

# The Export Patterns of the Chinese Office Equipment Manufacturing Industry Using Trade Data of 1984-2019

Yu Hong<sup>1</sup>, Na Li<sup>1</sup>, Lin Zhang<sup>1</sup> and Ting Liu<sup>2</sup>

<sup>1</sup>College of International Economics and Trade, Jilin University of Economy and Finance, Changchun, China

<sup>2</sup>Changchun Humanities and Sciences College, Changchun, China

**Keywords:** China, Office Equipment Product, Export Patterns.

**Abstract:** This paper used annual trade data of China's office equipment from 1984 to 2019, and analyzed the export pattern of office equipment. RSCAX index is used to analyze the comparative advantage of China's office equipment export, NX index is used to judge the net export ratio of office equipment, and HX index is used to judge the government intervention of China's office equipment industry. The study found that the comparative advantage of China's office equipment remained roughly balanced during the sample period, while the government imposed import restrictions. Although it maintains a trade surplus, its international competitiveness is still weak.

## 1 INTRODUCTION

High-tech products as the government's key support industry more and more attention, office equipment as one of the gradually into people's life, its trade status is also gradually improved. The proportion of China's office equipment in the world's exports has amounted to 35% of the world's total exports in the product with large trade surplus.

China has claimed that the Chinese trade policies are against trade protectionism. The trade surplus, however, may indicate that China has adopted trade promotion or import restriction policies in the office equipment products which are opposite to the free trade. This paper analyzes the trade pattern of office equipment in China during the 1984-2019 to explore the Chinese trade policy in the product. The marginal contribution this study attempts to make is to reassess the protectionist supporting trade policy in the Chinese office equipment manufacturing industry.

## 2 METHODS AND MATERIALS

### 2.1 Revealed Comparative Advantage

Balassa (1965) proposed the index of revealed comparative advantage to measure the comparative

advantage of import and export products (Balassa, 1965):

$$RCA_{X_{co}} = (X_{co}/X_c)/(X_{wo}/X_w) \quad (1)$$

where  $X$  represents exports, the subscript of  $C$  indicates China and that of  $O$  is for the office equipment,  $X_{wo}$  means the global office equipment exports.  $RCA_{X_{co}} > 1$  means that China has comparative advantage in specializing in the office equipment than the world average;  $RCA_{X_{co}} < 1$  means the opposite. The value range of  $RCA_{X_{co}}$  is  $[0, \infty]$  with uncertain mean and the distribution is asymmetric (Hinloopen, 2001).

This study used the logarithmic transformation as proposed by Dalum, Laursen and Villumsen (1998) (Dalum, 1998) to obtain the indicator of revealed symmetric comparative advantage

$$RX_{co} = RSCAX_{co} = (RCA_{X_{co}} - 1)/(RCA_{X_{co}} + 1) \quad (2)$$

The range of  $RX_{co}$  is  $[-1, 1]$  and distributed around the mean of 0.  $RCA_{X_{co}} > 1$  generates  $RX_{co} > 0$  and denotes comparative advantage;  $RCA_{X_{co}} < 1$  corresponds to  $RX_{co} < 0$  and shows comparative disadvantage.  $RCA_{X_{co}} = 1$  exactly implies  $RX_{co} = 0$ , meaning the specialization is identical to the world average.

### 2.2 Net Export Ratio

This research uses the indicator of net export ratio or

$$NX_{co}=(X_{co}-M_{co})/(X_{co}+M_{co}) \quad (3)$$

as a benchmark. The range is [-1, 1], and its average value is 0.  $NX_{co}>0$  implies trade surplus and  $NX_{co}<0$  suggests trade deficit.  $NX_{co}=0$  means the import is equal to the export.

### 2.3 Policy Intervention Index

Under free trade, a country should specialize in and export the products with comparative advantage and import those with comparative disadvantage (Lall, 2000; Boone, 2000).  $RSCA_{co}$  is equal to  $NX_{co}$  or

$$RSCA_{co}=NX_{co} \quad (4)$$

as the sufficient condition for free trade condition (Morrow, 2010; Pang, 2010; Hong, Guan, Su, 2012; Hong, Chen, Yang, 2019). The difference between  $NX_{co}$  and  $RSCA_{co}$  can be understood as the indicator of policy intervention in export or

