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An Empirical Study on the Relationship between the Development of Vocational Education and the Upgrading of Industrial Structure in China

Genjin SUN[1], Zhifan DING[2] , Mahboubeh BABAEE[3]

Abstract

Based on the VAR model and the time series data of the development of Chinese vocational education and the upgrading of industrial structure from 1985 to 2016, this paper empirically analyzes the interaction between the development of vocational education and the upgrading of industrial structure through the co-integration test and Granger Cause test. The research obtains the following three conclusions: First, there is a long-term equilibrium relationship among the rationalization of industrial structure, the upgrading of industrial structure, the scale of vocational education development and the quality of vocational education. Second, from an overall perspective, there is an interactive relationship between the development of vocational education and the upgrading of industrial structure. The industrial structure is rationalized, the industrial structure is advanced. The scale of development of vocational education and the quality of vocational education are promoted to varying degrees. Third, although the scale of development of vocational education and the scale of development of vocational education are Granger causes of each other. The high quality of the industrial structure and the quality of the development of vocational education are the causes of Granger causation. The high-level industrial structure is the cause of Granger causality in the development of vocational education, but the latter is not the Granger causality of the former. The development scale of vocational education and the quality of the development of vocational education are the causes of Granger causation.

Keywords: vocational education scale; quality of vocational education; rationalization of industrial structure; advanced industrial structure; VAR model.

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Introduction

Vocational education is an important part of modern national education system. It plays a key role in improving workers' skills and in materializing scientific and technological innovations. This is of great significance in promoting the optimization and upgrading of the industrial structure, weakening the structural unemployment problem and promoting the development of the national economy. The United States, Germany, Japan and South Korea and other developed countries attach great importance to vocational education. They embed vocational education in the process of industrial development and construct a differentiated vocational education model according to the structural features of different industries. They ensure that the industrial structure can be adjusted and upgraded smoothly by increasing the matching degree between labor supply and demand for industrial development talents (Mohseni, Jafari, & Babaee, 2015).

Nowadays, the pace of industrial restructuring and upgrading in the world has never stopped. And it shows the characteristics of science and technology, diversification and rapid, which put forward new requirements for the development of vocational education. The adjustment and upgrading of industrial structure and the development of vocational education mutual restraint and mutual promotion. Vocational education is inherently intimately linked to the industry. High-tech-oriented industrial structure upgrading requires a large number of high-quality and highly skilled industrial workers. This will promote the development of vocational education that is cultivated by high-quality industrial workers in terms of size, quality, geographical distribution, hierarchy and professional structure. The relationship between the development of vocational education and the upgrading of industrial structure forms an interdependent and supportive relationship. The mutual adaptation and coordination between the two is the guarantee for sustainable development.

At present, our country has become the second largest economy in the world. We are at a new stage of transition from an economic power to an economic power. However, we are still facing the challenge of moving from "Made in China" to "Made in High Quality" through the upgrading of value chains and industrial chains. One of the manifestations of this challenge is the shift in our economic structure from a labor-intensive to a technology-intensive one. As well as the development of a new generation of strategic emerging industries such as information technology, biology and high-end equipment manufacturing industry, the contradiction between the demand for high-quality technical personnel with the "great-nation craftsman spirit" and the effective provision of labor force has become increasingly prominent. In recent years, staged "shortage of mechanics" is a good example.

Since the reform and opening up, the cause of our country's vocational education has developed rapidly. We have trained a large number of senior skilled personnel.

This has made important contributions to improving the quality of workers, promoting the upgrading of the industrial structure and promoting economic and social development. However, the current development of vocational education cannot fully meet the needs of economic and social development. In particular, it cannot effectively meet the specific requirements of Chinese industrial restructuring and upgrading. In 2014, the State Council promulgated the "Decision on Accelerating the Development of Modern Vocational Education". It upped the development of modern vocational education to a national strategic plan. It aims to further develop the innovation-driven development strategy, create more space for talent bonuses, speed up the transformation of the economic development mode and upgrade and upgrade the industrial structure through training senior skilled personnel and improving the quality of workers.

