Analysis of the Lagging Time of Employment Structure in Vietnam

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Abstract
If any country's or region's employment structure lags behind the industrial structure adjustment, which shows that the two structures are not developing in coordination. However, the deviation degree of structure is mainly the imbalance between industrial structure and employment structure. The lag refers to the degree to which the employment structure lags behind the industrial structure in the time dimension, and when the relationship between industrial structure and employment structure is measured in terms of time. Employment lags behind time over a long horizon which in turn causes serious unemployment, and affect industrial structure adjustment and upgrade. The study construct an analysis model for the lag time of the employment structure and provide findings that will resolve the incompatible state of the two structures, and promote the healthy development of industrial structure and employment structure in Vietnam. Through the research conclusion it is revealed that, after three years, the effects of industrial structure adjustment fully reflected the change of employment structure in Vietnam.
Keywords: Lagging Time; Employment Structure; Vietnam

1. Introduction

Before the reform and opening up, Vietnam's economic development was very backward and economic condition factors were very low. After the reform and opening up, Vietnam government has taken active measures to promote the domestic industrial structure by restructuring and employment structure upgrading. Thus, both industrial structure and employment structure have entered into the period of continuous optimization and adjustment. The healthy economic development of a country or a region requires the mutual adaptation of the industrial structure and employment structure. But at present, there are some structural deviations in the two types of structures.

Economists are focusing their research work on industrial structure and employment structure relationship and through their empirical work they have defined some general rules. In the 17th century, an economists Petty found that the relative income differences between departments are the main reasons of labor flow between sectors. The British economist Clark investigated labor transfer problems between the industrial structures in many countries and then concluded that, the labor force transfer from the primary industrial structure to the secondary industrial structure with the increase in per capita national income and when the per capita national income level improves further, the labor force transfer to the tertiary industrial structure. This discovery by Petty and Clark is collectively known as Petty - Clark's law [1]. Researchers like Chenery [2] and Syrquin [3] constructed a model on the basis of the development and empirically studied the problem of industrialization and found that industrialization, urbanization and labor transfer are the mass of the interactive process. According to Tuyet Tran and Tinh Doan (2010) [4] document, although Vietnam has made a significant progress inchanging economic structure in which the share of agricultural contribution in GDP hasdramatically decreased over the last two decades, the employment structure changed slowly, consequently, majority of labour force is still in the agricultural sector. More recently, Do Hai Hung (2015) [1] paper uses discrete ratios of structure and the coordination coefficients of the industrial structure and employment structure to calculate Vietnam's industry structure and employment structure coordination for the period of 1995-2013, the results have shown that Vietnam's industry structure and employment structure from 1995 to 2013 is in a state of imbalance, the overall coordination is bad, coordination coefficients are showing obvious changes in volatility. Do Hai Hung (2017) paper uses the vector autoregression model to forecast for 2015-2020 year industrial structure and employment structure change trend in Vietnam, the forecast results show that industrial structure showed a trend towards high gradation, eventually transform to "321" pattern. However, the change of employment structure lags behind changes of the industrial structure, labor structure will be showing a "132" pattern[5].

At present, economists agree on the theory that the employment structure lags behind the industry structure. Previous studies on the evolution of industrial structure and employment structure in developing countries suggest that when two types of structures don't coordinate development, the employment structure lags behind the adjustment of industrial structure. However, the lagging time of the employment structure are not studied in Vietnam. For this study, we have used the Moore structure value and grey relation analysis method to build a lagging time model of employment structure in Vietnam.

2. Deviation degree of industrial structure and employment structure analysis in Vietnam

Deviation degree of structure is an important index to check the industry's employment proportion and the output value of industry whether balanced development.

Deviation degree of structure = (Industry A is A share of GDP/ The proportion of employment of industry A) – 1.

