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Analysis on Binary Marginal Characteristics of Chinese Bamboo and Rattan Products Export

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Abstract [Objectives] To analyze the changes of export binary margins of Chinese bamboo rattan products, so as to clarify its export model, and further promote the healthy development growth of Chinese bamboo rattan products export. [Methods] Based on the export trade data of bamboo and rattan products from 2008 to 2018 in UN Comtrade database, the binary marginal decomposition method was employed to analyze the export growth pattern of bamboo and rattan products between China and 22 major trading partners. [Results] This paper shows that the export growth pattern of bamboo and rattan products between China and the target countries during the investigation period was dominated by extensive margin, supplemented by intensive margin, indicating that the export growth of Bamboo and rattan products is mainly driven by the increase of export types of bamboo and rattan products, and the potential of export intensive margin needs to be further explored. [Conclusions] It is necessary to continuously increase export type of bamboo rattan products, build an information platform for bamboo rattan trade, and strengthen the ability of dealing with trade barriers, and strengthening technology innovation of bamboo and rattan industry, so as to improve added value of bamboo and rattan products, and form an intensive model of export growth of bamboo rattan products.

Key words China, Bamboo and rattan products, Export growth, Binary margin

1 Introduction

China is known as the "Kingdom of bamboo in the world". Joseph Needham, a famous British scholar, pointed out in his *History of Science and Technology in China* that the East Asian civilization was once called the "bamboo civilization", while China was called the "country of bamboo civilization". Bamboo and rattan have gradually attracted people's attention for their economic value, ecological value and cultural value. Meanwhile, bamboo and rattan have drawn much attention for their growth nature of fast growth and strong reproduction ability, as well as their economic utility in accelerating the economic development of mountainous areas, alleviating rural employment contradictions, and docking targeted poverty alleviation. In recent years, the EU countries as the representative of the "comprehensive ban on plastic, plastic restrictions" have advocated the use of paper or bamboo products instead. In addition, "Chinese corner" of the UN climate conference held in December 2019, put forward a session topic of "Solution of bamboo as substitutes of plastic for coping with climate change", and it has clearly illustrated the potential of bamboo and rattan products to reduce and replace the use of disposable plastic products, and cut down pollution emissions. China is one

of the countries with the most abundant bamboo rattan resources, average annual growth rate of export trade of bamboo rattan products to the world up to 12.29%^[1], and there is still tremendous room for export growth in the future.

At present, some scholars have made a comprehensive analysis from the aspects of trade overview, trade barriers, international competitiveness and trade potential of Chinese bamboo and rattan products. Existing studies show that the global export of bamboo and rattan raw materials is mainly concentrated in the Asia-Pacific region, while China is the world's largest exporter of bamboo and rattan weaving, bamboo and rattan furniture as well as seat products^[2], bamboo rattan furniture and bamboo flooring occupy a higher share in the international market, and the dominant comparative advantage of bamboo flooring is obvious, but the comparative advantage of bamboo flooring is decreasing^[3]. In addition, export markets such as South Korea, Canada, Russia, Thailand, Japan, the United States and Australia extend a tremendous potential^[5].

Under the background of economic globalization, Chinese bamboo and rattan products have been integrated into the global trade market with their unique advantages. However, with the increasingly strict standards in recent years, the export trade barriers of bamboo and rattan products have been steadily on the increase, and the export trade of Chinese bamboo and rattan products faces many challenges^[1]. In addition, some studies focus on the growth of export trade of products from the theory of comparative advantage^[6]; external market^[7]; specialized division of labor^[8]; global value chain^[9]; economies of scale^[10]; trade potential and efficiency^[11], etc. However, it is necessary to pay more attention on the micro structure for deeply clarifying the reality of China's specific product export growth^[12]. The new-new

