Dynamic Development Analysis of the Furniture Industry in Heilongjiang Province, China from the Perspective of Wood Processing and Furniture Import and Export

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Abstract

Raw material supply and trade changes are the main factors influencing the development of furniture manufacturing in Heilongjiang Province, China. In view of the dynamic association between indicators, wood processing is considered an essential raw material for furniture production, while import-export volumes indicate the changes in demand for furniture. When the Granger causality tests between indicators are performed, they suggest that wood processing has an obvious influence on furniture manufacturing. Through the Vector Auto-Regression model and the impulse response function, it is found that the interaction between wood processing and furniture making is strong. The relationship between furniture making and furniture import and export produces an expanding driving role or inhibiting effect, due to the uncertainty of import-export supply and demand. Finally, suggestions on promoting stable growth of Heilongjiang furniture making are proposed according to the analysis of the results.

Keywords: wood processing; furniture industry; import and export; dynamic development

1. Introduction

As the midstream and downstream sector of the wood industry, the furniture industry is a typical resource-based industry and also the secondary processing industry based on the wood processing industry. China has already become a great power in furniture production and the biggest exporter in the world. Over 1000 furniture enterprises are based in Heilongjiang Province and the number of employees is about 80000. Currently, the furniture manufacturing industry is clustered in areas of Harbin, Tsitsihar, Kiamusze, Yichun, Qitaihe and in the surrounding areas there has already been formed a diversified structure that gives priority to solid wood furniture and panel-type furniture. However, due to slow material supply, the furniture export and furniture industry development in Heilongjiang Province is lagging behind, performance of enterprises is unsatisfactory, and the effects of well-known brands are relatively weak. Therefore, it is of practical significance to know first how to raise the level of processing, to promote the secondary processing of furniture products, and to exploit market share overseas, while also satisfying the domestic market thus driving the development of Heilongjiang furniture manufacturing.

A lot of scholars expressed their opinions on the study of furniture manufacturing from different perspectives. The literature [1] indicates that multi-disciplinary views should be applied, human resource quality should be promoted, and the practice of only making

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profits from exported low-end products for Asian furniture enterprises should be abandoned. The literature [2] states briefly that both the sale and demand of the residential furniture industry are rising. Moreover, furniture that is sold to the U.S. is increasingly coming from China. Therefore, it can be observed that furniture export from China is a driving force on the manufacturing of furniture. The literature [3]puts forward the high-tech technology and advanced applied technology can facilitate the traditional furniture manufacturing industry, which should occupy a proper market share in the fierce international competition. The literature [4] conducted an empirical research on international competitiveness of the Chinese furniture manufacturing industry, from the perspectives of the scale of the industry, international trade power and industrial clustering, etc., and proposed recommendations that involve the speeding up of the industrial sector and technological progress. The literature [5] uses the analytic hierarchy process to confirm that there is a higher degree of correlation between the Gross National Product (GNP) and the demands on furniture manufacturing enterprises, on the consumer market and in China's furniture markets. The author thought that the market demand and the forecasting of China's furniture should be more systematic and be subdivided, which lays a foundation for the home conceptual design. Based on the results of the above-mentioned opinions and having the research perspectives (front-end production of wood processing and back-end furniture import-export trade changes), this paper analyzes the dynamic association for the development potential of Heilongjiang furniture manufacturing and it also provides a sound and reliable basis for promoting stable development in the Heilongjiang furniture industry. Thus, such a study has important practical significance.

2. Data Sources

Data sources: *Chinese Forestry Statistical Yearbook and Chinese Furniture Yearbook* from 2004-2014. Here, the data of Heilongjiang Province includes the Greater Khingan Mountains area.

