

Analysis on the Trade Comparative Advantage of Manufacturing Industry in Guangzhou to the Belt and Road Area: Based on the RSCA Index

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Abstract: After the economic development has entered the new normal stage, the manufacturing industry in Guangzhou faces new challenges and opportunities, and it urgently needs to change the way of its economy development. This paper uses the RSCA index to analyze Guangzhou's problems existing in the manufacturing industry, and to compare the situation to six different areas along the B&R. The results show that, Guangzhou has a long and steady comparative advantage in the garment and textile sector, metal products and leather products sector while it is comparative disadvantage in metal smelting and processing sector, chemical products sector and non-metallic mineral sector. From the perspective of regional comparison, Guangzhou has the strongest competitiveness with ASEAN and South Asia while it is complementarily with Central Asia and West Asia.

1 Introduction

As one of the earliest coastal open cities, Guangzhou has gradually become an export-oriented city and integrated into the global value chain division system led by the developed countries with its competitive advantages such as geographical location, business culture, labor and natural resources. Since the 90s of last century, Guangzhou has set up the automobile manufacturing, electronics manufacturing and petrochemical manufacturing as the three backbone industries of the city and this structure has not changed so far.

To date, the manufacturing industry in Guangzhou is still lagging behind in the R & D, design and marketing strategy. It is in the low-end position in the interest distribution map of the global value chain and gets a small share of interest. The slowdown of both the domestic and abroad economy has great impact on Guangzhou's manufacturing industry. The three traditional backbone industries cannot provide sufficient motivation to the manufacturing industry and its overall growth has slow down. In 2015, Guangzhou's total output value of manufacturing industry was 1.63 trillion

Yuan, an increase of 2% over the same period of previous year, accounting for 13.8% of the total output value of the province's manufacturing industry. The added value of manufacturing industry was 0.4 trillion Yuan, an increase of 2.2% over last year.

Although the scale of manufacturing in Guangzhou is constantly expanding, the growth rate has gradually shifted into the steady growth of low speed (see Figure 1). However, the initiative put forward by the Central Government of China such as 'Belt and Road', 'Going Out Strategy' and 'Made in China 2025' has brought new opportunities to enhancing Guangzhou's manufacturing industry. Facing the opportunities, the first task is to clarify the comparative advantages of manufacturing industries in Guangzhou to the Belt and Road area.

This paper uses the RSCA index to analyze the manufacturing industry situation in Guangzhou to the B&R area. In order to enhance its innovation capacity and its position in the global value chain, Guangzhou's manufacturing industry shall follow the rules of comparative advantages of international production capacity and broaden its cooperation space.

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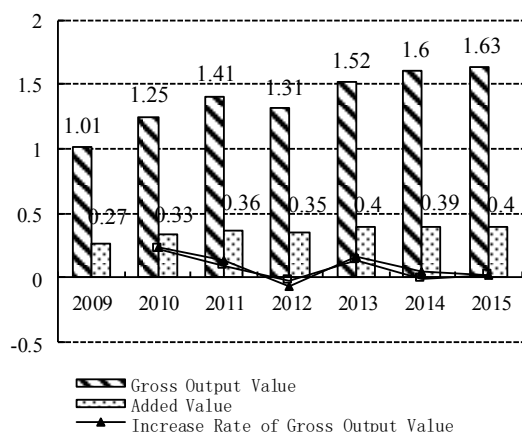


Fig. 1. Analysis on the development of Guangzhou's manufacturing industry¹ (Unit: Trillion Yuan)

2 Methods on comparative advantages analysis

2.1. RSCA Index Classified by Sectors

The RCA index (Revealed Comparative Advantage Index) is a commonly used measuring method in the literature of analysis on comparative advantage. It was first proposed by Balassa [1]. The formula is: $RCA_{ij} = (X_{ij}/X_j)/(X_{iw}/X_w)$, where X_{ij} is the export of product i from area j , X_j is the total export from area j , X_{iw} is the world's export of product i and X_w is world's total export.

