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Researching the Factors of Economic Growth in the Yangtze River Delta Region

—Based on the Panel Data of the City Domain

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Abstract

Based on the data of 25 cities in the Yangtze River Delta region of China, using the method of Lucas' endogenous economic growth model and establishing the fixed effect panel model, this paper makes an empirical analysis on the relationship between the industrial structure, the capital stock, the utilization of foreign capital, the degree of opening up, the government function, the infrastructure, the human capital, the development level of domestic trade and the economic growth in the Yangtze River Delta region. The results show that there is a significant long-term equilibrium relationship between the eight major economic factors and economic growth, and Eight economic factors have a different contribution to economic growth; the industrial structure is the most significant contribution to economic growth and the utilization of foreign capital is the most insignificant contribution to economic growth.

Keywords

1. Introduction

The Yangtze River Delta is located on the eastern coast of China. It includes Shanghai, Nanjing, Wuxi, Xuzhou, Changzhou, Suzhou, Nantong, Lianyungang, Huaian, Yancheng, Yangzhou, Zhenjiang, Taizhou, Suqian, Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, Zhoushan, Wenzhou, Jinhua, Quzhou, Taizhou and Lishui. The Yangtze River Delta is the key region of China's economic development. After 40 years of reform and opening up, the position of the Yangtze River Delta in the national economy has been continuously strengthened. The gross

domestic product of the Yangtze River Delta region is 150037.3 billion yuan, accounting for 20.16% of the national gross domestic product; the added value of the tertiary industry is 81514.92 billion yuan, accounting for 21.22% of the national added value of the tertiary industry; the total import and export value is 85018.52 billion yuan, accounting for 34.73% of the national total import and export value; and the total retail value of social consumer goods is 61624.52 billion yuan, accounting for 18.54% of the national total retail value of social consumer goods. The above added value of tertiary industry, total import and export and total retail sales of social consumer goods may be factors that affect the economic growth of the Yangtze River Delta region. Therefore, it is important to study the factors that affect the driving force of economic growth in the Yangtze River Delta, and whether there is a long-term equilibrium relationship between economic factors and regional economic development in the regional economic system, and the contribution of each factor to economic growth. It has important reference value and reference significance for maintaining the healthy economic development of the Yangtze River Delta region and formulating economic policies of other regions.

2. Literature Review

All along, the factor affecting regional economic development is an important research topic in the field of economics. Scholars at home and abroad have done a lot of research in this field. Desmet and Rossihansberg [1] believed that the overall transformation and upgrading of industrial structure was achieved under the alternation of scientific and technological innovation and leading industries. The transfer of factors from low-productivity growth sectors to high-productivity growth sectors simultaneously promoted economic growth and total factor productivity. Amitrajeet and Hamid [2] studied the interaction between human capital and knowledge spillover in the semi-endogenous economic growth model, and discussed the basic conditions for the scale effect of human capital on economic growth. McRae [3] believed that the increase of infrastructure supply would produce significant positive externalities. Helpman and Krugman [4] believed that foreign trade could promote economic growth through economies of scale. Zhang Tongbin [5] studied the dynamic transformation mechanism of China's economic growth, and found that the cumulative human capital has spillover effect on economic growth. Li Jing *et al.* [6] believed that in the process of economic transformation, the market allocation of human capital might fail, leading to mismatches, resulting in inadequate innovation power. Li Jian *et al.* [7] took human capital as the threshold variable and considered the impact of FDI on China's innovation ability. Ye Changyou and Wang Yanyan [8] empirically found that transportation infrastructure strengthened regional economic links and promoted regional economic growth, especially in railway and highway construction. Sun Zao *et al.* [9] estimated the impact of infrastructure investment on three major regional economic growth, and found that there was an inverted U-shaped relationship between infrastructure investment and economic