If deviation degree of structure is zero, it means the relationship between the employment proportion of the industry and the proportion of the output value of the industry is balanced. Then it is proved that these industries can drive enough labour, there is no shortage or surplus of the labour of the industry. But if deviation degree of structure is less than zero, it means these industries of the attraction of the labor not enough, so there is existing hidden unemployment and needs to be taken a step to move labour shift from these industries to other industry sectors. To use deviation degree of structure index, calculated 1995-2015 deviation degrees of structure of the industrial structure and employment structure of three industry in Vietnam. The results are shown in figure 1.1

Table 1.   Deviation degree of structure in Viet Nam

Year	Total deviation	Deviation degree of primary industry	Deviation degree of secondary industry	Deviation degree of tertiary industry
1995	4.07	-0.62	2.28	1.17
1996	4.03	-0.61	2.34	1.08
1997	4.22	-0.64	2.56	1.02
1998	4.16	-0.63	2.57	0.96
1999	4.21	-0.63	2.75	0.83
2000	3.78	-0.62	2.64	0.52
2001	3.64	-0.63	2.5	0.51
2002	3.35	-0.61	2.47	0.27
2003	2.97	-0.6	2.13	0.24
2004	3.16	-0.63	2.21	0.32
2005	2.42	-0.61	1.11	0.7
2006	2.27	-0.61	1.11	0.55
2007	2.2	-0.65	1.03	0.52
2008	2.02	-0.61	0.91	0.5
2009	2.02	-0.63	0.86	0.53
2010	1.91	-0.62	0.83	0.46
2011	1.77	-0.59	0.8	0.38
2012	1.73	-0.59	0.81	0.33
2013	1.77	-0.61	0.8	0.36
2014	1.74	-0.61	0.74	0.39
2015	1.73	-0.60	0.72	0.35

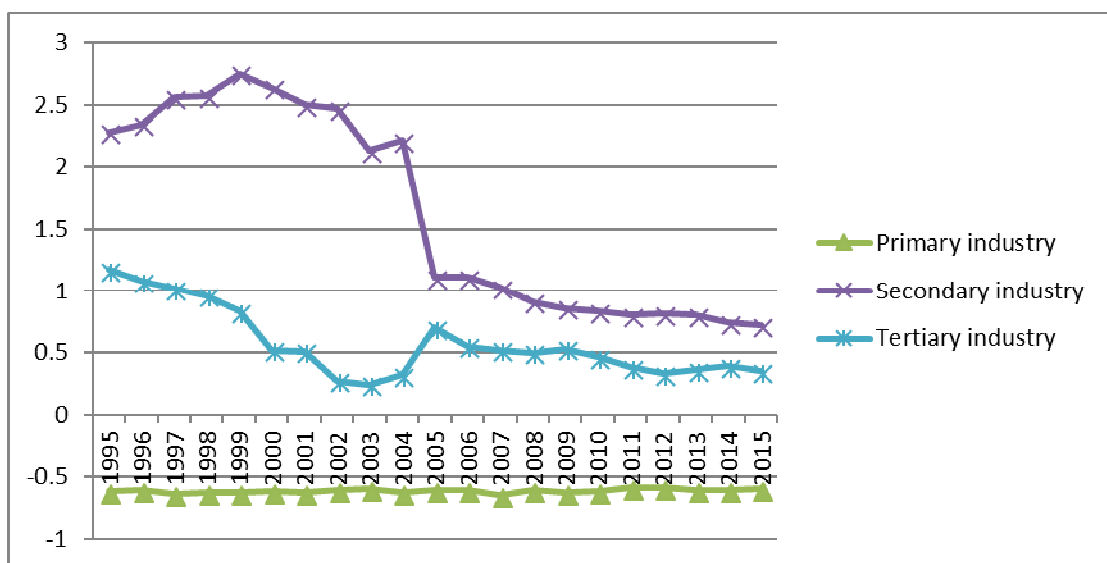Note: According to the statistical yearbook of Vietnam in 2017 calculated.