$$HX_{co}=NX_{co}-RSCA_{co} \quad (5)$$

The indicator of  $HX_{co}$  measures the disparity between net export ability and comparative advantage in export. Under perfect free trade there must be  $HX_{co}=0$ .  $HX_{co}>0$  means that the country has adopted export promotion trade policies, while  $HX_{co}<0$  implies the case of export restriction (Hong, Yang, Hu, Su, 2019; Hong, Guan, Su, 2013; Hong, Zhang, Hu, Shi, 2019; Chen, Yu, Hu, Hong, 2019).  $HX_{co}$  reflects whether China's net export capacity is higher or lower than its comparative advantage when it shows a certain comparative advantage in the import of products. If the trade pattern is in equilibrium, there should be  $HX_{co}=0$ . If  $HX_{co}>0$ , then the net export ratio is greater than the import, indicating that China has adopted a trade policy to increase the net export ratio of office equipment by restricting the import. If  $HX_{co}<0$ , it means that the import trade policy adopted by China is not restrictive, but has the feature of encouraging import (Hong, Song, Wang, Su, 2014; Hong, Yang, Hu, Shi, 2020; Hong, Chen, Yang, Hu, Ma, 2019; Hong, Yu, Yang, Hu, Ma, 2020; Hong, Hong, 2016).

### 2.4 Data Curation

We obtained the annual trade data of 1984-2019 from UN Comtrade database under the first edition classification of Standard International Trade (SITC Rev.1). According to the classification of Revision one (SITC Rev.1), we found the three-digit code of 714 is for the office equipment. SITC Rev.1 was employed because of its long sample period (Hong, Wang, Su, Mu, 2014; Shi, Yang, Hu, Hong, 2019;

Hong, Yu, Yang, Hu, Ma, 2020; Ma, Yang, Yu, Hu, Hong, 2020; Hong, Zhang, Hu, Ma, 2020).

The 2020 trade data of China and the world can be available in the later 2021, and some UN member countries may postpone to report the data. This fact makes the latest data this current research can obtain is by the year of 2019.

## 3 RESULTS AND DISCUSSION

### 3.1 The Evolution of The Chinese Trade Patterns

Figure 1 shows the time paths of  $RSCA_{co}$ ,  $HX_{co}$  and  $NX_{co}$  in China's office equipment export during the sample period.

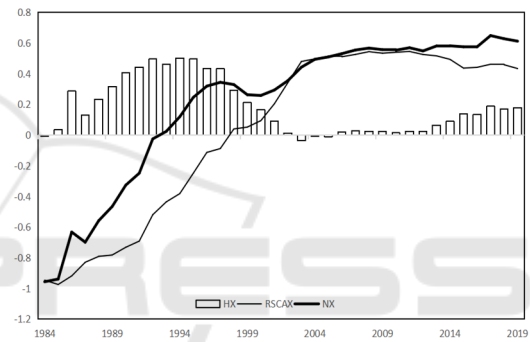


Figure 1: Time paths of the Chinese export patterns in the office equipment (1984-2019).

Firstly,  $RSCA_{co}$  showed a downward trend before 1997, and the index has always been negative. After 1997, the index turned from negative to positive and showed an upward trend and gradually slowed down. After 2014, the index showed a slight downward trend, but the overall trend was always positive. The overall trend shows that China's export of office equipment has turned from a comparative disadvantage to an advantage and has been maintained until now.

Secondly,  $HX_{co}$  basically remained stable during the sample period. In the 1990s, the value of  $HX_{co}$  was at its peak. Although the current index has always been positive, it has not exceeded the previous value. Except for the negative values from 2003 to 2005, the value of  $NX_{co}$  in the other years were basically positive, which means that the Chinese government's export policy for office equipment has been mainly to promote export. But the intensity of the policy has slowed considerably in recent years, suggesting that China is becoming less

dependent on exports, which may be related to its economic transformation.

What's more, the  $NX_{co}$  index is another group of data that changes significantly. Before 1992, the curve was in a negative number with  $NX_{co} < 0$ , but it gradually increased and approached 0. After 1992, the  $NX_{co}$  indicator became positive and kept rising. During 1999-2000, the index showed a downward trend, but after that, the index still tended to rise and remained stable gradually. The change of this index is similar to the change of  $RSCAX_{co}$  above.

Table 1 further reports the descriptive statistics of the Chinese export patterns in the office equipment industry.

Table 1: Descriptive statistics of the Chinese export trade patterns in the office equipment.

N=36	Minimum	Maximum	Mean	Standard Deviation
$RX_{co}$	-0.974	0.544	0.020	0.553
$HX_{co}$	-0.037	0.501	0.180	0.176
$NX_{co}$	-0.957	0.648	0.200	0.480

The results show that the Chinese  $RSCAX_{co}$  index reached the minimum value of -0.974 in 1985 and a maximum value in 2011. The average value is 0.02. It can be seen from Figure 1 that China's office equipment has turned from comparative disadvantage to comparative advantage, with the highest comparative advantage in 2011 and then gradually leveling off.

