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Research on cost-risk synergistic optimization model of cross-border logistics in Guangxi based on regression analysis

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Abstract Along with the vigorous implementation of the "E-commerce Guangxi, E-commerce ASEAN" project in Guangxi, Guangxi has ushered in a new development opportunity, and at the same time ushered in the corresponding risks. In this study, regression analysis and correlation analysis are used as the basic tools to construct a synergistic optimization model of cross-border logistics cost and risk in Guangxi. Five indicators of core elements of logistics, product, credit, talent and government are collected, and a cross-border logistics cost risk control measurement system containing fifteen secondary indicators is designed. On this basis, data-driven, technical support, and organizational collaboration are assembled to design a cross-border logistics cost risk co-optimization strategy. Through simulation verification, the model of this paper can effectively verify the five factors with significant positive influence ability on the cost risk control of cross-border logistics in Guangxi, and at the same time accurately predict the cross-border logistics demand in the next few years, which effectively reduces the cost risk of cross-border logistics in Guangxi. It provides practical guidance for the efficient and sound development of cross-border logistics in Guangxi, and also has profound reference significance for the synergistic optimization of cross-border logistics cost risk in other regions.

Index Terms regression analysis, correlation analysis, cross-border logistics, cost risk co-optimization

I. Introduction

In the context of the increasing digitization of global trade, cross-border e-commerce has become a new engine of China's foreign trade, which has played a positive role in promoting the diversification of China's economy [1], [2]. Among them, the development of cross-border e-commerce cannot be separated from the support of efficient and smooth logistics services [3]. However, with the increasingly fierce competition among cross-border e-commerce enterprises, the dividends of cross-border e-commerce enterprises are gradually disappearing, and in recent years, they have been subjected to the double-sided attack by social factors and cross-border e-commerce platforms' compliance policies, which has led to the increasing difficulties in cross-border e-commerce enterprises' survival, and there is an urgent need to carry out the optimization of the control of logistics costs, in order to reduce the costs and increase efficiency, and to improve the competitiveness of enterprises [4]-[7].

The transportation of cross-border e-commerce goods involves the flow of goods between different borders, with longer transportation distances and higher requirements for goods packaging and so on [8]. Compared with domestic logistics, cross-border e-commerce logistics enterprises face more uncertainty, which is reflected in logistics as risk [9], [10]. At this stage, cross-border e-commerce logistics exists in a variety of modes such as postal parcels and dedicated logistics [11]. The use of different logistics modes has different effects on solving the current problems of high cross-border logistics costs for small and medium-sized enterprises (SMEs), long distribution cycle, return and exchange of goods, as well as the lack of resource integration capacity, and the risks encountered by different logistics modes in the process of operation are different [12]-[14]. Therefore, how to target the various risks for reasonable control, while realizing the effective reduction of logistics costs, is the focus of attention of cross-border e-commerce logistics enterprises in Guangxi.

In this paper, nine cross-border e-commerce enterprises in Guangxi are selected for the study, and five influencing factors, namely, the core elements of logistics, products, credit, talents and government, are extracted. The correlation analysis method is used to initially analyze the correlation between the evaluation indexes, and then the regression analysis and multiple stepwise regression methods are used in turn to analyze the specific effect of these five influencing factors on the control of cross-border e-commerce logistics cost risk. Finally, based on the established mathematical model, analyze the independent variables and time change characteristics, forecast the cross-border logistics demand in Guangxi Province during the next five years, and use this as the technical support to propose corresponding optimization strategies for further collaborative optimization of cross-border logistics cost risk in Guangxi.

II. Regression analysis

II. A. General form of regression analysis

Correlation analysis [15] mainly describes the closeness of the correlation between variables, while regression analysis not only reveals the extent to which the variables interact with each other but also allows estimation and prediction by establishing regression equations.