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trade theory proposed by Melit provides a theoretical basis for studying the micro-structure of export trade growth, and divides export growth into intensive-margin and extended-margin^[13]. Intensive margin means export specialization, which means the export growth of a country mainly owing to continuous increase of the intensive margin of existing export enterprises, and the increase of export prices. Extensive margin means export diversification, which refers to the export growth of a country mainly relying on the growth achieved by new enterprises and new products entering the export target market^[14-15]. Hummels and Klenow further decomposed the intensive margin into the price margin and the intensive margin, deepening the microscopic structure investigation of export trade growth^[16]. To sum up, there are few existing literatures to analyze the specific path of export growth of Chinese bamboo and rattan products from the micro perspective, and also explore the dynamic evolution of Chinese bamboo and rattan products in different periods and different products. Thus, this paper is based on Shi Bingzhan's ternary marginal measure method^[17], and the bamboo rattan products export trade data of 22 major countries (2008 – 2018) in UN Comtrade Database to analyze the characteristics of the Chinese bamboo rattan products export trade, and export growth mode in China. Meanwhile, this paper make an analysis of bamboo rattan products in different counties and export intensive changes on the contribution of export growth, so as to clarify the export model, and further promote the healthy development growth of Chinese bamboo rattan products export (The 22 export trading partners are as follows: Australia, Belgium, Brazil, Canada, Chile, Czech Republic, France, Germany, Japan, Netherlands, New Zealand, Poland, South Korea, Russia, South Africa, Spain, Thailand, United Kingdom, United States, India, Malaysia, Mexico). Based on the analysis of the characteristics of export trade of Chinese bamboo and rattan products, we could master the export growth pattern of Chinese bamboo and rattan products on the whole and different stages. In addition, this paper also makes an analysis of the contribution of the variety of bamboo and rattan products and the change of binary margins to export growth.

2 Research methods

2.1 Export binary marginal decomposition method This paper follows Shi Bingzhan^[17] ternary marginal decomposition method. First, this paper decomposes exports trade flows of the bamboo rattan products of 22 major exporting countries into extensive margin and intensive margin, and then, the indexes of different export markets are summed up to obtain the overall export status of China to the selected export target countries. Third, based on the contribution of binary margin, the export growth pattern of Chinese bamboo and rattan products is analyzed.

2.2 Extensive margin The extension margin is defined as follows:

$$EM_{cm} = \frac{\sum_{i \in I_{cm}} P_{umi} X_{umi}}{\sum_{i \in I_{cm}} P_{umi} X_{umi}} \quad (1)$$

where c refers to China, m refers to the 22 importing country, i refers to a certain type of bamboo and rattan products, w is the reference country, and the world as the reference country in this paper, thus ensuring $I_{cm} \in I_{wm} \cdot P_{umi}, X_{umi}$, respectively refers to the export prices and export weights of different kinds of bamboo and rattan products to the world's trading partners; I refers to the collection of all types of bamboo and rattan products, and I_{cm}, I_{wm} refers to the collection of the types of bamboo and rattan products exported from China and the world to the 22 importing countries. The extensive margin indicates the proportion of China's export of bamboo and rattan products in the world's export category. The larger the value, the more types of production bamboo and rattan products China exporting to these 22 countries other than to the rest of world.

2.3 Intensive margin The definition of intensive margin is as follows:

$$IM_{cm} = \frac{\sum_{i \in I_{cm}} P_{cmi} X_{cmi}}{\sum_{i \in I_{cm}} P_{umi} X_{umi}} \quad (2)$$

where P_{cmi}, X_{cmi} respectively refers to the export prices and export weights of different kinds of bamboo and rattan products exported from China to its 22 trading partners. The intensive margin refers to the proportion of China's exports to the world's total exports among the same kinds of bamboo and rattan products that China and the world export to the 22 trading partners, which measures the depth of China's export of bamboo and rattan products, and the larger the value is, the more the quantity of China's export of the same kind of bamboo and rattan products compared with that of the world's trade partners.