Against the background of a new economic normal, Chinese industrial restructuring and upgrading and the development of vocational education have entered a new period of rapid growth. In-depth analysis of the interactive relationship between the development of vocational education and the upgrading of industrial structure is of great significance in exploring the path of positive interaction between the two.

Literature Review

Since Schultz (1960) groundbreaking research on the rate of return on investment in education, the overseas academic research on the relationship between education and economic growth has gone through two stages. These two stages are the study of the economic growth effect of educational scale (Denison, 1962; Arrow, 1973; Romer, 1986; Lucas, 1988) and the economic growth effect of educational quality Lee, 2000; Arum, Gamoran, & Shavit, 2007; Enders, 2010; Hanushek & Woessmann, 2012, Barro & Lee, 2013; Manuelli & Seshadri, 2014). The domestic academic circle studies the relationship between education and economic growth on the basis of foreign research achievements. It mainly focuses on the level of education development (Shi *et al.*, 2014; Yang, 2015; Liu, 2016), the economic growth effect of higher education (Di & Sun, 2014; Lao & Xue, 2016; Fan & Ma, 2017) and the economic growth effect of vocational education at different levels (Wang, 2011; Zhu & Xu, 2014; Wang & Sun, 2017).

In terms of the relationship between occupational education and industrial structure, some scholars focus on qualitative research on the interactive relationship between the development of vocational education and industrial restructuring (Yang, 2002; Meng *et al*., 2015; Liu, Zou, & Liu 2017; Li & Wang, 2018). Such as Su (2017) that the upgrading of industrial structure of the demand for application of technical personnel make vocational education in the scale, level and training mode to adjust. The development of vocational education promotes the upgrading of the industrial structure by stabilizing employment, improving labor productivity,

improving the quality of human capital and driving technological innovation. Some scholars use different measurement methods to study the coordination between vocational education and industrial structure (Liang & Xu, 2016; Gong, 2016). For example, Ma *et al.* (2017) collected data from 80,393 graduates, 256 secondary vocational schools and 1,939 employers in Jiangsu Province. They conducted an analysis of the coincidence degree between the structure of vocational education in Jiangsu Province and the industrial structure. Another part of scholars conducted empirical research on the relationship between vocational education and the upgrading of industrial structure through econometric methods. Through factor analysis and regression analysis, Shi & Xia (2016) found that there is a significant positive correlation between the human capital of Chinese vocational education and the optimization and upgrading of industrial structure. Taking Chongqing as an example, Zhou & Zhu (2017) found that the development of secondary industry is the Granger reason for the development of higher vocational education. The scale development of higher vocational education is the reason for the development of the tertiary industry, but there is no positive interaction between the development of higher vocational education and the development of the three major industries.

Existing research has provided a good foundation for exploring the deep relationship between the development of vocational education and the upgrading of industrial structure. However, there is still room for further expansion. First, as far as the research object is concerned, the existing researches pay more attention to the relationship between the development of vocational education and the upgrading of industrial structure in a specific area. Few studies have analyzed the overall situation in the country. Second, as far as the content of the study is concerned, the existing research only focuses on the correlation between the scale of development of vocational education and the industrial structure, the quality of vocational education development has not been covered and the definition of the specific content of the industrial structure upgrading is not clear. Thirdly, from the perspective of research, the existing researches pay more attention to the analysis of short-term relationship between vocational education and upgrading of industrial structure, but have not yet involved the analysis of long-term equilibrium relationship and the analysis of the short-term dynamic relationship that forms this long-term equilibrium. Therefore, based on the VAR model, this paper uses the time series data of the development of Chinese vocational education and industrial structure upgrading from 1985 to 2016 to test the relationship between the two by the co-integration relationship and Granger Cause in order to explore long-term equilibrium and short-term dynamic relationship between the two.

The remaining articles are arranged as follows: The third part introduces the research methods of this article from three aspects: variable selection, data description and model setting. The fourth part will conduct the co-integration test and Granger Cause test based on the VAR model to explore the long-term equilibrium and short-term dynamic relationship between the development of vocational education and the upgrading of industrial structure. The fifth part

draws the corresponding conclusion and enlightenment according to the result of empirical analysis.