The RCA index can measure the comparative advantage level of different trade sectors in an area. When RCA index of a specific trade sector is above 1, it indicates that the sector in this area has comparative advantage, otherwise it has comparative disadvantage. However, Benedictis[2] found in his further research that, the RCA index has the defect of asymmetric on measuring comparative advantage. When the index value is between 0-1, it is considered as of comparative disadvantage, while the value range is $[1, +\infty]$, it is considered as of comparative advantage. The judgment value of the two ranges is not symmetrical, which makes the measured indicators distribution skew and directly affects the intuitive judgment on the comparative advantages of various industrial sectors.

In view of this, this paper uses the RSCA index to correct the RCA index deviation [3]. The formula is: $RSCA = (RCA - 1)/(RCA + 1)$. By modifying the asymmetry bias of the RCA index, the RSCA index can be narrowed down the value range to $[-1, 1]$. If the value of RSCA index is $[0, 1]$, it indicates that the industrial sector has comparative advantage, while the value of $[-1, 0]$ has comparative disadvantage.

The variables used in this paper are from 1995 to 2014. The data are from the World Trade Database, the UN Trade Database, the World Bank Database and the Guangzhou Statistical Yearbook.

According to China's industry classification for national economic activities (GB-T4753-2011), the related manufacturing industry is divided into 11 sectors: food processing, wood products, non-metallic mineral, metal smelting and processing, chemical products, leather products, paper and printing, garment and textile, metal products, sports and entertainment and equipment manufacturing. The calculation results of RSCA index of the above manufacturing industry sectors are shown in Table 1.

Table 1. Results of RSCA index of Guangzhou manufacturing industry classified by sectors (1995-20174)