growth in the eastern and central regions, while there was no such curve relationship in the western region. Xia Xiangqian and Zhou Guofu [10] believed that if the government could reduce investment and administrative expenditure, and accordingly increase the social security and welfare expenditure needed for the development of science and technology, education and urbanization, in the long run, it could play a role in promoting total factor productivity and fundamentally improving the quality of China's economic growth. Sun Qunli *et al.* [11] measured 10 cities of Beijing-Tianjin-Hebei urban agglomeration, and found that the level of economic development had no significant negative impact on fiscal expenditure, while the level of foreign investment was negatively correlated with the efficiency of fiscal expenditure. Wang Zhijian and Wang Binhui [12] used ARMA model to model and forecast the total retail sales of consumer goods in China. Fu Deshen and Kong Lingqian [13] found that the upgrading of industrial structure and trade openness have a mutually reinforcing interactive relationship, and the degree of mutual promotion in China's eastern, central and western regions has significant differences. Liu Xiaoling *et al.* [14] took Hunan Province as an example to analyze the impact of foreign direct investment and import and export trade on regional economy. Zhang Jinghong *et al.* [15] used co-integration test and fractional regression to analyze the growth of processing export trade to China's economy. Chen Dongya and Tong Changfeng [16] believed that investment was an important engine of economic growth, and fixed assets investment was driving economic growth. There was also a long-term stable and two-way Granger causality between them, which promoted each other.

All the above papers have deeply studied the internal relationship between various economic factors and economic growth. Few papers have synthesized the main factors that may affect economic growth. Based on the panel data of 25 cities in the Yangtze River Delta region, this paper studies the factors of economic growth in the Yangtze River Delta, taking into account the industrial structure, capital stock, foreign capital utilization, degree of opening to the outside world, government functions, infrastructure, human capital and the level of domestic trade development. Panel data model is tested by unit root test, co-integration test to avoid false regression. Using Lucas' endogenous economic growth model theory, the long-term equilibrium relationship between regional economic growth and its influencing factors is deeply analyzed by establishing a fixed-effect panel model, and error correction and causality test are carried out.

3. Theoretical Model and Data

3.1. Model Design

In order to study the dynamic factors of economic growth in the Yangtze River Delta region, this paper adopts Lucas' endogenous economic growth theory model [17].

$$y = AK^{\beta} (uhL)^{1-\beta} h_{\varepsilon}^{\gamma} \ (\gamma > 0) \tag{1}$$

Formula (1), y is the total output; A is a constant term indicating the ini-

tial technological level; K is the stock of material capital; uhL represents the stock of human capital; h_ε^γ reflects the external effect of human capital, represents the exogenous technological level. The logarithm for both sides of Formula (1) is:

$$\ln y = \ln A + \beta \ln K + (1-\beta)\ln(uhL) + \gamma \ln h_\varepsilon \qquad (2)$$

The purpose of this model is mainly to study the dynamic factors of economic growth in the Yangtze River Delta region. Combining with the actual situation of economic development in the Yangtze River Delta region, various variables that may affect economic growth are added to the basic model, and then combining Formula (1) and Formula (2), the extension model of economic growth in the Yangtze River Delta region is obtained as follows:

$$\ln gdp_{it} = \beta_0 + \beta_1 \ln tii_{it} + \beta_2 \ln fai_{it} + \beta_3 \ln fdi_{it} + \beta_4 \ln iet_{it}$$
$$+ \beta_5 \ln fbe_{it} + \beta_6 \ln rd_{it} + \beta_7 \ln ocs_{it} + \beta_8 \ln scrt_{it} + \varepsilon_{it} \qquad (3)$$

Formula (3), subscript i is the mark of each city, $i = 1, 2, \cdots 25$. Subscript t is the mark of each year, $t = 2000, 2001, \cdots 2016$. β_0 is the intercept, ε_{it} is the random interference term. The variables involved in the Formula (3) and their simple meanings are shown in **Table 1**.