Research Design

Variable Selection

From a dynamic point of view, an economy's industrial structure changes include rationalization and high-level two dimensions (Qian, Zheng & Yu, 2011). Therefore, this paper selects two variables of rationalization of industrial structure and advancement of industrial structure as indicators of the upgrading of industrial structure. With the continuous improvement of the demand conditions for the upgrading of industrial structure and the continuous development of the development of vocational education, the quality of vocational education has also become a key issue in the development of vocational education. Therefore, this article chooses the two dimensions of the scale of development of vocational education and the quality of vocational education as a measure of the development of vocational education (Wang & Zhao, 2017). In order to carry out an empirical analysis of the relationship between the four variables, we need to select the measurement indicators to quantify them. The following four metrics will be explained.

Vocational Education Development Scale

Common indicators to measure the scale of education development are investment in education, the size of students (Wang & Sun, 2017), the number of vocational education institutions. Taking into account the continuity and availability of time series data, this paper selects the number of secondary vocational school graduates (NG) to measure the scale of development of vocational education. As graduates are directly concerned with the position of students, the choice of graduates as a measure of the scale of development of vocational education to consider its interaction with the upgrading of the industrial structure more meaningful.

The Quality of Vocational Education Development

Common indicators for measuring the scale of education include student professional ability (Wang, 2017), vocational education attraction, social reputation of vocational education, personnel training, research output and social services (Bi, 2014; Rong *et al*., 2016). Because of the continuity and availability of time-series data, improving the teacher-student ratio can improve the quality of education to some extent. Therefore, according to (Benos & Zotou, 2014), this paper selects

the secondary vocational school teacher-student ratio (TSR) to measure the quality of the development of vocational education.

Rationalization of Industrial Structure

Nowadays, the rational measure of industrial structure chosen by academia is very different because of its different connotation. More and more scholars (Qian, Zheng, & Yu, 2011) have recently redefined the Theil Index to measure the rationalization of industrial structure. The formula is as follows:

$$TL = \sum_{i=1}^{n}\left(\frac{Y_i}{Y}\right)\ln\left(\frac{Y_i}{Y}\Big/\frac{L_i}{L}\right) = \sum_{i=1}^{n}\left(\frac{Y_i}{Y}\right)\ln\left(\frac{Y_i}{L_i}\Big/\frac{Y}{L}\right) \quad (1)$$

Y, L, i, n are the total output value, total employment, industrial and industrial sectors. Y_i/L_i represents the labor productivity of various industries. According to the classical economics hypothesis, we can see that when the economy is balanced, the labor productivity of each industry is similar. So when the economy is in equilibrium, there is $Y_i/L_i = Y/L$, at this time $TL = 0$. Therefore, the closer the value *TL* is to 0, the closer the industrial structure is to an equilibrium state and the more reasonable the industrial structure. If the value *TL* is not 0, it indicates that the industrial structure deviates from the equilibrium and the industrial structure is unreasonable.

Since Theil Index not only reflects the relationship between the proportion of output value and the proportion of employment, but also takes into account the relative weight of each industry. It also possesses the theoretical basis and the economic meaning of deviation degree of industrial structure. Therefore, this article uses the Theil Index (TL) to measure the rationalization of industrial structure.

High-level Industrial Structure

In accordance with the law of industrial structure development, an outstanding feature of the upgrading of industrial structure is to gradually realize the service. That is, the growth rate of the tertiary industry is faster than the growth rate of the secondary industry (Wu, 2008). According to the existing literature, this article uses the output value ratio (TS) of the tertiary industry and the secondary industry as a measure of the advanced level of the industrial structure (Tao & Fang, 2015). This measure can clearly reflect the service-oriented tendency of the economic structure and make it clear whether the industrial structure is moving toward "service-oriented". The formula is as follows:

$$TS = Y_3/Y_2 \quad (2)$$

Among them, Y_2 and Y_3 represent the second industry output and the third industry output respectively. If the value of TS is rising, it means that the economy is moving towards service orientation and the industrial structure is gradually being advanced.

