Forecasting Supply and Demand of the Wooden Furniture Industry in China

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Abstract

China is the world's largest furniture producer and exporter, but its furniture industry has always been at the bottom of the global value chain. Wooden furniture is the most important component of China's furniture industry. Its capacity and scale have been expanding; however, the industry's income and profit growth rate have declined. China's wooden furniture industry is in a period of transition, and industry regulators, participants, and even investors need to understand the future development trends of the industry. This study collected time series data for annual sales as well as the value of output, exports, and imports of the wooden furniture industry in China and used the autoregressive integrated moving average (ARIMA) model to predict future market supply and demand. The study found that each figure will continue to grow over the next 5 years. However, the industry as a whole will face the challenge of oversupply. In addition, the domestic market share on behalf of industrial competitiveness will decline year by year. Through a comprehensive and systematic analysis of the changing trend of China's wooden furniture production and its domestic and foreign markets, this study is the first to predict the supply and demand of research, filling the gap in the research field of wooden furniture, and its research ideas have some innovation. It can provide a reference for industry regulators, enterprise decision makers, and domestic and foreign investors.

China is the world's largest furniture producer and exporter. The furniture industry in China has played an important role in the development of the national economy. The growth rate of retail furniture sales in China was 4.6 percent higher than that of the total retail commodity sales. At present, the total output and sales value of wooden furniture in China accounts for more than 60 percent of the total furniture manufacturing industry, with an annual growth rate higher than other types of furniture. As such, wooden furniture has an extremely important position in the furniture industry, but China's wooden furniture industry is facing a series of difficulties.

The industry has been fully integrated into the global value chain, and it has benefited from this integration. However, at the same time, it is suffering from a sharp rise in the cost of raw materials and profit exploitation, competing with manufacturers of primary furniture products and original equipment manufacturers. In addition, the majority of China's manufacturing industry is involved in the "fabrication" stage of production, which has low added value; this is especially true for labor-intensive industries such as the manufacture of wooden furniture (Zeng and Nie 2010).

China's wooden furniture exports accounted for about 98 percent of its total wooden furniture international trade. Indeed, out of all forest products, wooden furniture is China's highest earning foreign export (Han et al. 2009). However, in recent years, China's wooden furniture industry has faced an unfavorable international trade environment. Since the establishment of the World Trade Organization (WTO), the number of antidumping cases has decreased, but the proportion of antidumping cases against China has been increasing (Yang 2005). After the global financial crisis in 2008, the demand for wooden furniture in the international market became weak, and the comparative cost advantage of China's manufacturing industry gradually declined. Increasingly, developing countries with more factor advantages began to participate in the international division of

labor. In addition, increased technical and green barriers set up by developed countries have begun to pose severe challenges to the development of China's wooden furniture industry, leading to concerns about a loss of international competitive advantage (Lin et al. 2014).

Xu (2009) believed that China's furniture industry is facing slow global economic development, so it should focus on domestic demand and sustainable development in terms of resources and the environment. She believed that an important cause of the financial crisis in 2008 was the serious imbalance between the virtual and real economies, basically a serious imbalance between supply and demand, which led to serious global imbalance. Song (2011) believed that China's furniture industry should shift to a sustainable development model, focusing on efficiency, quality, and future efficacy. Since 2011, the industry has seen a year by year decrease in growth for both revenues and profits, with revenues declining from 25.71 to 5.8 percent in 2017 and profits going from 32.2 to 5.15 percent, respectively. This slowdown of income growth indicates that the growth of market demand is also slowing down. However, the scale of China's wooden furniture industry is expanding, and the momentum of productivity growth is not diminishing. According to data from the China Industry Information Network, the number of large-scale furniture manufacturing enterprises in China has increased from 4,125 in 2011 to 6,217 in the first half of 2018. He and Wang (2005) believed that 1997 was the cutoff point in terms of the transformation of the supply–demand relationship in China. Through a spot check of 613 different consumer goods, they found that China's consumer goods market is basically in a state of oversupply. This excessive supply indicates an inconsistency between China's supply and demand structures, and the main reason for it is the coexistence of low-technology content, excessive and repeated production, and insufficient effective supply. Will China's wooden furniture industry also face a problem of oversupply in the future? What trends will occur in the market structure of the whole industry? These are questions that industry regulators, businesses, trading partners, investors, and even practitioners want to answer, since they are related to the healthy development of the industry as a whole. These answers will determine whether furniture enterprises can maintain their competitive advantage, which is of fundamental interest to practitioners. The forecast of the future demand for the products is beneficial to the furniture manufacturing enterprises to ''order the production according to the demand,'' and make the strategic development target accordingly (Wang 2011b). The forecast of the change of China's wooden furniture import and export market is beneficial for China's furniture enterprises to adjust the future structure of the wooden furniture export market and improve the match with the world's import market structure (Gao et al. 2013), so as to adjust the overall trade strategy of China's wooden furniture industry, formulate relevant industrial policy and trade policy, and guide the healthy sustainable development of China's wooden furniture products trade (Zhang et al. 2017b).

Based on data for China's wooden furniture industry from 2001 to 2017, a time series analysis was adopted to forecast China's wooden furniture market over the next few years (2018 to 2023). Changing trends and growth rates of the industry's output value, sales value, export volume, and import volume were studied by forecasting the data, and the supply–demand relationship of the wooden furniture market was analyzed based on this information. Market demand at home and abroad was further deconstructed with the changing trends of domestic demand. From a macro

perspective, this article can serve as a necessary reference for government departments when formulating industrial policies, and on a micro level it can provide a reference point for wooden furniture manufacturers in adjusting the direction of their businesses. At the same time, this study can assist investors and industry insiders in understanding the future market trends of the industry and help them make accurate investment decisions. In the past, the prediction research on China's forest products generally concentrated on the import and export of primary wood products, and research on wooden furniture was rare. This study comprehensively analyzes the relationship between future market supply and demand based on the forecast of trends in the domestic and international market of China's wooden furniture industry. The content and ideas of this research have a certain degree of innovation.