Regression is a statistical method. Regression analysis is a computational method and theory used to study the association between one or more independent or predictor variables and a (continuous-valued) dependent or response variable. That is, when there is a correlation between the variables $X=\{x_1,x_2,\cdots,x_n\}$ and the random variable y, we can characterize this relationship using a mathematical formula as:

$$y=f(X)+\varepsilon \tag{1}$$

where X is the independent variable, y is the dependent variable, ε is the random error, and $f(\cdot)$ is the deterministic functional relationship between the independent variable and the dependent variable. When the value of the random variable X is determined, we can obtain the probability distribution of the dependent variable y through the correlation model. The ε as the random error describes the relationship between the independent and dependent variables as a random square.

II. B. Linear regression prediction

In regression analysis modeling, a model is called a univariate linear regression model if there is an approximately linear relationship between the independent variables and the dependent variable and there is only one predictive attribute. One-way linear regression [16] can be expressed as:

$$y=b+\omega x \tag{2}$$

where the variance of y is assumed to be constant, ω and b are the regression coefficients, which denote the slope and the intercept of the straight line on the Y axis, respectively, and also the regression coefficients can be viewed as weights, and can therefore be rewritten as:

$$y=\omega_0+\omega_1 x \tag{3}$$

At this point the univariate regression modeling is converted to an estimation of the regression coefficients ω and b. For the regression coefficients ω and b can be solved by the least squares method.

There is only one predictive attribute in the univariate linear regression, but in the real scenario the interactions between objective phenomena are complex, and multiple independent variables have an effect on the predictive objective, so multiple linear regression that analyzes the relationship between multiple predictive attributes and the objective attribute is proposed. If there are more than one predictive attribute in the regression prediction model, it is multiple linear regression, multiple linear regression is expanded from univariate linear regression, a model of multiple linear regression based on k predictive attributes is:

$$y=\sum_{i=1}^{k}\omega_i x_i+\omega_0 \tag{4}$$

where x_i is the value of the i th predicted attribute, and ω_i is the weight, whose value can be solved by the least squares method.

The least squares method is an effective method for estimating the weights of linear regression equations, and the method also has an important role in nonlinear regression. The principle of the least squares method is briefly described below.

If x and y have an exact linear relationship, then there is $y_i=\hat{y}_i$, but in reality, due to the error factor generally $y_i\neq\hat{y}_i$, so we have to estimate the slope ω and the intercept b of the straight line, that is, we have to determine the The estimates α and β minimize the sum of the distances of the regression line from all samples. In a general linear regression model, the linear residuals and Q are used to characterize the extent to which observations deviate from the regression line.

$$Q \equiv Q(\alpha,\beta) = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 = \sum_{i=1}^{n}(y_i - \alpha x_i - \beta)^2 \tag{5}$$

Least squares is the process of choosing the appropriate α and β values to minimize the value of Q. This makes the regression line closest to the values of all the observations. Thus the straight line $\hat{y} = \alpha x + \beta$ obtained by least squares is the one that minimizes the value of the sum of squares of the residuals and the value of Q among all possible lines. According to the method of finding extreme values in calculus theory, α and β should satisfy the following conditions:

$SS_e = \sum_{i=1}^{n}(y_i - \alpha x_i - \beta)^2$ such that SS_e is minimized, then it should be satisfied:

$$\begin{cases} \dfrac{\partial SS_c}{\partial \alpha} = 0 \\ \dfrac{\partial SS_c}{\partial \beta} = 0 \end{cases} \tag{6}$$

Solving this equation gives:

$$\begin{cases} \beta = \dfrac{\sum_{i=1}^{n} x_i y_i - \dfrac{(\sum_{i=1}^{n} x_i)(\sum_{i=1}^{n} y_i)}{n}}{\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2 / n} = \dfrac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sum_{i=1}^{n}(x_i - \overline{x})^2} \\ \alpha = \overline{y} - \beta\overline{x} \end{cases} \tag{7}$$

where (x_i, y_i) is the observed data pair, $\overline{x} = \sum_{i=1}^{n} x_i / n, \overline{y} = \sum_{i=1}^{n} y_i / n$.