Data Description

This article uses Chinese time series data from 1985 to 2016 for analysis. In measuring indicators, we need to obtain three industrial output and employment numbers, secondary vocational education graduates and teachers in China from 1985 to 2016. All the data come from the "China Statistical Yearbook" of the past years. Among them, the number of secondary vocational education graduates from 1985 to 1999 is the sum of the number of secondary vocational school graduates and the number of secondary vocational school graduates. This paper uses STATA13.0 statistical analysis software to test the empirical data.

Model Setting

In order to test the dynamic relationship among the scale of the development of vocational education in China, the rationalization of industrial structure and the quality of vocational education, VAR model was used to determine the dynamic influence of random disturbance on the variable system. The general mathematical expression of the model is:

$$y_t = \sum_{j=1}^{p} \beta_{t-j} y_{t-j} + \sum_{i=1}^{r} \gamma_{t-i} x_{t-i} + \mu_t \tag{3}$$

Among them, y_t means endogenous variables. y_{t-j} represents the lagged endogenous variable. x_{t-i} indicates the lagging exogenous variable. $j(j=1,2, ..., p)$ is the raw variable lag order. $i(i=1,2, ..., r)$ indicates the exogenous variable lag order. β_{t-j} is the parameter to be estimated of the exogenous lagged variable. γ_{t-i} is the parameter to be estimated before the endogenous lag variable. μ_t represents a random disturbance term. In general, the greater the lag order *p, r*, that is the longer the lag order, the model can better reflect the dynamic characteristics between variables. However, this will lead to more parameters to be estimated in the model, which will reduce the degree of freedom of the model and affect the significance of the estimated parameters. Therefore, when choosing the lag order, we should fully consider the balance between lag number and degree of freedom.

Evaluation and Measurement

We first perform a descriptive statistical analysis of the variables NG, TSR, TL and TS (see Table 1). We first perform a descriptive statistical analysis of the variables NG, TSR, TL and TS (see Table 1). As can be seen from Table 1, the average size of the development of vocational education (NG) is 3,669,500, the maximum is 6,746,000 and the minimum is 842,000. This shows that the scale of Chinese vocational education expanded rapidly. The average quality of development of vocational education (TSR) is 0.22, with a maximum of 0.48 and a minimum of 0.12. This shows that the development of vocational education in China to improve the quality of faster. The rationalization of industrial structure (TL) has an average of 0.23, a maximum of 0.32, and a minimum of 0.05. This shows that the degree of rationalization of Chinese industrial structure continues to increase. The average value of the Advanced Industrial Structure (TS) was 0.87, with a maximum of 1.29 and a minimum of 0.68. This shows that Chinese industrial structure has been continuously improved and the proportion of the tertiary industry has been increasing.

Table 1. Descriptive statistics of variables

	Average	Maximum	Minimum	Standard Deviation
The scale of Vocational Education (NG)	366.95	674.60	84.2	201.13
Quality of Vocational Education (TSR)	0.22	0.48	0.12	0.08
Rationalization of industrial structure (TL)	0.23	0.32	0.05	0.06
Advanced industrial structure (TS)	0.87	1.29	0.68	0.14

Stationarity Test

In order to prevent "pseudo-regression" phenomenon in the analysis of time-series data, this paper uses the ADF unit root test method proposed by Dickey & Fuller (1981) to test the stationarity of all the time-series data. Stationarity test results are shown in *Table 2*.

Table 2. Stationarity Test Results of Variables

Variable	ADF Value	Test Type(C, T, L)	Critical			Conclusion
			1%	5%	10%	
NG	-2.163	(1, 1,0)	-4.325	-3.576	-3.226	Non-stationary
TSR	-1.328	(1, 0, 2)	-2.473	-1.703	-1.314	Non-stationary
TL	-0.686	(0, 0, 2)	-2.652	-1.950	-1.602	Non-stationary
TS	-2.065	(1, 1, 2)	-4.334	-3.580	-3.228	Non-stationary
DNG	-6.419	(1, 0, 0)	-3.716	-2.986	-2.624	Stationary
DTSR	-7.365	(1, 0, 0)	-3.716	-2.986	-2.624	Stationary
DTL	-8.401	(1, 0, 0)	-3.716	-2.986	-2.624	Stationary
DTS	-3.447	(1, 0, 0)	-3.716	-2.986	-2.624	Stationary

Note: C, T, L are the intercept, trend and lag order. The constant term is then denoted C = 1, the constant term C = 0, the trend term T = 1 and the trend term T = 0. The guidelines they follow are SIC.