3.2. Selection and Data Sources of Dynamic Factors for Economic Growth in Yangtze River Delta Region

3.2.1. The Explanation of Dynamic Factors for Economic Growth

This paper assumes that the variables affecting the economic growth in the Yangtze River Delta include economic growth, industrial structure, capital stock, foreign capital utilization, degree of opening to the outside world, government functions, infrastructure, human capital and the level of domestic trade development. Among them, the explained variable is economic growth; it is expressed in terms of gross domestic product of each city. The setting of explanatory variables is as follows:

Industrial structure: It refers to the composition of various industrial sectors in the national economy and within each industrial sector. The history of human society shows that the level of development of tertiary industry refers to the accumulation of people in science, technology and management methods. For the active economic zone of the Yangtze River Delta, this index can express the upgrading of industrial structure caused by technological accumulation and innovation. The value-added of the tertiary industry of each city is used to measure the industrial structure.

Capital stock: It refers to the accumulated physical capital at a certain time point, which reflects people's actual grasp of material means of production. Capital stock is used as an index to measure capital investment and to measure the contribution of capital investment to economic growth. Fixed assets investment of each city is used to measure capital stock.

Foreign capital utilization: As the frontier of China's reform and opening up, the Yangtze River Delta has unique human and geographical advantages. On this

Table 1. Variable description.

Variable name	Variable meaning
gdp	gross domestic product of each city (100 million yuan)
tii	the value-added of the tertiary industry of each city (100 million yuan)
fai	fixed assets investment of each city (100 million yuan)
fdi	foreign direct investment of each city (100 million yuan))
iet	total import and export volume of each city (100 million yuan)
fbe	the total budgetary revenues and expenditures of local governments of each city (100 million yuan)
rde	highway density of each city (kilometre/100 Square kilometre)
ocs	the number of students in regular colleges and universities per 10000 people of each city (person)
scrt	total retail sales of social consumer goods of each city (100 million yuan)

basis, the policy advantages further make the Yangtze River Delta region become a key area for foreign investment for a long time, so foreign capital utilization has a certain impact on the economic growth of the Yangtze River Delta region. Foreign direct investment of each city is used to measure foreign capital utilization.

Degree of opening to the outside world: There are a large number of small and medium-sized private enterprises in the Yangtze River Delta region, and these enterprises mainly export trade and supply products to foreign markets, so they have a certain impact on the economic growth of the Yangtze River Delta region. Total import and export volume of each city is used to measure degree of opening to the outside world.

Government functions: Under the impetus of reform and opening up, the government plays an important role in the market economic system, and the transformation of government functions also has a certain impact on economic growth. The total budgetary revenues and expenditures of local governments of each city is used to measure government functions.

Infrastructure: It refers to the public service system that is used to ensure the normal development of national or regional economic activities. The improvement of infrastructure of a country or region is an important basis for its long-term sustainable and stable economic development. Highway density of each city is used to measure infrastructure. Among them: highway density = highway mileage/city area.

Human capital: It refers to the sum of economic value of knowledge, skills and physical strength existing in the human body. The core of human capital is to improve the quality of population. The number of students in regular colleges and universities per 10,000 people of each city is used to measure human capital. Among them: the number of students in regular colleges and universities per 10,000 people of each city = the number of students in ordinary institutions of

higher learning/the permanent population of the city × 10,000.

The level of domestic trade development: Domestic trade mainly refers to the trade of commodities and warehouse receipts in China. Domestic trade not only reduces the cost of products from internal and external economy of scale, but also promotes the division of labor and specialized economy, and improves the price competitiveness of products. Total retail sales of social consumer goods of each city are used to measure the level of domestic trade development.

3.2.2. Data Sources

In this paper, 25 cities in the Yangtze River Delta, Shanghai, Nanjing, Wuxi, Xuzhou, Changzhou, Suzhou, Nantong, Lianyungang, Huai'an, Yancheng, Yangzhou, Zhenjiang, Taizhou, Suqian, Hangzhou, Ningbo, Jiaxing, Huzhou, Shaoxing, Zhoushan, Wenzhou, Jinhua, Quzhou, Taizhou and Lishui, are selected as cross-sections of panel data. The time dimension is between 2000 and 2016. All the data in this paper come from Shanghai Statistical Yearbook, Jiangsu Statistical Yearbook, Statistical Yearbooks of each city in Jiangsu, Zhejiang Statistical Yearbook and Zhejiang Statistical Yearbook of each city. In the statistical yearbook, the unit of foreign direct investment and import and export volume is US dollars. In order to unify the statistical units, the exchange rate quotation at the end of each year is used to convert the US dollar into RMB (the exchange rate quotation comes from China Statistical Yearbook).