Materials and Methods

Methods

The autoregressive integrated moving average (ARIMA) model is a generalization model used in statistics and economics, especially in time series analysis. The basic processes of the Box-Jenkins ARIMA model include the autoregressive, differential, and moving average processes. Box and Pierce were the first to develop the ARIMA model. The basic idea of this model is to forecast the future value of a time series, such as a linear combination of a lag term of dependent variables and a series of random errors (Box and Pierce 1970). The ARIMA model is of great significance in the Box-Jenkins time series model, and it is also the most commonly used model to predict a time series that can be stabilized through differential analysis (Lu 2009). The advantages of the ARIMA model include the ability to speculate not only on the influence of system factors, such as continuous technological progress, sustainable growth of the labor force, continuous educational improvement, continuous formation of capital, and continuous improvement of total factor productivity, but also many unobservable factors, such as system change and climate change (Wang 2016). Zhang et al. (2017a) established a corresponding model for China's export trade based on the ARIMA model and analyzed it using a case study, fully verifying its accuracy. Even for short-term predictions, the ARIMA model is very effective and reliable. Moreover, since no assumptions about data are needed, the stochastic model is undistributed (Siluyele and Jere 2016). It is often chosen as the simplest method for combining a random walk model and trend.

The model ARIMA (p, d, q) is adopted in this study, where AR stands for autoregressive and parameter p is an autoregressive term, denoting the order of the autoregressive process; MA indicates the moving average; parameter q is the order of the MA; and d expresses the degree of differencing when the time series becomes stationary. The three parameters p, d, and q are nonnegative integers. The AR part of the time series data assumes that observations depend on some linear combination of previous observations until some number of maximum lags is added with error terms. The MA part is assumed to be a linear combination of random error terms and previous random error terms until some number of maximum lag terms are obtained (Box and Jenkins 1994).

Suppose that the stationary time sequence $y_t \sim I(d)$ is obtained by d times the difference of time series y_t, which is

$\Delta^d y_t = (1 - L)y_t$, and suppose c is a constant term and μ_t is a white noise random error. In this case, the model ARIMA (p, d, q) is as follows:

$$\Delta^d y_t = c + \sum_{i=1}^{p} \alpha_i \Delta^d y_{t-i} + \sum_{j=1}^{q} \theta_j \mu_{t-j} + \mu_t; t = 1, 2, \dots T$$

wherein

$$AR(p) : c + \sum_{i=1}^{p} \alpha_i \Delta^d y_{t-i} + \mu_t$$

$$MA(q) : c + \mu_t + \sum_{j=1}^{q} \theta_j \mu_{t-j}$$

Hamilton and Susmel (1994) proved that the ARIMA model was generally applicable to cases in which the time series of nonstationary time was stabilized by difference. The ARIMA model has been used by scholars for forecasting research in many fields, such as the transportation industry (Bhutto et al. 2017), manufacturing (Lam et al. 2009), big data (Dhote et al. 2018), the finance industry (Devi et al. 2013), and natural phenomena (Chen et al. 2010, Osamah and Muhammad 2015). The ARIMA model has played an important role in a wide range of economic studies, from industry-level market demand, supply (Aburto and Weber 2007, Ediger and Akar 2007, Li and Li 2017), and price forecasts (Contreras et al. 2003, Zou et al. 2007) to GDP research (Wei et al. 2010) and forecasts of total import and export volumes (Wang 2011a, 2017) at the national economy level. The ARIMA model is applied in forestry mainly to predict the import and export of wood products. Emang et al. (2010) indicated that the ARIMA model produced a good forecast of the volume of molding and chipboard exports from Peninsular Malaysia to the international market, and these forecasts could be used in decision-making processes and implemented in short-term marketing strategies for the export market. Upadhyay (2013) indicated that the ARIMA model could be easily used to forecast wood-based exports and imports using panel data. He concluded that the all-around trend of Indian exports and imports rose throughout the years studied. Acquah et al. (2015) found that the use of the ARIMA model with intervention analysis was very useful in explaining the dynamics and impact of policy regulations in the wood products sector. Not only did it measure the significance of the impacts on the export of wood products, but it also evaluated the decay of the impact. In this article, the ARIMA model is adopted to predict the future market supply and demand of China's wooden furniture industry, and the premise of this study is that there will be no significant change in the future external economic environment.

Samples and sources of data

The annual sales value, annual output value, annual export volume, and annual import volume in China's wooden furniture market were selected as the research objectives after fully considering the availability of data, which were collected from annual industry operation data from 2001 to 2017. On the basis of time series data recognition and preprocessing, based on the ARIMA model, the corresponding prediction models were established to predict and analyze the supply and demand of China's

wooden furniture industry over the next 6 years. It should be noted that the monetary units of the original data, such as sales and output values of wooden furniture, are in Chinese yuan (RMB). To maintain the consistency of the data studied, the initial processing operation of the monetary unit studied is carried out by converting RMB into US dollars. Reliable statistics form the basis of any analysis carried out by the forestry sector and are equally important for the formulation of policies for sustainable development in the short-term and for long-term projections (Ratnasingam and Ioras 2005). Relevant data for the wooden furniture industry in this study were sourced from the *China Furniture Yearbook*, *China Forestry Statistical Yearbook*, *China Timber and Wooden Products Industry Circulation Year-book*, and forward-looking economics databases. The annual RMB exchange rate is from the *China Statistical Yearbook*. The accuracy and timeliness of the data can be guaranteed by the repeated comparison of data from authoritative journals, professional research institutes, and public data. Previous studies on China's forest products mainly focused on the import and export of primary products such as wood, with less focus on wooden furniture. Based on the comprehensive forecasting of the domestic and foreign market changes of China's wooden furniture industry, this article comprehensively analyzes the relationship between market supply and demand in the future. The contents and ideas of this study are innovative to some extent.