II. C.Non-linear regression analysis

For non-deterministic correlations between variables, through a large number of observations, although it is not possible to accurately derive a functional relationship between the variables, it is possible to statistically analyze the observations to obtain the inherent statistical patterns in the data. This method of studying correlations between variables in statistics is regression analysis, and for a given set of data $(x_i, y_i), i = 1, 2, \cdots n$, the nonlinear regression model can be expressed as:

$$y_i = f(x_i, \beta) + \varepsilon_i \tag{8}$$

where $f(x_i, \beta)$ is a nonlinear function of β , such as $f(x_i, \beta) = \beta_0 + \beta e^{-\beta_2 x_i}$ and so on. If $f(x_i, \beta) = x_i^T \beta$, then it is a linear model. $\beta = (\beta_1, \beta_2, \cdots \beta_p)^T$ is the unknown vector of regression coefficients, ε_i is the random error, and it is assumed that the sequences $\varepsilon_1, \cdots, \varepsilon_n$ are independently homogeneous or independently normally distributed with mean 0 and variance σ^2 , the model can be expressed as:

$$Y = f(X, \beta) + \varepsilon = f(\beta) + \varepsilon \tag{9}$$

In Equation (9), $Y = (y_1, y_2, \cdots, y_n)^T, \varepsilon = (\varepsilon_1, \varepsilon_2, \cdots, \varepsilon_n)^T$, $f(X, \beta) = f(\beta) = (f(x_1, \beta), \cdots, f(x_n, \beta))^T$, and if $f(X, \beta) = X\beta$, the nonlinear model is modeled as a linear model.

For parameter estimation of nonlinear models has been the focus of research in the fields of prediction, cybernetics, signal recognition, etc. The most commonly used parameter estimation is the least squares estimation method. In recent years, with the rapid development of electronic computers, new parameter estimation methods, including the great likelihood method, Gauss-Newtor method, neural network method and so on. Among them, Gauss-Newton method is easy to fall into the local optimal solution, or does not converge, at the same time, its process is complex workload; the least squares method and great likelihood estimation using gradient information descent method must satisfy the conditions of the adaptive value function, smoothing the search space, and the performance index must be microscopically and so on, but in real life, due to the existence of the noisy point data, it is not possible to meet the algorithmic requirements; the use of neural network Determine the parameter values of nonlinear regression, although you can approximate the nonlinear function with arbitrary accuracy, but you must artificially determine the network structure of the neural network, only the appropriate network structure to get better results, while determining the appropriate network structure is a very difficult thing. In addition, some other parameter estimation methods, such as direct search method, gradient method, Hooke-Jeeves method, variable scale method, Nelder-Mead method, etc., but these methods are only effective in specific environments, and their restrictive conditions are too strong.

The essence of parameter estimation is to solve for the value of the parameter θ that minimizes the sum of squares of the deviations based on the known data set $(x_i, y_i), i = 1, \cdots, n$ when the structure of the nonlinear model has been determined.

$$J(\theta) = \sum_{i=1}^{n} (y_i - f(x_i, \theta))^2 \tag{10}$$

The problem of estimating the parameters of a model is converted into a problem of finding the minimum of a function.

III. Research methodology and modeling

III. A. Research methodology

This study believes that the core elements of logistics, product, credit, talent and government factors can directly affect the control of cross-border logistics cost risk in Guangxi, while focusing on the reality of the development of cross-border business in Guangxi, using multiple linear regression method, selected 10 cross-border e-commerce enterprises in Guangxi to create the core elements of logistics factors, product factors, credit factors, talent factors, government factors 5 The first-level indicators as the core of the indicator measurement system containing 15 second-level refinement indicators, so as to implement the selection and analysis of indicators in depth.

III. B. Modeling

Multiple linear regression modeling [17] is the use of regression analysis in data statistics to determine the relationship between the effects of 2 or more variables.