3. Development Status

In recent years, wood processing and furniture making in Heilongjiang Province have been developing rapidly (see Fig.1). In 2003, the production value of wood processing in Heilongjiang Province was 4.46 billion Yuan, while it increased to 28.06 billion Yuan in 2013. The average annual growth rate was 20.18%. By contrast, the production value of furniture making was 381.64 million Yuan in 2003, but it increased to 4.37 billion Yuan in 2013. The average annual growth rate was 27.62%. Furthermore, the production value of furniture making in 2012 reached the highest level at 5.36 billion Yuan. From the perspective of the changing trends in the production value of wood processing and of furniture making, there is a rising trend line.

In addition, it is argued that the production value of wood processing in 2003 was 11.69 times that of furniture making's production, but such a production value declined to 6.42 times in 2013. On the one hand, such a rate relation indicates that wood products in Heilongjiang Province are further processed, so as to gain more added values. On the other hand, it also shows that Heilongjiang Province still gives priority to primary forest products and needs to further adjust the industrial structure, for the sake of acquiring added value of more forest products.

The rapid development in furniture industry also facilitates the rapid development of the import and export trade of furniture products (see Fig.2).The import-export volumes of Heilongjiang furniture products in 2003 were $ 0.92 million and $49.51 million respectively, while they increased to $4.6 million and $205.05 million respectively in

2013. The average annual growth rates were 17.42% and 15.27% respectively. It can be observed from Figure 1 that fluctuations of import-export volumes in Heilongjiang Province are obvious, but there is still an obvious rising development tendency. In addition, the export volume of furniture in Heilongjiang Province from 2003 to 2013 was greater than the import volume. Furthermore, furniture export occupied a large portion in production value of the Heilongjiang furniture industry.
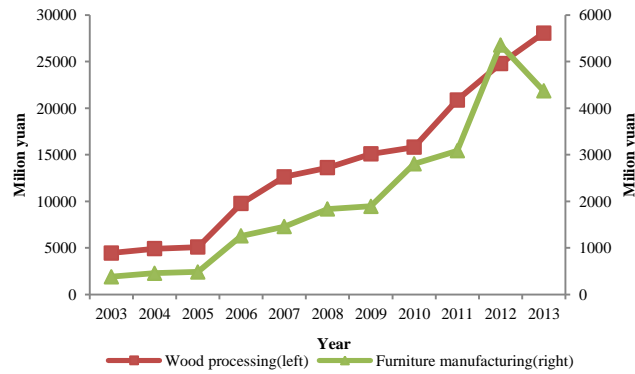
Figure 1.Production Value of Wood Processing and Furniture Making in Heilongjiang Province from 2003 to 2013
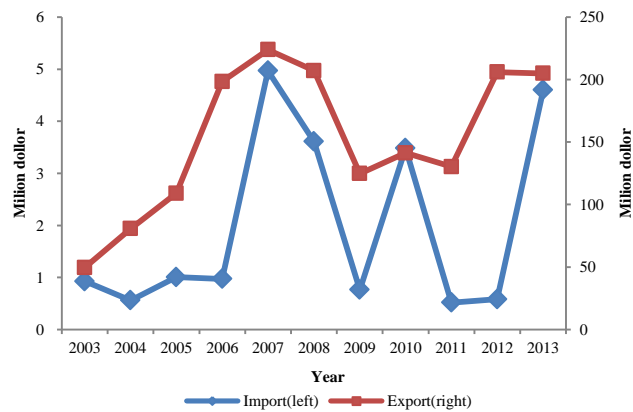
Figure 2. Changing Situation of Import-export Volumes of Furniture in Heilongjiang Province from 2003 to 2013

4. Model Methods

4.1. The Granger Causality Tests

The literature [6] indicates that the "Granger causality tests" are the statistical tests performed on the "leading-lagging" relation between two variables in the time domain. As for two variables X and Y, the Granger causality is required to estimate the following regression:

$$Y_i = \beta_0 + \sum_{i=1}^{m} \beta_i Y_{i-1} + \sum_{i=1}^{m} \alpha_i X_{i-1} \tag{1}$$

$$X_i = \delta_0 + \sum_{i=1}^{m} \delta_i X_{i-1} + \sum_{i=1}^{m} \lambda_i Y_{i-1} \tag{2}$$

β_0, β_i and α_i represent constant, Y's and X's lagged coefficients respectively; δ_0, δ_i and λ_i represent constant, X's and Y's lagged coefficients respectively.