2.4 Contribution rate of binary export margin Contribution rate of extensive margin and intensive margin: D_{em}, D_{im}

$$D_{em} = \frac{g_{em}}{g_m}, D_{im} = \frac{g_{im}}{g_m} \quad (3)$$

where g_{em}, g_{im} refers to the growth rate of extensive margin and intensive margin; g_m refers to the growth rate of China's export market share of bamboo and rattan products to the importing countries m (22 importing countries), and it is the sum of the growth rates of the extensive margin and the intensive margin, which can be expressed as follows:

$$g_m = g_{em} + g_{im} \quad (4)$$

3 Data analysis and findings

3.1 Data sources Based on the availability of export data of bamboo and rattan products, 22 export trading countries were selected from 2008 to 2018 because they have a large trade flow with strong representation. All trade data of bamboo and rattan products were obtained from UN Comtrade database. This paper classifies the classification of bamboo and rattan products by Wu Junqi and Zhang Yu^[2], bamboo rattan products are defined as bamboo rattan raw materials, bamboo food, bamboo rattan weaving and bamboo rattan furniture. The categories of bamboo rattan products are shown in Table 1.

Table 1 Categories covered by bamboo and rattan products

Category	HS-6 code	Product item
Bamboo and rattan raw materials	140110	Bamboo, sour bamboo and other bamboo
	140120	Rattan, endangered rattan and other rattan
Bamboo food	200591	Unfrozen bamboo shoots prepared or preserved without vinegar
Bamboo and rattan weaving	460121	Bamboo mats, matting materials and curtains
	460192	Braided bamboo and its parallel connection or braiding products
	460193	Braided cane, <i>etc.</i> , and its parallel connection or braiding products
	460211	Baskets and other articles made of bamboo
	460212	Basket and other articles made of rattan
	460122	Rattan mats, matting and curtains
Bamboo rattan furniture	940151	A seat made of bamboo, rattan, wicker and similar materials
	940381	Furniture made of bamboo, rattan, wicker and similar materials

3.2 Analysis of overall characteristics of export binary margins

The decomposition results of binary marginal overall characteristic of China's export trade of bamboo and rattan products are shown in Table 2. The dual margin of bamboo and rattan export has the following characteristics: (i) from 2008 to 2018, China's bamboo and rattan export shows an growth trend on the whole, and it is mainly driven by the extensive margin; (ii) export extensive marginal present the rise trend, the average annual growth rate of 3.67%, which shows that export species of China's bamboo rattan products more abundant than the world average export level of

bamboo rattan products. Thus, extensive margin is the major impetus of export growth of bamboo rattan products of, and it also suggests that consumers are not only satisfied with fixed bamboo rattan products. In addition, consumer demand diversification trend had been reinforced; (iii) From 2008 to 2018, the export intensive margin of bamboo and rattan products showed a fluctuating downward trend, with an average annual growth rate of -2.66%, indicating that on the whole the intensive margin had no significant promoting effect on the export growth of bamboo and rattan products (Table 3).

Table 2 Results of binary margin of Chinese bamboo and rattan products exports

Item	Year											Average annual growth rate//%
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
EM	0.511	0.519	0.533	0.522	0.408	0.582	0.483	0.415	0.569	0.729	0.733	3.67
IM	1.032	2.228	0.921	1.013	1.46	0.845	1.154	1.05	0.967	1.188	0.788	-2.66

Table 3 Rates of contribution of binary margins

Index	2008 – 2011		2012 – 2015		2016 – 2018	
	EM	IM	EM	IM	EM	IM
AAGR//%	0.71	-0.62	0.57	-10.41	13.50	-9.73
Contribution rate//%	788.89	-688.89	-5.79	105.79	358.09	-258.09

Note: EM refers to extensive index; IM refers to intensive index; AAGR refers to average annual growth rate.