4. Empirical Analysis

4.1. Panel Unit Root Test

Because panel data is an extension of cross-sectional data and time series data, panel data model studies the cross-sectional time series problem. Therefore, unit root test should be carried out before regression analysis of panel data, so as to avoid pseudo-regression. The unit root test of panel data can be divided into two categories. The first category is the unit root test under the same root condition, which includes LLC test, Hadri test and Breitung test. The second category is the unit root test under different root conditions, which includes IPS test, Fisher-ADF test and Fisher-PP test [18]. Among them, the original hypothesis of Hadri test is that there is no unit root, while the original hypothesis of the other four test methods is that there is unit root. In this paper, the unit root test of panel data is mainly based on LLC test, Fisher-ADF test and Fisher-PP test. The test results are shown in Table 2.

4.2. Co-Integration Test

The co-integration test methods of panel data can be divided into two categories: one is based on Engle and Granger two-step test, the specific methods are Pedroni test and Kao test; the other is based on Johansen test [19]. This paper mainly uses Kao test method; the original assumption of Kao test method is that there is no co-integration relationship between panel variables. The inspection results are shown in Table 3.

Table 2. Unit root test results for panel data.

variable	level value			First order difference value		
	LLC test	ADP test	PP test	LLC test	ADP test	PP test
lngdp	7.486 (1.000)	3.323 (1.000))	2.667 (1.000)	−5.338 (0.000*）	66.778 (0.024**)	69.400 (0.015**)
lntii	3/394 (0.999)	10.414 (1.000)	11.596 (1.000)	−−9.685 (0.000*)	101.477 (0.000*)	153.811 (0.000*)
lnfai	14.814 (1.000)	1.886 (1.000)	0.019 (1.000)	−6.139 (0.000*)	121.327 (0.000*)	139.100 (0.000*)
lnfdi	5.365 (1.000)	8.637 (1.000)	6.755 (1.000)	−14.709 (0.000*)	255.783 (0.000*)	249.036 (0.000*)
lniet	−0.843 (0.199)	9.563 (1.000)	14.737 (1.000)	−16.3811 (0.000)	224.759 (0.000*)	341.786 (0.000*)
lnfbe	−0.938 (0.174)	48.291 (0.381)	46.008 (0.472)	−6.693 (0.000*)	111.029 (0.000*)	162.114 (0.000*)
lnrd	7.223 (1.000)	3.084 (1.000)	2.299 (1.000)	−32.950 (0.000*)	263.251 (0.000*)	287.169 (0.000*)
lnocs	2.886 (0.998)	10.474 (0.999)	1.307 (1.000)	−18.639 (0.000*)	128.757 (0.000*)	216.661 (0.000*)
lnrde	3.833 (0.999)	27.491 (0.986)	31.887 (0.943)	−7.283 (0.000*)	101.759 (0.000*)	109.335 (0.000*)

Note: *, *** and *** indicate that the estimation of parameters is significant at 1%, 5% and 10% respectively. The values in parentheses are p, the same below.

Table 3. Results of panel co-integration test.

test method	name of statistics	statistic value
Kao test	ADF	−8.135 (0.000*)

The above results show that Kao test rejects the original hypothesis, indicating that there is a co-integration relationship among lngdp, lntii, lnfai, lnfdi, lniet, lnfbe, lnrd, lnocs and lnscrt.

