

Analysis on Trade Patterns in Electronic and Electrical Products: An Empirical Study of the U.S from 2008 to 2017

Fei WANG¹, Yang YU^{2,*} and Hui-long LI³

¹Department of Economics and Management, Jilin Police College, Changchun, 130117, China

²College of Humanities and Sciences, Northeast Normal University, Changchun, 130117, China

³Pressing Center, FAW-VW, Changchun, 130117, China

*Corresponding author

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Abstract. The development and protection of electronic and electrical industries are essential parts to America's national strategy. Using data from UNCOMTRADE database, This paper analyzed trade patterns in electronic and electrical products (HT1 category in Rev.2 classification) in the US from 2008 to 2017. By comparing NXR, RSCA and h indicators of individual HT1 product, we found distortions did exist in the export of electronic and electrical products, which hints the US government has established trade barriers to protect intellectual properties and technical innovation of high-tech products. However, it seems harmful to products' competence improvement in the long run. Further research has been carried out.

Introduction

High-tech products are technology and information intensive products. They are more and more on centre stages of the US' economy. Electronic and electrical products are parts of high-tech products that can bring GDP improvement and new job vaccines in the US. The U.S administration under President Donald Trump has implemented restrictive export policies to protect intellectual properties and technical innovations of high-tech products. High-technology exports from the U.S dropped from 32.53% in 1990 to 13.82% in 2017, as a percentage of total manufactured exports. Undoubtedly, the protectionism in trade policies can reduce the U.S' negative balance of trade, which seems the most important objective of current administration's trade policy. However, whether the US could benefit more in the long run is the focus discussion of this essay.

Measurements and Classification for Trade Patterns

Measurements for Trade Patterns

RCA(short for the revealed comparative advantage) index, proposed by Balassa ^[1], is used to measure the relative export performance of a product or a basket of products of the same trait in a country, It is assumed that we could get the indicator through the following modeling:

$$RCA_{is} = (X_{is}/X_i)/(X_{ws}/X_w) \quad (1)$$

In the above modeling, X_{is} could be calculated by the export of product s of country i during the empirical period, X_i could be measured by the value of total export of country i during the same measuring period, X_{ws} shows us the value of the world's export of product s and X_w reports the whole value of export of the world of all kinds of commercial products during the same time path.

(X_{is}/X_i) represents the proportion of the export of product s in the whole export of country i in a certain year. (X_{ws}/X_w) reports the contribution of product s ' export to the world's total export in a certain year. $(X_{is}/X_i)/(X_{ws}/X_w)$ shows us the comparison of product s ' export contribution to country i with the world's average export contribution of product s . If $RCA > 1$, product s contributes more to country i 's export than the world's average contribution of product s , so we say the export of

product s in country i has comparative advantage, if $RCA < 1$, we say the export of product s in country i has no comparative advantage or comparative disadvantage.

The value range of RCA is from 0 to ∞ , and the interval makes it difficult to compare RCA with other relative indexes. So the improved symmetric index proposed by Laursen^[2] is as follows:

$$RSCA_{is} = (RCA_{is} - 1) / (RCA_{is} + 1) \quad (2)$$

The interval of $RSCA$ is from -1 to 1, and when $RCA > 1$, we have $RSCA > 0$, when $RCA < 1$, we have $RSCA < 0$. The improved equitation facilitates comparison and analysis with other indexes which indicate tendency of trade patterns. For example, the following equitation

$$NXR_{is} = (X_{is} - M_{is}) / (X_{is} + M_{is}) \quad (3)$$

NXR_{is} measures the net export status of product s in country i , and we assume the figure could be calculated by the above equitation. X_{is} represents the export of product s in country i in a certain year, while M_{is} represents that of the import correspondingly. $X_{is} - M_{is}$ shows us the value of net export of product s in country i , $X_{is} + M_{is}$ reports the trade flows of both import and export of product s , it reflects the trade ability of a certain product. $(X_{is} - M_{is}) / (X_{is} + M_{is})$ compares product s ' net export ability with its trade ability. If $NXR_{is} > 0$, we resume product s has export ability during the empirical period, if $NXR_{is} < 0$, we say product s in country i has net import ability.

