Research on the Application of Statistical Analysis in Asset Valuation Market Method

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Abstract: Statistical analysis of data is the basis of asset evaluation, and it is widely used in asset evaluation. The operation of market method is simple and the results are easy to understand. However, due to the imperfect market and incomparable information, market method has difficulties in obtaining reference materials and adjusting indicators. This paper combines the statistical method with the market method of asset evaluation, uses cluster analysis to detect the reference selected in the corresponding market, and then uses SPSS software to test the correlation between the selected indicators and the evaluation value, and uses grey correlation analysis to determine the weight of the reference to improve the asset appraisal market law.

1. Literature Review

This template, Traditional asset appraisal procedures generally go through the stages of economic behavior, project commissioning, project implementation and project archiving. In the process of asset appraisal, the scientific estimation of the value of the assessed assets on the base day of appraisal can be regarded as a quantitative understanding of the specific overall situation. At the same time, the business of asset appraisal is to collect relevant information and information to a large extent. In fact, it is also a kind of statistical investigation work, which is an organic combination of statistical analysis and asset evaluation methods.

At present, a set of evaluation system has been formed at home and abroad, which is mainly composed of three traditional methods: cost method, market method and income method[1]. However, with the deepening of research, people find that traditional evaluation methods have certain limitations[2]. Cost method is difficult to determine the portfolio value of assets, and it is easy to ignore non-monetary factors. The incompleteness of domestic capital market leads to market method. It is difficult to determine the appropriate comparable object; the income method requires enterprises to provide predictable cash flow, so people are constantly exploring more accurate and efficient evaluation methods. Zhang Runqing and Zong Yixiang [6] (2002) pointed out that the theory of time series analysis in statistics reflects the development and change of economic phenomena and reveals the trend and regularity of economic phenomena over time, which is consistent with the idea that the income method takes into account the time value of money. This method can provide predictable cash flow for enterprises, thus solving the difficulties existing in the income method. Point. Yan Jieyu and Ma Ruiting [8](2014) pointed out that the two major difficulties of market law in practical operation, the determination of reference objects and the adjustment of differences, can be improved precisely by statistical methods. Li Shiwei and Ding Sheng [7] (2009) put forward the application of cluster analysis in the field of economics. Cluster analysis provides solutions for the difficulty of determining reference objects in market law. Xie Rusong [5] (2014) discussed how to apply grey relational analysis to the market method of forest asset evaluation. This method solved the difficulty of index adjustment in the market method and further improved the market method. Artificial intelligence standardization white paper[3](2018) points out that AI can reduce human investment and improve work efficiency, but also can do faster

and more accurate than manual work. The use of statistical methods can reduce the subjectivity of asset evaluation methods and make the conclusions more objective and true.

With the continuous improvement of the market and the maturity of the asset evaluation method system, the cost method, the market method and the income method are closely combined with the statistical methods in the practical application. No matter within a single method or between methods and methods, the figure of statistical methods can be found. This also confirms the extensive application of statistical methods in asset evaluation methods.

2. Difficulties of Asset Assessment Market Method

2.1 Market Law and Its Main Steps.

First, Market method is a method of estimating the value of assets to be assessed by collecting data such as reference materials and their recent transaction prices on the current market, analyzing the differences between reference materials and adjusting their prices through analogy, and then deducing the method of estimating the value of assets to be assessed. The concrete formula is as follows:

$$E_i = K_i \times G_i \tag{1}$$

In the formula (1): E_i is the adjusted evaluation value of the i reference, K_i is the comprehensive adjustment coefficient of the i reference and G_i is the transaction price of the i reference.

The comprehensive adjustment coefficient is composed of a series of factors affecting the price, and its calculation formula is as follows:

$$K_i = \prod_{j=1}^{n} K_{ij} \tag{2}$$

In the formula (2): the coefficient adjusted for the i reference object according to the j index and n is the number of indicators.

After adjusting the price of the reference by the above formula, different initial evaluation values are obtained, and then the final evaluation values are calculated. The calculation formulas are as follows:

$$E = \sum \omega_i \times E_i \tag{3}$$

In the formula (3): ω_i is the weight for each reference .

The main steps of market law are as follows:

(1) We should have clear objects of asset appraisal and look for similar references;

Find the factors that have great influence on the value of assets according to the types of assets, and analyze and adjust the value of these different factors according to the reference, and get the initial results;

The initial evaluation results are analyzed, and the rationality of the initial results is analyzed by statistical analysis or other methods.

