Research Article
The Empirical Analysis on Man-made Board Market Price Fluctuation Characteristic

Xu Sufei and He Yong
Department of Economics and Trade, Guilin University of Aerospace Technology,
Gui Lin, Guangxi, China

Abstract: Based on the analysis of the fluctuations trend of man-made board price, this study has carried on the empirical research to the fluctuations characteristics of man-made board price using ARCH class models in our country. The research showed that: market price fluctuations of plywood, fiberboard and particleboard in China have significant agglomeration. In addition, the main man-made board market did not show the characteristics of the high risk with high reward. Therefore, some suggestions to stabilize man-made board market price have been put forward.

Keywords: ARCH model, man-made board, price fluctuation

INTRODUCTION

With China's long-term stable growth of national economy and steady improvement of people's life quality, the demand of urban and rural residents on the floor, furniture and other wood products is rising. In addition, abnormally rapid development of construction also makes the consumption of man-made board continue to improve. In recent years, with the influence of the manufacturing cost, market supply and the national economy, the price of man-made board presents fluctuations with certain amplitude. According to man-made board price index in China timber price index website: in the first half of 2012, China man-made board price showed a trend of decline; In the second half of the price volatility, man-made board price index is around 130.5 (June 2006 as the base period) up and down; In the first half of 2013, man-made board price is down again compared with the price before and price index fluctuates around 129.5. The fluctuations of Man-made board price will bring impacts with different degrees on upstream and downstream man-made board industries, such as wooden furniture and architectural decoration industry (Feng *et al*., 2012).

Therefore, the study of the characteristics of man-made board market price fluctuations and putting forward feasible suggestions have important practical significance to the stability and control of man-made board market risk (Diaa *et al*., 2014). Current research in the field of timber price, mainly concentrated in the analysis of the log price fluctuations and price influence factors on the analysis of log, such as Chen (2010) the quantitative analysis for China's timber price

fluctuations and to judge the stability of the timber price, to solve the contradiction between supply and demand of wood provide a theoretical basis and practical operation methods; Yi (2012) analyzed the collective forest right system reform of forestry policy impact on timber price; Ma and Wang (2013) in the wood, for example, analyzed the impact of fluctuations in the price of the forestry policy of forest products (Chen and Ma, 2013). And the study of man-made board price fluctuate little, therefore, This article will use ARCH class models to analyze market price fluctuation characteristics of different types of man-made board.

Considering that the man-made board mainly includes three types: plywood, fiberboard and particleboard products, this study mainly collected the products market price index of the three categories and analyzed the regularity and risk of price fluctuations, so as to provide reference for dealing with the market price fluctuations of the man-made board in our country.

Market price fluctuations situation of main man-made board: This paper studies the market price fluctuations of man-made board in our country, according to ≪China forestry statistical yearbook≫ (2011), the statistics show that during the period of "11th five-year plan", three boards production of plywood, fiberboard and particleboard accounted for 81.54% of total man-made board production, while the proportion was 86.00% in 2011, so the three kinds of man-made board were took as the research object and analyzing their market price fluctuations.

Corresponding Author: He Yong, Department of Economics and Trade, Guilin University of Aerospace Technology, Gui Lin, Guangxi, China
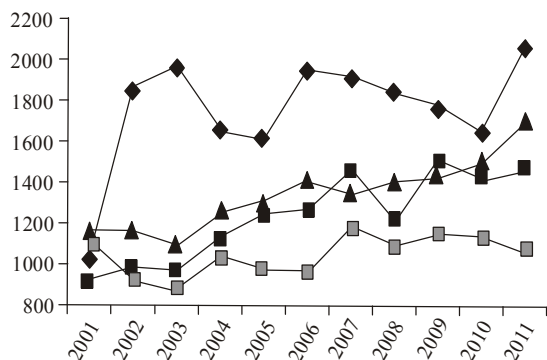
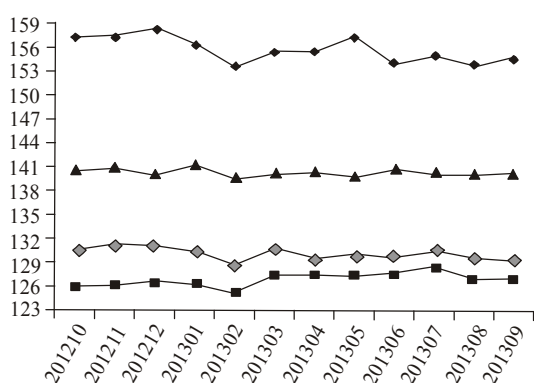Fig. 1: Market price trend of man-made board between 2001-2011

Fig. 2: Market price index fluctuation of man-made board between Oct. 2012-Sep. 2013

