An Empirical Analysis of Hubei Province Second Industrial Structure and Economic Growth

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Abstract. China has experienced three decades of steady and rapid development, and has made great achievements, this country is transforming from an agricultural country into a traditional sense of the big industrial nation. But our country’s economic growth is still relying on the extensive mode of growth, industrial structure is unreasonable, the economic resources of industry between reasonable effective configuration and circulation. Industrial manufacturing simple extensive, consumption development road, bring a lot of environmental pollution. The second industry in the national economy accounted for the largest, economic development is still mainly relying on the second industry. In this article, through Eviews 6.0 software related empirical model it’s established to analyze relationship between industrial structure and economic growth in Hubei province, so as to study the specific relationship between the industrial structure and economic growth in Hubei province, to further grasp and better improve the two relations, to promote economic growth in Hubei province providing reasonable suggestions.

1. Introduction

In this paper, the sample interval is used from 1990 to 2012, data from Hubei province statistical yearbook (2013).

This article uses the Hubei province GDP (Y) on behalf of the economic growth from year to year, and with the second industry output value structure is the second industry output value of GDP (X1), and the second industry of employment structure of the second industry practitioners from both of the proportion of the total number of (X2) to represent the industrial structure. Using 1990 as the base period GDP index to adjust GDP at current prices for comparable price GDP for the RY, in order to make the data of the trend line and eliminate possible heteroscedasticity, logarithmic transformation of various variables do get lnGDP, lnX1, lnX2.

2. The Empirical Analysis

In Hubei province of the specific relationship between the industrial structure and economic growth, economic growth led to the change of industrial structure, the adjustment of industrial structure and drive the economic growth of Hubei province, and they promote each other. How to determine the relationship between them? Below province, it’s studied from the perspective of the research of relationship between the industrial structure and economic growth.

2.1 Model selection

Based on the problems mentioned above and the characteristics of the correlation coefficient, we select the granger causality test in econometrics theory model to study the relations of between industrial structure and economic growth in Hubei province. On the one hand, it can avoid the emergence of the phenomenon of spurious correlation, on the other hand it can also be specific to determine whether there is a unidirectional influence of causality between them.

Granger causality test is a famous British econometrician Granger (Granger) define causality in 1969 and its inspection on the basis of development. It based on the system of vector autoregressive (VAR) to define, assume that each variable forecast time series of all information contained in these variables. Inspection to estimate two regression equations as follows:
\[ X_t = \sum_{i=1}^{m} \lambda_i Y_{t-i} + \sum_{i=1}^{m} \delta_i X_{t-i} + \mu_{2t} \]  
(2.1)

\[ Y_t = \sum_{i=1}^{m} \alpha_i X_{t-i} + \sum_{i=1}^{m} \beta_i Y_{t-i} + \mu_{1t} \]  
(2.2)

If you accept the null hypothesis \( H_{01}: \beta_1 = \beta_2 = \ldots = \beta_m = 0 \), it is not the Granger cause, or say yes Granger reason; If you accept the null hypothesis \( H_{02}: \lambda_1 = \lambda_2 = \ldots = \lambda_m = 0 \) Means that is not the Granger cause, or say that \( r \) is \( X \), Granger reason. The partial regression coefficient is zero joint inspection can be done by F test, structure F statistics are as follows:

\[ F = \frac{(RSS_R - RSS_{UR}) / m}{RSS_{UR} / (n - k)} \]  
(2.3)

Among them and respectively under the null hypothesis or constrained regression residual sum of squares and unconstrained regression residual sum of squares, \( m \) said lag order, sample number \( n \), \( k \) said the regression factor of an unconstrained regression. If the calculated F value is greater than the given threshold, reject the null hypothesis, shows that there is a causal relationship; accept the null hypothesis, conversely shows that there is no causal relationship.