The quantitative relationship statistics can be expressed as $Y = \omega 1X1 + \omega 2X2 + \cdots + \omega nXn + e$. Where e is distributed in normal form and the error value can be determined as 0. The process involved in the multiple linear regression analysis contains: selecting the variables that are linked and creating a questionnaire; implementing the analysis of reliability and validity of the data; implementing the analysis of correlation between the independent and dependent variables and excluding non-valid data; and using the relevant computational procedures to carry out the multiple linear regression to obtain the results. The research model of this paper can be defined as:

$$Y = \beta_0 + \beta_\eta X_{\eta\omega} \tag{11}$$

In the research process, *Y* represents the dependent variable, which is the cost risk control ability of Guangxi cross-border e-commerce companies, and X and X_η refer to the independent variable and the five kinds of first-level indicators that can directly act on the cost risk control ability of the company, respectively. Where $X_{\eta\omega}$ represents the 15 second-level indicators that can directly act on the cost risk control ability of such companies, β represents the parameter to be estimated, and the subscript η represents the ηth element that can act on the cost risk control ability of such companies, where the value of β ranges from 1 to n, with n takes values in the range (0, 1, 2, 3 ......).

III. C. Data sources

In this study, nine cross-border e-commerce companies in Guangxi are selected as the research object, and the employee information is mainly: male and female gender, age range and position held. The basic information of the company contains: company type, company business cycle, types of products sold, and monthly shipments. The company's operational information is mainly: the trading system platform, logistics and transportation, transaction payment methods, professional and technical personnel needs, industry confidence and customer recognition. Cross-border e-commerce cost risk control influencing factors are selected: the core elements of logistics, product, credit, talent, government five level 1 indicators as the core, containing 15 secondary indicators. The Likert 5-level scale was used to assign the measurement indicators to values. The SPSS 22.0 program was used to measure the variables, determine their precision, and derive relevant results.

III. D. Survey information

This study conducted a network questionnaire survey on employees in nine cross-border e-commerce enterprises in Guangxi, the number of questionnaires issued was 510, 500 questionnaires were received, and the recovery rate was 98.04%. The enterprises' platforms include Ali International, Sell-through and Ebay. Logistics companies include EMS, FEDEX and other logistics companies. Bank transfer and third-party transfer are used as the core of financial transactions. Enterprises are very concerned about talent, especially for logistics management, marketing and platform operation professionals have a greater demand. This paper constructs the core elements of logistics, product, talent, credit and government factors, five first-level indicators, and through the subdivision of the fifteen secondary indicators, constituting the entire measurement system as shown in Table 1, the main comprehensive evaluation of the degree of influence of each indicator. Among them, the talent factor has the highest comprehensive average score of 4.04 points, and the core elements of logistics have the lowest comprehensive average score of 3.67 points.

Table 1: Guangxi cross-border logistics cost risk control measure system

Index		Average score	Comprehensive score
Logistics factor	The logistics cost burden is light	3.56	3.67
	High efficiency	3.74	
	Supply chain connectivity	3.70	
Product factor	cheap	3.73	3.71
	Product safety certification	3.68	
	Brand good	3.72	
Credit factor	Return service	3.68	3.68
	The product is shipped	3.68	
	Credit for payment	3.73	
	Price tag	3.63	
Talent factor	Knowledge of electrical business	4.05	4.04
	Understand the market	4.08	
	Attention to talent needs	3.99	
Government factor	Government supervision	3.73	3.78
	Government subsidies are good	3.82	

IV. Empirical analysis of data

IV. A. Factor analysis

Analyzed by SPSS22.0, the value of KMO is 0.738, which is greater than 0.7, the approximate chi-square of Bartlett's test of sphericity statistic is 738.452, and the degree of freedom is 130, and the value of Sig. of Bartlett's test of sphericity is 0.000, which is less than 0.01, and it reaches the significant level, and the overall correlation matrix has the existence of a common factor between them, and the The MSA values of all variables are greater than 0.5, indicating that there is a certain correlation between the data, which satisfies the prerequisites of factor analysis. By factor analyzing the data and eliminating erroneous loadings, five factors with eigenvalues greater than 1 were finally extracted as principal components from the 15 component items, which cumulatively explained 62.5% of the variance. Factor analysis was performed by orthogonal rotation and principal component analysis.

IV. B. Reliability analysis

In this study, the reliability was examined using Cronbach's Alpha value, and 18 variables were analyzed by SPSS19.0, and the Cronbach's Alpha value of all samples reached 0.718, and the Cronbach's for each item Alpha value reaches above 0.65, which indicates that the data reliability of this questionnaire is high and the reliability of each questionnaire is basically acceptable.

