The Optimization of Foreign Trade Structure in Hubei Province and Its Impact on the Transformation of Economic Development Mode

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Abstract: This paper takes Hubei Province as the research object and evaluates the transformation of Hubei's economic development mode, of which 22 indicators are selected from 2005 to 2017 in terms of economic development level, social development level and scientific and technological development level. By using principal component analysis, this paper could analyze the influence of foreign trade structure on the transformation of Hubei's economic development mode. Then, with the help of Johansen co-integration analysis and error correction model, the data from 2000 to 2017 are selected to analyze the influencing factors of Hubei's foreign trade structure change, and the long-term equilibrium relationship between them is established. The results show that the foreign trade structure of Hubei province has a significant impact on the transformation of its economic development mode, especially on the structure of major exporters. And the main problem about the foreign trade structure lies in the slow development of processing trade and insufficient investment in private enterprises. Finally, the corresponding countermeasures are put forward.

1. Introduction

Since the reform and opening up, Hubei's economy has developed rapidly and the level of productivity has also improved greatly, but the growth pattern is biased towards extensive growth. As China's economy enters the "new normal", the mode of economic development also needs to be changed. In order to achieve the development goals of the "13th Five-Year Plan" period, we must adhere to the five development concepts which contain "innovation, coordination, green, openness, and sharing"[1] (Y.H. Zheng,2016). As one of the old industrial production bases of China, Hubei has a good industrial base and is generally in the middle stage of industrialization. Industrial development has also promoted the continuous integration of Hubei's economy and international economy, and the scale of foreign trade has gradually expanded.

Many scholars have analyzed the current situation of China's foreign trade. K. Yang (2019) analyzed the impact of the export in different phases on the upgrading of China's manufacturing industry [2]. X. Yuan (2010) proposed that foreign trade structure is the spatial expansion of industrial structure [3]. By granger causality test, Q.B. Huang (2010) drew a conclusion that China's export trade has no obvious effect on the primary industry, while import trade is the main reason for the development of the secondary industry [4]. Y.Y. Yuan (2004) established an evaluation system for the sustainable development of China's foreign trade based on the overall social and economic functions [5]. M.G. Dong (2004) proposed that China should optimize the trade structure, improve the technological content and trade competitiveness of export products by technological progress, thus achieving the virtuous circle between technological progress and trade development [6].

According to the views of the above scholars, this paper makes a further study on the foreign trade structure of Hubei province. Firstly, it analyzes the influence of foreign trade structure on the transformation of Hubei's economic development mode. Secondly, it explores the long-term equilibrium relationship between Hubei's foreign trade structure and its influencing factors from multiple perspectives.

2. The Construction of Index System and Selection of Variable

In order to evaluate the transformation of Hubei's economic development mode, we referred to H.B. Chen's [7](2013) evaluation system for the transformation of China's economic development mode, considering the three aspects of economic development level, social development level and scientific and technological development level. By combining the development of Hubei province, finally we determined the 22 impact index of the transformation of Hubei's economic development mode. By analytic hierarchy process (AHP), according to the importance of each index to its superior index, a hierarchical index system is established to evaluate the transformation of economic growth mode in Hubei province. As shown in table 1_{\circ}

The foreign trade structure is not a single indicator. We will analyze it from four aspects: the structure of trade mode, the structure of major exporters, the structure of trade market and the structure of foreign capital utilization. The structure of trade mode means the proportion of various trade mode adopted by a region in foreign trade [8](H.Y. Ye, 2015), of which general trade and processing trade are the main ones. And general trade is the main trade mode to promote Hubei's economic development, so we will select the proportion of general trade export (X1) and the proportion of processing trade export (X5) in the total export as indicators of trade mode structure. The structure of major exporters(X2) is indicated by the proportion of the export of private enterprises in the total export. The higher the proportion is, the stronger the competitiveness of local enterprises in the international market become. the structure of trade market (X3) refers to the proportion of each country or regional group in a country's foreign trade within a certain period [9](J.L. Chen, 2015), which could reflect the degree of economic and trade links between a country and other countries. In this paper, we select the proportion of Latin America in Hubei's foreign trade to measure the trade market structure. The higher the proportion is, the closer the trade relationship between Hubei province and Latin America will be, and the more diversified the foreign trade market structure become. The structure of foreign capital utilization (X4) refers to the proportion of service industry in foreign direct investment. Although Hubei province, richly endowed by nature, is a land of plenty, we cannot only focus on the development of agriculture and industry. The service industry is the new point of growth in economic development. The larger the proportion of service industry in FDI, the more conducive to the transformation of economic development mode in Hubei province.