According to the historical stages of China's export growth share of bamboo and rattan products, this paper divides into three stages including 2008 – 2011, 2012 – 2015 and 2016 – 2018, and examines the contribution of binary margins to the export growth of bamboo and rattan products respectively. The results are shown in Table 3. In 2008 – 2011, average annual growth of extensive margin of Chinese bamboo rattan products is 0.71%, the contribution rate of 788.89%, and a slight decline in 2012 – 2015 with an average annual growth rate of 0.57%, but in 2016 – 2018 extensive margin shows strong contrarian rise, average annual growth rate and contribution rate are 13.50% and 358.09% respectively, which may be related to consumers' green consumption consciousness in recent years for bamboo rattan products possess a characteristic of green environmental protection, and there is a soaring consumer demand for different types of bamboo and rattan products. Meanwhile, intensive marginal average annual growth shows a more significant downward trend, and the average annual growth is 10.41%, which shows that as a whole, export growth is driven

by the extensive margin of bamboo rattan products, and intensive marginal contribution to the export growth is limited, namely the types of bamboo rattan products export has become greatly rich, which promotes the export growth of the Chinese bamboo rattan products, but promoting effect of intensive margin of on exports is not obvious.

3.3 Binary marginal analysis of Chinese bamboo and rattan products export at bilateral trade level

In order to further analysis of exports growth model of bamboo rattan products at the national level, this paper selects the top 10 countries in the trade volume of China's bamboo and rattan products export target countries in 2018 to explore the binary marginal characteristics of China's bamboo and rattan products export with its major partners. The results of export growth of binary marginal of bamboo and rattan products are showed in Table 4 and Table 5. (i) For South Korea, during the sample period, China's export market share of bamboo and rattan products to South Korea continues to grow, and it is mainly driven by the intensive marginal, showing a steady ris-

ing trend, with an average annual growth rate of 2.25%. However, the extensive margin has a limited effect on exports, with an average annual growth rate of -0.19%. (ii) As far as Canada is concerned, the growth of extensive margin is the main factor driving the growth of China's exports to Canada. The average annual growth rate of extensive margin up to 6.80%, and it shows a fast rising trend, but the intensive margin shows a slight downward trend, with an average annual growth rate of -0.39%, which indicates that the expansion of export categories has promoted the growth of China's export volume of bamboo and rattan products. (iii) For Chile, the contribution of intensive margin and extensive margin to export growth both are obvious, the average annual growth rate is 7.27% and 5.55% respectively, showing a double-driven growth status, indicating that there is an escalating trend of the export intensive margin of bamboo and rattan products, while the export category of China expands. (iv) As far as France and Germany are concerned, the increase of extensive margin has a promoting effect on the growth of bamboo and rattan products export, and its annual average growth rate is 7.81% and 6.51% respectively. Besides, the growth rate of intensive margin is 0.94% and 0.71% respectively, indicating that intensive margin shows a slow growth trend with the increase of export categories. (v) For

Japan, extensive margin boost the export of bamboo and rattan, while the intensive margin decline, with an average annual growth rate of 1.58% and -0.26% respectively. (vi) In the case of Malaysia, the extensive margin has a particularly significant effect on export trade, with an average annual growth rate of 11.22%. However, the intensive margin shows an obvious downward trend, with an average annual growth rate of -9.85%, indicating that while export category of bamboo and rattan products is growing rapidly, the intensive margin has a negative effect on export trade. (vii) In terms of New Zealand and the United States, intensive margins show a trend of decline, but the extensive margin of the two countries increase obviously for their growth rate of 4.12% and 5.33% respectively, indicating that the export growth of bamboo and rattan products of the two countries mainly accounts for the increase of extensive margin, and the increase of the export category of bamboo and rattan products promotes the growth of export trade volume. (viii) In the case of the UK, the average annual growth rate of its intensive margin exceeds that of the extensive margin. The average annual growth rate of the intensive margin has jumped from 0.497 in 2008 to 1.180 in 2018, which ups to 9.03%, indicating that the growth of exports to the UK mainly rely on the growth of intensive margin.