Long term trend of man-made board market prices:
Since 2001, average sales price trend of main man-made board in our country is shown in Fig. 1. It can be seen that the actual average price of plywood has the trend of rising and decrease before 2006, while during 2006-2010, there was a trend of continuously decline and it rose again in 2011 with a large scope. The actual average price of hardboard and Medium Density Fiberboard (MDF) presented the rising trend on a whole during 2001-2011. Compared with 2001, hardboard prices rose by 1.59 times in 2011, while for Medium Density Fiberboard (MDF), the price rose 1.46 times in 2011. Average price of particleboard fluctuated during 2001-2007, while there was a basically steady trend after 2008 and the actual average sales price was 1100 Yuan/m^2.

Short term trend of man-made board market prices:
According to man-made board price index of China Timber price index website (Taking June 2006 as the base period), the price index of Man-made board between Oct, 2010 and Sep, 2013 was shown in Fig. 2. Since Oct, 2012, price index changes of Medium Density Fiberboard (MDF) can be divided into three stages. Before December, 2012, plywood price is relatively stable remaining at around 157 Yuan/m^2, between January-June in 2013, plywood price has small amplitude fluctuation, minimum price index was 153.05 Yuan/m^2 in February and maximum was up to 156.96

Yuan/m^2 in May. After July in 2013, plywood price tended to be relatively stable with prices remaining at around 154 Yuan/m^2.

The price index of Medium Density Fiberboard (MDF) was divided into three relatively stable stages. The price index was remaining around 126 before February and August-September in 2013. Between March-July in 2013, its price index maintained at around 127. For particle board, its price index has tended to be relatively stable since October in 2010 and it basically did not appear fluctuation process with a large degree and the basic price index was around 140. From the comprehensive view, although the price index of plywood and Medium Density Fiberboard (MDF) was being in different degree of volatility, but its degree of rise and decrease was not large, while the particle board price index has been in a relatively stable trend. Therefore, during October, 2012-September 2013, man-made board price index tended to be stable as a whole, although there was a small amplitude trend of fluctuations, there was no sharp rise and fall process.

EMPIRICAL ANALYSIS ON MAN-MADE BOARD MARKET PRICE FLUCTUATION CHARACTERISTIC

Data sources and research methods: In order to better analysis of fluctuation features of main man-made board market price, monthly data of August 2010 to September 2013 was taken as samples and market price fluctuation characteristics of plywood, medium density fiberboard and particleboard were mainly analyzed.

Data was from man-made board price index which was released by China timber price index. Here the method of price returns rate was mainly adapted to analyze the features of man-made board price fluctuations. The formula was shown as:

$$Y_t = \ln p_t - \ln p_{t-1}$$

where, P_t represents price index of one kind of man-made board in t month.

In this study, firstly, descriptive analysis and unit root stationary test of all kinds of man-made board price index and price yields sequences were done; Secondly, with the aid of ARMA model to set the mean equation and ARCH-LM test were finished; Finally GARCH model and GARCH-M model were established (Härtl *et al.*, 2013). GARCH model mainly tested whether market price fluctuations have cluster building; GARCH-M model mainly tested whether man-made board market has characteristic of high risk with high return (Table 1).

MODEL ESTIMATE RESULT

According to the autocorrelation and partial correlation analysis of time series and further according to fit goodness R2, information criterion AIC, DW

Table 1: Statistic of man-made board price return rate

	Mean	Standard value	Skewness	Kurtosis	JB test	JB test p-value
Plywood	0.0134	0.0489	2.0612	7.8868	63.0149	0.0000
Fiberboard	0.0056	0.0485	-1.5485	12.6852	159.4012	0.0000
Particle board	0.0052	0.0452	1.9013	11.8115	141.9914	0.0000

Table 2: ARCH model result of man-made board price return rate

	Model	α_0	α_1	β_1	β_2	ρ
Plywood	GARCH (1, 1)	0.000018* (1.91)	0.75** (11.10)	0.21** (3.14)		
	GARCH (1, 1)-M	0.000016 (1.55)	0.61** (8.85)	0.35** (5.62)		0.11 (1.13)
Fiberboard	GARCH (1, 1)	0.000009 (1.53)	0.58** (6.27)	0.32** (2.78)		
	GARCH (1, 1)-M	0.000010 (1.36)	0.59** (4.29)	0.31* (1.90)		0.04 (0.24)
Particle board	GARCH (1, 2)	0.000005 (1.34)	0.48* (1.63)	-0.16* (-1.82)	0.28** (2.33)	
	GARCH (1, 2)-M	0.000005 (1.29)	0.38* (1.67)	-0.16* (-1.86)	0.30** (2.34)	-0.03 (-0.23)

Z: Statistic value; *: Be significant under 10% level; **: Be significant under 5% level

statistic value, order of ARMA model of all kinds of man-made board return rate sequence was determined. ARMA (2, 2), ARMA (1, 1) and ARMA (2, 1) were finally chosen as the final model of price sequence of plywood, medium density fiberboard and particleboard respectively. In order to verify whether there is ARCH effect, ARCH-LM test was done to the residuals of the above model, respectively. Test results were shown as follows: under 5% significance level, when lag order number was chosen 6, return rate sequences of plywood, medium density fiberboard and particleboard existed significantly heteroscedasticity effect, namely these sequences have advanced ARCH effect, so GARCH model was built.