2.2 Difficulties in Market Law.

(1) The acquisition of reference objects. Because of the incompleteness of the market and the asymmetry of information, there are some defects in the process of selecting reference objects, such as data collection is difficult, and it is vulnerable to the influence of subjective judgment of the evaluators. To a certain extent, it will lead to the deviation of the selection of reference objects and reduce the accuracy of the selection of reference objects.

(2) Determination, quantification and adjustment of indicators. The inaccuracy of the selection of reference material leads to the difference between the reference material and the assets to be

evaluated, which leads to the difficulty of determining, quantifying and adjusting the corresponding indicators. At the same time, the incomparability between the reference material and the assets to be evaluated also brings some difficulties to the determination, quantification and adjustment of the market law indicators.

3. Statistical Analysis in the Asset Valuation Market Law

3.1 Improvements in Reference Acquisition.

The market method adopts the principle of substitution when selecting reference objects. The basic idea is to select a number of assets that have been traded recently and have the same or similar assets as the reference object. Unlike the alternative principle, cluster analysis [7] is a Exploratory analysis, in the process of classification, people do not have to give a classification standard in advance, it can automatically classify from the sample data.

The basic steps of cluster analysis:

(1) When all the samples are regarded as one class, a total of n classes are obtained;

(2) define the distance between the sample and the sample and the class and class;

(3) Calculate the distance between the categories, and merge the two nearest categories into one class and form a new class;

(4) Repeat the above steps until all samples can no longer form a new class;

(5) Draw a clustering graph and obtain the results of the clustering analysis.

3.2 Improvement of the Determination, Adjustment and Quantification of Indicators.

(1) Determining indicators.The correlation test in the statistical method or the non-parametric analysis of the independent sample is used to detect the correlation between the pre-set index and the value of the asset to be assessed, and the index with high correlation with the value of the asset to be assessed is selected as the final index.

(2) Adjustment indicators.Under market conditions, how to adjust some incomparable information is a key point in the evaluation using the market method. Generally, the index theory in statistics provides a shortcut for the evaluator by selecting the appropriate metrics. The corresponding correction factor can solve the problem of adjustment of incomparable information.

(3) Quantitative indicators.The traditional simple averaging method does not conform to objective facts, because each of the selected reference objects is different from the similarity of the assets to be assessed, and the degree of influence is different. Therefore, when calculating the final result, certain weight should be selected for different reference objects.Below, using the gray correlation analysis to improve the traditional method[4].

Grey relational analysis is a quantitative sorting method that analyzes the closeness of its curve shape according to different factor series. It uses the degree of relevance to sort the proximity of different reference objects and the evaluation object and determine the weight. The model is established as follows.

Set the adjustment factor of the evaluation object to the reference number column:$X0=(x_{01},x_{02},.....x_{0n})$,The adjustment factor of the reference is the comparison series:$Xi=(x_{i1},x_{i2},.....x_{in})$,Then the correlation coefficient rij of X0 and Xi at the j indicator is:

$$r_{ij} = \frac{\min \min |x_{0j} - xi_j| + \rho \max \max |x_{0j} - xi_j|}{|x_{0j} - xi_j| + \rho \max \max |x_{0j} - xi_j|}$$

(4)

In the formula: ρ is the resolution coefficient, the value range is $0 < \rho < 1$. Generally, $\rho = 0.5$,coefficient represents the degree of correlation between the values at the j index, and the average value is called the correlation degree r_{0i}. The calculation formula is as follows:

$$r_{0i} = \frac{1}{n} \sum_{j=1}^{n} r_{ij}, i = 1,2...n$$

(5)

If the two factors change at a higher degree, the degree of association between the two factors is higher, and the closer the reference object is to the evaluation object, the weight ω_i of the reference object is obtained:

$$\omega_i = \frac{r_{0i}}{\sum_{i=1}^{n} r_{0i}}, i = 1,2...n$$

(6)

4. Case Analysis

4.1 Case Information.

In order to evaluate the price of a residential building, a survey of five similar residential buildings was conducted in the vicinity of the residential building. The details are shown in Table 1:

Table 1. Residential building transaction case data

Residential building	deal price (yuan/m2)	Date of transaction	Trading situation	Location status	Status of equity	Transaction
A	5100	2017.11.30	+2%	0	-2%	-4%
B	5800	2018.6.30	+21%	-3%	0	-5%
C	5200	2018.1.31	0	+3%	+2%	-2%
D	5300	2016.7.31	0	+1%	-1%	+2%
E	5000	2018.5.31	-3%	0	-1%	+1%

According to another survey, the market price of such residential buildings increased by 1.5% per month from July 1, 2016 to January 1, 2017, and then decreased by 0.5% per month from November 1, 2017, and from 2017 to 11 The market price from January 1st to April 30th 2018 is basically unchanged, and will increase by 1% every month. The most appropriate 3 transaction instances were selected as comparable objects to estimate the value of the residential building on August 31, 2018.

Evaluation value = reference price × transaction date correction coefficient × transaction situation correction coefficient × real estate status correction coefficient (including location status correction coefficient, equity status correction coefficient, transaction physical correction coefficient)

4.2 Acquisition of Reference Objects.

Cluster analysis was performed on the reference building A-E residential building given in the case data.

(1) Quantification and standardization of data

Table 2. Standardized data

Residential building	deal price (yuan/m^2)	Date of transaction	Trading situation	Location status	Status of equity	Transaction
A	-.57795	.13908	.64291	-1.09460	.41327	-.78699
B	1.66962	-1.21596	.96437	.66912	-1.78784	-1.11490
C	-.25686	.13908	-1.08280	.77822	.50311	-.13117
D	.06422	1.47960	-1.08280	.74185	.43573	1.18049
E	-.89903	-.54181	.55832	-1.09460	.43573	.85257

(2)Software processing results

The clustering analysis of the standardized data was performed by using the system clustering method in SPSS, and the following results were obtained:

Table 3. Summary of case processing

Case						
effective		Missing		total		
N	percentage	N	percentage	N	percentage	
5	100.0	0	.0	5	100.0	
a.square Euclidean Distance used						
b. Ward coupling						

Table 3 shows that all five samples selected entered the cluster analysis process.

Table 4. Cluster Table

Order	Cluster combination		coefficient	First appearance cluster		Next order
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	1	5	1.631	0	0	3
2	3	4	3.444	0	0	3
3	1	3	11.396	1	0	4
4	1	2	24.000	3	0	0

Table 4 shows that Sample 1 and Sample 5 were first clustered, and the distance between samples was 1.631. The results of this clustering will be used in the subsequent Step 3 clustering; Step 2 of Clustering In the sample 3 and sample 4, the distance between the samples is 3.444, and the clustering result will be used in the third step clustering. Similarly, the remaining samples are clustered in turn, and finally 5 All the samples were grouped together.
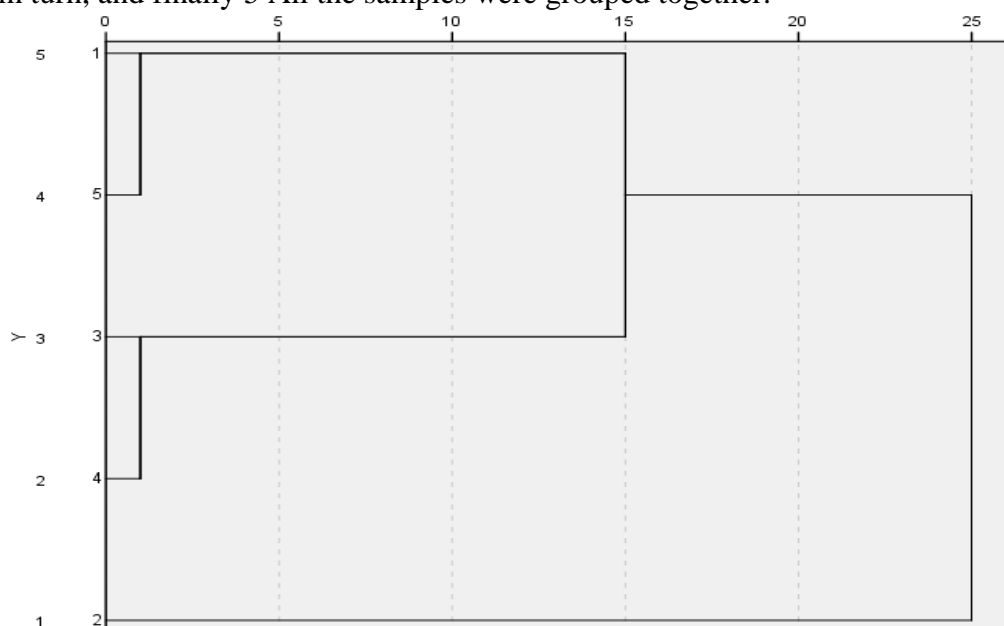