IV. C. Correlation analysis

This study uses correlation analysis to analyze the correlation between the evaluation indicators, and to conduct a preliminary test with the research hypothesis of this study. The results of the correlation analysis are shown in Table 2. According to the correlation analysis in the following table, it can be seen that the correlation coefficients of the core elements of logistics, products, talents, credit and government factors are 0.319, 0.322, 0.268, 0.280, 0.362 at the level of 0.01, which are all positive and greater than 0.05, and the significance P-value is less than the requirement, which is significant. It indicates that there is a significant positive correlation between the five factors of core elements of logistics, product, talent, credit and government and cross-border logistics cost risk control.

Table 2: Relevant analysis results

	Logistics factor	Product factor	Credit factor	Talent factor	Government factor
Pearson correlation	0.319**	0.322**	0.268**	0.280**	0.326**
Significance (double side)	0.000	0.000	0.002	0.001	0.000
N	500	500	500	500	500

IV. D. Regression analysis

It is used to verify the results of the correlation analysis, explain the relationship between independent variables and dependent variables, and write the regression equation. The core elements of logistics, product, credit, talent, government as independent variables, logistics cost risk control as dependent variables, through SPSS22.0 to do multiple regression analysis, to get the results of regression analysis,validation data as shown in Table 3-Table 5.

The results show that the independent variables (core elements of logistics, products, credit, talents, and government) are at the significance levels of 0.000, 0.000, 0.000, 0.000, and 0.000, respectively, and the corresponding regression coefficients are 0.308, 0.278, 0.289, 0.269, and 0.311, respectively, and the significance of the five indicators is obvious, which means that the correlation between the core elements of logistics, products, credit, talents, and government and cross-border logistics cost risk control is significant.

According to the results of regression analysis, the multiple linear regression equation of the influencing factors of Guangxi cross-border logistics cost risk control can be established: Cross-border logistics cost risk control=3.524+0.308(core elements of logistics)+0.278(products)-0.289(credit)+0.269(talents)+0.311(government).

Table 3: Coefficient

Model	Nonnormalized coefficient		Standard coefficient	t	Sig.
	B	Standard error	Trial version		
Constants	3.524	0.065		55.481	0.000
Logistics factor	0.308	0.065	0.316	4.512	0.000
Product factor	0.278	0.065	0.315	4.251	0.000
Credit factor	0.289	0.065	0.323	4.365	0.000
Talent factor	0.269	0.065	0.289	4.235	0.000
Government factor	0.311	0.065	0.296	4.229	0.000

Table 4: Model summary

Model	R	R^2	Adjusted R^2	Standard estimation error	Durbin-Watson
	0.522*	0.278	0.254	0.833	1.905

Table 5: Anova

Model	Sum of squares	df	Mean square	F	Sig.
Regression	38.452	4	9.456	14.561	
Residual error	102.465	150	0.685		
Total	14.0917	154			

IV. E. Multiple Stepwise Regression

Multiple stepwise regression is a method used to model the relationship between logistics demand and economic indicators in order to improve forecasting accuracy and reduce the effects of multicollinearity. Its basic idea is to introduce regression equations step-by-step based on the magnitude of each factor's effect on the dependent variable and determine the significance of the variable through statistical tests. If the variable is not significant, it is moved out of the model until all variables are significant on the dependent variable. The introduction of new variables is then considered, and the variable with the largest and significant effect on the dependent variable is selected for introduction into the equation. This process is repeated until there are no significant factors to introduce and no insignificant variables that need to be moved out.

Multiple stepwise regression is a practical and widely used method of statistical analysis, the optimal multiple linear regression equations are obtained through computational techniques stepwise regression in which variables are introduced gradually, the standardized normal P-P plots and standardized residual histograms are shown in Figures 1 and 2, respectively. The final model coefficients obtained were tested significant and the explanatory variables were significant as a whole (R=0.53, Sig=0.000). Also, the Durbin-Watson statistic (DW=2.044) indicates the absence of autocorrelation. These results give the model good interpretability and predictive power.