The above-mentioned two models may have 4 results:

Firstly, X has an one-way influence on Y, namely entire coefficients of X's lagging items in Formula 1 are non-zero, while entire coefficients of Y's lagging items are zero;

Secondly, Y has an one-way influence on X, namely entire coefficients of Y's lagging items in Formula 2 are non-zero, while entire coefficients of X's lagging items are zero;

Thirdly, there is a bidirectional influence between Y and X, namely entire coefficients of X and Y's lagging items are non-zero;

Fourthly, there is no influence between Y and X, namely entire coefficients of X and Y's lagging items are zero.

Aiming at the above-mentioned results, two regression models with and without X (or Y) are calculated respectively. It is argued that the causal relationship between X and Y can be judged by using square of regression residuals and establishing F statistics between X and Y.

4.2. The VAR Model and Impulse Response Function

The literature [7] indicates that the Vector Auto-Regression (VAR) model analyzes lagging relations between model variables and describes dynamic influences, which are caused by random shock disturbances of some variables, on the other variables in the system, from the two perspectives of model endogenous variables and other system variables. The particular form of the model is:

$$\mathbf{y}_t = \mathbf{\Phi}_1 \mathbf{y}_{t-1} + \cdots + \mathbf{\Phi}_p \mathbf{y}_{t-p} + \mathbf{H}\mathbf{x}_t + \mathbf{\varepsilon}_t \quad t = 1, 2, \cdots, T$$

(3)

Here, $\mathbf{y}_t$ is a k-dimensional endogenous variables, $\mathbf{x}_t$ is a d-dimensional exogenous variable vectors, p is a lagging order, T is the number of samples, $\mathbf{\Phi}_1 \cdots \mathbf{\Phi}_p$ are k∗k-dimensional endogenous variables, $\mathbf{H}$ is a k∗d-dimensional exogenous variable coefficients, $\mathbf{\varepsilon}_t$ is random disturbance, and there are no related relations between $\mathbf{\varepsilon}_t$ and other endogenous or exogenous variables.

Besides, the impulse response function can be applied to display the dynamic influences of the VAR model in the specific form of the functional graph, so the Vector Auto-Regression model and impulse response function can be used to analyze the dynamic association among wood processing, furniture import and export and furniture making in Heilongjiang Province. Because the research emphasis lies in analyzing the internal relations between wood processing, furniture import and export, and furniture making, all variables should be considered as endogenous variables and ignore the influences of other factors (namely there are no exogenous variables) in the process of building the VAR model. Moreover, it is necessary to apply EViews5.0 to construct the VAR model and impulse response function between two variables.

5. Model Results

The production value of wood processing is regarded as Variable X, the production value of furniture making is viewed as Variable Y, and the import-export volumes of furniture are IM and EX respectively. The results of model calculation are shown as follows.

5.1. Calculation of Granger Causality

According to the basic methods of Granger Causality tests that were mentioned in Table 1, the experiments were performed using the three variables selected: wood processing, furniture import and export, and production value of furniture making respectively.

