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Analysis of the Value Factors of Chinese Painting Artworks based on Grey Correlation Analysis

Dongping Tang, Jianuan Lin*

School of Business Administration, South China University of Technology, Guangzhou, Guangdong, China, 510641, China

Abstract

As the cultural industry continues to develop with the attention of countries around the world, the art market has seen a period of unprecedented prosperity and development, and the pricing of artworks has received widespread attention. This thesis combs through domestic and international literature on art pricing, studies the current situation of the Chinese art investment market, and determines a value indicator system for Chinese painting artworks. Using the gray correlation method, the values of the variables taken in the qualitative factors are scored and quantified, and the gray correlation of each characteristic factor is analyzed in combination with the quantitative factors, so as to achieve the selection of significant variables and further optimize the value indicator system of domestic painting artworks.

Keywords

Gray Correlation Analysis; Chinese Painting Artwork; Value Factors.

1. Review of the Literature

Artworks are priced differently from general commodities, and the relationship between price influencing factors and prices is inextricably linked. Scholars at home and abroad have conducted more mature research on the factors influencing art prices. Starting with macro factors, scholars have obtained the finding that economic cycles have a significant impact on the art market, with significant correlations between the money supply, GDP per capita, inflation, exchange rates, and interest rates and changes in art market prices. From the micro factors, the study found that the attributes of the creator of the artwork as well as the attributes contained in the artwork itself are the determining factors of the artwork price, where the attributes of the artist include the artist's popularity and survival status[1], age, gender, and nationality[2], and the attributes of the artwork include the complete state of the artwork, the material of the artwork[3], the style and subject matter, the size of the artwork, the historical distance, and the whether the work is signed by the artist. In terms of sales factors, the location of the transaction has a greater impact on the price of artwork due to the aggregation effect of consumers, and the study found that auctioneer[4] and seasonal factors in art pricing studies also have a significant impact on the price of artwork[5].

2. Preliminary Determination of Value Indicators of Chinese Painting Artworks

Chinese painting artworks are mainly divided into oil paintings and Chinese paintings, and these works are the focus of this paper. In this paper, by combing through the literature and in view of the current situation of the domestic painting artwork auction market, 14 factors influencing the price of painting artworks were selected from three levels: macro factors, micro factors and auction factors to determine the price evaluation index system of Chinese painting artworks, as shown in the following table.

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Table 1. Chinese painting artwork price evaluation index system

Levels	Segmentation	Characteristic variables
Macro Factors	-	GDP per capita, money supply, inflation rate
Micro factors	Painter	Painter's popularity, painter's survival status
	Paintings	The size of the painting, the material of the painting, the subject of the painting, the way the painting is framed, the Number of times the painting was recorded, date of creation of the painting
Auction Factors	-	Auctioneer, auction location, auction season

Table 2. Preliminary price index system for Chinese painting artworks

Levels	Variables	Characteristic	Evaluation method/value range
Macroeconomic factors	GDP per capita	Quantitative variables	GDP per capita in the year the painting was traded, data available in the "China Statistical Yearbook"
	Money supply	Quantitative variables	Using "M2" broad money supply
	Inflation rate	Quantitative variables	The consumer price index (CPI) is used to express the inflation rate

Table 3. Preliminary price index system for Chinese painting artworks(Continuation Sheet)

Levels	Variables	Characteristic	Evaluation method/value range
Painter attributes	Survival of painters	Qualitative variables	Living, deceased
	Painter popularity	Qualitative variables	Total 10 painters: Zhang Daqian, Qi Baishi, Fu Baoshi, Li Keran, Wu Guanzhong, Huang Binhong, Cui Ruquiao, Xu Beihong, Jiang Guohua, Fan Zeng
Painting Properties	Size of the painting	Quantitative variables	Size of the painting area (in square feet)
	Painting materials	Qualitative variables	3 types of materials: paper, silk, paper
	Painting framing method	Qualitative variables	There are 5 forms: mirror, vertical scroll, fan, album, and hand scroll
	Number of paintings recorded	Quantitative variables	Count the number of artwork entries, no entries are indicated by "0"
	Date of the painting	Qualitative variables	There are 7 decades: 1900-1949, 1950s/60s, 1970s, 1980s, 1990s, 2000s, 2010 onwards
Painting Properties	Painting Subjects	Qualitative variables	A total of 4 subjects: figures, landscapes, birds and flowers, special
Auction Factors	Auctioneer	Qualitative variables	6 auctioneers in total: Poly Beijing, China Guardian, Sotheby's, Christie's, Xiling Yinshe, Beijing Rongbao
	Auction Location	Qualitative variables	Total 3 auction locations: Beijing, Hong Kong, Shanghai
	Auction Season	Qualitative variables	Total 2 seasons: autumn, spring

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A simple classification of the qualitative and quantitative attributes of the Chinese painting artwork price evaluation index system is conducted. The data of quantitative variables are obtained directly by means of data collection, while qualitative variables need to be further determined by preliminary analysis of the collected data to determine the range of values.