Secondly,  $HX_{co}$  index reached the lowest in 2003 and the highest in 1994, with an average value of 0.18. This shows that in 1994 China limits the import of office equipment at the most, while in 2003, encourages the import of office equipment, but according to figure 1 we can see that in addition to special before and after 2003, the rest of the year China's imports are more restricted for office equipment, but, in recent years, the limit of strength is a little reduce than normal.

Finally, the  $NX_{co}$  index reached its lowest value in 1984 and its highest value in 2017. This indicator suggests that China is gradually narrowing its trade deficit in office equipment and encouraging exports to a trade surplus. The mean value of this indicator over the sample period was 0.2.

### 3.2 One Sample T-Test of The Chinese Export Statistics

Table 2 reports the one-sample t-test results of  $RX_{co}$ ,  $NX_{co}$  and  $HX_{co}$ . The test value is set to zero to test

whether the sample mean is statistically significant different from 0.

Table 2: One-sample t-test results for the indicators of  $RX_{co}$ ,  $NX_{co}$  and  $HX_{co}$ .

Test value=0	T-stat	Degree of freedom	Sig. (2-tailed)	Mean difference
$RX_{co}$	0.216	35	0.830	0.017
$NX_{co}$	2.503	35	0.017	0.200
$HX_{co}$	6.153	35	0.000	0.180

The t-test results show that the mean of three indicators are all greater than zero. The significance of  $RSCAX_{co}$  is 0.830, being statistically insignificantly different from 0. This fact shows that China has no comparative advantage in the export of office equipment. On the other hand, the indicators of  $NX_{co}$  and  $HX_{co}$  are both positive and significant at 0.05 level, implying that China has gained trade surplus in the trade of the office equipment by t export promotion. Note that China has no significant comparative advantage in this product, our findings indicate that China has adopted protectionist industrial policies as other countries have done (Farzin, 1998; Pierce, 1974; Arita, 2017; Costinot, 2012).

### 3.3 Discussion

The results that China has been export promoting is not confined to the office equipment manufacturing industry. Previous studies found plenty evidence that the Chinese government has deliberately promoted the export in most products in the trade of goods such as the primary products (Hong, Dong, Mu, 2018), agricultural products (Hong, Su, 2010; Hong, Yin, Yang, Mu, 2018; Hong, Yin, Ren, Mu, 2018), energy products (Hong, Su, 2011; Hong, Chen, Yang, Liu), low-technology products (Hong, Ren, Shao, Mu, 2018; Hong, Ren, Yin, Mu, 2018), as well as the high-technology products (Hong, Qu, Wang, Liu, 2021; Hong, Zhang, Li, Liu, 2021). The puzzle is that there are both comparative advantaged and comparative disadvantaged products or industries. For the office equipment manufacturing industry, China has rather been comparative advantaged although the comparative advantage is insignificant.

Our findings are consistent to the previous studies. The above mentioned studies imply that the Chinese trade promotion policy intervention has not mainly target at improving the comparative advantage of the products or the industries. Comparative advantage of a product or an industry can largely reveal the technology besides the factor

endowment of labor and capital. The evolution of the degree of the comparative advantage can be also understood as the changes in a country's independent R&D ability, which may be crucial to the long-term development of the office equipment manufacturing industry.

The Chinese government may promote the export in the office equipment products to support the industry in afraid of losing its tiny comparative advantage, or the main purpose has been the trade surplus which can facilitate the Chinese employment and help to improve the Chinese economic growth. This does not necessarily mean that the Chinese export promotion has not been interactively connected to the comparative advantage in the office equipment industry. The nexus, however, need to be explored by further econometric analysis instead of mere observation and guess.

#### 4 CONCLUSIONS

This paper analyzed the revealed symmetric comparative advantage ( $RX$ ), the net export ratio ( $NX$ ) as well as the indicator of policy intervention index ( $HX$ ) of the Chinese trade in the office equipment products by using the annual trade data from the year of 1984 to 2019.

We documented that China has not been significantly comparative advantaged in the export of the office equipment but the trade surplus is significant ( $p=0.017$ ), which reflects that China has deliberately promote the export of the product. This can be explained by the Chinese relatively poor independent R&D ability, which has made the country to be specialized in the low-end of the industrial chain. This study argues that China has adopted protectionist export promotion policies in the export of office equipment.

The effects of the trade (export) policy intervention upon the Chinese comparative advantage in the product, however, requires further econometric analysis in order to provide the empirical evidence. What is more, this study focused on the export patterns of the Chinese office equipment products. The policy intervention that revealed in the Chinese import patterns requires another independent study instead of the simple assumption.