We can see from *Table 2* that the original time series data of NG, TSR, TL and TS did not pass the stationarity test at 5% significance level. We cannot reject the null hypothesis. The time series of these indicators exist in unit root. Then we make the first-order difference on the above time-series data. All data passed the stability test at 5% significance level. From this it can be concluded that NG, TSR, TL and TS are first-order single integer sequences and we can perform co-integration analysis on them.

Co-integration Test

NG, TSR, TL, and TS are first-order single integer sequences with the same order of monolithic features. To further examine the long-term stability of these variables, we will perform the Johansen co-integration test. Co-integration test results shown in *Table 3*.

Table 3. Johansen Co-integration Test Results

Null Hypothesis	Trace Test		Maximum Eigenvalue Test	
	Trace Statistics	Threshold (5%)	The Largest Eigenvalue Statistics	Threshold (5%)
None	49.5761	39.89	33.2225	23.80
At most 1	16.3536*	24.31	10.3172	17.89
At most 2	6.0364	12.53	5.4230	11.44

Note: * indicates rejection of null hypothesis at 5% significance level.

We can see from *Table 3* that the co-integration test shows that there is a linearly independent co-integrating vector at 5% significance level. The Maximum Eigenvalue Test also showed that the null hypothesis of "co-ordinate rank of 0" was rejected, but the null hypothesis of "co-ordinal rank of 1" could not be rejected at 5% significance level. Therefore, whether it is the characteristic root test or

the Maximum Eigenvalue Test, there is a co-integration relationship between the variables.

We use Johansen's Maximum Likelihood Estimation (MLE) to estimate the long-run equilibrium in the system. After being normalized, the co-integration equation is:

$$TL = -20.6584 + 1.1582TS + 0.0197NG + 2.7788TSR \quad (4)$$

From (4), we can see that there is a positive correlation among rationalization of industrial structure (TL), scale of vocational education (NG), quality of development of vocational education (TSR) and advanced industrial structure (TS), which is in line with the expectation of economic theory. Although the coefficient before TSR and TS is greater than 1, the numerical value space of TSR and TS is [0, 1]. Its magnitude of change is small, so the coefficient is acceptable.

VAR Model Building

From the above analysis, it can be seen that the time series data of TL, TS, NG and TSR are first order I (1). And there is co-integration between them, so VAR model can be constructed.

Determination of the Lag Order P

When choosing the lag order P, on the one hand, we want the lag order to be large enough to fully reflect the dynamic characteristics of the constructed model. On the other hand, the larger the lag order, the more parameters that need to be estimated and the less freedom the model will have. So we need to consider comprehensively. It is necessary to have a sufficient number of lags and a sufficient number of degrees of freedom. Based on the Likelihood Ratio (LR) test, the AIC and SBIC minimum criteria, the lag order is determined to be 4 (see *Table 4*).

Table 4. The Determination of VAR Model Lag Order

Lag	Log L	LR	FPE	AIC	HQIC	SBIC
0	40.595	-	8.6e-07	-2.613	-2.556	-2.424
1	121.816	162.44	8.3e-09	-7.272	-6.952	-6.321
2	154.16	64.689	2.8e-09	-8.440	-7.982	-6.727*
3	170.509	32.698	3.4e-09	-8.465	-7.708	5.991
4	204.588	68.159*	1.5e-09*	-9.756*	-8.767*	6.521