Table 1. Granger Causality Tests

	Null Hypothesis	Lag	F-Statistic	Probability
$X \leftrightarrow Y$	Y does not Granger Cause X	1	0.5277	0.4911
	X does not Granger Cause Y		8.8744	0.0205
$IM \leftrightarrow Y$	Y does not Granger Cause IM	2	0.5137	0.6330
	IM does not Granger Cause Y		0.6839	0.5553
$EX \leftrightarrow Y$	Y does not Granger Cause EX	2	1.0138	0.4404
	EX does not Granger Cause Y		1.6926	0.2934

It can be found that the optimal lag order of wood processing and furniture making in Granger causality tests is 1, and the optimal lag order of furniture import and export and furniture making is 2. In addition, from the perspective of the results of the Granger causality tests, only wood processing has prominent Granger causality for furniture making at a 0.05 confidence level, while other Granger causality tests are passed. Furthermore, in the probability of Granger causality, compared with influences of furniture import, influences of furniture export on furniture making are relatively obvious. Though the effects of the Grander causality tests are not that ideal, the VAR model can be further established to show the influential paths of furniture making and other indicators which can be described using the impulse response function, for the sake of analyzing processing and furniture import and export's internal dynamic effects on furniture making in Heilongjiang Province.

5.2. The VAR Model

According to the VAR model one can calculate the effects between the variables of wood processing, furniture import and export, and furniture making respectively. The calculation results are shown as follows:

(1) Wood Processing and Furniture Making

In the condition of lag order 1, the VAR model of wood processing and furniture making can be obtained. At the moment, two R^2 of the model are $R_X^2 = 0.9549$ and $R_Y^2 = 0.8861$ respectively. Meanwhile, F values of the two models are $F_X = 74.0475$ and $F_Y = 27.2420$ respectively. Entire fitting effects of the model are very good.

$$\begin{bmatrix} X_t \\ Y_t \end{bmatrix} = \begin{bmatrix} 1944.4110 \\ -811.4837 \end{bmatrix} + \begin{bmatrix} 0.8824 & 1.0038 \\ 0.3049 & -0.4001 \end{bmatrix} \begin{bmatrix} X_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \qquad (4a)$$

It is argued that furniture making's derived demands for wood processing are relatively large. The contribution margin is 1.0038. In other words, in the case of the other static factors, for every 1 unit that the production value of furniture making increases the unit value for wood processing increases 1.0038. The contribution margin of wood processing for furniture making is 0.3049. In the same situation, every 1 unit production value of wood processing increases 0.3049 unit production value for furniture making.

(2)Furniture Import and Furniture Making

In the condition of lag order 2, the VAR model of furniture import and furniture making can be obtained. At the moment, 2 R^2 of the model are $R_{IM}^2 = 0.2779$ and $R_Y^2 = 0.9332$ respectively. Meanwhile, F values of the two models are $F_{IM} = 0.3848$ and $F_Y = 13.9593$ respectively. Thus, it can be observed that furniture making has lower explanatory ability to furniture import, but furniture import has stronger explanatory

ability to furniture making.

$$\begin{bmatrix} IM_t \\ Y_t \end{bmatrix} = \begin{bmatrix} 2.3331 \\ 556.35 \end{bmatrix} + \begin{bmatrix} -0.0690 & 0.0018 \\ -116.14 & -0.4637 \end{bmatrix} \begin{bmatrix} IM_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} 0.0241 & -0.0023 \\ -98.90 & 2.1780 \end{bmatrix} \begin{bmatrix} IM_{t-2} \\ Y_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \qquad (4b)$$

From the model parameters, no matter it is lag order 1 or lag order 2, influences of furniture import on furniture making are negative values. In other words, import restrains inherent production. Such a situation conforms to physical truth. From the perspective of numerical magnitude, compared with order 1, inhibition of order 2 starts to diminish as time goes by.

(3) Furniture Export and Furniture Making

In the condition of lag order 2, the VAR model of furniture export and furniture making can be obtained. At the moment, 2 R^2 of the model are $R_{EX}^2 = 0.5586$ and $R_Y^2 = 0.9514$ respectively. Meanwhile, F values of two models are $F_{EX} = 1.2654$ and $F_Y = 19.5814$ respectively. Similarly, furniture making has lower explanatory ability to furniture export, but furniture export has stronger explanatory ability to furniture making.