#### ACKNOWLEDGEMENTS

This work was financially supported by Jilin Provincial Social Science Fund (2020J58, 2020J60) and Changchun Social Science Fund (CSK2020ZYJ-001) and the College Poverty Stricken Students Supporting Programme funded by Jilin Provincial Ecological Industry Company Limited.

#### REFERENCES

- A. Costinot, D. Donaldson, I. Komunjer, "What goods do countries trade? a quantitative exploration of ricardo's ideas," *Rev. Econ. Stud.*, vol. 79 (2), 2012, pp. 581-608.
- B. Balassa, "Trade liberalisation and "revealed" comparative advantage I," *Manchester Sch.*, vol. 33 (2), 1965, pp. 99-123.
- B. Dalum, K. Laursen, G. Villumsen, "Structural change in OECD export specialisation patterns: despecialisation and 'stickiness'," *Int. Rev. Appl. Econ.*, vol. 12 (3), 1998, pp. 423-443.
- C. J. Chen, K. X. Yu, A. J. Hu, Y. Hong, "How does the import restriction Granger cause the comparative advantage of the USA 's fossil energy imports?," *Basic Clin. Pharmacol. Toxicol.*, vol.126 (S4), 2019, pp. 307.
- D. Pang, Y. Hong, "Measuring distortions of trade patterns: an application to China," *IEEE International Conference on Service Operations and Logistics and Informatics (SOLI 2010)*, 2010, pp. 424-429.
- G. Shi, Y. M. Yang, A. J. Hu, Y. Hong, "Assessing the effectiveness of the import restriction on improving the Israeli services export comparative advantage," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S4), 2019, pp. 342-343.
- J. Hinloopen, C. V. Marrewijk, "On the empirical distribution of the balassa index," *Rev. World Econ.*, vol. 137 (1), 2001, pp. 1-35.
- J. Boone, "Competitive pressure: the effects on investments in product and process innovation," *The Rand J. Econ.*, vol. 31 (3), 2000, pp. 549-569.
- J. L. Pierce, J. J. Enzler, "The effects of external inflationary shocks", *Brooking Papers Econ. Activity*, vol. 5 (1), 1974, pp. 13-61.
- P. M. Morrow, "Ricardian-Heckscher-Ohlin comparative advantage: Theory and evidence," *J Int. Econ.*, vol. 82, 2010, pp. 37-151.
- P. Ma, Y. M. Yang, K. X. Yu, A. J. Hu, Y. Hong, "How have the degree of import restriction impacted Japan's revealed comparative advantage in the services exports?," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S1), 2020, pp. 121.
- Q. Hong, Y. Hong, "Does Japan limit its imports for comparative advantage reasons?-the case of agricultural manufactures," 2016 3rd International Conference on Social Science, 2016, pp. 497-501.