Table 4 Results of intensive margins at major trading partners level

Country	2008	2010	2012	2014	2016	2018	AAGR//%
South Korea	0.971	1.016	1.075	0.880	1.250	1.213	2.25
Canada	0.815	0.654	0.586	0.821	0.554	0.784	-0.39
Chile	0.773	0.694	1.819	0.969	0.733	1.559	7.27
France	0.307	0.413	0.481	0.465	0.594	0.337	0.94
Germany	0.787	0.705	0.85	0.679	2.947	0.845	0.71
Japan	1.012	1.029	1.061	1.059	1.019	0.986	-0.26
Malaysia	6.631	3.541	3.200	2.870	3.655	2.351	-9.85
Netherlands	0.192	0.191	0.175	0.151	0.139	0.099	-6.41
UK	0.497	0.300	0.751	0.710	0.743	1.180	9.03
USA	0.761	0.620	0.666	0.767	0.823	0.308	-8.65

Note: AAGR refers to average annual growth rate.

Table 5 Results of extensive margin at major trading partners level

Country	2008	2010	2012	2014	2016	2018	AAGR//%
South Korea	0.970	0.964	0.921	0.840	0.837	0.952	-0.19
Canada	0.507	0.505	0.672	0.749	0.622	0.979	6.80
Chile	0.547	0.599	0.498	0.454	0.506	0.939	5.55
France	0.420	0.465	0.536	0.508	0.536	0.891	7.81
Germany	0.521	0.565	0.621	0.638	0.183	0.979	6.51
Japan	0.850	0.870	0.909	0.890	0.909	0.994	1.58
Malaysia	0.125	0.242	0.034	0.252	0.193	0.362	11.22
Netherlands	0.619	0.486	0.792	0.799	0.706	0.927	4.12
UK	0.576	1.093	0.597	0.532	0.589	0.888	4.42
USA	0.587	0.685	0.645	0.610	0.543	0.987	5.33

Note: AAGR refers to average annual growth rate.

3.4 Analysis of binary margins at different types of bamboo products level

From the perspective of the differences in the export of different types of bamboo and rattan products, the changes in the export volume of Bamboo and rattan products are mainly driven by the changes in the export types of bamboo and rattan fur-

niture, bamboo and rattan weaving products, and the fluctuations in the export growth of bamboo and rattan products mainly rely on the changes in their export types. (i) As far as bamboo and rattan furniture is concerned, the export share of China's bamboo and rattan furniture is on the rise during the research period, and the pro-

moting effect of the intensive margin is more obvious, which shows that the intensive margin rises from 0.075 9 in 2008 to 0.497 5 in 2018, with an average annual growth rate of 20.68%. However, extensive margin shows a relatively slow-growth trend, with an average annual growth rate of only 1.02%, indicating that the export growth of bamboo and rattan furniture is mainly driven by bamboo and rattan furniture. (ii) In terms of bamboo rattan raw materials, and it shows less promoting effects on the export trade of Chinese bamboo rattan compared with bamboo rattan furniture and bamboo rattan weaving products. During the research period, extensive margin and intensive margin fluctuate slightly, but extensive mar-

gin presents obviously catalytic effects than intensive margin. (iii) In terms of bamboo and rattan weaving, the increase of its export share is mainly driven by the extensive margin, which shows that the export intensive margin increases from 0.554 7 in 2008 to 0.593 7, with an average annual growth rate of 0.68%. However, annual growth rate of bamboo and rattan weaving of the extensive margin is -4.85%, indicating that the export types of bamboo and rattan weaving shows a decline trend. The export growth of bamboo and rattan weaving is mainly driven by the intensive margin of bamboo and rattan weaving.

Table 6 Results of binary margins at different types of bamboo products level

Year	I	II	III	I	II	III
	IM	IM	IM	EM	EM	EM
2008	0.076	0.330	0.555	0.517	0.825	1.276
2009	0.188	0.355	0.547	0.466	0.819	1.411
2010	0.200	0.360	0.551	0.472	0.815	1.020
2011	0.295	0.380	0.552	0.469	0.819	1.160
2012	0.264	0.406	0.578	0.453	0.851	1.073
2013	0.332	0.404	0.561	0.469	0.804	1.167
2014	0.352	0.372	0.575	0.467	0.855	0.981
2015	0.415	0.227	0.546	0.505	1.648	0.954
2016	0.450	0.404	0.544	0.516	0.877	0.941
2017	0.475	0.400	0.567	0.561	0.864	1.062
2018	0.498	0.351	0.594	0.572	0.880	0.777
AAGR // %	20.680	0.610	0.680	1.020	0.650	-4.850

Note: I refer to bamboo and rattan furniture, II refers to bamboo and rattan Raw materials, III refers to bamboo and rattan weaving, and AAGR refers to annual growth rate.