Factors affecting the foreign trade structure include foreign direct investment, capital stock, industrial structure and technological progress [10]. In this paper, we select four indicators to measure them: foreign direct investment in Hubei province (FDI), total capital formation in Hubei province (CAP), the proportion of secondary industry in Hubei province (GDP 2) and the proportion of total social research and development expenditure in Hubei province's GDP (RD).

Primary indexes	weights	Secondary indexes	weights	Tertiary indexes	weights	Calculated weights
		Economic	0.1	GDP growth rate	0.4	0.012
		growth	0.1	GDP per capita	0.6	0.018
		Structural	ctural 0.3	The proportion of the tertiary industry in the GDP	0.5	0.045
		optimization		The proportion of hi-tech products in total export	0.5	0.045
development	0.3	0.3 Economic benefit	0.3	Growth rate of fiscal revenues	0.4	0.036
development				Gross labor productivity	0.6	0.054
		Sustainable Development	0.3	Energy consumption in the province (million tons of standard coal)	0.5	0.045
				Energy resource consumption elasticity coefficient	0.5	0.045

Table 1	Evaluation	index	system	of eco	nomic	growth	in	Hubei	provinc	ce
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		Quality of labor	0.3	The number of college students per 10,000 population	0.4	0.036
		force	0.3	The number of professional and technical personnel	0.6	0.054
				The level of residents' consumption	0.1	0.021
Social	0.3			The per capita net income of rural residents	0.1	0.021
development	0.3	Living standard	07	The per capita disposable income of urban residents	0.1	0.021
			0.7	Engel's coefficient of rural residents	0.25	0.0525
				Engel's coefficient of urban residents	0.15	0.0315
				The number of medical beds per 1,000 population	0.3	0.063
				The proportion of R&D expenditure in GDP	0.5	0.06
Scientific development	0.4	Technical input	0.3	The proportion of Industrial enterprise R&D expenditure in new product sales revenue	0.3	0.036
	0.4			The number of scientific and technological personnel	0.2	0.024
		Tashnalasy		The number of patent applications	0.4	0.112
		output	0.7	The number of invention patents	0.4	0.112
				new product sales revenue	0.2	0.056

3. The Influence of Foreign Trade Structure on The Transformation of Economic Development Mode in Hubei Province

3.1 Evaluation of the Transformation of Economic Development Mode in Hubei Province.

Among the 22 three-level indicators in table 1, Energy consumption in the province, Energy resource consumption elasticity coefficient, Engel's coefficient of rural residents and Engel's coefficient of urban residents are all negative indexes. Therefore, positive management is necessary. In this paper, "Min-Max standardization" method is used to deal with it.



Figure. 1 The transformation of economic development mode in Hubei province, 2005~2017

After the process, all index scores are positively correlated with the economic development mode. Scores are then weighted according to the evaluation index system and processed data, and the evaluation results of the transformation of economic development mode (Y1) in Hubei province could be obtained, as shown in Fig. 1. it is observed that since the "eleventh five-year plan", the economic development mode in Hubei province has gradually changed, and the transformation speed is relatively fast, showing a steady upward trend, which indicates that the economy of Hubei province is developing healthily and stably.

3.2 The Influence of Foreign Trade Structure on The Transformation of Economic Development Mode in Hubei Province.

When studying problems, too many variables will lead to inaccurate or overly complex model construction. But in fact, there is a certain correlation between some variables, that is, the coincidence of information exists. Principal Component Analysis (PCA) is to obtain a set of new indices with fewer and unrelated variables by dimensionality reduction and retaining most information of the original variables. We would use SPSS2.0 to analyze the sample data.

(1) Multicollinearity test

The regression analysis was conducted with the structure of trade mode (X1), the structure of major exporters (X2), the structure of trade market (X3) and the structure of foreign capital utilization (X4) as independent variables and the transformation of economic growth mode of hubei province (Y1) as dependent variables. The results are as follows:

$$y_i = 2.078 - 0.065x_{1i} + 0.161x_{2i} + 0.16x_{3i} + 0.003x_{4i}$$
(1)

 $R^2 = 0.979, F = 91.365$

As the result shows, the goodness of fit and F-statistics are very significant. However, the t-test values of the coefficients of other variables except x_{2i} are not significant, which is a typical sign of collinearity.