4.3. Selection of Panel Data Models

There are usually three forms to select the panel data model: the first one is the mixed estimation model. From time perspective, there is no significant difference between different individuals; From cross-section perspective, there is also no significant difference between different cross-section, then panel data can be directly mixed together and parameters can be estimated by ordinary least squares method. The second is the fixed effect model. If the intercept of the model is different for different cross-section or time series, the regression parameters can be estimated by adding virtual variables to the model. The third is the random effect model. If the intercept term in the fixed effect model includes the average effect of cross-section random error term and time random error term, and both random error terms obey normal distribution, the fixed effect model becomes a random effect model.

In the selection method of panel data model, we often use F test to decide whether to choose mixed model or fixed effect model, and then use Hausman test to determine whether to establish random effect model or fixed effect model.

4.3.1. *F* Test

Fixed effect model is divided into three types: individual fixed effect model, time fixed effect model and individual time fixed effect model. If we are fixing indi-

viduals, we should choose individual fixed effect model. However, we still need to choose to use individual fixed effect model or mixed estimation model. Therefore, it is necessary to take F value test.

H_0: For different cross section models, the intercept term is the same (mixed estimation model is the appropriate model).

H_1: For different cross sectional model, the intercept term is different (the individual fixed effect model is the appropriate model).

The F statistic is defined as:

$$F = \frac{\left(SSE_r - SSE_u\right)/\left(T + K - 2\right)}{SSE_u/\left(NT - T - K\right)} \tag{4}$$

In Formula (4), SSE_r and SSE_u respectively represent the sum of residual squares of mixed estimation model and individual fixed effect model respectively, and SSE_r and SSE_u are calculated by Eviews 10.0 software; N denotes the number of cross-section members (25 cities of the Yangtze River Delta region in this paper, N = 25); T denotes the total number of observation periods of each cross-section member (the time dimension from 2000 to 2016 in this paper, T = 17); K denotes the number of explanatory variables. After calculation, The F value is obtained,

$F = 43.71 > F_\alpha\left(T-1, NT-T-K\right) = F_{0.05}\left(16, 400\right) = 1.69$. So reject the original hypothesis and choose the individual fixed effect model.

4.3.2. Hausman Test

We usually choose fixed effect model or random effect model by Hausman test. The original hypothesis and alternative hypothesis are as follows:

H_0: Individual effects have nothing to do with explanatory variables (random effects model is a suitable model).

H_1: Individual effect is correlated with explanatory variables (fixed effect model is the appropriate model).

Eviews 10.0 software is used for Hausman test. The results are shown in **Table 4**.

Table 4 shows that the original hypothesis should be rejected and the alternative hypothesis should be accepted. The fixed effect model is a suitable model. Therefore, the results of F test and Hausman test show that the fixed effect model should be chosen.

There are multiple cross-sectional individuals. In order to reduce the effect of heteroscedasticity and synchronous correlation that are caused by cross-sectional data, a likelihood-independent regression method is used to estimate the generalized least squares of the model, and the regression analysis of Formula (3) is carried out. The results are shown in **Table 5**.

Then, the unit root test is carried out on the residual sequence ε_{it} produced by regression analysis of panel data. The test results are shown in **Table 6**.

LLC test, Fisher-ADF test and Fisher-PP test reject the original hypothesis at 1% confidence level, indicating that the residual sequence is stable. Therefore,

Table 4. Hausman test results for random effects.

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross section random	106.228	8	0.000*

Table 5. Panel data regression results.

variable	regression coefficient	t test value	p value
c	1.552	32.794	0.000*
lntii	0.610	15.056	0.000*
lnfai	0.019	3.356	0.001*
lnfdi	0.017	3.799	0.000*
lniet	0.103	10.179	0.000*
lnfbe	−0.080	−4.341	0.000*
lnrd	0.046	3.221	0.001*
lnocs	−0.019	−1.869	0.062***
lnrde	0.220	5.950	0.000*

Table 6. Unit root test of the original value of residual sequence.