2.2 Model is established in this paper

(1) The performance data

Using data of 1990-2012 annual data, the basis of specific use calculated at comparable prices get total gross domestic product reflect the calendar year in hubei province economic situation; With the second industry output value proportion of the total gross domestic product (X1), and the second industry professionals accounted for the proportion of the total number of employed (X2) reflects the historical situation of industrial structure of index data, the concrete numerical value as shown in the figure below.

The figure 1 shows that the regional GDP growth in Hubei province since 1990, Hubei province economic development in three stages: the first phase of regional GDP growth rate increased rapidly, from 10.8% in 1990 to 28.29% in 1994. The second stage slowing economic growth, GDP growth rate from 24.01% in 1995 fell to 3.70% in 1999. The third stage and a certain degree of speed up the economic growth, increased from 9.79% in 2000 to 22.95% in 2011.

![Figure 1](image1.png)

By as shown in figure 2, the second industrial structure in hubei province since 1990 three profound changes have taken place, the second change of industrial structure present in hubei province from 1990 to 2012 the following trends: the first stage: 1990-1992, the second industry share showed a trend of increase, but increase fast, its growth rate increased to 4.31% in 1990 from 23.55% in 1992. The second stage (1993-1993, the second industry share increased very slowly, its growth rate from 20.91% in 1993 to reduce to 8.61% in 2002. The third stage (2003-2003, the
second industry share growth to accelerate again, its growth rate increased from 14.39% in 2003 to 26.38% in 2011.

![Figure 2. During 1990-2012 in Hubei province area the second industry output value of GDP.](image)

As shown in figure 3, you can see the second industry in Hubei province since 1990 four deep changes have taken place in the employment structure, embodied in:

First stage (1990-1990), the second industry employment in proportion to reduce, the reason is because these two years comes as the national economic system reform, reform facing many enterprises in hubei province plant mergers, restructuring, makes some practitioners fired or laid off.

The second stage (1992-1992), the second industry proportion adding workers, the reason is because after the first three years of economic system reform of continuous efforts, the economic order has obvious improvement, the whole national economy has returned to normal growth, and the main task of the reorganization of the governance has been basically completed, most of the enterprises, factory in hubei province began to gradually revival, and raised the related workers.

The third stage (1997-1997), the second industry proportion again reduce workers (especially in 1998, the second industry reduce employment in proportion to the lowest point) reason is that the Asian financial crisis is forcing many domestic enterprises, factories closing, at the same time makes a lot of workers laid off the second industry.

The fourth stage (2003-2003), the second industry employment in proportion increase again except special points (2008) this is because China’s economy is over 1997 years since the Asian financial crisis of the adjustment of recovery, is entering a new rapid growth, with the central series of the policy of expanding domestic demand and relevant policy support, a large number of enterprises and factories quickly restore vitality, while increasing the proportion of practitioners.

![Figure 3. During 1990-2012 in Hubei province region accounted for the proportion of the total number of employed workers in the second industry.](image)
(2) Data stationarity test

Natural logarithm transformation for data do not change the causal relationship between the original variables, and can make its trend linearization, eliminate heteroscedasticity phenomena exist in the time series, respectively to GDP, the second industry output value proportion, the proportion of the first secundiparity practitioners as a natural logarithm transformation, were recorded as InGDP, lnX1, lnX2 and the data for further analysis.

Before the granger causality test, the best first to analyze the data of stability, improve the effect of causality test. Here the ADF test, including ADF test model in the form of:

$$\Delta Y_t = \alpha_0 + \gamma T + \beta Y_{t-1} + \xi_2 \Delta Y_{t-2} + \ldots + \xi_p \Delta Y_{t-p} + \epsilon_t$$  

(2.4)

The null hypothesis $H_0 : \beta = 0$. The alternative hypothesis $H_1 : \beta < 0$ receive $H_0$ means that the sequence, $Y_t$ has a unit root and is smooth. Among them, $\epsilon_t$ as the white noise, $\Delta$ as the check grade operator, $\alpha_0$ as the constant term, $T$ as trend factor. On lnGDP and lnX1, lnX2, ADF test, and the test results are shown in table 1.