Figure 1. Deviation degree of structure figure in Viet Nam [8]

From table 1 and figure 1.1, over the course of 20 years, deviation degree of three industry is varied differently, the specific changes are as follows:

(1) Deviation degree of structure of the primary industry

In this case, the two structures of the primary industry show uncoordinated state, there is a large amount of surplus labor of employment structure. As the economy develops, per capita income is rising, the surplus labour of the primary industry should also gradually shift to higher income industries. So, deviation degree index shows a decreasing trend. Since 1995, deviation degree of the primary industry in Vietnam hasn't more changed, the rate of decline very slowly, it means the surplus labor force of primary industry is moving slowly to other industries, and it has low digestion efficiency.

(2) Deviation degree of structure of the secondary industry

From figure 1.1, can be seen, since 1995, deviation degree value of the secondary industry in Vietnam has been greater than zero, the value of deviation degree of structure is in a state of apparent descent. It is different with deviation degree of primary industry, deviation degree from 2.28 in 1995 down to 0.72 in 2015. Vietnam's secondary industry absorbs labour force space is larger, it means the output value of the secondary industry is greater than the proportion of employment of secondary industry, comparative of labor productivity relatively high.

Overall, at present, although deviation degree of structure of the secondary industry in Vietnam tends to shift to a balanced state, its deviation degree of structure value is still high. So, the two structures still have an uncoordinated state. In this case, it shows that the proportion of output value of the secondary industry is increasing but these industries absorption of labour insufficient, it means the proportion of employment of secondary industry still lags behind that of the output value of the secondary industry.

(3) Deviation degree of structure of the tertiary industry

From figure 1.1 can be seen, the change state of deviation degree of structure of the tertiary industry is the same as that of the secondary industry, but the fluctuation degree is differentiated. The change of the tertiary industry is the first rise then decline in the trend. Value deviation degree of structure always greater than zero. It was from 1.17 in 1995 down to 0.35 in 2015; it shows that the output value of Vietnam's tertiary industry is higher than that the proportion of employment. Overall, as the industrial structure is continuously adjusted and upgraded, the two structures of Vietnam's tertiary industry tend coordination state, the absorptivity of the labor is becoming stronger and stronger, so the evolution of the two structure will be consistent.

In short, in the recent twenty years, the problem with Vietnam's primary industry is that there is a large amount redundant of labour, need to solve their problems just can be coordination and development of the two structure of the primary industry. For the secondary industry, the problem with primary industry is different, the secondary industry need to absorb more labour, there is need to take measures to train the rest of the workforce and improve the skills of the workforce, that would speed up the ability of the secondary industry to absorb labour, to promote coordinated development of the two structure of secondary industry. For the tertiary industry, there is also shortage labour in this industry, need to absorb more labour. However, the development of high-tech industry is higher and higher with the requirement, workers not easy to keep up with the requirement of their industries in time. So at present, the tertiary industry absorbs the labor ability is lower than the secondary industry.

3. Calculation of the lagging time of Employment Structure in Viet Nam

3.1. Lagging index

In order to measure the process of industrial restructuring, the economists（John.H.Moore,1978）proposed the "Moore structure index", which based on the Angle between the spatial vectors and the evolution of the GDP share of the three industries [6].

$$\varepsilon = \arccos \frac{\sum_{i=1}^{n} W_{i,t_1} W_{i,t_2}}{\sqrt{\sum_{i=1}^{n} W_{i,t_1}^2} \sqrt{\sum_{i=1}^{n} W_{i,t_2}^2}} \qquad （1\text{-}1）$$

The basic principle of the Moore structure's change value is assuming that n industries are taken as column vectors, if in the total output value of the three industries, a change in the proportion of an industry indicates that the angle between the industry and other industries is different. All the vectors are summed up to get the structural changes between the three industries in different periods. The change value of Moore's structure is calculated by measuring the angle between different stage columns，to measure the structural changes between the three industries in different periods, the calculation formula of this index is as follows:

W_{i,t_1} is the proportion of the i industry in the t_1 period in the total output value. W_{i,t_2} is the proportion of

the i industry in the t_2 period in the total output value. Because the Moore value represents the relative change of industrial structure in different periods, as a result $0 \leq \varepsilon \leq \dfrac{\pi}{2}$

If ε is bigger, it means the degree of industrial structure change is bigger. At different times, as the value of ε increases, the proportional relationship between the three industries will also increase. The change value of Moore structure not only represent the dynamic process of the output ratio relation between different industries in different periods, but also analyze the share situation between different groups, then related Other fields to structural changes can also be studied. In addition, the range of time series can be selected in practical application for analyze the changes in the industrial structure at a specific stage. Based on the fact that the Moore index can be enough to reflect the dynamic process of structural evolution in practical applications, so this research selects Moore structure index to calculate of the lagging time of Employment Structure in Viet Nam.

3.2 Grey relational analysis model
Grey relational analysis is an important part of the grey system theory, it is an analytical method which is equally suitable for the number of samples and the random samples, the calculation is minimal as well as very convenient [7]. The grey relational analysis method is used for quantitatively compare the correlation degree between various factors in the system, and the correlation degree is used as the standard to measure the degree of correlation between factors. In fact, it is a quantitative comparative analysis of dynamic process development trend. According to the similarity degree of the geometric form of sequence curve in the relation whether or not closely related. If sequence curves is closer, the correlation between sequences would be greater. It is shown that the development direction and speed of the two sequences are similar, and then the relationship between the two sequences is close, as indicate below.

Set $X_0 = \left(x_0(1), x_0(2), ..., x_0(n) \right)$ is system feature sequence

$X_i = \left(x_i(1), x_i(2), ..., x_i(n) \right)$ $(i = 1, 2, ..., m)$ is system behavior sequence

The two system sequences have the same length, all of which are 1- time interval sequence.

Definition $X_0^0 = (x_0^0(1), x_0^0(2), ..., x_0^0(n))$, $X_i^0 = (x_i^0(1), x_i^0(2), ..., x_i^0(n))$ is X_0 and X_i of the zero of the starting point

Among them:

$$x_i^0(k) = x_i(k) - x_i(1) \qquad (i = 0, 1, 2, ..., m; k = 1, 2, ..., n)$$

make: $|s_0| = \left| \sum_{k=2}^{n-1} x_0^0(k) + \dfrac{1}{2} x_0^0(n) \right|$

$$|s_i| = \left| \sum_{k=2}^{n-1} x_i^0(k) + \dfrac{1}{2} x_i^0(n) \right|$$

$$|s_i - s_0| = \left| \sum_{k=2}^{n-1} (x_i^0(k) - x_0^0(k)) + \dfrac{1}{2} (x_i^0(n) - x_0^0(n)) \right|$$

to : $\varepsilon_{0i} = \dfrac{1 + |s_0| + |s_i|}{1 + |s_0| + |s_i| + |s_i - s_0|}$ $(i = 1, 2, ..., m)$ （1-2）

The grey absolute correlation of sequence X_0 and X_i, the property of the absolute correlation of grey is expressed as follows:

Firstly, $0 < \varepsilon_{0i} \leq 1$

Secondly, The geometric shape of ε_{0i} with X_0 and X_i, it has nothing to do with its relative position, or it doesn't change the absolute correlation.

Finally, anything two sequences are not absolutely irrelevant.

ε_{0i} constant is not zero.

In the process of analysis, this system studies the relationship between the characteristic behavior of the system

and the behavior of related factors, it mainly focuses on the order of the correlation degree between the system characteristic behavior sequence and the related factors, and it's not exactly the magnitude of the correlation. If $\varepsilon_{0i} > \varepsilon_{0j} \ (i, j = 1, 2, ..., m, i \neq j)$, according to the theory of the grey advantage analysis, the correlation between the feature sequence X_0 and the behavior sequence X_i is superior to the behavior sequence X_j, remember to $X_i > X_j$. If $j = 1, 2, ..., m, j \neq k$, $X_k > X_j$, X_k is optimal fator, it means the behavior sequence X_k is most closely related to the feature sequence X_0.