In this paper, we crawled the information related to 137,813 lots from July 2016 to November 2021 in the Artron art website platform through crawler technology, used Microsoft Excel 365 to clean, extract and integrate the auction information data, and made further value range determination for the qualitative variables in Table 1 based on the data statistics, as shown in Table 2.

Based on the variables and their values summarized in Table 3, the paintings containing all the above variables and their specific values within the selected range were screened, from which 129 pieces were randomly selected and their related data were formed into a sample data for subsequent analysis.

3. Analysis and Optimization of Chinese Painting Artwork Value Index Evaluation System based on Grey System Theory

Gray correlation analysis can quantitatively describe and compare the dynamics of developmental changes in uncertain systems, and its basic principle is to determine the closeness of the connection by judging the similarity between a reference series and several comparison series. There are more qualitative factors in this paper, and in order to ensure the accuracy of the correlation results, this paper will use the method of slope correlation analysis to analyze the gray correlation of each variable and calculate the relationship between each variable and the price of artwork.

Before analyzing the gray correlation of each variable, it is necessary to rank and score each value of the same qualitative variable. In order to ensure that the scores of the values of the variables are relatively objective and real, this section uses the slope correlation as the importance criterion to score the values of the variables by linear interpolation. After reasonably assigning scores to the values of qualitative variables, the slope correlation between each variable and price is calculated using the gray correlation method, and the variables are ranked and filtered in order to optimize the evaluation system of Chinese painting artwork value indexes and build a relatively systematic painting artwork evaluation index system that is in line with the current situation of the domestic art market.

According to the results of the variable correlation calculation, the variables of the Chinese painting artwork value index system can be ranked, and the results are shown in Table 4 below.

As shown in Table 4, the variables with high correlations are painting material, GDP per capita, and painting size, all of which exceed 0.7. Among all indicators, the value of painting material has the most significant impact on the price of paintings; the value of material is the most direct reflection of the cost of paintings, and the rarity of painting material is a key indicator to be considered when pricing artworks. GDP per capita is the core reflection of the socio-economic environment, and economic development has contributed to the prosperity of the cultural industry, while also revealing the motivation of consumers to purchase artworks from a macro level. As GDP per capita rises, consumers' willingness to buy and collect paintings and artworks will increase, and the art trade market will gradually mature. In general, the larger the size, the more paint and materials the artist has invested in the painting, and the more time he or she has invested in the painting, and the more it reflects the artist's level of painting and therefore the higher the price. The variable with the lowest correlation is the creation date of the painting, which is only 0.0924, indicating that the creation date of the painting has the least influence on the pricing of artworks compared to other variables, and the priority of this variable is

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relatively low, so the age of the painting is considered to be removed in the subsequent model construction.

Table 4. Indicator correlation calculation and ranking results

Serial number	Variables	Relevance
1	Painting materials	0.7605
2	GDP per capita	0.7601
3	Painting size (square feet)	0.7082
4	Auction Season	0.6834
5	Number of paintings recorded	0.6815
6	Consumer Price Index (CPI)	0.6104
7	Auction Location	0.5239
8	Money supply M2 (billion yuan)	0.5127
9	Survival of painters	0.4973
10	Auctioneer	0.4640
11	Painting framing method	0.4343
12	Painting Subjects	0.3294
13	Painter popularity	0.2371
14	Date of the painting	0.0924

Table 5. Chinese painting artwork value index system

Levels	Variables	Variable Correlation
Macro Factors	GDP per capita	0.7601
	Consumer Price Index (CPI)	0.6104
	Money supply M2 (billion yuan)	0.5127
Painter attributes	Survival of painters	0.4973
	Painter popularity	0.2371
Painting Properties	Painting materials	0.7605
	Painting size (square feet)	0.7082
	Number of paintings recorded	0.6815
	Painting framing method	0.4343
	Painting Subjects	0.3294
Auction Properties	Auction Season	0.6834
	Auction Location	0.5239
	Auctioneer	0.464

Under the framework of the indicator hierarchy in Section 2, this section analyzes and ranks the variables in terms of gray correlation, eliminates the lowest correlation variable of the creation era of the painting, optimizes the Chinese painting artwork value indicator system, and obtains an indicator system that meets the current situation of China's art market. In order to facilitate readers' view, this paper categorizes and summarizes the Chinese painting artwork

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value indicator system, as shown in Table 5, which can provide readers with certain reference and reference significance when they compare and analyze the pricing of Chinese painting artworks.

4. Conclusion

In this paper, the characteristic variables of Chinese painting artworks are comprehensively summarized and reasonably classified, and on this basis, information related to more than 130,000 auction items from 2016 to 2021 is collected, and through the extraction, processing and integration of the information, the available data set is obtained, and suitable variable values are selected through data statistics to initially determine the value index system of Chinese painting artworks.

The gray correlation analysis method is used to achieve the importance ranking and reasonable scoring of each variable taken in the qualitative variables, and the slope correlation degree of each variable taken as the scoring standard is calculated. On this basis, the slope correlation between each characteristic variable and the price of artwork is calculated, and under the framework of artwork index classification, the Chinese painting artwork value index system is ranked and optimized, and a painting artwork value index system is constructed in line with the current situation of the domestic market.

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