$RSCA_{is}$ and NXR_{is} bear intervals both from -1 to 1, so it is possible to compare the two indexes; according to traditional international trade theories, a country should export the products with high comparative advantages or factor endowment; while importing products with comparative disadvantages or we say lack of factor endowment.^[3] These theories proved that if a county exports products with high domestic productivity while importing products with low domestic productivity, both partner countries will benefit from the trade. This essay holds the same view that a country's net export ability should be in accordance with its comparative advantage when in free trade, that is, $RSCA_{is} = NXR_{is}$.^[4] So we say equilibrium will be achieved when $RSCA_{is} = NXR_{is}$. Otherwise, a distortion may occur when $RSCA_{is} < NXR_{is}$ or $RSCA_{is} > NXR_{is}$. Trade tendency hints strength of governmental behaviors which drive trade away from free mode.^[5]

$$h_{is} = RSCA_{is} - NXR_{is} \quad (4)$$

We introduce h equitation to measure policy interference. The heavier the policy stimulates, the larger distortion between $RSCA_{is}$ and NXR_{is} appears.

Data Sources and Classification

In this paper, we compiled data from the website of Commodity Trade Statistics Database (COMTRADE) of the United Nations^[6], which is a statistical repository of official international trade mainly for merchandised export and import. We gathered data of the US' export of high-tech products, sample period from 2008 to 2017. Lall, a professor of Oxford University, allocated all the 230 three-digit level commercial products (SITC Rev.2) into six categories in his working paper in 2000, which are primary products (PP), resource-based manufactures (RB), low technology manufactures (LT), medium technology manufactures (MT), high technology manufactures (HT), and other transactions (OTHER).^[7]

This paper defines high technology products according to Professor Lall's allocation. According to Professor Lall, HT products could also be separated into HT1, electronic and electrical products and HT2, other high-tech products. The HT1 category includes the following products:

HT: high technology products(18 products)

HT1: electronic and electrical products(11 products)

716,718,751,752,759,761,764,771,774,776,778

HT2: other high-tech products (7 products)

This paper mainly talks about the trade patterns of HT1 products.

Empirical Analysis

We divide 11 HT1 products into 3 groups to analyze due to their different relations among *RSCA*, *NXR*, and *h* indexes.

Trade Pattern Analysis of Figure 1 Products of HT1

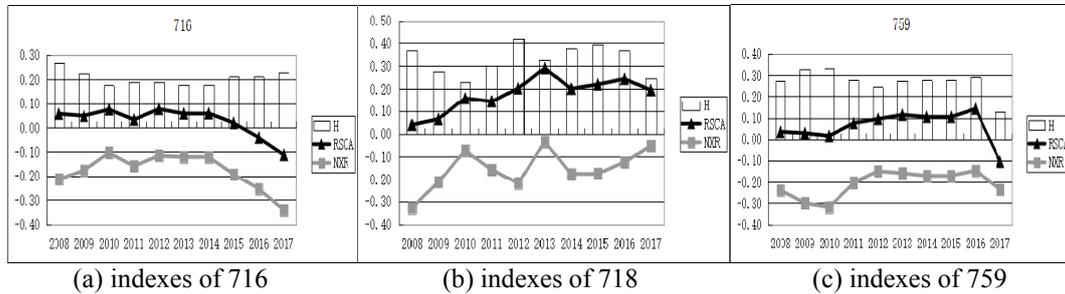


Figure1. Product 716 Rotating electric plant and parts thereof, 718 other power generating machinery and parts thereof, 759 parts and accessories

All figure 1 products enjoy the similar characteristic illustrated in the above figures. During sample period, their *RSCA* curves stand slightly above horizontal line which show comparative advantages exist but not with big strength; their *NXR* curves stand under the horizontal line which mean they have net import during time period, we can see distortion between their comparative advantages and their import capability.

We can also see similar developing trend between *RSCA* and *NXR* curves in the above figures, the coincidence may indicate consistent trade policy restriction during sample period, which made distortion of trade unchangeable. Fig.1(b) shows the strongest distortion among the three, with medium- level comparative advantages in average. Fig.2 analyzed product 718, which mainly refer to power generating machinery and parts. In 2013, the *RSCA* of this product peaked at 0.29 and in 2012, the biggest distortion occurred with 0.42. Strong trade intervention can be drawn from Fig.1(b) .

Power generating machinery and parts with new-tech are crucial to merchandised industry, the US has established trade barriers to this kind of products at the cost of improving GDP by exporting it.