Results and Discussion

Forecasting model

Stabilization of time series.—In solving such problems as sales forecasting, the ARIMA model has many limitations in terms of an actual random series, requiring time series to meet the requirement of stationary status. Therefore, before choosing a suitable analysis model, the stability of the time series must be determined first, and the difference method used to make the nonstationary time series stationary. In this study, the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller 1979) was used to further judge the stationary status of the time series. This method controlled the correlation of high-order sequences by adding the lagged difference term μ_t of the dependent variables to the right side of the regression equation. The original time series of sales, output value, export volume, and import volume of wooden furniture are shown in Figure 1.

The original time series diagram of each variable shows that the time series studied has an obvious upward trend, which is $y_t = c + \alpha t + \mu_t$, $t = 1, 2, \dots$, where μ_t is a stationary random variable with a mean of 0. Therefore, the ADF test formula containing a constant and time trend term is selected:

$$\Delta y_t = c + \delta^t + \rho y_{t-1} + \sum_{i=1}^{\rho-1} \varphi_i \Delta y_{t-i} + \mu_t$$

where

$$\rho = \left(\sum_{i=1}^{\rho} \alpha_i \right) - 1, \varphi_i = - \sum_{j=i+1}^{\rho} \alpha_j$$

c is a constant term, δ^t is a time trend term, and Δy_{t-i} is a time lag term. The hypothesis is $H_0: \omega = 0$. If the test result
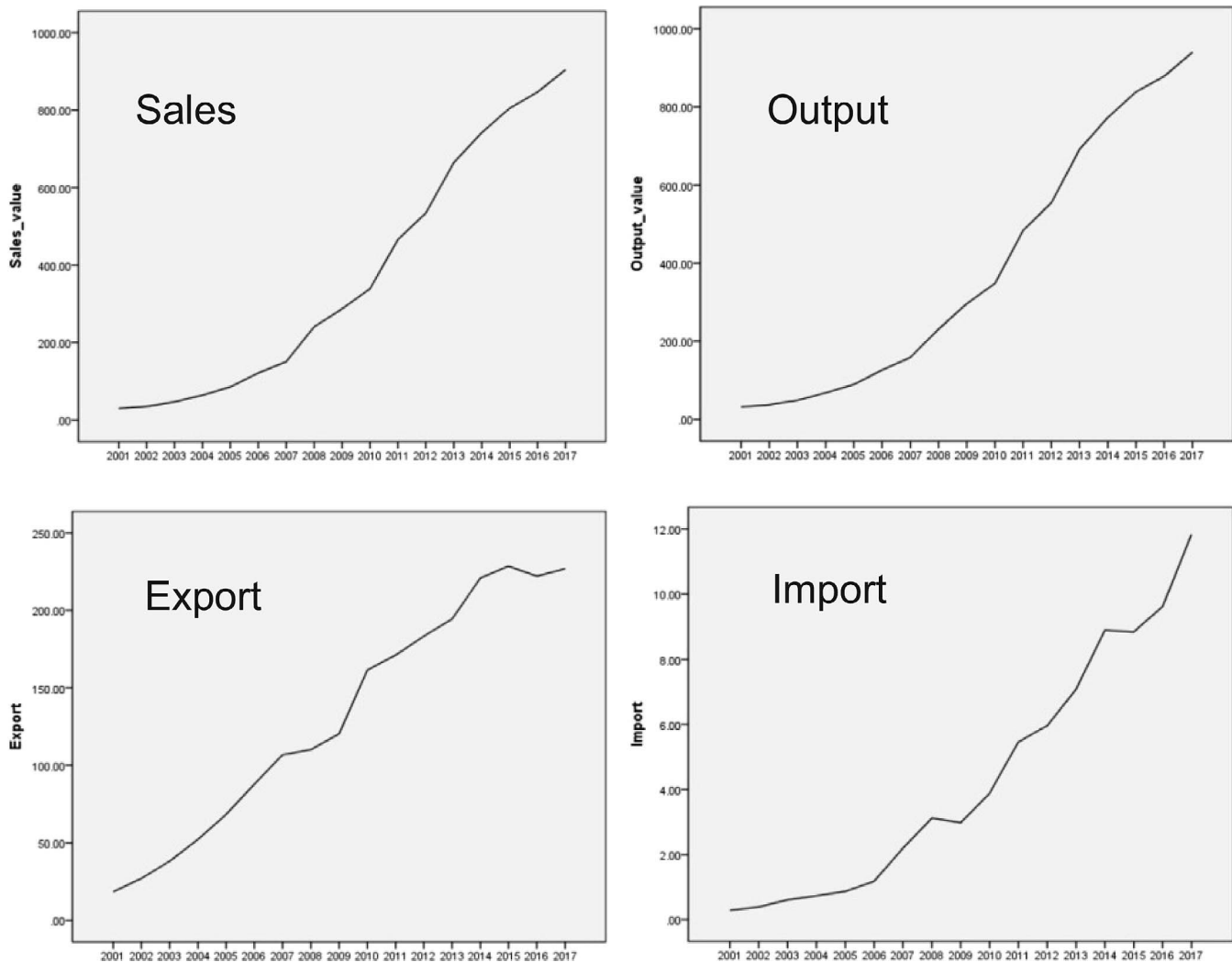
Figure 1.—Original time series data.

cannot reject the 0 hypothesis, the time series is nonstationary. The ADF test results are shown in Table 1.

As shown in Table 1, the *t* statistics of the original time series all fall outside the confidence interval, so the original hypothesis cannot be rejected. Meanwhile, it is proved that the time series to be predicted has a unit root, that is, nonstationary time series. For nonstationary time series, the differential processing transformation should be used to transform it into a stationary sequence. Differential transformation eliminates the linear trend in the sequence by subtracting item by item.

The results of the ADF test show that after two differences, the *t* statistics of sales value, output value, and import volume fall within the confidence interval of 0.01. After the first difference of the export volume, the *t* statistics fall within the confidence interval of 0.05. Therefore, the time series after the difference is stationary.

