Analysis of the Current Situation and Countermeasures for Guangdong's Electrical Industry Exports under the Belt and Road Initiative

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Abstract: The electrical industry in Guangdong Province has developed rapidly under the support of the Belt and Road Initiative but still faces challenges such as product standards, logistics shortcomings, imbalanced export structure, and trade protectionism. This paper first analyzes the current situation of Guangdong's electrical industry exports, then empirically studies the influencing factors of Guangdong's electrical product exports using customs data from 2015 to 2023. The results show that the GDP of trading partners, Guangdong's GDP, population size of trading partners, and the RMB exchange rate significantly promote Guangdong's electrical product exports. Finally, this paper explores suggestions for the development of Guangdong's electrical industry.

Keywords: Guangdong Electrical Industry; Exports; Influencing Factors; Current Situation Analysis

1. Introduction

Since the reform and opening up, the electrical product industry has had a profound impact on the national economy, closely related to improving people's quality of life and driving the development of light industry technology, playing a crucial role in industrial development. In recent years, Guangdong Province has received continuous policy support from the state, achieving rapid development in its manufacturing sector and occupying an important position in the global market [1]. With its product advantages, Guangdong's electrical products have achieved unprecedented success in exports. Since the proposal of the Belt and Road Initiative, trade barriers among member countries have relatively decreased, providing significant opportunities for electrical exports and contributing to a rapid growth in trade volume. In 2023, Guangdong's household appliance exports accounted for 5.6% of the province's total export value, maintaining a leading position nationwide. However, due to the complex domestic and international environment, Guangdong's electrical exports have shown unstable growth trends in recent years, severely affecting supply-demand balance. Therefore, this paper aims to analyze the current situation and problems of Guangdong's electrical industry exports under the Belt and Road background and propose reasonable suggestions for high-quality development.

2. Analysis of the Current Situation of Guangdong's Electrical Industry Exports

Guangdong Province ranks among the top in terms of scale and complete industrial chain in China's electrical industry, with the Pearl River Delta region being particularly developed. Notable brands such as Haier, Gree, Midea, Hisense, and XIAOBO dominate the market. In 2023, Guangdong's household appliance manufacturing scale continued to grow, accounting for over 40% of the domestic market share. The output of Color television, air conditioners, washing machines, and refrigerators in Guangdong ranks first nationwide and remains growing. In terms of export trade, Guangdong's household appliance exports accounted for 5.6% of the province's total export value in 2023, showing a sustained growth trend [2,3].

2.1 Export Scale

Guangdong Province is a traditional manufacturing powerhouse with its electrical industry export scale consistently ranking at the forefront nationwide. As shown in the Figure 1, from 2015 to 2022, Guangdong's electrical export continuously increased, with stable growth from 2015 to 2018. There was a brief stagnation in growth from 2018 to 2019, followed by rapid growth of about 24.5% from 2020 to 2021. However, from 2021 to 2023, the export experienced stagnation or decline, indicating a

shrinking international market share for Guangdong's electrical products. This may be related to weak global economic demand and reduced consumer spending.

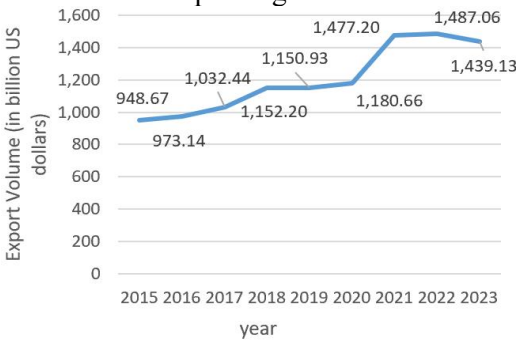

Figure 1. Total Electrical Appliance Export Volume of Guangdong Province from 2015 to 2023

2.2 Main Market Export Situation

Guangdong's electrical industry has a comprehensive range of products, including home appliances, industrial electric appliances, and consumer electronics, with product quality ranked among the top in China. We can see from Figure 2 that Guangdong's electrical exports to the Belt and Road countries increased from 27.56billion to 27.56billion to 54.35 billion from 2015 to 2023, with an annual growth rate of 12.15%. Major markets include India, Indonesia, Vietnam, Russia, Thailand, the United Arab Emirates, Malaysia, the Philippines, Hungary, Poland, etc. From 2015 to 2022, Guangdong's electrical export rose steadily, with an average annual growth rate of 14.72%, reaching a peak of $55.98 billion in 2022. However, from 2022 to 2023, there was a slight decline in export, possibly due to weak international market demand and industrial chain relocation [4].