Table 1. Stationarity test result table.

<table>
<thead>
<tr>
<th>The sequence</th>
<th>ADF test value</th>
<th>5% significant level threshold</th>
<th>Receive the original hypothesis probability value</th>
<th>If stationary series</th>
</tr>
</thead>
<tbody>
<tr>
<td>DlnGDP</td>
<td>-5.602326</td>
<td>-3.710482</td>
<td>0.0017</td>
<td>Yes</td>
</tr>
<tr>
<td>DlnX1</td>
<td>-4.475976</td>
<td>-3.733200</td>
<td>0.0140</td>
<td>YES</td>
</tr>
<tr>
<td>DlnX2</td>
<td>-5.818339</td>
<td>-3.658446</td>
<td>0.0007</td>
<td>YES</td>
</tr>
</tbody>
</table>

According to table 1, the lnGDP resulting from the natural logarithm transform time series variable in the raw water at ordinary times is smooth, but after the first order difference is stationary series, shows that the variable of first-order single whole sequence; Natural logarithm transformation after the lnX1 and lnX2 after the first order difference time series variable is smooth, this variable is a first order list of the whole sequence. This is to illustrate the three time series are first order. We know that after first order difference DlnGDP, DlnX1, DlnX2 data can be on behalf of the economic growth changes and changes in industrial structure. Therefore, it’s the difference of three time series cointegration relationship test to study the relationship between industrial structure and economic growth in Hubei province.

It’s not directly with non-stationary time series data of regression analysis are invalid, if there is a co-integration relationship between variables, is for them to do the results of the regression is still effective, so use Engte - two footwork Granger test whether there is a co-integration relationship between them.

Using the Eviews 6.0, calculated formula is as follows:

$$D\ln GDP = 9.809809D\ln X_1 + 3.762385D\ln X_2 - 39.73102$$

$$R^2 = 0.755564$$

$$\text{adjustment} R^2 = 0.731120$$

Residual difference as a model $\mu_t$, $\mu_t$: Do the ADF test. The results show that the residual sequence $\mu_t$: In the 5% significance level is smooth. The time series with DlnX1, DlnGDP, DlnX2 long-term equilibrium relationship between, shown as in table 2:
Table 2. The model of residual time series stationarity test.

<table>
<thead>
<tr>
<th>Augmented Dickey-Fuller test statistic</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test critical values:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1% level</td>
<td>-3.788030</td>
<td></td>
</tr>
<tr>
<td>5% level</td>
<td>-3.012363</td>
<td></td>
</tr>
<tr>
<td>10% level</td>
<td>-2.646119</td>
<td></td>
</tr>
</tbody>
</table>

Model to estimate the results by the equation 2.2 shows that the assumption that under the condition of other variables constant, changes in the structure changes of the second industry in Hubei province and economic growth is the same, namely when 1% of the second industry output value structure, the actual economic output would increase by 9.809890%; 1% in the same way, when the second industry employment structure changes, actual economic output would increase by 3.762385%, which conform to match the first-clark’s law.

3. The Granger Causality Test

For a group of cointegration relationship between vector, can show that the proportion of long-term and stable relationship between them. But whether they constitute a causal relationship, need through the granger causality test to determine.

According to the principle of granger causality test, using the Eviews 6.0, the change of industrial structure and economic growth in Hubei province were analyzed, and the granger causality relationship between the results of the analysis is shown in table 3.

Table 3. Granger test results (lag order number m = 2).

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The second industry output value proportion not granger cause of the total cost of</td>
<td>21</td>
<td>4.12089</td>
<td>0.0360</td>
</tr>
<tr>
<td>the production in Hubei province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hubei province GDP is not the granger cause the second industry output value</td>
<td></td>
<td>4.64161</td>
<td>0.0257</td>
</tr>
<tr>
<td>proportion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The proportion of secondary industry practitioners are not granger cause of the</td>
<td>21</td>
<td>8.54156</td>
<td>0.0030</td>
</tr>
<tr>
<td>total cost of the production in Hubei province</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hubei province GDP is not the granger cause the proportion of secondary industry</td>
<td></td>
<td>4.38906</td>
<td>0.0302</td>
</tr>
<tr>
<td>practitioners</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The inspection result from table 3: at 5% significance level, the second industry output value structure and economic growth in Hubei province into a two-way causal relationship, which influences each other. At the same time, the second industry employment structure and economic growth in Hubei province go into a two-way causality, namely the influence each other.

