share of China's research output published in English was relatively low in those years. Consequently, given that high ranking journals are all English-language journals, the percentage of high-quality papers published in top journals is more likely low as well.

After 2006, publications in Chinese followed a path greatly divergent from that of English-language publications (see Figure 8). The annual output in Chinese remained

[7] The languages for aggregate total include not only English and Chinese but also some other languages such as Japanese, German, French, etc.

stagnant throughout the following years. Publications in English, however, exhibited a sharp increase and the gap between the number of total publications and that of English-language publications narrowed. In 2013, papers published in English accounted for 72 per cent of Chinese total output[8].

Figure 8: growth trends of publication in China (by language category)



Source: Scopus - SciVerse Elsevier.

Note: Document type is "article" and this does not include conference papers, editorials, notes, reviews, etc.

Zhou and Leydesdorff (2006) states that Chinese scientists have not published sufficiently in in international journals and suggest that they "may consider changing their focus from domestic journals to international ones". Our study shows that this was well the case in the earlier years. However, the structure of journal sources (in terms of languages) in China has changed greatly after 2006.

6. Conclusions

China has witnessed impressive growth in S&T in the past decade. From both quantitative and qualitative perspectives, this paper examines the comparative advantages of China's scientific research by academic discipline. Its findings can be summarized as follows:

[8] One should keep in mind that this paper studies only publications indexed by Scopus. Beyond the journals indexed by Scopus, there are also many more other Chinese journals which were not taken into consideration in this paper.

1) In general, hard science drives the growth of scientific output in China, while soft science remains rather weak. The five fields with the highest comparative advantages are *Engineering*, *Energy*, *Materials science*, *Computer science* and *Chemical engineering*. Most of the fields in China with comparative advantages are large ones with the most publication records. Yet *Energy* is the only exception, being a small field, but having a rather high comparative advantage score. This indicates China's great efforts in promoting this field and it plays an important role in the worldwide total.

2) The group of fields with the lowest comparative advantage scores over the years include *Psychology*; *Arts and humanities*; *Nursing*; *Health professions*; *Social science*; *Economics*, *econometrics and finance*; *Dentistry*; and *Veterinary*. These fields are small in nature, i.e. the publication numbers in those fields are very low in both China and the rest of the world. Nevertheless, China is weaker in these fields compared to other countries.

3) The development of academic disciplines is more balanced from the qualitative than from the quantitative perspective. Namely, the gap between the most advantageous field and the most disadvantageous one in the sense of quality is smaller than that in the sense of quantity.

4) Most academic disciplines in China have improved their comparative advantages in publication quality over the studied years. *Biochemistry, genetics and molecular biology (Bio)* is the only large field which has high publication numbers in China but has decreased its comparative advantage in quality.

5) Since 2006 the growth of scientific output in China has been driven mainly by publications in English-language journals. The continuous increase of publications in English-language journals (compared to those in Chinese ones) suggests that research output by Chinese researchers is becoming more and more visible to readers outside of China. This is likely to lead to more citations in the future.

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Annex

Table A1: Numbers of total journals by field

categories	nr of journals	top 5%
Agricultural and biological science	1692	85
Arts and Humanities	2217	111
Biochemistry, Genetics and Molecular Biology	1677	84
Business, Management and Accounting	932	47
Chemical Engineering	490	25
Chemistry	743	37
Computer science	1295	65
Decision Sciences	256	13
Dentistry	141	7
Earth and Planetary Sciences	926	46
Economics, Econometrics and Finance	726	36
Energy	385	19
Engineering	2173	109
Environmental science	1038	52
Health Professions	341	17
Immunology and microbiology	460	23
Materials science	912	46
Mathematics	1158	58
Medicine	5840	292
Multidisciplinary	96	5
Neuroscience	440	22
Nursing	492	25
Pharmacology, toxicology and pharmaceutics	654	33
Physics and astronomy	939	47
Psychology	970	49
Social Sciences	4119	206
Veterinary	187	9

Source: Scopus and SCImago Journal Rank.

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