3.3 The results
3.3.1 Measure lagging index

Table 2.   Results of lagging index of employment structure in Vietnam

Year	Moore structure of value		Year	Moore structure of value	
	Industrial structure	Employment structure		Industrial structure	Employment structure
1995	1.816	0.444	2005	1.978	2.857
1996	3.032	0.512	2006	0.135	1.416
1997	0.531	0.443	2007	2.094	0.606
1998	2.551	0.362	2008	1.432	0.822
1999	2.679	4.059	2009	0.981	3.020
2000	1.829	0.769	2010	1.346	1.095
2001	0.479	5.315	2011	0.842	1.564
2002	1.157	1.775	2012	1.904	0.613
2003	0.969	2.032	2013	1.742	0.629
2004	5.315	3.378	2014	2.186	0.569

Note: 1. According to the relevant data of Vietnam statistical yearbook 2017.
    2. According to formula 1-1 calculated.

$$\varepsilon_{1995} = \arccos \frac{\sum_{i=1}^{3} W_{i,1995} W_{i,1996}}{\sqrt{\sum_{i=1}^{3} W_{i,1995}^2} \sqrt{\sum_{i=1}^{3} W_{i,1996}^2}}, ...\varepsilon_{2014} = \arccos \frac{\sum_{i=1}^{3} W_{i,2014} W_{i,2015}}{\sqrt{\sum_{i=1}^{3} W_{i,2014}^2} \sqrt{\sum_{i=1}^{3} W_{i,2015}^2}}$$

According to the formula 1-1, the lag index is calculated for the change of the two types of structures in Vietnam from 1995 to 2015. The study took Vietnam's three major industries as column vectors, 1995 year as the base period to change, one year as the time period for change. Through Moore's formula, the relevant figures of the industrial structure and employment structure of Vietnam calculated from 1995 to 2015. The calculation results are shown in table 2.

As can be seen from table 2, the change of the dynamic state of the structure in Vietnam has own characteristics and principles. Overall, the adjustment of employment structure in Vietnam is slower than the adjustment of industrial structure. The industrial structure large fluctuations are around the year 1999, but from 1995 to 1999, the rate of change of the employment structure increased, showing development trends in Vietnam. But this rate of change in the employment structure has fallen significantly since 2009, from 3.020 in 2009 down to 0.569 in 2014.

3.3.2. Lagging time

This study consider the relevant data of Moore structure value of the industrial structure and employment structure in Vietnam from 1995 to 2015, used to grey relation analysis model to measure the lagging time of employment structure in Vietnam. Taking Moore structure value of the industrial structure from 1995 to 2004 as the benchmark feature sequence is X_0.

The data sequence length of the benchmark feature sequence and system behavior sequence is 10 years. According to the grey absolute relation degree formula. Calculated the absolute relation between X_0 and X'_0, and note is ε_{00}.

The benchmark feature sequence X_0 is kept constant, and the Moore structure value of the employment structure is shifted to the right for one year, the length of the moving time is 1, and the sequence length remains the same. The new system behavior sequence X_1 was constructed with the employment structure of Moore structure in 1996-2005 and to calculate the absolute correlation between X_0 and X_1, note is ε_{01}. That is the absolute correlation degree between the structure value sequence of the employment structure in 1996-2005 and the structure value sequence of the industrial structure in 1995-2004. Similarly, the system behavior sequence X_2，X_3,……,X_9 is constructed. Then, the grey absolute relation between the employment structure and the Moore structure value of the industrial structure is calculated from the time of moving time T from 2 to 10 is ε_{01},

ε_{02}, ε_{03},….,ε_{09}.