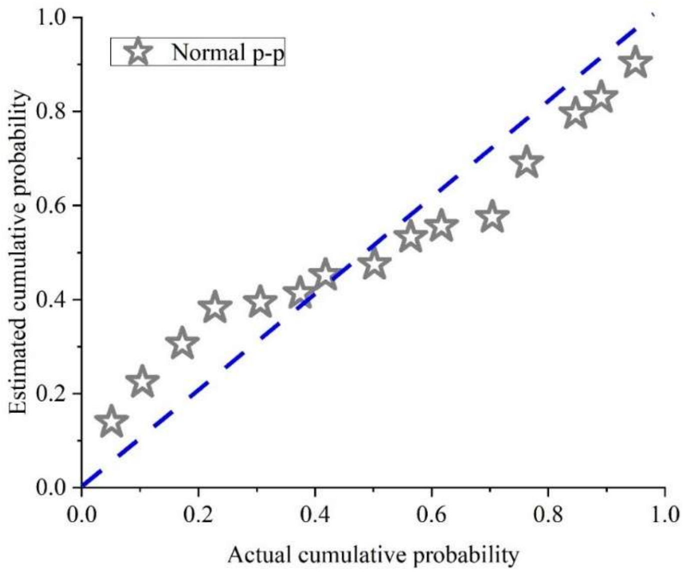

Figure 1: Standardized residual normal p-p diagram

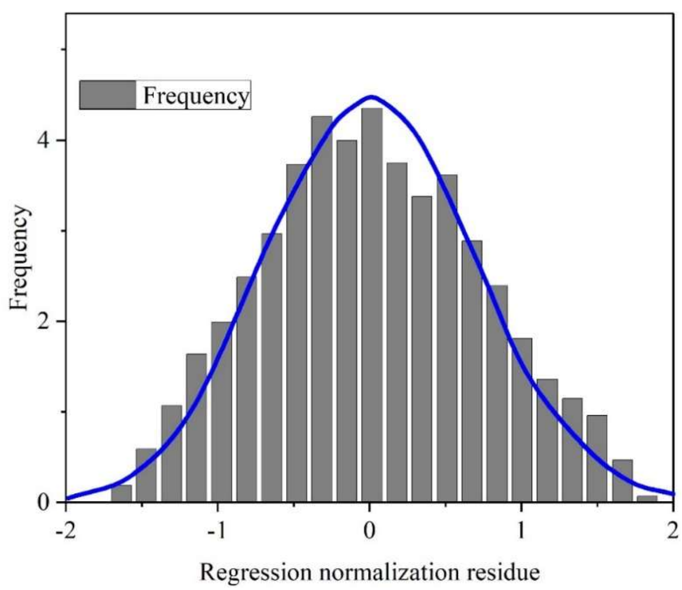

Figure 2: Standardized residual histogram

IV. F. Model predictions

By analyzing the relationship between the changes in the model independent variables and time, the values of the respective variables for the next five years are predicted, from which the predicted value of cross-border logistics demand in Guangxi Province for the period 2025-2029 is derived. For the predicted values of the independent variables, this paper adopts the method of curve regression to determine the change rule over time, and determines the results of logistics demand prediction by comparing the quadratic curve, cubic curve, logarithmic curve, exponential curve, composite curve, and the growth curve function, the results of which are shown in Table 6.

In the next five years, the predicted value of cross-border logistics demand in Guangxi Province and various indicators show a rising trend year by year, and the overall scale of demand is large. And through the construction of the model of cross-border logistics demand, it is found that among the indicators, the value added of industry and the gross domestic product per capita have the most significant influence on cross-border logistics. Combined with the background of national integrated development, in order to fully adapt to the predicted demand for cross-border logistics in Guangxi Province, the government can increase investment, encourage enterprises to increase the construction of cross-border logistics facilities, and improve the coverage and quality of cross-border logistics facilities. It also establishes a sound cross-border logistics regulatory system, encourages cooperation among cross-border logistics enterprises, improves the efficiency of cross-border logistics transportation, improves the quality of life of residents as the final end of consumption, and meets the demand of residents for cross-border logistics, so as to better realize the efficient development of cross-border logistics in Guangxi Province, and at the same time, reduce the risk of cross-border logistics costs in Guangxi.