variable	LLC test	ADP test	PP test
The original sequence of residuals	−9.112 (0.000*)	154.369 (0.000*)	148.370 (0.000*)

there is a significant co-integration relationship between economic growth and industrial structure, capital stock, foreign capital utilization, degree of opening to the outside world, government functions, infrastructure, human capital and the level of domestic trade development. The co-integration equation is as follows:

$$\ln gdp_{it} = 1.552 + 0.610 \ln tii_{it} + 0.019 \ln fai_{it} + 0.017 \ln fdi_{it} + 0.103 \ln iet_{it}$$
$$- 0.080 \ln fbe_{it} + 0.046 \ln rd_{it} - 0.019 \ln ocs_{it} + 0.220 \ln scrt_{it} + \varepsilon_{it} \quad (5)$$

Above all, we can find that there is a long-term equilibrium relationship between economic growth and industrial structure, capital stock, foreign capital utilization, degree of opening to the outside world, government functions, infrastructure, human capital and the level of domestic trade development in the Yangtze River Delta. From the perspective of output elasticity, industrial structure has the greatest impact on regional economic growth. If the industrial structure is increased by 1 percentage point, the economic growth will increase by 0.610 percentage points. The tertiary industry in the Yangtze River Delta region has rapidly developed, and has initially formed a modern industrial layout dominated by the tertiary industry. Its management model and R&D capability are in the advanced ranks. The level of domestic trade development has a greater impact on regional economic growth. If the level of domestic trade development is increased by 1 percentage point, the economic growth will increase by 0.220

percentage points. The degree of opening to the outside world has a greater impact on regional economic growth. If degree of opening to the outside world is increased by 1 percentage point, the economic growth will increase by 0.103 percentage points. The total import and export volume of the Yangtze River Delta region has been growing steadily since the reform and opening-up. Infrastructure also has a greater impact on regional economic growth. If infrastructure is increased by 1 percentage point, the economic growth will increase by 0.046 percentage points. Infrastructure construction in the Yangtze River Delta region is relatively perfect, and various public service systems can guarantee the normal development of regional economic activities. Infrastructure also has a greater impact on regional economic growth. If infrastructure is increased by 1 percentage point, the economic growth will increase by 0.046 percentage points. Infrastructure construction in the Yangtze River Delta region is relatively perfect, and various public service systems can guarantee the normal development of regional economic activities. Capital stock also has a greater impact on regional economic growth. If capital stock is increased by 1 percentage point, the economic growth will increase by 0.019 percentage points. After a period of development in the Yangtze River Delta region, capital stock has accumulated a lot, and capital investment in various economic activities is sufficient. The impact of foreign capital utilization on regional economic growth is obvious. If foreign capital utilization is increased by 1 percentage point, the economic growth will increase by 0.017 percentage points. The regression coefficient of human capital and government functions are negative. Researching on the relationship between human capital and economic growth, one of the key and difficult points is how to measure human capital. Because of the different measurement methods, the corresponding conclusions are often quite different and lack of comparability. For example, using panel data of 14 European countries from 1980 to 2004, Elias and Micaela [20] empirically studied the impact of human capital on economic growth. When different methods are used to measure human capital, the final conclusions are significantly different. Researching on the relationship between government functions and economic Growth, some scholars also believe that the enhancement of government economic capacity restricts economic growth or has no correlation. For example, Fu Wenlin and Shen Kunrong [21] believed that the proportion of GDP expenditure in government budget is negatively correlated with economic growth.

4.4. Error Correction Model and Causality Test

Co-integration theory constructs a long-term dynamic equilibrium relationship between some non-stationary variables. The errors between these sequences and equilibrium are called equilibrium errors. The model is modified by the equilibrium error of co-integration combination, which becomes the error correction model. Its idea can be summarized: The imbalances that occur in one period will be revised in the next period. On the premise of co-integration relationship, er-

ror correction model of panel data can be established.

$$\Delta \ln y_{it} = \beta_0 + \sum_{i=1}^{m} \beta_{0,i} \Delta \ln y_{i,t-i} + \sum_{i=1}^{m} \beta_{1,i} \Delta \ln x_{1i,t-i}$$
$$+ \cdots \sum_{i=1}^{m} \beta_{n,i} \Delta \ln x_{ni,t-i} + \lambda ECM_{it} + \varepsilon_{it} \qquad (6)$$