According to the coefficient requirements of ARCH class model and criterion of AIC minimum value of overall model, of GARCH (1, 1), GARCH (1, 2), GARCH (2, 1) and GARCH (2, 2) model of all kinds of man-made board were used in the comparison respectively. Finally, GARCH (1, 1) model was chosen for plywood and medium density fiberboard, GARCH (1, 2) model was chosen for chipboard (Table 2).

Plywood: GARCH (1, 1) model of plywood estimate result showed that both $\alpha1$ and $\beta1$are significantly different from 0 under 5% level, which suggested that the price return sequence of plywood has significant fluctuations. $\alpha_1+\beta_1 = 0.96$, which is less than 1 and it showed that impact of price fluctuation of the plywood price in the past to the future decreased and gradually disappeared. Estimate results of plywood GARCH (1, 1) -M model showed that $\alpha_1+\beta_1 = 0.11$ of plywood price variance, but it was not significantly different from 0 under 10% level. Therefore, it means that plywood market hasn't the characteristics of high risk with high reward.

Fiberboard: Estimate results of medium density fiberboard GARCH (1, 1) model showed that both α_1 and β_1 are significantly different from 0 under 5% level, which suggested that the price return sequence of medium density fiberboard has significant fluctuations. $\alpha_1+\beta_1= 0.90$, which is less than 1 and it showed that the impact of price fluctuation of medium density

fiberboard in the past has gradually decreased on the future. The estimate result of medium density fiberboard GARCH (1, 1)-M model showed that $\alpha_1 + \beta_1 = 0.04$ of MDF price variance, but it was not significantly different from 0 under 10% level. Therefore, it means that MDF market hasn't the characteristics of high risk with high reward.

Particle board: GARCH (1, 2) model of particle board estimate result showed that both α_1, β_1, β_2 are significantly different from 0 under 10% level, which suggested that the price return sequence of particle board has significant fluctuations. $\alpha_1+\beta_1+\beta_2 = 0.60$, which is less than 1 and it showed that impact of price fluctuation of the particle board price in the past to the future gradually decreased.

Estimate results of particle board GARCH (1, 2) -M model showed that $\rho = -0.03$ of particle board price variance, but it was not significantly different from 0 under 10% level. Therefore, it means that particle board market hasn't the characteristics of high risk with high reward.

RECOMMENDATIONS

In order to stabilize man-made board market price and promote stable development of this industry, some suggestions were put forward.

Promote the construction of man-made board future market: At present, sell of man-made board is generally through the dealers, from the ex-factory price to purchase price, such as furniture factory and decorate company and the other consumer companies and the market price difference is bigger, while future companies will help to shape public rational man-made board prices.

In addition, man-made board processing enterprises are often in a weak position, facing the upstream enterprises' passive price adjustment and even facing the downstream enterprises, they can't timely adjust the ex-factory price, thus it's necessary to launch futures varieties of man-made board to stabilize the market price and reduce the enterprise risk.

Stabilize timber prices: Stabilize price is the key to keep the man-made board price stability. Therefore, first thing is to speed up the cultivation of forest resources and improve quantity and quality of forest resources, in order to alleviate the domestic timber supply and demand imbalances; Secondly, we must through stability of forestry policy and improvement of the regulatory mechanism of timber price to promote the healthy development of timber market, in order to prevent timber price volatility.

Strengthen market regulation and control of man-made board downstream industries: With the development of the real estate industry, it is inevitable to bring a large number of man-made board consumption, which affects market price of man-made board. Therefore, countries should continue to adjust and control the development of downstream industries of man-made board to and prevent the overheating trend of real estate industry development, so as to maintain the man-made board materials prices to be stable.

Strengthen supervision and monitoring of man-made board daily market price: To strengthen the early warning of man-made board market price monitoring, forecasting work and pay close attention to dynamic market price of man-made board (Joshi *et al.*, 2013). Moreover, carrying on strict management to illegal actions, such as price fraud hoarding, price collusion and other illegal behaviors, in order to safeguard the normal price of man-made board market order.

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