Identification and selection of ARIMA models.—The stationary time series data, after differential processing, satisfy the stationary requirement of the ARIMA prediction model. Then, according to the correlation characteristics of the ARIMA model, the values of *p* and *q* are identified preliminarily from the autocorrelation graph (ACF) and partial autocorrelation graph (PACF) of the stationary time series after differential processing. SPSS 21 was used for modeling, and the possible values of parameters *p* and *q* in the ARIMA (*p, d, q*) model were fitted repeatedly. The best prediction model was determined by the significance level of the model parameters, stationary status, R^2, normalized Bayesian information criterion (BIC) value, and fitting degree between actual value and predicted value. The results of model recognition selection for the time series to be predicted are shown in Table 2.

The ACF and PACF values of the models above are used to test the white noise of the model residuals. The test results are shown in Figure 2.

Forecast of annual output value, sales value, export volume, and import volume for China's wooden furniture industry

Based on the forecasting models in Table 3, the predicted results for the sales value, output value, export volume, and import volume of China's wooden furniture industry from 2018 to 2023 are shown in Table 3.

Forecast of annual sales.—Based on the model AR (1, 2, 0), the sales value of China's wooden furniture from 2018 to

Table 1.—Augmented Dickey-Fuller test of the time series.

Series	Difference	Augmented Dickey-Fuller test statistic		Test critical values		
		t statistic	Prob.	1% level	5% level	10 level
Sales value	0	−2.452199	0.3431	−4.667883	−3.7332	−3.310349
	2	−7.227583	0.0000	−2.740613	−1.96843	−1.604392
Output value	0	−2.422382	0.3542	−4.80008	−3.791172	−3.342253
	2	−7.663822	0.0000	−2.740613	−1.96843	−1.604392
Export value	0	−1.508911	0.7824	−4.667883	−3.733200	−3.310349
	1	−3.366951	0.0313	−4.004425	−3.098896	−2.690439
Import value	0	−1.979809	0.5580	−4.886426	−3.828975	−3.362984
	2	−8.207168	0.0000	−2.771926	−1.974028	−1.602922

2023 was forecast. The model fitting and forecasting results are shown in Figure 3.

The model fitting results showed that the fitting effect between the actual value and fitting value was good, which basically reflected the change trend of the sales value. China's wooden furniture sales are expected to grow steadily over the next few years, with estimated annual sales of $129.923 billion by 2023. It is estimated that the average annual sales growth rate will be 6.22 percent between 2018 and 2023, which is basically the same as the growth rate in previous years, indicating that the market demand at home and abroad for China's wooden furniture has stabilized after the high-speed development stage that started at the beginning of this century.

Forecast of annual output.—Based on the model AR (1, 2, 0), the output value of China's wooden furniture from 2018 to 2023 was forecast. The model fitting and forecasting results are shown in Figure 4.

According to the model fitting results, the actual value and fitting value show an approximately complete fitting, which reflects the change trend of the output value well. The output value of China's wooden furniture is expected to grow steadily over the next few years, with an estimated annual output value of $143.23 billion by 2023. It is expected that the annual production growth rate of wooden furniture will fluctuate between 5.3 and 9.5 percent over the next few years, with an average growth rate of 7.29 percent. This is in contrast to the average annual growth rate of 24.06 percent that was seen from the beginning of this century until 2017. Luo and Cao (2008) found that low-value-added global manufacturing links are distributed mainly in Asian countries with an abundant and cheap labor force, especially in China.

The technology content of wooden furniture production is low, and it is highly dependent on the input of raw materials and human resources. Industry entry barriers are also relatively low, and many small- and medium-sized enterprises occupy leading positions in the industry, so the output value of China's wooden furniture in recent years has improved greatly. Moreover, faced with the pressure of RMB appreciation and the financial crisis of 2008, costs of raw material and labor have risen; however, wooden furniture production in China kept rising (Dong 2010). This shows that labor costs have a significant positive impact on the competitiveness of the wooden furniture industry, but are not a key element (Lin et al. 2014). It can be predicted from the forecast for the growth rate of output value that production growth will tend to be stable in the future. China's wooden furniture industry is experiencing a second stage of development, which is characterized by the gradual transformation from quantity expansion to quality upgrading.

Forecast of export value.—Based on the model AR (1, 1, 0), the export volume of China's wooden furniture from 2018 to 2023 was forecast. The model fitting and forecasting results are shown in Figure 5.

The model fitting results show that the actual value and the fitting value fit well; this can reflect the changing trend in the export volume of wooden furniture. The export volume is expected to increase rapidly over the next few years, with an estimated annual output value of $42.986 billion by 2023. As such, in the next few years, it is expected that the export growth rate of China's wooden

Table 2.—Results of model recognition selection for the time series to be forecast.

Forecast	Model	Parameter	Estimation	SIG	Sta R^{2a}	RMSE[b]	MAPE[c]	Normalized BIC[d]
Sales value	(1,2,0)	constant	0.018	0.882	0.638	32.299	5.266	7.492
		AR lag 1	−0.593	0.023				
Output value	(1,2,0)	constant	4.219	0.004	0.983	6.367	1.776	4.785
		AR lag 1	−0.836	0.000				
Export value	(1,1,0)	constant	0.176	0.166	0.588	13.040	6.196	5.656
		AR lag 1	0.870	0.000				
Import value	(2,2,0)	constant	−0.004	0.691	0.835	0.422	6.775	−1.005
		AR lag 1	−0.579	0.001				
		AR lag 2	−0.846	0.000				