- S. Arita, J. Beckman, L. Mitchell, "Reducing transatlantic barriers on U.S.-EU agri-food trade: what are the possible gains?," *Food Policy*, vol. 68 (1), 2017, pp. 233-247.
- S. Lall, "The technological structure and performance of developing country manufactured exports, 1985-98," *Oxford Development Stud.*, vol. 28 (3), 2000, pp. 337-369.
- Y. Hong, J. Guan, H. Su, "Can export facilitation improve Chinese comparative advantage? panel Granger causality tests using data of 1982-2011 trade in services," *Adv. Inform. Sci. Serv. Sci.*, vol. 4 (19), 2012, pp. 296-303.
- Y. Hong, C. J. Chen, Y. M. Yang, A. J. Hu, "Granger causality between Korea's net export and the comparative advantage in the exports of electro medical and x- ray apparatus," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S4), 2019, pp. 52.
- Y. Hong, Y. M. Yang, A. J. Hu, H. W. Su, "Exploring Granger non-causality of the Japanese employment rate and the trade in services," *Adv. Soc. Sci. Edu. Hum. Res.*, vol. 357, 2019, pp. 140-144.
- Y. Hong, J. Guan, H. Su, "How does chinese trade pattern in goods diverge from equilibrium? an empirical examination using data of 1987-2011," *Adv. Inform. Sci. Serv. Sci.*, vol. 5 (2), 2013, pp. 352-360.
- Y. Hong, X. Y. Zhang, A. J. Hu, G. Shi, "The export promotion and the comparative advantage in Israel's trade of the primary agricultural products," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S4), 2019, pp. 307-308.
- Y. Hong, Z. Song, J. Y. Wang, H. W. Su, "Comparative advantage of food exports, rural-urban income disparity and agricultural employment: empirical evidence from China," *Pharm. Res.*, vol. 6 (1), 2014, pp. 439-445.
- Y. Hong, M. X. Yang, A. J. Hu, G. Shi, "Examining Granger causal relationship between the USA's export promotion and comparative advantage of telecommunication products using a more sophisticated weighting," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S4), 2020, pp. 317-318.
- Y. Hong, C. J. Chen, Y. M. Yang, A. J. Hu, P. Ma, "Granger causality between Korea's net export and the comparative advantage in the exports of electro medical and x- ray apparatus," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S4), 2019, pp. 48.
- Y. Hong, K. X. Yu, Y. M. Yang, A. J. Hu, P. Ma, "The United States' export promotion and comparative advantage in the trade of medicinal and pharmaceutical products: 1962-2018," *Basic Clin. Pharmacol. Toxicol.*, vol. 126 (S4), 2020, pp. 56-56.
- Y. Hong, J. Wang, H. Su, X. Mu, "Panel cointegration analysis of export facilitation and comparative advantages: the case of Chinese low-technology manufactures," *Bio Technology: an Indian J.*, vol. 10 2014, pp. 6040-6048.
- Y. Hong, K. X. Yu, Y. M. Yang, A. J. Hu, P. Ma, "Exploring Granger causality of China's policies of export promotion and import restriction in the medicinal and pharmaceutical products," *Basic Clin. Pharmacol. Toxicol.*, vol. 126(S4), 2020, pp. 61-62.
- Y. Hong, X. Y. Zhang, A. J. Hu, P. Ma, "Econometric znalysis of the Israeli Trade protectionism and the export comparative advantage of the primary agricultural products," *Basic Clin. Pharmacol. Toxicol.*, vol.126 (S4), 2020, pp. 305-306.
- Y. H. Farzin, K. J. M. Huisman, P. M. Kort, "Optimal timing of technology adoption," *J. Econ. Dynamics Control*, vol. 22, 1998, pp. 779-799.
- Y. Hong, W. J. Dong, X. W. Mu, "The distortion of the trade patterns in the U.S. primary products," *DEStech Transactions on Social Science Education and Human Science*, (March), 2018, doi:10.12783/dtssehs/icems2018/20187.
- Y. Hong, H.W. Su, "Can strategic trade policies improve comparative advantages of exports? a heterogeneous panel analysis of Chinese agro based manufactures," *Proceedings of 2010 International Colloquium on Computing, Communication, Control, and Management (CCCM2010)*, 2010, pp. 652-655.
- Y. Hong, Z. M. Yin, Y. M. Yang, X. W. Mu, "Assessing the trade policy of the U.S. agro-Imports," *2018 International Conference on Mathematics, Modeling, Simulation and Statistics Application (MMSSA2018)*, 2018, pp. 155-158.
- Y. Hong, Z. M. Yin, S. S. Ren, X. W. Mu, "How far are the U.S. agro-imports distorted away from free trade?," *2018 5th ERMI International Conference on Art, Education and Social Sciences (ERMI-AES 2018)*, 2018, pp. 470-475.
- Y. Hong, H. W. Su, "Tight energy supply constraints and technological progress," *Energy Procedia*, vol.11, 2011, pp. 3151-3156.
- Y. Hong, C. J. Chen, D. Yang, T. Liu, "Short-run and long-run Granger causality analysis of the United Kingdom's trade patterns in the fossil energy trade," *IOP Conference Series 702 012008*, doi:10.1088/1755-1315/702/1/012008.
- Y. Hong, S.S. Ren, B. N. Shao, X.W. Mu. "A comparative analysis on the export and import trade patterns of the Chinese low-technology manufactures," *2018 3rd PIL International Conference on Business, Social Sciences and Information Science (PIL-BSI 2018)*, 2018, pp. 78-83.
- Y. Hong, S.S. Ren, Z. M. Yin, X. W. Mu, "Exploring the Chinese import policy on the low-technology manufactures of garments, textiles and footwear," *DEStech Transactions on Social Science Education and Human Science (March) (2018)*, doi:10.12783/dtssehs/ichss2017/19555.
- Y. Hong, B. B. Qu, Y. Wang, T. Liu, "A comparative analysis on the import and export trade patterns of China's mechanical and electrical products," *IOP Conference Series 1978 (2021) 012064*, doi:10.1088/1742-6596/1978/1/012064.
- Y. Hong, L. Zhang, N. Li, T. Liu, "Empirical analysis on the export trade patterns in the Chinese antibiotic products," *IOP Conference Series 1978 (2021) 012046*, doi:10.1088/1742-6596/1978/1/01204.