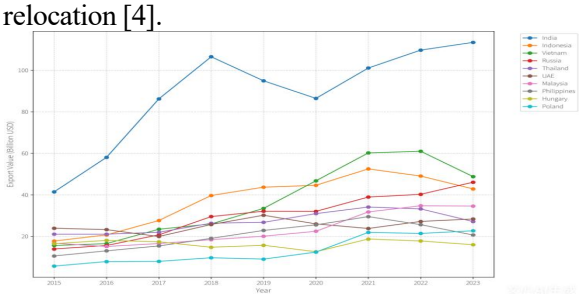

Figure 2. Export Situation in Major Markets along the "Belt and Road" from 2015 to 2023 (Unit: Billion US Dollars)

3. Empirical Analysis of Influencing Factors for Guangdong's Electrical Industry Exports under the Belt and Road Initiative

3.1. Sample Data Selection and Explanation

Most of Guangdong's electrical industry trade involves exports. A multiple linear regression model was constructed based on the province's export situation:

$$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + \mu_t \quad (1)$$

As shown in the Table 1: Y represents Guangdong's electrical product export, X_1 denotes the gross domestic product (GDP) of "Belt and Road" importing countries, X_2 represents Guangdong's regional GDP; X_3 indicates the population size of "Belt and Road" countries; X_4 is the RMB exchange rate (RMB/USD); t represents the time period from 2015 to 2023; μ_t denotes the random error term [5-7].

Table 1. Descriptive and Theoretical Explanation of Independent Variables

Variable	Meaning	Expected Sign
X_1	Gross domestic product (GDP) of "Belt and Road" import countries in year t	+
X_2	Gross domestic product (GDP) of Guangdong Province in year t	+
X_3	Population size of "Belt and Road" countries in year t	+
X_4	RMB exchange rate index in year t (RMB/100 USD)	+

The theoretical analysis serves as a crucial foundation for model construction in empirical research. Based on international trade theory, factors influencing Guangdong's electrical appliance export volume can be explained through four core variables: the GDP of "Belt and Road" import countries (import country GDP), Guangdong's regional GDP (Guangdong GDP), population size of "Belt and Road" countries, and the RMB exchange rate.

According to this model and trade dynamics between importing and exporting countries, the following hypotheses are proposed regarding the model's variables:

1.The economic level of "Belt and Road" import countries with which Guangdong conducts electrical appliance exports will positively affect the export volume. Hence, a positive correlation is expected.

2.Higher Guangdong GDP levels will lead to greater export volumes of electrical appliances. Growth in Guangdong's GDP is expected to facilitate increased exports, with a positive coefficient.

3.A larger population size in import countries will result in higher Guangdong electrical appliance export volumes, with a positive coefficient

anticipated.

4.A higher RMB exchange rate index (indicating currency depreciation) will correlate with increased Guangdong electrical appliance exports, with a positive coefficient expected.

Within the "Belt and Road" countries that engage in electrical appliance exports with Guangdong, Indonesia, India, Russia, Vietnam, Thailand, UAE, Malaysia, Philippines, Hungary, Poland, Turkey, Pakistan, Singapore, Saudi Arabia, Bangladesh, Czech Republic, Iran, Myanmar, Israel, and Ukraine were selected as the top twenty export markets by transaction volume. Data from these markets were incorporated into the previously developed multiple linear regression model for analysis. From 2015 to 2023, the combined import value of electrical appliances from these twenty countries accounted for 32.72% of Guangdong's total electrical appliance exports, with projections indicating a further increase in 2024. These markets hold significant importance for Guangdong's electrical appliance exports, making their selection valuable for this study.

3.2 Descriptive Statistics and Tests

3.2.1 Descriptive Statistics

This paper constructs a gravity model based on the export trade status of the electrical appliance industry in Guangdong Province. Data on exports between Guangdong and twenty trading partner countries-namely, India, Indonesia, Vietnam, Russia, Thailand, the United Arab Emirates, Malaysia, the Philippines, Hungary, Poland, Turkey, Pakistan, Singapore, Saudi Arabia, Bangladesh, the Czech Republic, Iran, Myanmar, Israel, and Ukraine-were collected from customs websites over the period from 2015 to 2023. Descriptive statistics were conducted using EViews software, as shown in Table 2.