Further, it can be seen from Table 2 that the eigenvalues of the three dimensions are close to 0, and the conditional indexes of the third, fourth, and fifth dimensions are greater than 10, thereby judging that there is a serious commonality among the four variables. In this case, the results obtained by ordinary linear regression will be biased, and the multi-collinearity can be eliminated by principal component analysis.

Madal	Dimension	Eigenvalue Condition		Variance Proportions				
Widder Dimension		Eigenvalue	index	(Constant)	X1	X2	X3	X4
	1	4.848	1.000	.00	.00	.00	.00	.00
	2	.105	6.799	.00	.01	.40	.00	.01
1	3	.035	11.817	.00	.02	.10	.19	.21
	4	.010	22.034	.01	.19	.47	.79	.23
	5	.002	47.269	.98	.78	.03	.01	.55

Table 2 Collinearity diagnostics

(2)Principal component analysis

The key of principal component analysis is to transform many variables with correlation into fewer and unrelated principal factors, and the principal factors should contain the information in the original variables as much as possible [11](L.Y. Hu, 2018).

Component		Initial Eigenva	alues	Extract	Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1	1.845	46.118	46.118	1.845	46.118	46.118	
2	1.438	35.947	82.065	1.438	35.947	82.065	
3	.486	12.155	94.220				
4	.231	5.780	100.000				

Table 3 Total variance explained

As shown in table 3, the cumulative contribution rate of eigenvalues of the first two indicators

reached 82%, indicating that using these two indicators to represent the foreign trade structure in Hubei province will not lose too much effective information. Therefore, the first two indexes are defined as the principal components with explanatory ability, comprehensively reflecting the foreign trade structure in Hubei province.

Taking the extracted principal components Z1, Z2 as the new comprehensive independent variables, and still taking the transformation of economic development mode in Hubei province(Y1) as the dependent variable, the regression analysis is conducted again:

$$y_i = 4.658 + 1.339z_{1i} + 2z_{2i} \tag{2}$$

R2=0.94,F=43.508

As shown as Eq. 2, the F-statistic is 43.508, which is significant at 1% level, that is, the linear hypothesis of the model is suitable. And the R^2 was 0.94, which reflected that the model had a good fitting effect. At the same time, it can be seen from the significance of the coefficient that the two principal components extracted have a strong ability to explain the transformation of economic development mode in Hubei province. But these two principal components do not have clear economic implications, so it is necessary to convert them into the original variables, and the results are as follows:

$$y_i = 4.658 - 0.292x_{1i} + 1.414x_{2i} + 1.007x_{3i} + 0.811x_{4i}$$
(3)

According to the regression results, the influence of various foreign trade structure factors on the transformation of economic development mode in Hubei province can be calculated. As shown in Table 4, each foreign trade structure factor has a significant impact on the transformation of economic development mode in Hubei province. Precisely:

If the proportion of general trade export in the total export increases 1 percent, the transformation index of economic development mode will decrease by 0.292 units, which is different from what we expected. However, the absolute value of its coefficient is very small, so it has little influence on the transformation of economic development mode. It is caused by the large proportion of general trade in Hubei's total exports, which makes general trade reach saturation. On the other hand, due to the lack of innovation ability in Hubei province, general trade has reached a bottleneck, and it is difficult to rise to a new stage.

The structure of major exporters is a factor that has the greatest influence on the transformation of economic development mode in Hubei, with an impact of 48.1%. If the proportion of the export of private enterprises in the total export increases 1 percent, the transformation index of economic development mode will increase by 1.414 units. There are a large number of private enterprises in Hubei province, and the increase of their export proportion represents the improvement of local enterprises' competitiveness in the international market. In addition, private enterprises have the structural advantages of less capital and smaller scale which could avoid risks and make adjustments, and it is extremely sensitive to market trends. Therefore, it plays a certain role in promoting industrial upgrading and technological progress.

If the proportion of Latin America in Hubei's foreign trade increases 1 percent, the transformation index of economic development mode will increase by 1.007 units, with an impact of 34.25%. Under the background of national emphasis on diversification of foreign trade market, the export market structure in Hubei province is also improving and gradually diversifying. The development of Latin American market is one of the manifestations of the sustained and stable development of foreign trade in Hubei province. In the process of breaking into new markets, the internal structural adjustment and technological innovation of enterprises are conducive to promoting industrial development and structural optimization, thus promoting the transformation of economic development mode in Hubei province.