Formula (6), $\ln y$ is the logarithmic form of dependent variable, $\ln x_n$ is the logarithmic form of the nth independent variable, Δ is the first-order differential operation, m is the lag order, ECM_{it} is the long-term equilibrium error. In Formula (6), if β_n is significantly different from 0, the nth independent variable is the short-term Granger cause of the dependent variable; if λ is significantly different from 0, the independent variable is the long-term Granger cause of the dependent variable.

Based on the co-integration analysis of panel data in the Yangtze River Delta, the error correction model between GDP and first-order single-integer variables is obtained as follows:

$$\Delta \ln gdp_{it} = \beta_0 + \beta_1 \Delta \ln tii_{it} + \beta_2 \Delta \ln fai_{it} + \beta_3 \Delta \ln fdi_{it} + \beta_4 \Delta \ln iet_{it} + \beta_5 \Delta \ln fbe_{it}$$
$$+ \beta_6 \Delta \ln rd_{it} + \beta_7 \Delta \ln ocs_{it} + \beta_8 \Delta \ln scrt_{it} + \lambda ECM_{it} + \varepsilon_{it} \qquad (7)$$

Formula (7), Δ denotes first-order differential operation, and ECM denotes long-term equilibrium error. The causality among variables can be identified by the significance test of the coefficients of the error correction model. Firstly, all $\beta_i (i = 1, 2, \cdots 8)$ in the error correction model are tested. The original hypothesis is $H_0 : \beta_i = 0 (i = 1, 2, \cdots 8)$. The original hypothesis is rejected if it passes the significance test, it can judge the short-term causality between economic growth and the eight major influencing factors; otherwise, it accepts the original hypothesis and proves that there is no short-term causality. Secondly, The long-term causality among variables can be judged by testing the significance of coefficient λ of error correction item ECM_{it}. The original hypothesis is $H_0 : \lambda = 0$. The original hypothesis is rejected if it passes the significance test, it can judge the long-term causality between economic growth and the eight major influencing factors; otherwise, it accepts the original hypothesis and proves that there is no long-term causality. The error correction model can be analyzed by Eviews 10.0 software. The results are shown in Table 7.

As shown in Table 7, the regression results of the error correction model are as follows:

$$\Delta \ln gdp_{it} = 0.664 \Delta \ln tii_{it} + 0.011 \Delta \ln fai_{it} + 0.002 \Delta \ln fdi_{it} + 0.069 \Delta \ln iet_{it}$$
$$- 0.037 \Delta \ln fbe_{it} + 0.015 \Delta \ln rd_{it} + 0.013 \Delta \ln ocs_{it} \qquad (8)$$
$$+ 0.279 \Delta \ln scrt_{it} - 0.232 ECM_{it} + \varepsilon_{it}$$

The above results show that, for the error correction model, except for variables $\Delta \ln fdi$ and $\Delta \ln fai$, the regression coefficients of other variables $\Delta \ln tii$, $\Delta \ln iet$, $\Delta \ln rd$ $\Delta \ln scrt$ are significant and not zero at 1% significant level. The regression coefficients of variables $\Delta \ln fbe$ and $\Delta \ln ocs$ are significant and not zero at 10% significant level. That is to say, except for foreign

Table 7. Test results of panel data error correction model.