[a] Sta R^2 = stationary R squared.
[b] RMSE = root mean square error.
[c] MAPE = mean absolute percentage error.
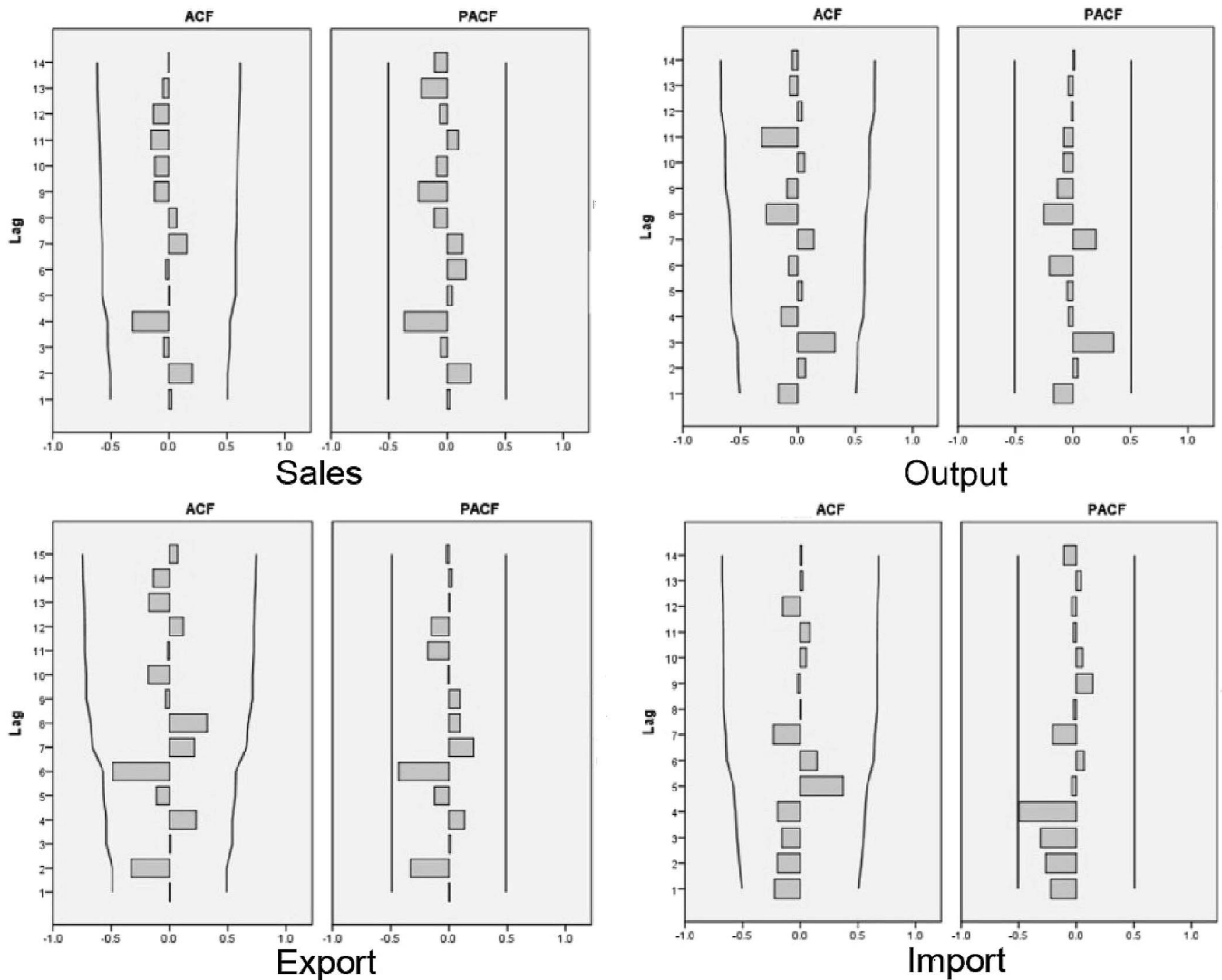[d] Normalized BIC = normalized Bayesian information criterion.

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Figure 2.—White noise test of model residual sequence by an autocorrelation and partial autocorrelation function value.

furniture will be significantly accelerated, showing an increasing trend year over year. By 2023, the annual export growth rate will increase to 18.09 from 4.55 percent in 2018, with an average growth rate of 11.33 percent. In contrast, exports of wooden furniture from China since 2001 showed an increasing trend every year, but they were unstable because of the influence of the international economic situation and trade environment. In particular, the financial crisis in 2008 caused a sharp decline in the growth rate of exports for 2 years. After the economic recovery in 2010, they began to surge again. Since then, furniture exports rose for the next 6 years, but the growth rate stabilized. However,

in 2016, the export volume of wooden furniture decreased for the first time by 2.83 percent.

The impact of unpredictable factors on exports over the next few years cannot be ruled out. For example, the furniture industry will be hit relatively hard by the trade divergence between China and the United States that started in 2018. The United States is the largest export market for China's furniture, accounting for 38.2 percent of all Chinese exports of wooden furniture in 2017. Miu et al. (2018) proved that the growth of China's wooden furniture exports to the United States is highly dependent on the expansion of imports. Affected by antidumping measures and competitive pressure from Thailand and Vietnam, the product structure

Table 3.—Forecast results for sales, output, export, and import values.

Model[a]	2018	2019	2020	2021	2022	2023
Sales value (1,2,0)	957.16	1018.08	1080.24	1148.54	1220.85	1299.23
Output value (1,2,0)	1029.22	1102.90	1197.51	1262.18	1359.63	1432.30
Export value (1,1,0)	237.22	254.28	279.61	315.24	364.01	429.86
Import value (2,2,0)	13.99	15.82	18.26	20.99	23.28	25.89

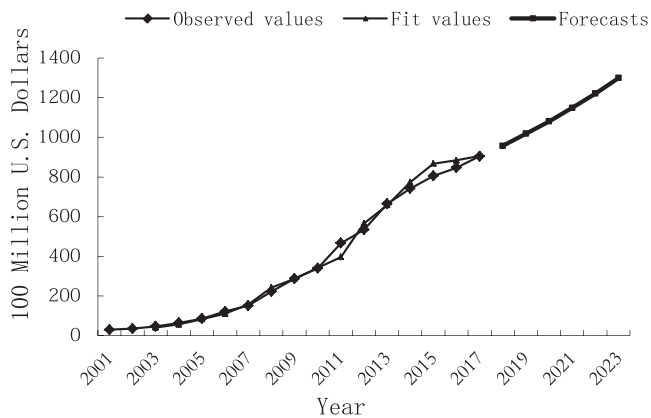[a] Units: 100 million US dollars.