If the proportion of service industry in foreign direct investment increases 1 percent, the transformation index of economic development mode will increase by 0.811 units, which indicates the necessity of strengthening trade in services in Hubei Province.

As a new economic growth point in Hubei Province, the service industry has developed rapidly in recent years. And the increase of the proportion of service industry in foreign direct investment

influence factors	Increase in transformation index of economic development mode due to 1% increase in factors (%)	Influence of factors (%)
the proportion of general trade export in the total export(X1)	-0.292	-9.93
the proportion of the export of private enterprises in the total export(X2)	1.414	48.10
the proportion of Latin America in the total export(X3)	1.007	34.25
the proportion of service industry in foreign direct investment(X4)	0.811	27.59

reflects the optimization of the structure of foreign investment utilization in Hubei province.

Table 4 Influence of factors on the transformation of economic development mode in Huber
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4. Empirical Analysis of the Influencing Factors of Foreign Trade Structure in Hubei Province

From the above analysis, it can be seen that the foreign trade structure of Hubei province has a significant impact on the transformation of economic development mode. So what are the factors that affect the foreign trade structure? We will take the proportion of processing trade export(X5) and the proportion of the export of private enterprises (X2) in Hubei's total export as the index of foreign trade structure. Then the four variables of foreign direct investment in Hubei province (FDI), total capital formation in Hubei province (CAP), the proportion of secondary industry in Hubei province (GDP 2) and the proportion of total social research and development expenditure in Hubei province's GDP (RD) are selected to analyze their impact on foreign trade structure

For the validity of regression, the data of FDI and CAP should be pretreated: FDI divided by 10 times GDP for the year; CAP divided by GDP for the year. In addition, in order to eliminate the possible heteroscedasticity in the sample data, we will take the logarithm of all variables.

4.1 Unit Root Test.

In order to avoid false regression, before the dynamic analysis of time series variables, we should test the stationarity of each variable. Unit root (ADF) tests were performed on the above four explanatory variables and two explained variables by Eviews6.0.

As shown as Table 5 and Table 6, at the significance level of 5%, all explanatory variables show their first-order difference stationary, which also indicates that the original variables are non-stationary. Among the explained variables, the original variable of trade mode structure (lnX5) is stable, while the major exporters structure (lnX2) is first-order stable.

Variables	ADF test statistic	1% level	5% level	stationary
Δln(FDI) (***)	-3.390148	-2.71751	-1.96442	yes
$\Delta \ln(CAP)(**)$	-2.571723	-2.72825	-1.96627	yes
Δln(GDP2)(**)	-2.14312	-2.71751	-1.96442	yes
Δln(RD)(***)	-4.322154	-2.71751	-1.96442	yes

Table 5 Unit root (ADF) test on the independent variables

Note:(***),(**)indicates that the ADF test statistic is significant at the 1% and 5% levels, respectively, which means the data is stationary

Variables	ADF test statistic	1% level	5% level	stationary
Ln(X5)(**)	-3.429087	-3.886751	-3.052169	yes
$\Delta \ln(X2)(***)$	-7.930982	-2.717511	-1.964418	yes

Table 6 Unit root (ADF) test on the dependent variables

Note:(***),(**)indicates that the ADF test statistic is significant at the 1% and 5% levels, respectively, which means the data is stationary

4.2 Johansen Co-integration Test.

Because the original variables are not stable, the traditional linear regression analysis cannot be used to test the correlation among them. However, all independent variables have the same order sequence, and the order is not less than the explained variables', indicating that there may be some linear combination among variables that is stable, that is, there is a long-term stable relationship, which can be judged by Johansen co-integration test. Since there are many variables involved in this paper, and the sample data is not enough to conduct a co-integration test for all variables in the same time, we refer to the method of grouping variables adopted by H.M. Liu [12], and conduct co-integration tests for each group of variables.

(1)Co-integration test of influencing factors and the trade mode structure

The influencing factors are divided into two groups, then Johansen co-integration test of each group's factors and the trade mode structure is conducted separately. Group 1: test the co-integration relationship between ln(X5), ln(FDI) and ln(CAP); Group 2: test the co-integration relationship between ln(X5), ln(GDP2) and ln(RD).