$$\begin{bmatrix} EX_t \\ Y_t \end{bmatrix} = \begin{bmatrix} 86.2255 \\ 188.80 \end{bmatrix} + \begin{bmatrix} 1.2557 & -0.0625 \\ 8.3292 & -0.9587 \end{bmatrix} \begin{bmatrix} EX_{t-1} \\ Y_{t-1} \end{bmatrix} + \begin{bmatrix} -0.9776 & 0.1015 \\ -11.127 & 2.9977 \end{bmatrix} \begin{bmatrix} EX_{t-2} \\ Y_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix}$$

(4c)

From the model parameters, it can be observed that furniture export has a stronger driving effect on furniture making in order 1(8.3292), but it produces inhibition in order 2(-11.127). Such a change is mainly related to furniture inventory. In other words, if current production can't be exported effectively, it will cause inhibition on later furniture production.

5.3. Impulse Response Function

According to the above-mentioned three VAR models, the impulse response function diagrams between every two variables can be further drawn, so as to analyze the dynamic association among wood processing, furniture import and export, and furniture making.

The Dynamic Association between Wood Processing and Furniture Making. It is obvious from Figure 3 that furniture making in Heilongjiang Province causes 1 unit shock disturbance during the initial period (1 unit standard deviation 1.6349095 billion Yuan) and results in 0 unit shock disturbance on wood processing in order 1, but causes 468.253 million Yuan of shock disturbance in order 2. With the relative disturbance, it is increased slightly and reaches a driving role of 594.0644 million Yuan in order 10. Besides, from the upper and lower limits of shock disturbance's double standard deviation, the driving role in order 10 is the strongest and can reach 2.371072 billion Yuan. On the contrary, inhibition can reach up to -1.18294 billion Yuan.
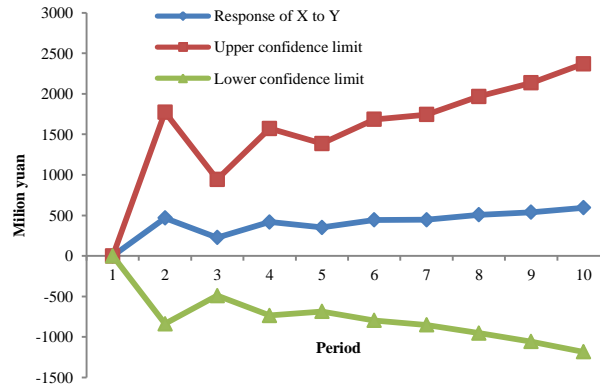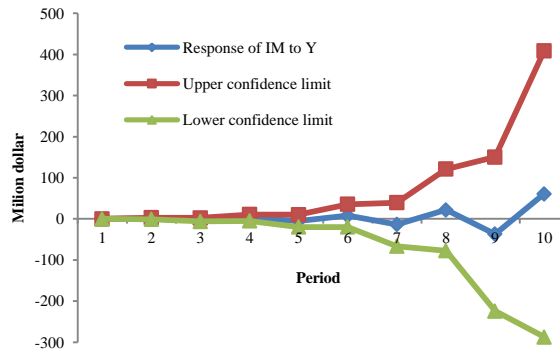
Figure 3. Impulse Response of X to Y