Variable	Regression coefficient	T test value	p value
$\Delta\ln tii$	0.644	10.312	0.000*
$\Delta\ln fai$	0.011	0.893	0.372
$\Delta\ln fdi$	0.002	0.625	0.533
$\Delta\ln iet$	0.069	5.377	0.000*
$\Delta\ln fbe$	−0.037	−1.766	0.078***
$\Delta\ln rd$	0.015	3.964	0.000*
$\Delta\ln ocs$	0.013	1.686	0.093***
$\Delta\ln scrt$	0.279	5.398	0.000*
ECM	−0.232	−4.896	0.000*

capital utilization and capital stock, there is a short-term causal relationship between industrial structure, degree of opening to the outside world, government functions, infrastructure, human capital, the level of domestic trade development and economic growth. Secondly, the regression coefficient of error correction ECM_{it} is −0.232, which is significant and not zero at 1% significant level, indicating that short-term fluctuations of explanatory variables have a reverse correction effect on long-term equilibrium. That is to say, if the last period's GDP deviates from the equilibrium state by 1 percentage point, the next period's GDP will be adjusted to the equilibrium state by 0.232 percentage points. At the same time, there is a long-term causal relationship between the eight factors and the economic growth in the Yangtze River Delta.

5. Conclusion and Suggestion

Based on the data of 25 cities in the Yangtze River Delta from 2000 to 2016, this paper uses Lucas' endogenous economic growth model and establishes a fixed effect panel regression model to analyze the relationship between economic growth and industrial structure, capital stock, foreign capital utilization, degree of opening to the outside world, government functions, infrastructure, human capital and the level of domestic trade development in the Yangtze River Delta region. The main results are as follows: Firstly, eight economic factors have passed the significance test, and the contribution of eight economic factors to economic growth is different industrial structure which is the mainly largest contributor of economic growth. If industrial structure is increased by 1 percentage point, the economic growth will increase by 0.610 percentage points. The contribution of foreign capital utilization is the smallest; if foreign capital utilization is increased by 1 percentage point, the economic growth will increase by 0.017 percentage points. Secondly, there is a long-term co-integration relationship between economic growth and industrial structure, capital stock, foreign capital utilization, degree of opening to the outside world, government func-

tions, infrastructure, human capital and the level of domestic trade development in the Yangtze River Delta region. These eight economic factors are the long-term Granger causes of economic growth in the Yangtze River Delta region. Except for capital stock and foreign capital utilization, other economic growth factors are also the short-term Granger causes of economic growth in the Yangtze River Delta region. Based on the above conclusions, this paper puts forward the following suggestions:

Firstly, optimize the industrial structure of the Yangtze River Delta region: promote the optimization and upgrading of traditional industries; strengthen scientific and technological innovation; release new vitality of traditional industries; accelerate the transformation of new and old economic momentum; consolidate the foundation of sustainable and healthy economic development. Accelerating the development of modern service industry, promoting the mutual promotion of modern service industry and traditional service industry, accelerating the innovation and development of service industry and cultivation of new momentum, these are important.

Secondly, adhere to the opening up of the Yangtze River Delta region: continue to develop foreign trade; accelerate the transformation of foreign trade growth mod; optimize the structure of import and export commodities; strive to improve the quality and efficiency of foreign trade; these are significant.

Thirdly, improve the capital stock in the Yangtze River Delta: optimize the economic structure; aim at improving the quality and efficiency of the capital stock; change the mode of economic growth; take a new road of industrialization; change the extensive mode of economic growth; realize the new expansion of the quantity on the basis of steadily improving the quality of the capital stock; these are crucial.

Fourthly, strengthen the infrastructure in the Yangtze River Delta region: build a reasonable distribution; complete function and efficient operation of infrastructure system; accelerate the construction of comprehensive channels inside and outside the region; form a system suitable for the development layout and industrial layout of the urban agglomeration in the Yangtze River Delta; these are vital.

Fifth, make rational and effective use of foreign capital in the Yangtze River Delta: rationally guide foreign investment; optimize industrial structure; guide foreign investment to modern services such as finance, logistics, information technology, software and technology development with high added value; further encourage foreign investment in R&D centers, high-tech industries, advanced manufacturing industries and energy-saving rings; these are essential.

Sixth, stabilize the level of domestic trade development in the Yangtze River Delta region: continue to vigorously promote the development of modern circulation mode; improve the level and quality of opening-up in the field of domestic trade; enhance the competitiveness of circulation subjects; establish a conservation-oriented domestic trade development mechanism; there are momentous.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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