4 Conclusions and recommendations

4.1 Conclusions Based on HS-6 customs code export trade data of 22 major importing countries of bamboo rattan products in the UN Comtrade Database (2008–2018), this paper employs binary marginal decomposition methods to analyze the export growth patterns of different bamboo and rattan products in different periods and in different target countries. Study shows that: (i) as a whole, the export growth model of bamboo and rattan products is dominated by extensive margin, and supplemented by intensive margin, which further indicates that the export quality of bamboo and rattan products in China improves continuously, and the consumption demand for bamboo and rattan products presents diversification; (ii) In terms of different stages, the export extensive margin of Chinese bamboo and rattan products shows a growth trend, and it is mainly driven by the extensive margin. However, the intensive margin shows a downward trend, which may be related to the strictness of phytosanitary standard of specific bamboo and rattan products, trade barriers such as ecological labeling and stricter environmental regulations in relevant trading partners during this period, resulting in the decline of the export quantity of bamboo and rattan products; (iii) From the perspective of the major bamboo and rattan export trading countries, due to the differences in the export products of the major trading partners, the fluctuation of export share is different, but on the whole, the export

growth of China's bamboo and rattan products to different countries during the research period is mainly driven by the extensive margin, and the intensive marginal effect is limited; (iv) From the perspective of different types of bamboo and rattan products, the intensive margin of bamboo and rattan raw materials, bamboo and rattan weaving as well as bamboo and rattan furniture improves continuously, among which the growth rate of bamboo and rattan furniture is significant, while the extensive margin of bamboo and rattan weaving presents a downward trend.

4.2 Recommendations Based on the above research conclusions, we come up with following recommendations: (i) continuously deepening the promotion effect of export extensive margin of bamboo and rattan products on export trade, and meanwhile exploring the contribution potential of export intensive margin of bamboo and rattan products. In addition, maintaining the diversification of export types of bamboo and rattan products, increasing the technological innovation of products, enhancing the added value of new bamboo and rattan products, and realizing intensive mode of the export growth of bamboo and rattan products; (ii) Diversifying the export market of Chinese bamboo and rattan products, and strengthening the economic and trade cooperation in related fields, so as to diversify the potential risks faced by Chinese bamboo and rattan products. Through the establishment and consolidation of multilateral and bilateral economic and trade cooperation, the po-

agement field, that is, the value of customers is different. 80% of corporate profits are mainly derived from a fixed 20% of customers. For companies, it is necessary to pay attention to distinguishing the value of customers. Enterprises should classify customers and take different strategies and management methods for different customers, focus on the most valuable customers, try to establish and maintain long-term cooperative relationships with customers, and promote frequent purchases and use of the company's products, and accordingly get more cash flow and profit.

In summary, customers have become the center of all production and operation activities of enterprises in the world. Enterprises should take the customer relationship as their important assets to operate, and realize its value preservation and increase. Especially, in a more competitive market in the future, customers must be regarded as the top priority of the enterprise's assets, and only

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tential consumer market of bamboo and rattan products should be explored in depth, and the export of high-quality bamboo and rattan products to the emerging trade market should be enhanced, so as to optimize the export market structure of bamboo and rattan products; (iv) Improving the export technical standards of bamboo and rattan products, strengthening the building of information platform for bamboo and rattan products trade, and enhancing the ability to cope with trade barriers. Bamboo rattan products export enterprises need to rein export standards, improve the quality of bamboo rattan products, meanwhile, building up information platforms of trade barriers for bamboo and rattan products, and combined with the International Network for Bamboo and Rattan and the World Bamboo and Rattan Communication, mastering dynamic and all-round information bamboo rattan products, so as to break through the bondage of trade barriers, and promote the steady and healthy development of the bamboo rattan products export trade.

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