In addition, it is obvious from Figure 4 that wood processing in Heilongjiang Province causes 1 unit shock disturbance during the initial period (1 unit standard deviation 7.992583 billion Yuan) and results in 403.2806 million Yuan of shock disturbance on furniture making in order 2. Afterwards, the value of shock disturbance presents the rising trend and reaches a maximal driving role of 820.3031 million Yuan in order 10. Similarly, the upper and lower limits of wood processing's double standard deviation driving role on furniture making present the expanding trend. Upper and lower limits in order 10 are 2.15197 billion Yuan and -511.36 million Yuan respectively.
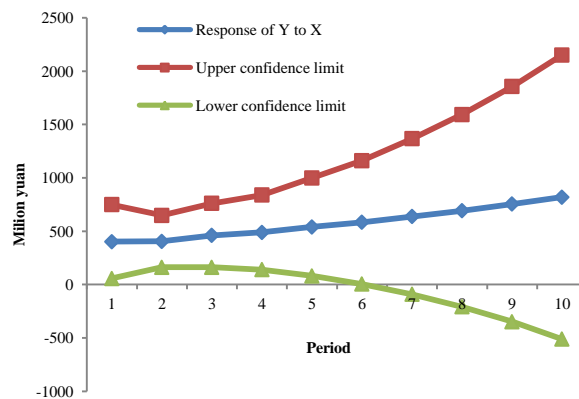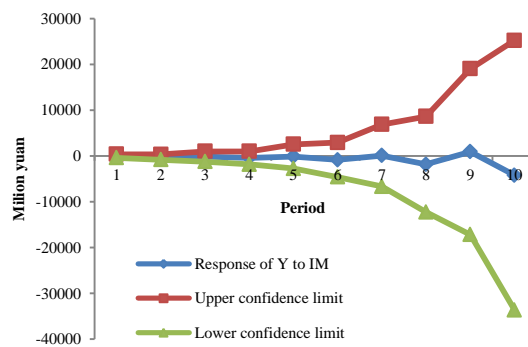

Figure 4. Impulse Response of Y to X

The Dynamic Association between Furniture Export and Furniture Making. It is obvious from Figure 5 that furniture making in Heilongjiang Province causes 1 unit shock disturbance during the initial period (1 unit standard deviation 1.6349095 billion Yuan) and results in 0 unit shock disturbance on furniture import in order 1, but causes $0.955186 million of shock disturbance in order 2. Afterwards, shock disturbance fluctuates around 0, but also presents the expanding trend. However, it can be found that the driving role caused by furniture making in Heilongjiang Province on furniture import is very small. Furthermore, from the perspective of upper and lower limits of shock disturbance's double standard deviation, furniture making's upper and lower limits on shock disturbance of furniture import also have a gradually expanding trend. Nevertheless, from the numerical value of driving (or inhibiting) effects, it is still very small by comparison with other impulse response values.

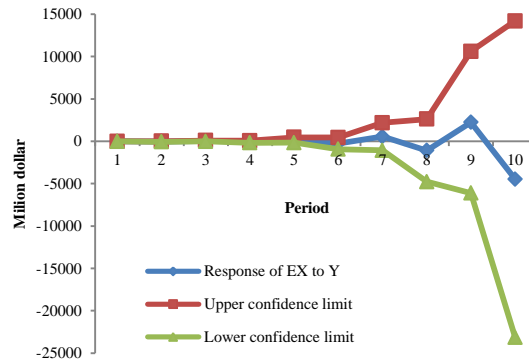**Figure 5. Impulse Response of IM to Y**

Besides, It is obvious from Figure 6 that furniture imports in Heilongjiang Province cause 1 unit shock disturbance during the initial period (1 unit standard deviation $1.7726 million) and result in -25.1777 million Yuan of inhibiting disturbance on furniture making in order 1. Afterwards, the entire shock disturbance shows a declining trend and reaches the minimal -848.6 million Yuan in order 6. Then, shock disturbance fluctuates around 0. Similarly, upper and lower limits of furniture import double standard deviation's driving role on furniture making indicate an expanding trend.
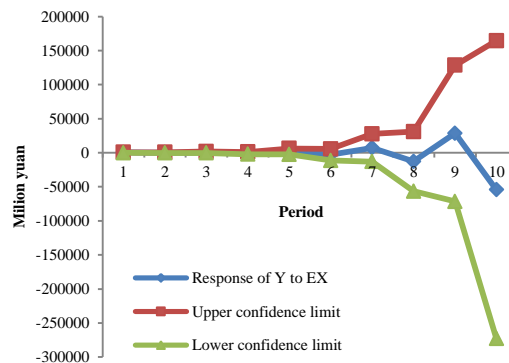