Fig.1 Trading case clustering diagram

From the clustering diagram, the following conclusions can be drawn: through the repeated clustering process, the selected five reference objects are clearly divided, and the clustering analysis adopts the method of "from the back to the front" to select the reference objects in the market method. The test is performed, that is, the similarity of the selected reference object is judged, so in this case, the three most suitable transaction examples A, C, and E are selected as comparable objects.

4.3 Determination, Quantification and Adjustment of Indicators.

Only for the three comparable objects which were selected.
(1) Determining indicators
Using the SPSS correlation test, the correlation between the six indicators, such as the selected transaction, and the transaction price is detected.

Table 5. Correlation test between transaction status and transaction price

Hypothesis test summary			
Null hypothesis	test	sig	Decision maker
The distribution of the transaction price is the same in the transaction category	Independent sample - Kruskal-Walls test null hypothesis	0.284	Keep the null hypothesis

As shown in Tab.5, the sig value = 0.284, the original hypothesis is retained, and the correlation between the transaction situation and the transaction price can be judged to be significant. The correlation test process was repeated for the other four indicators such as the transaction date, and the results were consistently shown: the correlation between the selected indicators and the transaction price was significant.

(2) Adjusting indicator differences

The correction coefficient is used to adjust the difference of the above six indicators. The calculation principle of the correction coefficient is: compare the value of the asset to be estimated with the corresponding value of the reference object for an indicator.

A: $5100 \times \dfrac{100}{102} \times \dfrac{104.06}{100} \times \dfrac{100}{98} = 5309.18$ (yuan/m2)

C: $5200 \times \dfrac{100}{100} \times \dfrac{104.06}{100} \times \dfrac{100}{101} = 5357.54$ (yuan/m2)

E: $5000 \times \dfrac{100}{97} \times \dfrac{103.03}{100} \times \dfrac{100}{100} = 5310.82$ (yuan/m2)

(3) Quantitative indicators

①traditional simple averaging method

The average value is taken as the evaluation result. Therefore, the value to be estimated is: (5309.18 + 5535.54 + 5130.82) / 3 = 5,328.85 (yuan / m2).

This method artificially selects the mean value, has certain subjectivity, and adopts a simple elimination method for the outliers, ignoring the potential connection between the outliers and the value of the assets to be assessed.

② Improved grey correlation analysis method

Table 6. Values for |X0j-Xij|

	j=1	j=2	j=3	j=4	j=5
i=1	0.0406	0.02	1	0.02	0.04
i=2	0.0201	0.21	0.03	1	0.05
i=3	0.0406	1	0.03	0.02	0.02
i=4	0.0609	1	0.01	0.01	0.02
i=5	0.0303	0.03	1	0.01	0.01

Table 7. Reference object relevance and weight

Reference	Correlation	Weights
A	0.9050	0.3322
C	0.9337	0.3427
E	0.8858	0.3251

The value of the asset to be assessed based on the reference weight is:

5100×0.3322+5200×0.3427+5000×0.3251=5101.76 (yuan/m2).

Although the calculation result of the gray correlation analysis method in this case is not much different from the simple average method, the gray correlation analysis method does not set the screening criteria in advance, and considers the influence of all reference objects on the value of the assets to be evaluated, so the method is more realistic and More scientific.

5. Conclusion

This paper mainly uses cluster analysis and grey relational analysis to improve the selection of market method reference objects and the identification, quantification and adjustment of indicators. Cluster analysis overcomes the subjectivity of market method when selecting reference objects, and makes the conclusion more Objective and true, the gray correlation analysis takes into account the weight of all reference objects and is more in line with actual needs.

In general, the market method has the advantages of simple principle and easy acceptance of results. It also has certain advantages in the three traditional methods of asset valuation, and its two

difficulties in the operation process, finding reference objects and adjusting differences It is precisely the application of statistics. If the theory and method of statistics can be fully utilized in the market law, I believe that these two difficulties can be overcome, and the application of market law in practice is more extensive.

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