Firstly, the VAR model should be established. According to the information criteria of AIC and SC, and considering the sample size, the optimal lag order of the model was determined as lag order 2, so the co-integration test could be judged as lag order 1. As shown as table7 and table 8, according to the trace test, at the significance level of 5%, Ln(X5) has three long-term stable co-integration relationships with ln(FDI) and ln(CAP), one long-term stable co-integration relationship with ln(GDP2) and ln(RD). The co-integration equations between variables of each group and the trade mode structure are:

$$\ln X_{5_{(t-1)}} = 0.8829 - 0.878 \ln FDI_{(t-1)} - 0.8877 \ln CAP_{(t-1)}$$
(4)

(5)

$$\ln X_{5_{(t-1)}} = -10.539 + 2.4468 \ln GDP2_{(t-1)} - 0.1289 \ln RD_{(t-1)}$$

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.884772	50.24803	29.79707	0.0001
At most 1 *	0.457939	15.67458	15.49471	0.047
At most 2 *	0.307387	5.876552	3.841466	0.0153

Table7 Johansen Co-integration test 1

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level

Table7Johansen Co-integration test 2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.645164	32.03092	29.79707	0.0272
At most 1	0.594905	15.45333	15.49471	0.0507
At most 2	0.060304	0.995176	3.841466	0.3185

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

According to the co-integration equation, it can be obtained that the proportion of the secondary industry (GDP2) has a positive correlation with the trade mode structure index (X5) and is in a

long-term equilibrium relationship. When the proportion of the secondary industry increases by 1%, the trade mode structure index increases by 2.4468%. This shows that Hubei province, as one of the old industrial cities in China, develops rapidly in the secondary industry, which is dominated by processing trade. The trade mode structure index (X5) has a negative long-term equilibrium relationship with foreign direct investment (FDI), total capital formation (CAP) and the proportion of total social research and development expenditure in GDP (RD). Among them, for every 1% increase in FDI, the trade mode structure index will decline by 0.878%, which reflects that the actual utilization of foreign direct investment in Hubei province is mainly invested in the general trade industry, but the proportion in the processing trade field is not high. As a result, when FDI increases, the proportion of processing trade export decreases. For every 1% increase in RD, the trade pattern structure index (X5) will drop by 0.1289%. The increase in scientific and technological input can promote the progress of industrial technology, so as to achieve independent innovation. More industries have invested in general trade after technology upgrades, so that the proportion of processing trade export decreases.

(2)Co-integration test of influencing factors and the major exporters structure

Similarly, the influencing factors are divided into two groups, then Johansen co-integration test of each group's factors and the major exporters structure is conducted separately. Group 1: test the co-integration relationship between ln(X2), ln(FDI) and ln(CAP); Group 2: test the co-integration relationship between ln(X2), ln(GDP2) and ln(RD). At the significance level of 5%, Ln(X2) has one long-term stable co-integration relationships with ln(FDI) and ln(CAP), one long-term stable co-integration relationships with ln(FDI) and ln(CAP), one long-term stable co-integration relationships with ln(RD). The co-integration equations between variables of each group and the trade mode structure are:

$$\ln X_{2(t-1)} = 2.8424 + 3.4601 \ln FDI_{(t-1)} + 16.3338 \ln CAP_{(t-1)}$$
(6)

$$\ln X_{2(t-1)} = 7.0783 - 1.2127 \ln GDP2_{(t-1)} + 1.4296 \ln RD_{(t-1)}$$
⁽⁷⁾

According to the co-integration equations, it can be obtained that the major exporters structure index (X2) has a positive long-term equilibrium relationship with foreign direct investment (FDI), total capital formation (CAP), and the proportion of total social research and development expenditure in GDP (RD), but a negative correlation with the proportion of the secondary industry (GDP2). Among them, for every 1% increase in FDI, the major exporters structure index increased by 3.4601%. For every 1% increase in CAP, the major exporters structure index increased by 16.3338%; For every 1% increase in RD, the major exporters structure index increased by 1.4296%. For every 1% increase in GDP2, the major exporters structure index increased by 1.2127%.