Trade Pattern Analysis of Figure 2 Products of HT1

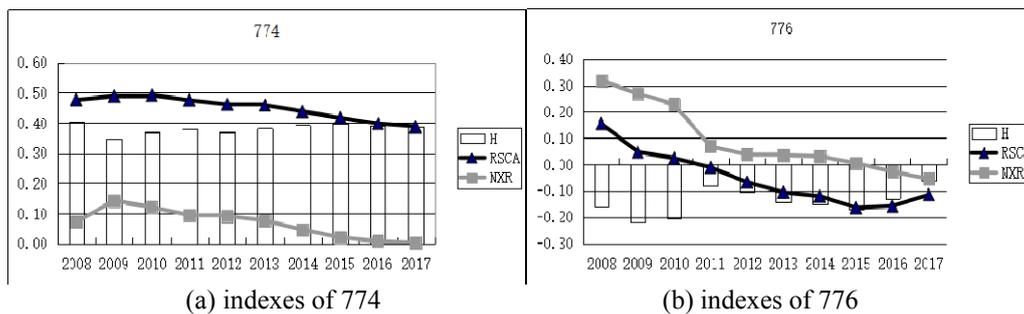


Figure 2. Product 774 Electric apparatus for medical purposes and radiological apparatus, 776 Thermionic, cold cathode and photo-cathode valves and tubes

Figure 2 include product 774 and 776. The performance of the two products are unique and irregular during analyzing period, which need more attention.

Fig.2(a) reports very strong comparative advantage of product 774 with a top at 0.49 in *RSCA* curve in 2010, correspondingly the *NXR* curve in fig.4 shows weak export ability of product 774. The *h* indicator also illustrates very big distortion at around 0.40 in average. Product 774 refers to electric apparatus for medical purposes and radiological apparatus, which has a long history in the US to be put on trade barriers. However, technology improvement hasn't been seen through empirical period by trade protection.

The opposite status can be seen in Fig.2(b) Product 776, mainly refer to thermionic, cold cathode and photo-cathode valves and tubes, has increasingly stronger comparative disadvantages. The *NXR* curve stands above the *RSCA* line, which illustrates stronger export capability compared with its comparative advantage. The negative deviation of *h* indicator shows stimulus export policies may be carried out by the US government.

Trade Pattern Analysis of Figure 3 Products of HT1

As the sample products 751 and 778 illustrated in Fig.3(a) and Fig.3(b) separately, all of the Figure 1 products of HT1 are with comparative disadvantages and negative export capabilities. Distortions still exist, which of them are relatively strong; specific technical improvement cannot be concluded.

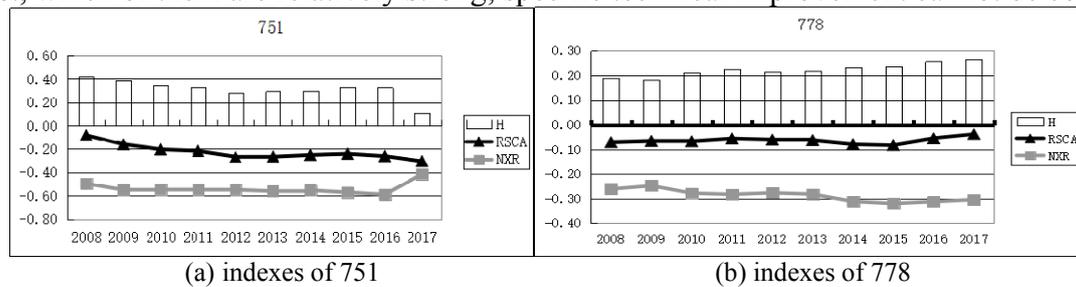


Figure 3. Product 751 office machines, 778 electrical machinery and apparatus.752automatic data processing machines, 761 television receivers, 764 telecommunications equipment, 771electric power machinery

Conclusion

This paper mainly analyzes trade patterns of electronic and electrical products (HT1) in the US. By individually analyzing *RSCA*, *NRX* and *h* indexes of each product in this category, we receive the following conclusions:

Over a half of electronic and electrical category products have no export comparative advantages, 3 of them have medium strength export comparative advantages and 2 of them have relatively strong export comparative advantages.

No matter with comparative advantages or not, almost all of electronic and electrical category products have no export capability. The distortion of trade patterns exist in each product, However, government intervention seem getting comparative advantages worse year by year.^[5]

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