Figure 6. Impulse Response of Y to IM

The Dynamic Association between Furniture Export and Furniture Making. It is obvious from Figure 7 that furniture making in Heilongjiang Province causes 1 unit shock disturbance during the initial period (1 unit standard deviation 1.6349095 billion Yuan) and results in 0 unit shock disturbance on furniture export in order 1. Afterwards, shock disturbance fluctuates around 0. However, with the expansion of fluctuating value, it reaches a driving role of $ 2.246842 billion in order 9. In addition, from the perspective of upper and lower limits of shock disturbance's double standard deviation, the strongest driving role in order 10 can reach $ 14.19453 billion. If it produces inhibition, the maximum also can reach $-23.1459 billion.

Figure 7. Impulse Response of EX to Y

In addition, it is obvious from Figure 8 that furniture export in Heilongjiang Province causes 1 unit shock disturbance during the initial period(1 unit standard deviation $59.0654 million) and results in driving disturbance of 296.4577 million Yuan on furniture making in order 1. Afterwards, shock disturbance presents the rising trend and reaches the maximal 645.7495 million Yuan in order 3. Then, shock disturbance fluctuates around 0, but the numerical value is also expanding. Similarly, upper and lower limits of furniture import double standard deviation's driving role on furniture making present the expanding trend. Moreover, maximal driving role reaches 164.3658 billion Yuan in order 10, or it can -272.962 billion Yuan of inhibition. As a matter of fact, the driving role and inhibition are mainly determined by contradictions between external demands and internal supplies.

Figure 8. Impulse Response of Y to EX

6. Discussions

The following conclusions can be obtained through the above-mentioned analysis results:

Now the forest product processing in Heilongjiang Province still attaches the most importance to primary forest product processing, so it loses lots of potential added value of forest products. Furniture export occupies a larger proportion in Heilongjiang furniture making. According to Granger Causality Tests and results of the VAR model, it can be found that wood processing has an obvious driving role on furniture making. From the perspective of the impulse response function, the interaction between wood processing and furniture manufacturing is the most significant. The influences of furniture export on furniture making are more remarkable than that of furniture import. Furthermore, the shock disturbance between furniture making and furniture import and export produces mutual promotion or mutual inhibition, due to uncertainty of trade supply and demand. No matter it is wood processing or furniture import and export, the mutual driving (or

inhibiting) relationship with furniture making presents the rising trend, as time goes by.

7. Suggestions

Firstly, increase wood processing ability and improve added value of forest products.

The main reason for relatively weak furniture making production ability in Heilongjiang Province attributes to insufficient transfer ability of raw material supply and lower scientific value added content of products. Thus, this requires the government support for the progress of enterprises. First of all, the government should guide and safeguard sustainable utilization of forest resources and conservation of woods. Secondly, it is necessary to implement industrial cluster development strategies and brand marketing strategies to improve the whole competitiveness of the wood processing industry. Then, it is also important to encourage industrial innovation, introduce advanced production technology and equipment, and improve innovation competitiveness. Finally, it must enlarge investment strength and safeguard industrial sustainable competitiveness, and improve added value of forest products, while taking full advantage of forest resource advantages in Heilongjiang province.

Secondly, enlarge furniture product export and fully drive the development of the furniture industry.

In order to better develop the furniture industry in Heilongjiang Province, a perfect export market structure must emerge, a promotion of long-term development of the furniture industry is necessary and it must begin with the following aspects: Firstly, enterprises should set up the idea of "environmental protection" to cope with technical barriers to trade and to establish brand consciousness and innovation consciousness. Secondly, they should fully grasp the furniture demand tendency of furniture exporting target countries and adjust supply quantity and structure of furniture production in time. Then, it is necessary to optimize export market structure, implement diversified strategies of the export market, to reinforce training of professionals and to improve design level integration with international demands.

Acknowledgements

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