| | Food processing | Wood products | Metal smelting and processing | Chemical products | Non-metallic mineral | Metal products |
|------|-------------------------|------------------|-------------------------------|--------------------|--------------------------|----------------|
| 1995 | 0.373 | -0.663 | -0.983 | -0.044 | -0.599 | 0.630 |
| 1996 | 0.326 | -0.689 | -0.985 | -0.602 | -0.584 | 0.580 |
| 1997 | 0.280 | -0.687 | -0.988 | -0.504 | -0.568 | 0.679 |
| 1998 | 0.233 | -0.548 | -0.990 | -0.406 | -0.552 | 0.688 |
| 1999 | 0.186 | -0.409 | -0.993 | -0.309 | -0.536 | 0.737 |
| 2000 | 0.139 | -0.269 | -0.995 | -0.211 | -0.520 | 0.606 |
| 2001 | 0.038 | -0.234 | -0.993 | -0.165 | -0.346 | 0.815 |
| 2002 | -0.102 | -0.144 | -0.994 | -0.328 | -0.218 | 0.574 |
| 2003 | -0.008 | -0.352 | -0.995 | -0.423 | -0.386 | 0.229 |
| 2004 | -0.077 | -0.426 | -0.995 | -0.299 | -0.496 | 0.506 |
| 2005 | -0.206 | -0.296 | -0.998 | -0.444 | -0.607 | 0.497 |
| 2006 | -0.237 | -0.108 | -0.997 | -0.372 | -0.654 | 0.651 |
| 2007 | -0.370 | -0.343 | -0.997 | -0.291 | -0.631 | 0.268 |
| 2008 | -0.456 | -0.840 | -0.990 | -0.403 | -0.702 | 0.227 |
| 2009 | -0.626 | -0.460 | -0.987 | -0.519 | -0.666 | 0.863 |
| 2010 | -0.726 | -0.736 | -0.983 | -0.505 | -0.811 | 0.738 |
| 2011 | -0.761 | -0.711 | -0.990 | -0.439 | -0.818 | 0.651 |
| 2012 | -0.781 | -0.329 | -0.988 | -0.521 | -0.746 | 0.280 |
| 2013 | -0.818 | -0.817 | -0.986 | -0.572 | -0.619 | 0.825 |
| 2014 | -0.816 | -0.830 | -0.988 | -0.562 | -0.202 | 0.792 |
| | Equipment manufacturing | Leather products | Garment and textile | Paper and printing | Sports and entertainment | |
| 1995 | -0.782 | 0.501 | 0.537 | -0.844 | 0.501 | |
| 1996 | -0.556 | 0.419 | 0.234 | -0.868 | 0.645 | |
| 1997 | -0.809 | 0.559 | 0.686 | -0.878 | 0.479 | |
| 1998 | -0.681 | 0.700 | 0.371 | -0.881 | 0.778 | |
| 1999 | -0.549 | 0.840 | 0.674 | -0.862 | 0.671 | |
| 2000 | -0.417 | 0.981 | 0.976 | -0.842 | 0.632 | |
| 2001 | -0.364 | 0.837 | 0.565 | -0.813 | 0.440 | |
| 2002 | -0.157 | 0.677 | 0.742 | -0.793 | 0.800 | |
| 2003 | 0.290 | -0.366 | 0.378 | -0.724 | 0.719 | |
| 2004 | 0.543 | -0.176 | 0.594 | -0.601 | 0.597 | |
| 2005 | 0.710 | -0.228 | 0.321 | -0.545 | 0.507 | |
| 2006 | 0.777 | -0.083 | 0.603 | -0.432 | 0.328 | |
| 2007 | 0.864 | -0.604 | 0.486 | -0.333 | 0.662 | |
| 2008 | 0.807 | 0.027 | 0.672 | -0.133 | 0.140 | |
| 2009 | 0.666 | 0.109 | 0.734 | -0.239 | -0.266 | |
| 2010 | 0.644 | -0.338 | 0.735 | -0.556 | -0.256 | |
| 2011 | 0.551 | -0.820 | 0.939 | -0.547 | -0.645 | |
| 2012 | 0.717 | -0.228 | 0.799 | -0.591 | -0.489 | |

¹ Data collected from Guangzhou statistical information network: <http://www.gzstats.gov.cn/>

| | | | | | |
|------|-------|-------|-------|--------|--------|
| 2013 | 0.875 | 0.607 | 0.354 | -0.535 | -0.186 |
| 2014 | 0.756 | 0.546 | 0.398 | -0.529 | -0.420 |

From Table 1 we see: First of all, from the changes of index of Guangzhou's manufacturing industries divided by industrial sectors, the comparative advantage index are positive in garment and textile sector and metal products sector, while they are negative on metal smelting processing sector, chemical processing and manufacturing sector, non-metallic mineral products sector and paper and printing sector. That means that Guangzhou has a long and steady comparative advantage in the labor-intensive industries such as garment and textile and metal products. However, Guangzhou shows a long-term disadvantage in manufacturing industries such as metal smelting processing, chemical processing and manufacturing, non-metallic mineral products.

Secondly, the average RSCA index value of Guangzhou's metal smelting sector is -0.9 (even in some years the index value is -0.998) and the average RSCA index value of the paper printing sector, wood processing sector and non-metallic mineral products sector are around -0.7. These important manufacturing sectors are at a relatively significant disadvantage.

Thirdly, from the time trend of RSCA index, the RSCA index of Guangzhou's equipment manufacturing sector raised from the -0.782 to 0.756, which shows that over the past 20 years, the equipment manufacturing sector with high technology content in Guangzhou has been growing strongly and the effect of industrial transformation and upgrading is obvious.