In summary, the core elements of logistics, products, credit, talent and government factors are the most important influencing factors to focus on in cross-border logistics in Guangxi. These factors affect the enterprise's cross-border logistics cost risk management ability, and also test the enterprise's market adaptability and competitive strategy. Therefore, enterprises must establish effective cross-border logistics cost risk management mechanisms and adopt prevention, response and transfer strategies to minimize the impact of risks on their operations and ensure efficient and smooth logistics activities, so as to enable Guangxi Province to maintain its competitive advantages in the global market.

Table 6: Logistics demand forecast

Time	Industrial added value	Per capita GDP	Cross-border logistics demand / 10,000 tons
2025	22715.45	60142.91	1758.44
2026	23162.41	68481.02	1925.89
2027	25639.44	73198.25	2101.41
2028	28146.32	76994.52	2394.43
2029	30683.14	79169.94	2611.06

V. Cross-border logistics cost-risk synergy optimization strategy

Cross-border logistics cost risk synergistic optimization strategy applies the theoretical results in the synergistic optimization model based on regression analysis constructed in this paper to the actual operation process of cross-border logistics in Guangxi, and further synergistically optimizes the cost risk of cross-border logistics in Guangxi through specific strategies.

V. A. Data-driven decision optimization strategies

Big data and analytics tools play a crucial role in the data-driven decision-making process. By collecting and analyzing historical and real-time data, companies can identify market trends, customer behavior patterns, and potential bottlenecks in the supply chain. This approach allows companies to extract valuable data from massive amounts of data to support evidence-based decision making. For example, by analyzing historical transportation data, companies can predict future demand fluctuations to optimize inventory management and transportation plans to reduce inventory costs and improve customer satisfaction. In addition, real-time data analysis can help companies to respond to market changes in a timely manner, such as adjusting transportation routes to avoid sudden natural disasters or political conflict zones.

V. B. Decision optimization strategies for technical support

With the development of advanced technologies such as artificial intelligence and machine learning, these technologies are increasingly used in decision optimization. Using these new technologies, enterprises can deeply analyze a large amount of complex data to obtain more accurate risk assessment and path optimization suggestions. In this paper, we learn to predict the cross-border logistics demand in Guangxi province based on historical data to help enterprises take preventive measures in advance. Similarly, the application of artificial intelligence algorithms can automatically plan optimal transportation paths and scheduling plans, which not only improves logistics efficiency, but also reduces transportation costs.

V. C. Decision optimization for organizational synergy

In a globalized business environment, cross-sectoral and cross-regional collaboration is essential for decision-making optimization. The flow of information and consistency in decision-making can be ensured through the establishment of effective collaboration mechanisms. This includes the establishment of a unified information platform that allows employees from all relevant departments and regions to access and share critical information, thereby increasing the adaptability and resilience of the entire supply chain.

VI. Conclusion

Based on the multiple linear regression model, this paper establishes a synergistic optimization model of cross-border logistics cost risk in Guangxi, and explores the influence of five factors, namely the core elements of logistics, products, credit, talents and government, on the cost risk control of cross-border logistics in Guangxi.

Regression analysis was applied to quantify the relationship between each element and cost risk control, and the correlation coefficients of the five factors were 0.319, 0.322, 0.268, 0.280, and 0.362, respectively, which proved that the core elements of logistics, products, credit, talents, and the government have a significant positive influence relationship on the control of cost risk of Guangxi's cross-border logistics, and all of them are able to significantly enhance the cross-border logistics cost risk.