Based on the analysis of the above regression results, it can be seen that the actual utilization of foreign direct investment in Hubei province has more investment in private enterprises, which promotes the status of private enterprises in international trade. Therefore, the increase of foreign direct investment promotes the optimization of the major exporters structure. The positive effect of RD on the export proportion of private enterprises in the total export reflects that private enterprises in Hubei province pay more attention to investment in science and technology, and technological progress strengthens the improvement of international competitiveness of private enterprises. The increase of the proportion of the secondary industry reflects the improvement of productivity in Hubei province, but the decrease of the major exporters structure index indicates that other enterprises develop more rapidly than the private enterprises in Hubei's secondary industry.

4.3 Error Correction Model.

The above co-integration equation reflects the long-term equilibrium relationship among variables, but the variables often deviate from equilibrium in the short term, so it needs to be adjusted. In this paper, a vector error correction model (VEC) is established to reflect the short-term fluctuation relationship among variables. The lag order of the error correction model is the same as that of the co-integration test. The error correction term is introduced into the above four co-integration equations to obtain:

$$\Delta lnX_5 = -0.039 + 0.605\Delta lnX_{5(t-1)} - 0.379\Delta lnFDI_{(t-1)} + 1.268\Delta lnCAP_{(t-1)} - 1.085vecm_{(t-1)}$$
(8)

As shown in Eq. 8, the influencing factors of the short-term change of the trade mode structure index are divided into two parts: one part is influenced by the three variables of lag period $\ln(X5)$, $\ln(FDI)$ and $\ln(CAP)$; the other part is influenced by the adjustment effect of error correction terms. The short-term changes of $\ln X5$ with one-period lag and $\ln(CAP)$ with one-period lag will lead to positive changes of the trade mode structure index in the current period, while the $\ln(FDI)$ with one-period lag has a negative impact on the trade mode structure index in the current period. On the other hand, the coefficient of error correction term -1.085 < 0, indicating that there is negative feedback in this model, which makes the short-term fluctuation correct to the long-term equilibrium. In other words, when the variable deviates from the long-term equilibrium, the increment of the trade mode structure index will adjust to the long-term equilibrium at the rate of 1.085 under the influence of the last phase of foreign direct investment and the total capital formation, and finally form the long-term equilibrium.

$$\Delta ln X_5 = -0.037 + 0.204 \Delta \ln X_{5(t-1)} + 1.051 \Delta \ln GDP2_{(t-1)} + 0.731 \Delta \ln RD_{(t-1)} - 0.623 vecm_{(t-1)}$$
(9)

As shown in Eq. 9, similarly, the influencing factors of the short-term change of the trade mode structure index are divided into two parts: the error correction term coefficient -0.623 < 0, indicating that there is also negative feedback in this model, which makes the short-term fluctuation correct to the long-term equilibrium. That is, when the variable deviates from the long-term equilibrium, the increment of the trade mode structure index will adjust to the long-term equilibrium at the rate of 62% under the influence of the proportion of the secondary industry and the proportion of total social research and development expenditure in GDP in the last period, and finally form the long-term equilibrium. The short-term changes of $\ln(X5)$, $\ln(GDP2)$ and $\ln(RD)$ with one-period lag will lead to positive changes of the trade mode structure index in the current period.

$$\Delta ln X_2 = -0.050 + 0.490 \Delta ln X_{2(t-1)} - 0.650 \Delta ln F DI_{(t-1)} - 0.793 \Delta ln CAP_{(t-1)} - 0.059 vecm_{(t-1)}$$
(10)

As shown in Eq. 10, the influencing factors of the short-term change of the major exporters structure index are divided into two parts: The short-term changes of lnX2 with one-period lag will lead to positive changes of the major exporters structure index in the current period, while the ln(FDI) and ln(CAP) with one-period lag have a negative impact on the major exporters structure index in the current period. On the other hand, the coefficient of error correction term -0.059<0, indicating that there is negative feedback in this model, which makes the short-term fluctuation correct to the long-term equilibrium. In other words, when the variable deviates from the long-term equilibrium at the rate of 5.9% under the influence of the last phase of foreign direct investment and the total capital formation, and finally form the long-term equilibrium. Compared with model (8) and model (9), it corrects more slowly.

$$\Delta ln X_2 = 0.318 - 0.102 \Delta ln X_{2(t-1)} - 2.279 \Delta ln GDP2_{(t-1)} - 0.093 \Delta ln RD_{(t-1)} - 0.473 vecm_{(t-1)}$$
(11)