2.2. Comparative Analysis to the B&R Area

In order to provide a clearer analysis of the comparative advantages of manufacturing industries in Guangzhou to the 65 countries along the Belt and Road area², we need to conduct a horizontal comparative analysis. We make X_w and X_w in the formula $RCA_i = (X_i / X_g) / (X_w / X_w)$ representing the B&R area and we will see the comparative advantage in Guangzhou to B&R area. The Table 2 shows the RSCA index of manufacturing industries in Guangzhou to B&R area from 1995 to 2014.

²According to the national data along the Belt and Road Network of China (<https://www.yidaiyilu.gov.cn>), 65 countries were selected as the research samples, including India, Ethiopia, Bosnia and Herzegovina, Montenegro, Turkmenistan, Lithuania, Latvia, Palestine, Albania, Afghanistan, Estonia, Pakistan, Slovenia, Croatia, Lebanon, Oman, Bahrain, Yemen, Egypt, Jordan, Syria, Indonesia, Philippines, Singapore, Israel, Azerbaijan, Armenia, Czech Republic, Bangladesh, Belarus, Cambodia, Georgia, Myanmar, Brunei, East Timor, Bhutan, United Arab Emirates, Thailand, Vietnam, Hungary, Iraq, Iran, Kyrgyzstan, Laos, Kazakhstan, Qatar, Kuwait, Moldova, Maldives, Malaysia, Macedonia, Mongolia, Nepal, Poland, Bulgaria, Romania, Serbia, Saudi Arabia, Slovakia, Tajikistan, Russia, South Africa, Sri Lanka, Turkey, Ukraine and Uzbekistan.

Table 2. RSCA index of manufacturing industries in Guangzhou to B&R area(1995-2014)

| | Food processing | Wood products | Metal smelting and processing | Chemical products | Non-metallic mineral | Metal products |
|------|-------------------------|------------------|-------------------------------|--------------------|--------------------------|----------------|
| 1995 | -0.136 | 0.626 | -0.989 | -0.911 | -0.890 | -0.556 |
| 1996 | -0.221 | 0.455 | -0.990 | -0.827 | -0.879 | -0.785 |
| 1997 | -0.461 | 0.194 | -0.991 | -0.744 | -0.869 | -0.513 |
| 1998 | -0.701 | 0.333 | -0.991 | -0.660 | -0.859 | -0.242 |
| 1999 | -0.556 | 0.672 | -0.992 | -0.577 | -0.848 | -0.390 |
| 2000 | -0.411 | 0.411 | -0.993 | -0.493 | -0.838 | -0.537 |
| 2001 | -0.739 | 0.474 | -0.990 | -0.449 | -0.747 | 0.157 |
| 2002 | -0.632 | 0.276 | -0.989 | -0.542 | -0.713 | 0.503 |
| 2003 | 0.095 | 0.401 | -0.988 | -0.583 | -0.791 | 0.519 |
| 2004 | 0.379 | -0.736 | -0.990 | -0.527 | -0.827 | 0.523 |
| 2005 | 0.468 | -0.886 | -0.995 | -0.599 | -0.872 | 0.238 |
| 2006 | 0.309 | -0.941 | -0.991 | -0.517 | -0.866 | 0.147 |
| 2007 | 0.652 | -0.160 | -0.994 | -0.424 | -0.804 | 0.012 |
| 2008 | -0.674 | 0.329 | -0.965 | -0.645 | -0.893 | 0.104 |
| 2009 | 0.225 | -0.326 | -0.955 | -0.612 | -0.864 | 0.118 |
| 2010 | 0.239 | -0.579 | -0.957 | -0.629 | -0.873 | 0.256 |
| 2011 | 0.371 | -0.624 | -0.959 | -0.653 | -0.874 | 0.491 |
| 2012 | 0.318 | -0.292 | -0.950 | -0.689 | -0.873 | 0.388 |
| 2013 | 0.239 | -0.691 | -0.950 | -0.700 | -0.836 | 0.197 |
| 2014 | 0.432 | -0.725 | -0.969 | -0.728 | -0.714 | 0.298 |
| | Equipment manufacturing | Leather products | Garment and textile | Paper and printing | Sports and entertainment | |
| 1995 | -0.613 | 0.299 | 0.357 | 0.336 | 0.613 | |
| 1996 | -0.586 | 0.347 | 0.223 | 0.091 | 0.571 | |
| 1997 | -0.559 | 0.396 | 0.395 | -0.155 | 0.813 | |
| 1998 | -0.653 | 0.445 | 0.286 | -0.400 | 0.591 | |
| 1999 | -0.551 | 0.494 | 0.417 | -0.646 | 0.101 | |
| 2000 | -0.448 | 0.543 | 0.549 | -0.891 | -0.389 | |
| 2001 | -0.496 | 0.551 | 0.642 | -0.417 | -0.196 | |
| 2002 | -0.432 | 0.349 | 0.690 | -0.357 | 0.724 | |
| 2003 | -0.151 | 0.040 | 0.042 | 0.419 | 0.151 | |
| 2004 | -0.024 | 0.082 | 0.216 | -0.336 | -0.319 | |
| 2005 | 0.046 | 0.044 | 0.439 | 0.459 | 0.024 | |
| 2006 | 0.025 | 0.667 | -0.010 | -0.377 | -0.720 | |
| 2007 | 0.030 | 0.794 | 0.017 | -0.299 | 0.676 | |
| 2008 | 0.293 | 0.781 | -0.014 | -0.426 | 0.350 | |
| 2009 | 0.291 | 0.657 | 0.586 | -0.030 | 0.322 | |
| 2010 | 0.423 | 0.626 | 0.541 | -0.711 | 0.080 | |
| 2011 | 0.418 | 0.679 | 0.577 | -0.957 | 0.466 | |
| 2012 | 0.519 | 0.771 | 0.473 | -0.868 | -0.099 | |
| 2013 | 0.460 | 0.843 | 0.434 | -0.057 | 0.013 | |
| 2014 | 0.449 | 0.724 | 0.821 | -0.222 | -0.302 | |