The Estimation of VAR Model Parameter

VAR (4) models are established for the variables NG, TSR, TL and TS. The output are as follows:

$$\begin{bmatrix} TL \\ TS \\ NG \\ TSR \end{bmatrix} = \begin{bmatrix} -0.1727 & 1.1136 & 1.1126 & 2.7425 \\ 0.0037 & 0.9876 & 0.0674 & -0.0044 \\ 0.3105 & 0.5860 & 0.0113 & 1.7562 \\ -0.2876 & 0.1418 & 0.0819 & 1.3102 \end{bmatrix} \begin{bmatrix} TL_{-1} \\ TS_{-1} \\ NG_{-1} \\ TSR_{-1} \end{bmatrix} + \begin{bmatrix} 0.3766 & 0.0113 & 1.1126 & 5.2640 \\ 0.0585 & 0.0440 & 0.0674 & 0.3200 \\ 0.5441 & 0.5860 & 0.2173 & 1.1553 \\ 0.4431 & 0.1418 & 0.2980 & 0.9835 \end{bmatrix} \begin{bmatrix} TL_{-2} \\ TS_{-2} \\ NG_{-2} \\ TSR_{-2} \end{bmatrix}$$
$$+ \begin{bmatrix} 0.6298 & 1.0021 & 1.7125 & 1.6205 \\ 0.0603 & 0.1439 & 0.2632 & 0.2579 \\ 0.4551 & 0.3105 & 0.2962 & 0.3726 \\ 0.2628 & 0.0709 & 0.4145 & 0.7086 \end{bmatrix} \begin{bmatrix} TL_{-3} \\ TS_{-3} \\ NG_{-3} \\ TSR_{-3} \end{bmatrix} + \begin{bmatrix} 0.4862 & 4.2465 & 0.9433 & 1.5610 \\ 0.0739 & 0.0930 & 0.0715 & 0.0908 \\ 0.0082 & 0.0716 & 1.0346 & 1.0615 \\ 0.1770 & 0.0949 & 0.5183 & 0.4536 \end{bmatrix} \begin{bmatrix} TL_{-4} \\ TS_{-4} \\ NG_{-4} \\ TSR_{-4} \end{bmatrix} + \begin{bmatrix} -2.1622 \\ 2.9151 \\ 0.1905 \\ -0.5600 \end{bmatrix} \quad (5)$$

According to VAR (4) model (5), we can draw the following four conclusions. First, the value of lag phase 3 has the greatest contribution to the rationalization of the current industrial structure. The lag phase 2, 3 and 4 of the high-level industrial structure, the scale of vocational education development and the quality of vocational education have a positive impact on the rationalization of industrial structure. Second, the quality of vocational education in the lag phase 1 has a negative impact on the advancement of the industrial structure. The lag of other variables all have a positive impact on the advancement of the industrial structure. Among them, the value of lag phase 1 has the greatest effect on promoting the advancement of the industrial structure in the current period. Third, all variables lagging from 1 to 4 have a positive impact on the scale of development of vocational education. This shows that the rationalization of industrial structure, the high level of industrial structure and the quality of the development of vocational education have played a catalytic role in the development of vocational education. Lag phase 1's own role is the largest. Fourth, in addition to the rationalization of the industrial structure in the first lag phase, all the lags of other variables have a positive impact on the quality of the development of vocational education. Among them, the value of lag phase 1 makes the greatest contribution to the quality improvement of current vocational education.

The Discrimination of VAR Model Stability

We conducted a Wal-Mart test on the coefficients of each of the equations and all the equations. The results show that the coefficient of each order is more. From the results of LM test, we can see that the residuals of vector autoregressive model (VAR) are normal distribution and have no autocorrelation. All the unit roots of the model are within the unit circle and the model is stable. The model test results are shown in Figure 1.

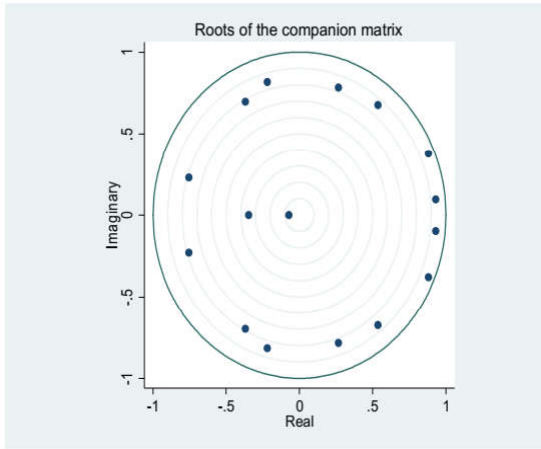

Figure 1. Discrimination of the Stability of Vector Autoregressive Model

Granger Causality Test

The test of co-integration shows that there is a long-term equilibrium relationship among the scale of NG education, quality of TSE, rationalization of industrial structure (TL) and the advancement of industrial structure (TS). However, whether this long-term equilibrium relationship has a certain causal relationship still needs further empirical test. We can use the Granger causality test to test the causal relationship between variables. The test results are shown in *Table 5*.