This paper establishes a risk collaborative optimization model for cross-border logistics cost in Guangxi and designs its practical application strategy. The optimization of cross-border logistics cost risk synergy in Guangxi province is accomplished by making full use of big data and analysis tools, deep analysis of complex data using artificial intelligence and machine learning algorithms similar to the risk synergy optimization model in this paper, and the establishment of cross-departmental and cross-regional collaboration mechanisms. The efficient and practical risk management techniques mentioned in this paper provide theoretical and practical support for the development of cross-border logistics in Guangxi Province.

References

[1] Wang, L., & Sup, P. (2020). The impact of cross-border e-commerce development on China's international trade and economic development. International Journal of New Developments in Education, 2(6), 8.

[2] Zhong, M., Wang, Z., & Ge, X. (2022). Does cross-border e-commerce promote economic growth? empirical research on China’s Pilot Zones. Sustainability, 14(17), 11032.

[3] Qi, X., Qin, W., & Lin, B. (2024). Case study on synergistic development strategy of cross-border e-commerce and logistics: An empirically model estimation. Plos one, 19(6), e0304393.

[4] Liang, Y., Guo, L., Li, J., Zhang, S., & Fei, X. (2021). The impact of trade facilitation on cross-border E-Commerce transactions: Analysis based on the Marine and land cross-border Logistical Practices between China and countries along the “belt and road”. Water, 13(24), 3567.

[5] Giuffrida, M., Mangiaracina, R., Perego, A., & Tumino, A. (2017). Cross-border B2C e-commerce to Greater China and the role of logistics: a literature review. International Journal of Physical Distribution & Logistics Management, 47(9), 772-795.

[6] Ma, W., Cao, X., & Li, J. (2021). Impact of logistics development level on international trade in China: A provincial analysis. Sustainability, 13(4), 2107.

[7] Bandaranayake, N., Kiridena, S., Kulatunga, A. K., & Dam, H. (2024). Analysing cross-border logistics operations for performance improvement: development and validation of a reference model. Operations Management Research, 1-22.

[8] Wang, D., & Li, W. (2021). Optimization algorithm and simulation of supply chain coordination based on cross-border E-commerce network platform. Eurasip Journal on Wireless Communications and Networking, 2021, 1-19.

[9] Sun, P., & Gu, L. (2021). Optimization of cross-border e-commerce logistics supervision system based on Internet of Things technology. Complexity, 2021(1), 4582838.

[10] Ji, J., Zheng, H., Qi, J., Ji, M., Kong, L., & Ji, S. (2023). Financial and Logistical Service Strategy of Third-Party Logistics Enterprises in Cross-Border E-Commerce Environment. Sustainability, 15(8), 6874.

[11] Shen, W. X. (2024). A method for selecting multiple logistics sites in cross-border e-commerce based on return uncertainty. International Journal of Electronic Business, 19(4), 344-361.

[12] Liu, Y. (2022). A Cross-Border e-Commerce Cold Chain Supply Inventory Planning Method Based on Risk Measurement Model. Mobile Information Systems, 2022(1), 6318373.

[13] Xie, Z. (2023, March). Logistics Distribution Optimization System of Cross-Border e-Commerce Platform Based on Bayes-BP Algorithm. In The International Conference on Cyber Security Intelligence and Analytics (pp. 30-39). Cham: Springer Nature Switzerland.

[14] Wang, D. (2025). Research on Cost and Risk Co-minimization Model of Cross-border Logistics in Guangxi Based on Monte Carlo Approach. J. COMBIN. MATH. COMBIN. COMPUT, 127, 1567-1586.

[15] Fang Chen,Chenyang Zou,Yongmen Zhou,Songtao Hu & Jianghong Mao. (2025). Correlation analysis of abrasion resistance of rubber concrete with microstructure and pore structure. Construction and Building Materials,475,141211-141211.

[16] Shih-Ming Huang & Jar-Ferr Yang. (2013). Unitary Regression Classification With Total Minimum Projection Error for Face Recognition.. IEEE Signal Process. Lett.,20(5),443-446.

[17] Ryoya Oda,Hirokazu Yanagihara & Yasunori Fujikoshi. (2025). On model selection consistency using a kick-one-out method for selecting response variables in high-dimensional multivariate linear regression. Communications in Statistics - Theory and Methods,54(8),2451-2465.