As shown in Table 2, from view of the change of manufacturing RSCA index of Guangzhou to the B&R area, the results are positive in garment and textile sector, metal products sector, leather products sector and sports and entertainment sector for most of the time, which reveals a long-standing comparative advantage, while they are negative in metal smelting and processing sector, chemical products sector and non-metal mineral products sector, which shows a long-standing comparative disadvantage. From the view of value of the RSCA index, the value of Guangzhou's metal smelting index wanders around -0.97 and the index value of non-metallic mineral products is around -0.84, which indicates that these

important manufacturing sectors are of a significant comparative disadvantage. From the view of trend of the index, the index of equipment manufacturing sector rose from -0.613 of comparative disadvantage to 0.449 of comparative advantage. The index of food processing sector also fluctuated from a comparative disadvantage point to a comparative advantage point. This comprehensively explains that the transformation effect is significant in the equipment manufacturing sector and food processing sector in Guangzhou in recent years.

We group the 65 countries along the B&R area into six major regions as ASEAN, West Asia (WA), Central Asia (CA), South Asia (SA), the Commonwealth of Independent States (CIS), Central and Eastern Europe (CEE)(see Figure 2).

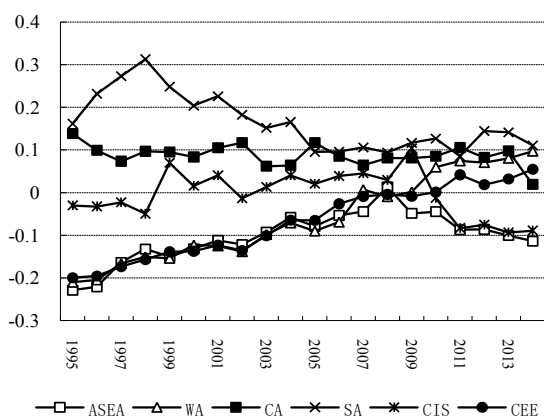


Figure 2 Comparative Advantages of Manufacturing Industries in Guangzhou to the Six Groups of B&R Area