Table 5. Variables' Granger Cause Relationship Test Results

Equation	Excluded	Chi2 Statistic	P Value	Conclusion
TL	TS	29.346	0.000	TL is Granger reason for TS
TL	NG	5.736	0.000	TL is the Granger of NG
TL	TSR	58.467	0.000	TL is Granger reason for TSR
TS	TL	26.688	0.000	TS is Granger reason for TL
TS	NG	13.874	0.008	TS is NG Granger reason
TS	TSR	17.267	0.002	TS is Granger reason for TSR
NG	TL	44.556	0.000	NG is Granger reason for TL
NG	TS	2.303	0.680	NG is not a Granger reason for TS
NG	TSR	10.636	0.031	NG is Granger reason for TSR
TSR	TL	145.24	0.000	TSR is Grange reason of TL
TSR	TS	7.774	0.100	TSR is the Granger reason for TS
TSR	NG	14.763	0.000	TSR is the Granger of NG

From Table 5, it can be seen that under the 1% significance level, TL is the cause of Granger causality respectively with the scale of vocational education (NG), the quality of development of vocational education (TSR) and the advancement of the industrial structure (TS). Industrial Structure Advancement (TS) and Vocational Education Development Quality (TSR) are Granger's cause and effect. The Industrial Structure Advancement (TS) is the Granger causality factor in the development of vocational education (NG), but the latter is not the Granger causality of the former. The scale of vocational education (NG) is the Granger causality at the 5% significance level of TSR. But the Quality of Vocational Education Development (TSR) is the cause of Granger's causality under the 1% significance level of the development scale of vocational education (NG).

Discussion and Conclusion

Based on the VAR model, this paper empirically analyzes the long-term equilibrium and short-term dynamic relationship between the development of vocational education and the upgrading of industrial structure through the co-integration test and Granger Cause test by using the time series data of the development of Chinese vocational education and the upgrading of industrial structure from 1985 to 2016. The research obtains the following three conclusions: First, there is a long-term equilibrium relationship among the rationalization of industrial structure, the upgrading of industrial structure, the scale of vocational education development and the quality of vocational education. Second, from an overall perspective, there is an interactive relationship between the development of vocational education and the upgrading of industrial structure. The industrial structure is rationalized, the industrial structure is advanced. The scale of development of vocational education and the quality of vocational education are promoted to varying degrees. Third, although the size of the development of vocational education and the rationalization of the structure of the professional industry are closely related to the scale of the development of vocational education, the quality of the development of vocational education and the high-level industrial structure, it is Granger's cause and effect. The high quality of the industrial structure and the quality of the development of vocational education are the causes of Granger causation. The high-level industrial structure is the cause of Granger causality in the development of vocational education, but the latter is not the Granger causality of the former. The Scale of Vocational Education Development and the Quality of Vocational Education Mutual Granger Causality.

Based on the above conclusions, this paper draws the following enlightenment: First, we should establish a diversified investment channels for vocational education, vocational education to enhance infrastructure and teaching equipment. We should gradually raise the funding for vocational education students, improve practical training conditions, optimize the construction of vocational education teachers

and scientifically plan the scale and quality of vocational education. Second, we must establish a long-term mechanism for the coordination of university-enterprise multiple entities, value integration, interest integration, resource integration and coordinated implementation. We should strive to form a targeted vocational education system that combines learning with practice and production with learning to promote the coordinated development of vocational education and industrial development. Thirdly, by optimizing the level of vocational education and professional setting, we should construct a dynamic adjustment of the structure of professional education and the demand forecasting mechanism of industrial development to improve the matching between the development of vocational education and the industrial structure.

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