As shown in Eq. 11.Similarly, the influencing factors of the short-term change of the major exporters structure index are divided into two parts: the error correction term coefficient -0.473 < 0, indicating that there is also negative feedback in this model, which makes the short-term fluctuation correct to the long-term equilibrium. That is, when the variable deviates from the long-term equilibrium, the increment of the major exporters structure index will adjust to the long-term equilibrium at the rate of 47.3% under the influence of the proportion of the secondary industry and the proportion of total social research and development expenditure in GDP in the last period, and

finally form the long-term equilibrium. The short-term changes of ln(X2), ln(GDP2) and ln(RD) with one-period lag will lead to negative changes of the major exporters structure index in the current period. And the coefficient of ln(RD) with one-period lag is small, indicating that the short-term increase in technical input has no obvious negative impact on the export proportion of private enterprises, while the change of industrial structure has a greater impact on it.

As shown in table 9, it can be seen that the AIC and SC of the four error correction models are small, and the log-likelihood value of them is large, indicating that the fitness of the model is reasonable and the overall explanatory ability is strong.

	Mode(8)	Mode(9)	Mode(10)	Mode(11)
Log likelihood	87.9395	84.78809	85.70521	83.54342
Akaike information criterion	-8.742438	-8.348512	-8.463152	-8.192928
Schwarz criterion	-7.873276	-7.479349	-7.593989	-7.323766

Table 9 Overall Test of VEC Model

5. Conclusions

The foreign trade structure in Hubei province has a remarkable influence on the transformation of economic development mode. Among them, the structure of major exporters is the most important factor, and the structure of trade market and the structure of foreign capital utilization would positively promote the transformation of economic development mode. However, as general trade accounts for a large proportion in Hubei province and processing trade develops slowly, the trade mode structure of Hubei province has a negative impact on the transformation of economic development mode.

Further, according to the VEC model, there is a long-term equilibrium relationship among the foreign trade structure of Hubei province and foreign direct investment, capital stock, industrial structure and scientific and technological investment. It can be seen that the proportion of foreign direct investment actually utilized in Hubei province is not high in the field of processing trade; the relationship between the development of science and technology and the export of processing trade industry is not close enough; and the investment of state-owned enterprises and joint ventures in the secondary industry is relatively large, and so on. On the other hand, in the short term, the changes of capital stock, industrial structure and scientific and technological input have a significant impact on the increase of trade mode structure of major exporters, foreign direct investment, capital stock, industrial structure and scientific and technological input all have negative adjustment effect, among which the change of industrial structure has a great influence on it, while the increase of technological input has no obvious influence.

In view of the above conclusions, the foreign trade structure can be optimized from the following aspects to promote the transformation economic development mode in Hubei province:

First, according to the analysis above, there is a significant negative correlation between R&D investment and the proportion of processing trade export, and a significant positive correlation between R&D investment and the optimization of major exporter structure. Therefore, the key measure to improve Hubei's export trade capacity is to increase investment in research and development. The increase of R&D investment can promote the progress of industrial technology, so as to achieve independent innovation and enable more industries to invest in general trade and improve general trade efficiency after technology upgrading. On the other hand, private enterprises should attach importance to investment in science and technology, accelerate technological progress, encourage qualified private enterprises in the province to expand overseas, and improve the competitiveness of local enterprises in the international market.

Secondly, the main problem of Hubei province's foreign trade mode structure lies in the low proportion and low efficiency of processing trade. In this regard, the links between technological progress and processing trade should be strengthened to increase the technology value- added of export products. In addition, we should seize the opportunity of cooperation with foreign enterprises, fully study, utilize and improve the high-tech contained in the processed products, and make good use of the technology spillover effect of processing trade. On the other hand, due to the actual use of foreign direct investment in Hubei province is mainly invested in the general trade industry, FDI and foreign trade mode structure represented by the proportion of processing trade export in the total export is negatively correlated. Therefore, it is necessary to increase foreign direct investment in processing trade, implement upgrading strategy for processing trade, and promote the increase of trade surplus in Hubei province.

Third, as a new growth point of economic development in Hubei province, the service industry plays a positive role in promoting the upgrading of foreign trade structure and the transformation of economic development mode. Therefore, it is necessary to adjust the structure of foreign capital utilization in Hubei province, attach importance to the introduction of high-level service projects required, and promote the service industry in the province with import projects. To enhance the capacity of service trade and promote the optimization of the structure of service industry in the province, so as to promote its integration with international trade.

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