The Figure 2 shows change trend of the comparative advantage of Manufacturing Industries in Guangzhou to the Six Groups of B&R Area. From 1995 to 2014, Guangzhou's manufacturing industry has maintained its comparative advantage to South Asia (SA) and Central Asian (CA). However, there have been signs of declining in recent years, especially to South Asian. Since 1998, a significant downward trend has appeared. Although Guangzhou's manufacturing industry has more advantages in technology and high technological development than South Asia and Central Asia which makes Guangzhou maintaining a comparative advantage for a long time, as the cost of labor increases and the demographic dividends disappeared in Guangzhou, labor cost advantage in South Asia and Central Asia gradually appears [4], and the comparative advantage of Guangzhou's manufacturing industry is becoming weakened.

From 1995 to 2008, Guangzhou has been at a disadvantage position to ASEAN, West Asia (WA) and Central and Eastern Europe (CEE), but the disadvantage was constantly diminishing. The main reason may be that economic development of West Asia and Central and Eastern Europe and manufacturing exports were severely affected were the global financial crisis.

To ASEAN, Guangzhou's manufacturing industry turned from a comparative disadvantage to a comparative advantage in 2008, but turned into a comparative disadvantage in 2009 and continued to expand. After the global financial crisis in 2008, the domestic economic growth slowed down and the demand in the international market was sluggish. All these unfavorable factors weakened the international competitiveness of Guangzhou's manufacturing industry. Guangzhou and ASEAN countries have generally similar manufacturing structures, but ASEAN countries have lower labor costs [5], which enlarges the comparative disadvantage of manufacturing in Guangzhou to ASEAN.

In recent years, Guangzhou's manufacturing industry is under double pressure: the internal labor costs and operating costs continue to rise and the external economic conditions have continued to slump. In such situation, the trade condition is deteriorating. The low-end manufacturing industries have been hit by low-cost impacts from the Southeast Asia countries; while in the domestic market, the high-end manufacturing industries were suffered from the competitiveness from developed countries.

As a result, Guangzhou's manufacturing industry has begun to enter a new normal situation under the dual pressures from inside and outside.

3 Conclusion and suggestion

Guangzhou needs to develop the science and technology industries and promote the relevant policies on improving the development of modern manufacturing industry to promote the relevant policies as follows:

First of all, Guangzhou should make reasonable preparation of its advanced manufacturing industry development plan to promote technological innovation in industrial enterprises. Take advantages of the opportunities of Industry 4.0 era and 'Made in China 2025' strategy to deepen the innovation of industry and information transformation.

Secondly, Guangzhou should formulate the high-end manufacturing development plans to strengthen the support of emerging industries. In order to support the breakthroughs of core manufacturing technology and its carrier construction and to cultivate the backbone enterprises, Guangzhou should increase the proportion of R&D expenditures in the city. Guangzhou can make full use of the capital resources like integrating the existing government funds, introducing the social capital, establishing the industry development funds or even establish the investment funds with Guangdong Province to attract more innovative investment enterprises.

Thirdly, a combination of policies should be introduced to promote manufacturing enterprises to reduce the cost of production factors and the business burden.

Finally, the government should give full play to its role as a platform for foreign exchange and cooperation such as the Guangzhou Overseas Exchange Association to guide the resources of overseas Chinese businessmen and overseas Chinese experts and scholars to flow into

Guangzhou and help the advanced manufacturing projects, personnel and funds to settle down in Guangzhou.

Acknowledgements

This work is partially supported by Key Grant Projects of Philosophy and Social Sciences Research, Ministry of Education of China (Grant No.16JZD018). Yonghui Han is the corresponding author, the e-mail is hanyonghui2006@foxmail.com.

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