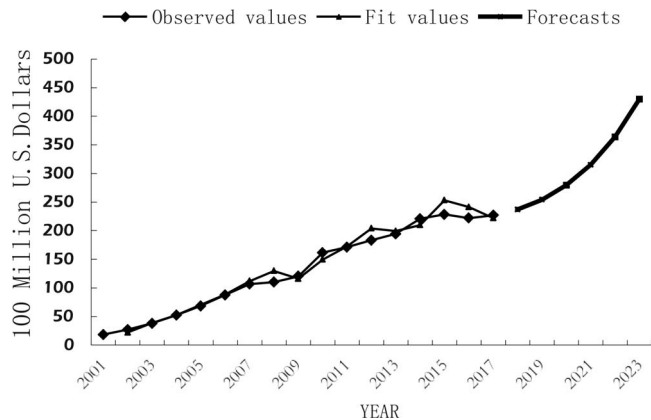Figure 3.—Model fit for sales value.

Figure 5.—Model fit for export value.

has not been well adapted to changes in the target market demand structure, and it has gradually lost its export advantage. Moreover, the industry is susceptible to irrational trade protection measures; for example, at the end of 2003, the United States conducted an antidumping investigation into China's wooden bedroom furniture. The number of enterprises involved in the case reached 200; the resulting high punitive tariffs imposed of nearly 200 percent were a very serious blow to the industry. Since 2018, trade disputes between China and the United States have arisen repeatedly. The US government has raised tariffs on Chinese exports (including furniture) several times. On September 24, 2018, the US government imposed a 10 percent tariff on Chinese goods and increased it to 25 percent on January 1, 2019. The Chinese government immediately countered with a 10 percent tariff on imports from the United States, including hardwood sawdust. In this way, the export costs of many of China's wooden furniture enterprises will increase by 35 percent at both ends: the import of raw materials and the export of the final product (Xu 2018). If the tariff level increases substantially, furniture exports will be greatly affected, and some enterprises engaged mainly in export trade may lose money. In addition, developed countries such as the United States and those of the European Union have also introduced a series of policies and measures to promote sustainable forestry development and combat illegal trade in timber and

forest products through various measures such as technical standards, environmental certification, forest certification, and social responsibility certification, such as the *European Union Forest Law Enforcement, Governance and Trade (FLEGT) Plan*; *EU Timber Regulations*; and the *Lacey Act* of the United States. At present, there is no consensus on the definition, standard, and inspection of timber legitimacy in the world. China's forest certification system is still in its infancy. How to obtain timber from legitimate sources has become a prominent issue in China's import timber trade (Su et al. 2012). Furniture manufacturers have to replace suppliers in order to issue certificates of legal sources of wood, and the cost of testing has been greatly increased, which greatly increases the export difficulty of China's wooden furniture (Lin et al. 2015). However, from another point of view, China is opening up more. With the implementation of the concept of the "Belt and Road (the Silk Road economic belt and the 21st century maritime Silk Road)" (Xu 2018), emerging trade markets are bound to grow stronger, offsetting the negative impact of trade disputes. Since 2013, China's furniture exports have shifted from the three traditional markets to emerging markets such as free trade agreements (FTA) and Brazil, Russia, India, and China (BRICS) countries. The overall export growth to emerging markets has been relatively fast, with the contribution of export volume to the new export value reaching 79.86 percent (Sun and Xiao 2016). In 2017, China's exports of wooden furniture to the "Belt and Road" countries were valued at $10.14 billion and $9.91 billion, accounting for 44.6 and 43.8 percent of China's total exports of wooden furniture, respectively, occupying an important position in China's wooden furniture export market (Xiao and Hu 2018).
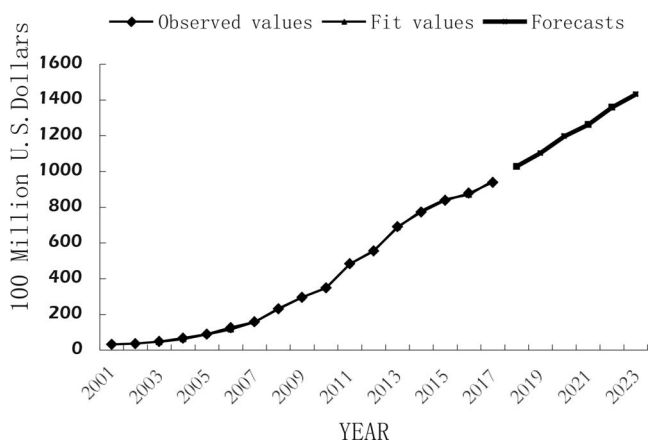
Forecast of import value.—Based on the model AR (2, 2, 0), the value of imports to China's wooden furniture market from 2018 to 2023 was forecast. The model fitting and forecasting results are shown in Figure 6.

The results showed that the fitting effect between the actual value and the fitting value was good, which basically reflected the change trend of imports. The import value of wooden furniture to China is expected to grow steadily over the next few years, with an estimated import volume of $2.589 billion by 2023. China is gradually becoming an emerging importer of furniture, importing high-grade furniture products. At present, the main sources are Italy, Germany, and other European countries (Gaston and
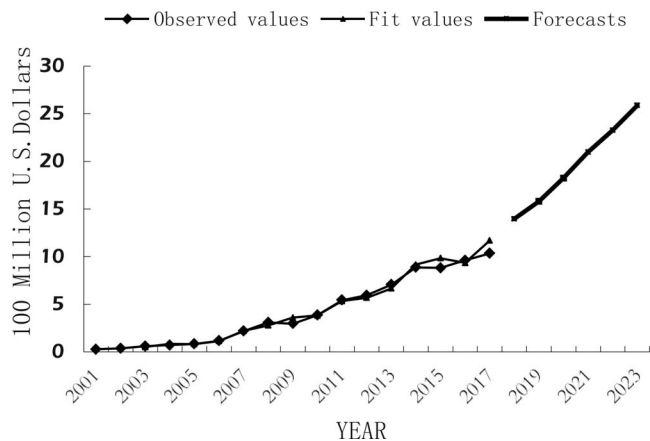

Figure 4.—Model fit for output value.