4. Error Correction Model

Cointegration relationship only reflects the long-term equilibrium relationship between variables. To make up for the lack of long-term static model, can through the error correction model reflect the long-term equilibrium effect on short-term volatility error correction mechanism. Is this model reflects the explained variable short-term fluctuations in short-term fluctuations can be explained variable and two variables of long-term equilibrium deviated from two part of the explanation.

$lnGDP$ and $lnX1$, $lnX2$ no significant error correction model is set up, and gradually eliminate variables after get:
\[ \Delta \ln GDP = -0.419812 \Delta \ln X_1 + 1.307348 \Delta \ln X_2 + 0.153678 - 0.004095C \] (4.1)

\[ R^2 = 0.468207 \]

adj \[ R^2 = 0.379575 \]

By formula (4.1) shows the ECM (1) coefficient is 0.004095 approximate equal to zero, at the same time the ECM (1) the probability value is very big, therefore was not significant, so from the point of view of model correction mechanism. That GDP of the second industry output value structure of Hubei province, Hubei province, and the second industry employment structure have no effect on short-term volatility.

5. Conclusions

From the empirical analysis of the above results, we can get the following conclusions:

1. Fluctuation of the second industrial structure in Hubei province, and there is a cointegration relationship between the economic growth: there is some economic mechanism between the industrial structure and economic growth with common change trend. Although Hubei in 1990-1990 the second the change of industrial structure and economic growth are not has the stability, but in the long term they are highly relevant statistics, long-term stability of the unique existence of dynamic equilibrium relationship. By the regression model is a positive relationship between them, that the increase in the proportion of the industrial structure can increase the economic aggregate, this fits with the first-clark's law also conform to the historical experience of industrial structure evolution. So can through adjusting the industrial structure in Hubei province to promote economic growth.

2. The second industrial structure change is the cause of the changes in economy. This is because the economic growth rate of total output in the output equals to all departments share of weighted and growth rate of output for the weighting of the department. Therefore, under the condition of unbalanced growth rate of output in the department, the structure changes will have important effect on the total growth rate. In this paper, the empirical shows that the proportion of secondary industry output value structure of hubei and the growth of real output into the same direction change relations, shows that the marginal productivity of the second industry of hubei province is higher than other industries. And secondary industry employment structure in hubei and the actual output growth was gone, that means the first and third industry employment off to the second industry, can make the scale of production gradually expand, thereby promote economic growth. i.e., labor transfer and upgrade of industrial structure is still the key to economic growth in hubei province, has brought the huge resource allocation efficiency, promoted the economic growth the relevant industry policies for the government to provide the basis.

3. Real economic growth is the cause of the change of industrial structure in Hubei province. Empirical shows that economic growth is bigger than the effect of the change of industrial structure in Hubei province, this is because the government gives full play to the regulatory role of the market mechanism, Hubei province issued a series of relevant policies, make it play a dominant role of market allocation of resources. Thus, study on the optimization of industrial structure of Hubei province to promote economic development at the same time, to strengthen the construction of market system through the market to adjust the configuration of resources between industries, to adapt the change of industrial structure to the economic growth.

The success of the economic structure transformation will drive the development of Hubei province so as to realize the goal of better and faster economic development, we must follow the general rule of change of industrial structure and economic development, from a strategic height to make the industrial structure adjustment policy guidance and the rational allocation of resources, and constantly optimize the industrial structure, promote the development of the deepening of the industrial structure, eventually to promote the sustained healthy and rapid development of economy.
References