According to the grey analysis method, a comparison was made between all the grey relation degrees ε_{01}, ε_{02}, ε_{03},….,ε_{09} from 0-10. The maximum value of the grey absolute relation in time T is the lagging time of employment structure. It is shown that the system behavior sequence of employment structure is the much similar with the benchmark feature sequence of industrial structure. With the change in time T, the calculation results of the grey absolute relation degree of Vietnam's employment structure and industrial structure Moore index are shown in table 3.

The absolute relation results can be seen from table 3. When T=0, the relevant data was obtained by Moore lagging indicator in 1995-2004, then the benchmark feature sequence and system behavior sequence are obtained. The absolute relation index of the two is 0.8059, it means industrial structure and employment structure were more related at that time. When T=3, the Moore structure value of the behavior sequence based on the employment structure is the most closely related to the grey absolute relation of the Moore structure value of the industrial structure, (0.843). After that, the absolute relation degree of the structure value gradually decreases. It can be seen from the above analysis that when T=3, it means the employment structure behavior sequence also shifted to the right which is 3 years, the system behavior sequence composed of the behavior sequence of the employment structure in 1998-2008 and the system benchmark sequence of the industrial structure Moore value composed is very significant in 1995-2004, this reveals they are highly correlated. Hence, after three years, the influences of industrial structure adjustment is fully reflected in the change of employment structure in Vietnam, therefore it can be considered that the change of employment structure in Vietnam lags behind the industrial structure, with a three years lagging time.

Table 3.   Absolute relation of lagging index

Step length T	Absolute relation	Step length T	Absolute relation
0	0.8059	5	0.401
1	0.7409	6	0.7392
2	0.8189	7	0.5435
3	0.8843	8	0.5491
4	0.7499	9	0.5804

Note：According to the results of Moore's structure, the results are calculated according to the 1-2 formula.

Overall, this study uses relevant data of the two types of structures in Vietnam from 1995 to 2015, applying the grey relation analysis and time translation method, based on the Moore structure value to calculate the lagging time of employment structure in Vietnam. This study concludes across three strands; first, from a dynamic point of view, Moore's structure value can be judged through the evolution of the employment structure and industrial structure in Vietnam, and the study suggests a lagging problem of the employment structure in Vietnam. Secondly, the grey relation analysis method can be used to accurately measure the specific lagging time. A third important finding is that the employment structure in Vietnam lags behind the industrial structure, by a period of three years.

Substantially, the optimization of the employment structure is the optimization of the labor resource allocation. The employment structure in Vietnam lags behind the industrial structure by three years, distorting the allocation of resources; resulting in wastage of lot of resources. Therefore, the future development of industrial policy in Vietnam must take into account both industrial upgrading and employment promotion. At the same time, it is necessary to rationally allocate labor resources from the reality of lagging employment structure, so as to coordinate with the evolution of industrial structure, and to form a benign employment operation mechanism and to promote the healthy development of Vietnam's economy.

4. Conclusion

In the process of economic development, industrial structure and employment structure each other interact, mutual restriction, presents some internal interaction, operating requirements and the economic health of the industrial structure and employment structure to adapt to each other, and coordinated development.

This study through to 1995-2015 in Vietnam's detailed data for analysis, and used the Moore structure value and the grey relation analysis method, to build a lagging time model of employment structure in Vietnam. According to the following main to conclude:

First, from a dynamic point of view, Moore's structure value can be judged through the evolution of the employment structure and industrial structure in Vietnam, and the study suggests a lagging problem of the employment structure in Vietnam.

Second, the grey relation analysis method can be used to accurately measure the specific lagging time.

Third, the employment structure in Vietnam lags behind the industrial structure, by a period of three years.

Employment lags behind time over a long horizon which in turn causes serious unemployment, and affect industrial structure adjustment and upgrade. To construct an analysis model for lag time of employment structure

and provide findings that will resolve the incompatible state of the two structure, and promote the healthy development of industrial structure and employment structure in Vietnam.

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