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Figure 6.—Model fit for import value.

Figure 7.—Supply and demand forecast.

Pahkasalo 2018). In the next few years, demand by some consumer groups for high-grade foreign furniture will continue, but the overall increase in the import market will not be large. Domestic market demand for wooden furniture is still met mainly by domestic production. The production technology for wooden furniture in China is progressing gradually, and product quality improvements will also replace a portion of the import demand.

Supply and demand of China's wooden furniture market

Based on the prediction results of the model above, the future supply and demand of China's wooden furniture market were analyzed.

The supply and demand of the market are shown in Figure 7; the sum of the annual output value and import volume were used to calculate the total annual supply, and the total annual sales value was used to calculate the total demand. According to the predicted results, the supply of wooden furniture in China will reach $145.819 billion by 2023, and the demand will be $129.923 billion. According to the data, before 2017, the average annual production and sales rate of China's wooden furniture was 96.22 percent, of which the rate in 2017 was 96.24 percent. According to the prediction data of the model, the production and sales rate of wooden furniture in China will reach 90.71 percent by 2023, and the trend will decrease over the next few years, indicating that the supply of China's wooden furniture industry will gradually increase. According to the import forecast data, the annual import volume of wooden furniture to China will not fluctuate greatly over the next few years. Therefore, the added value of the oversupply will come mainly from domestic production, and the whole industry will be faced with the problem of overcapacity. Considering the impact of exchange rate fluctuations on supply and demand, the exchange rate of RMB has been depreciating since 2018.The depreciation of the exchange rate will stimulate a growth in exports of wooden furniture, but it will also increase import costs for raw materials and equipment. The external dependence of China's wood consumption in 2016, calculated by Shi et al. (2018), was 27.95 percent. In the short term, wooden furniture manufacturers may be affected by the rising cost of raw materials. However, with the gradual growth of domestic plantations in the next few years, China's external dependence will decline, which will
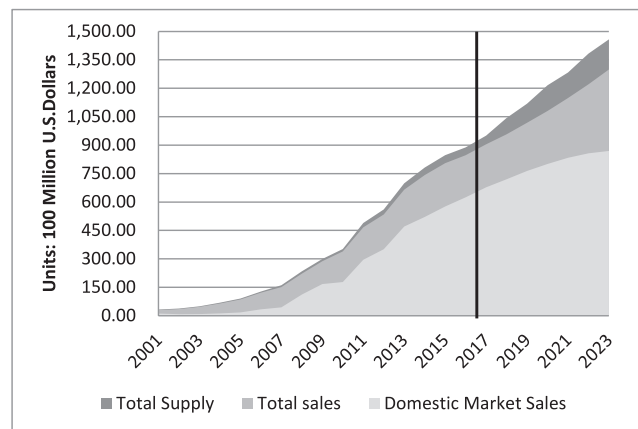
offset the rising cost of raw materials for wooden furniture. On the other hand, the rapid development of wooden furniture production in China depends largely on cheap labor costs. However, the comparative advantage based on natural resource endowment is short term; such an advantage can be gained by other countries imitating the model in a short time. This comparative advantage will inevitably be weakened or lost due to changes in the resource situation (Song 2007). With the development of China's economy, the price of labor is bound to rise, and the cost advantage will be weakened. If the trend of supply exceeding demand continues to expand, enterprises will face difficulties such as overstock of products, higher operating costs, and difficulties in capital turnover. Therefore, realizing the transition of China's furniture industry from resource-oriented to capital-oriented and transforming the driving force of trade, so as to establish the core competitive advantage, will become the keys to achieving continued trade growth and the sustainable development of industry (Song 2007).

Changes in domestic market demand

Domestic market demand is the driving force of industrial development and one of the important factors determining international market competitiveness (Porter 1990). Although the overall scale of China's wooden furniture market is large, the per capita level of furniture consumption is not high due to China's large population. A higher demand level for products by domestic consumers will stimulate manufacturing enterprises to constantly upgrade and advance their technology, thus promoting the continuous improvement of product quality. High quality and high value-added products will also enhance international market competitiveness. Accordingly, an increase in the domestic market demand is very important for the promotion of competitiveness in the wooden furniture industry.

According to the data, in 2007, the domestic market share of all sales in China's furniture manufacturing industry exceeded the export share and began to grow rapidly. The average domestic market share in the following 10 years was 62.2 percent. During this period, the annual market share increased and decreased, and reached a maximum of 74.91 percent in 2017.

Relevant predicted data indicate that the domestic market demand will increase over the next few years (Table 4). It is

Table 4.—Forecast of domestic market demand.

Model[a]	2018	2019	2020	2021	2022	2023
Total sales	957.16	1018.08	1080.24	1148.54	1220.85	1299.23
Export value	237.22	254.28	279.61	315.24	364.01	429.86
Domestic sales value	719.94	763.8	800.63	833.3	856.84	869.37

[a] Units: 100 million US dollars.

expected that the total sales in the domestic market will reach $86.937 billion, achieving an average annual growth rate of 4.26 percent by 2023. However, the growth rate of the domestic market will decrease annually, from 6.09 percent in 2018 to 1.46 percent in 2023. At the same time, the share of the domestic market in the total sales will also decline year by year; it reached 75.22 percent in 2018 and is expected to reach 66.91 percent in 2023.