Table 2. Descriptive Statistics

	Y	X_1	X_2	X_3	X_4
M	1204.598	123485.3	10.63889	289041.4	698.5556
MED	1152.190	120119.7	10.80000	289553.3	707.0000
MAX	1487.050	152469.5	13.57000	299849.7	757.0000
MIN	948.6600	99403.50	7.470000	276937.2	623.0000
SD.	213.3094	18421.07	2.122619	7523.986	42.52973
Skew	0.288377	0.371189	-0.079028	-0.171661	-0.437503
K	1.560041	1.964823	1.757304	1.928292	2.213393
JB	0.902298	0.608519	0.588478	0.474910	0.519146
Prob.	0.636896	0.737669	0.745098	0.788632	0.771381
Sum	10841.38	1111368.	95.75000	2601373.	6287.000
SSD	364007.4	2.7109	36.04409	4.5308	14470.22

3.2.2 Model Multicollinearity Testing

The variance inflation factor (VIF) test was used to assess the multicollinearity among the explanatory variables. As shown in Table 3, the VIF values for X_1, X_2, and X_3 all exceeded 10, indicating severe multicollinearity among these variables.

Table 3. VIF Test

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
C	42927158	180621.0	NA
X_1	3.00E-05	1964.202	38.10006
X_2	17431.54	8595.392	293.7403
X_3	0.000596	209530.3	126.1271
X_4	1.460084	3007.769	9.877491

3.2.3 Handling Multicollinearity

Logarithmic transformations were applied to all variables. The model achieved an R^2 of 0.952960 and an adjusted R^2 of 0.905920, with a high goodness-of-fit. The F-test statistic was statistically significant. However, the natural logarithm of X_3 ($\ln X_3$) proved insignificant, and its regression coefficient had an unexpected sign. Despite the transformation, the model retained severe multicollinearity, necessitating further refinement.

To address this issue, the stepwise regression method was employed to identify and remove variables contributing to multicollinearity. The final model retained X_1, X_2, and X_4, yielding results as shown in Table 4.

Table 4. Regression Model Results

Variable	Coef	SE	T	Prob.
C	-634.4301	1046.813	-0.606059	0.5709
X_1	0.006317	0.006675	0.946482	0.3874
X_2	24.88655	79.23554	0.314083	0.7661
X_4	1.136841	1.642849	0.691993	0.5198
R^2	0.934147	MED		1204.598
Adj. R^2	0.894635	SD		213.3094
SE	69.24031	AIC		11.61415
SSR	23971.10	SC		11.70180
LL	-48.26366	HQ		11.42499
F-sta	23.64210	DW		1.630977
Prob	0.002213			

The conclusions are drawn as follows: With other variables held constant, for every additional 100 million US dollars in the gross domestic product (GDP) of the importing country, the total value of electrical appliance exports will increase by 0.00612 million US dollars; for every additional 100 million yuan in the GDP of Guangdong Province, the total value of electrical appliance exports will increase by 0.002488 million US dollars; and for every additional 1 yuan (per 100 US dollars) in the RMB exchange rate, the total value of electrical appliance exports will increase by 113 million US dollars.

3.3 Chapter Summary

This chapter conducts an empirical study on the

export trade of electrical appliances from Guangdong using a multiple linear regression model. Based on the above regression analysis, the GDP of the top 20 markets (by transaction volume) – including India, Indonesia, Vietnam, Russia, Thailand, the United Arab Emirates (UAE), Malaysia, the Philippines, Hungary, Poland, Turkey, Pakistan, Singapore, Saudi Arabia, Bangladesh, the Czech Republic, Iran, Myanmar, Israel, and Ukraine – along with the regional GDP of Guangdong Province and the RMB exchange rate, all exert a promoting effect on the export trade of Guangdong's electrical appliances.

Specifically, with other variables remaining unchanged: for every additional 100 million US dollars in the GDP of the importing country, the total value of electrical appliance exports increases by 0.00612 million US dollars; for every additional 100 million yuan in the GDP of Guangdong Province, the total value of electrical appliance exports increases by 0.002488 million US dollars; and for every additional 1 yuan (per 100 US dollars) in the RMB exchange rate, the total value of electrical appliance exports increases by 113 million US dollars.

4. Countermeasures and Suggestions

4.1 Break Green Trade Barriers and Innovate Production Technology

Guangdong's electrical industry should actively address technical barriers by increasing R&D investment and introducing advanced international environmental protection technologies. Enterprises should focus on intellectual property rights and adopt ISO9001 and CE certifications to meet international standard [8].

4.2 Market Expansion and Channel Innovation

To counteract the sluggish export performance from 2022 to 2023 under the Belt and Road framework, Guangdong should establish overseas branches, agents, and distributors to expand sales networks. E-commerce platforms like Amazon and Alibaba International should be utilized to enhance product visibility and sales conversion rates through data analytics [9].

4.3 Promoting Digital Supply Chains

Guangdong should accelerate the development of a provincial cross-border e-commerce platform that integrates logistics, payment, and customs procedures to enable “one-click export.” At the same time, enterprises should be encouraged to adopt blockchain-based traceability technologies to improve supply-chain transparency and credibility, thereby reducing logistics costs, enhancing supply-chain resilience, and increasing customer satisfaction. [10].

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