There may be several reasons for this trend. Wang (2011b) found that population growth rate, economic factors, and natural resources all played an important role after analyzing the macro factors affecting domestic furniture market demand. From 2005 to 2015, China's real estate industry was in a period of rapid development, with 84.04 million residential units sold, according to the national bureau of statistics. The real estate industry has greatly promoted the development of the downstream furniture industry, and the domestic market share has also increased rapidly. However, from the end of 2016, the state began to introduce a policy of restricting the purchase of commercial housing; coupled with a series of earlier real estate control policies, China's real estate growth will slow down in the future, which will have a certain impact on furniture demand. In addition, as the most populous country, population growth factors affect domestic furniture consumption. In the 1980s, China's social and economic stability and development ushered in a baby boom. People born in the 1980s reached marriageable age after 2000, and the demand for new houses and furniture reached a peak, which is shown by the rapid development of the real estate industry in previous years and the increase in the proportion of domestic furniture consumption. However, after that peak, domestic consumption demand will slow down. Figure 8 shows the total demand of the domestic furniture market is increasing, but the trend shows signs of slowing down, and the domestic market share is also decreasing. This also indicates that China's wooden furniture manufac-

turers are paying more attention to the international market, with further opening up of China and the implementation of the national ''Belt and Road'' strategy.

Conclusions

1. It is expected that from 2018 to 2023, the output value, total sales, and export and import volumes of China's wooden furniture industry will maintain sustained growth. Among these, the export volume growth rate will continue to accelerate year over year, with the average annual growth rate reaching 11.33 percent; the growth rate of the output and sales values will remain relatively stable, with an average annual growth rate of 7.29 and 6.22 percent, respectively; and the average annual growth rate for import volume will decrease, with an annual growth rate of about 14 percent. However, due to the small import base, the impact on the supply and demand relationship is not obvious.

2. It is expected that by 2023, the situation of oversupply in the wooden furniture industry in China will be further aggravated, and enterprises will face the problem of overproduction. In the next few years, the production and sales rate of wooden furniture will decrease. It is estimated that the production and sales rate in 2023 will be 90.71 percent, which is nearly 6 percentage points lower than in 2017. Overproduction is estimated to be worth $13.3 billion, five times the estimated amount of imports. In 2017, the total sales of 18 listed companies, representing China's wooden furniture manufacturing industry, were only $9.1 billion. The concentration degree of China's wooden furniture industry is low, and the industry is dominated by small- and medium-sized enterprises. The serious overproduction problem will cause many small enterprises to face a survival dilemma.

3. It is expected that the domestic market share of China's wooden furniture will decline year by year over the next few years, and will gradually decline by 9 percentage points from 2018 to 2023. Meanwhile, the international market share will increase synchronously.

Combined with the research conclusions above, the following recommendations are put forward for the development of China's wooden furniture industry.

China's furniture industry has great domestic consumption capacity. Although the per capita annual consumption of furniture is only a little more than 200 yuan, which is only 1/8 to 1/12 of the consumption in developed countries (e.g., 250 dollars per year in the United States, 430 euros per year in Germany, and 252 dollars per year in Japan), it has great development potential (Xu 2018). The study found that in the next few years, the international market share will gradually increase, so China's wooden furniture enterprises may consider adjusting their target market, balancing the development of the domestic and foreign markets. On one hand, this can help producers avoid increasingly fierce
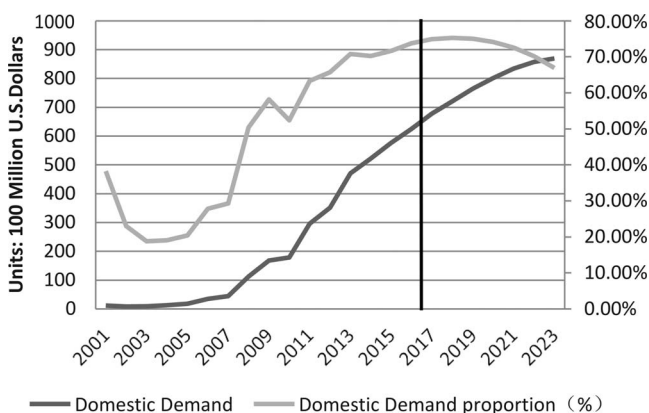

Figure 8.—Domestic market demand and proportion.

export market competition and the negative impact of uncertain trade barriers and disputes. On the other hand, it can fundamentally enhance industrial competitiveness. Under the ''Belt and Road'' initiative, China's furniture industry enterprises should seize opportunities, appropriately transfer industries, and develop new markets so as to avoid potential hazards caused by overconcentration of export markets at this stage.

According to the ''Smile Curve'' (Shi 1996), the industrial chain is divided into three parts: research and design, manufacturing, and marketing, and the added value of products is higher at both ends than in the middle. China's wooden furniture industry should attach importance to ''innovation'' and get rid of the status quo at the bottom of the industrial chain as soon as possible. Whether from a design, production, or circulation perspective, innovation is needed. Governments and enterprises should pay more attention to talent and technological innovation. The design of furniture should fully meet the personalized requirements of consumers and attach importance to the protection of intellectual property rights. Furniture production should strengthen the input of automation, reshape the scientific and efficient production process, and realize a transformation from a labor-intensive to technology-intensive industry as rapidly as possible. In terms of the circulation link, attention should be paid to adapting to changes in the market environment at home and abroad, especially considering the influence of the Internet economy on the traditional market environment, and innovation of the business model of these enterprises should be actively realized. The process of business model innovation involves remodeling the entire value chain, which will be a very complex and difficult project.

Limitations

This study is an exploratory study based on a time series analysis of operating data for China's wooden furniture industry since 2001. Owing to limitations in data availability and integrity, the number of data samples is relatively small, and the accuracy of model prediction data needs to be tested against actual values. However, as far as the development of China's wooden furniture industry is concerned, the entire industry began developing rapidly in the early decades of this century, and the use of such sample data can better represent the form of industrial development. In the future, further research can be carried out based on a gradual increase in actual data samples. On one hand, this can verify the impact of changes in the market environment on the accuracy of data prediction, and, on the other hand, it can improve the accuracy of predictions and help grasp the changing trend of market supply and demand in the industry.

Acknowledgments

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