similarity between different real estate units, the higher the weight values". Even for the same type of properties, because of the discrepancy on attributes which are reflected on prices, they can be considered as different products meeting the needs of different consumers. Therefore, we use the proximity to measure the degree of similarity between different real estate units. As the proximity is still a fuzzy concept, the quantification still needs the assumptions, simulation and techniques.

(4) Acquiring transaction data. This is the most fundamental step of UVA. Data acquisition should be consistent and accurate. In order to ensure the accuracy of data, elimination of abnormal values, data processing and correlation are necessary.

In light of the importance and complexity of adjustment coefficients, this paper further elaborates on them as follows.

THE CONSTRUCTION OF ADJUSTMENT COEFFICIENTS

Adjustment coefficients are the core and basis of the UVA. Only through the adjustment coefficients, the price relationship between real estate units is reflected. Based on adjustment coefficients, the city's real estate units are no longer isolated, but interconnected and have formed a network of price relationship. By identifying appraisal sets, each appraisal set is consistent and has a certain degree of substitutability. Therefore, we can use the microscopic differences between the attributes of real estate units to reflect their different effects on real estate prices. As a result, the adjustment coefficients have formed.

Therefore, the construction of adjustment coefficients requires an in-depth study on each appraisal set with similar properties in the early stage. Next, we need to find out the main factors affecting prices and the degree of impact on prices. Then, the adjustment coefficients are identified by comparing the attribute differences of real estate units with those of standard property.

The range of constructing the adjustment coefficients is internal. As the process of identifying an appraisal set has already taken the location factors into account, the construction of adjustment coefficients mainly considers the individual factors. For residential properties, we should include floor no, orientation, layout. For street shops, floor no and width of facing street should be considered. For each attribute, there is a corresponding adjustment coefficient which is shown as follows:

$$S = 1 + \sum_{i=1}^{m} J_i X_i$$

S represents the adjustment coefficient while J represents the attribute difference between the estimated real estate unit and the standard real estate unit. X is the ith unit factor affecting the price. For example, for the factor of floor no, within a certain appraisal set, the floor no increases by one floor, the price is raised by 1%. If a real estate unit is on the 12th floor, the standard unit is on the 10th floor, with other properties remain the same, the adjustment coefficient of estimated real estate unit is $1+(12-10)\times1\%=1.02$.

The attribute values can be obtained from either a hedonic price model or

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appraisers' experiences depending on the sufficiency of data within an appraisal set. When there are sufficient amount of data in an appraisal set satisfying the basic requirements of multiple regression analysis, quantitative analysis along with qualitative analysis are more proper. However, in the absence of enough data in an appraisal set, qualitative analysis will be the major method to be used.

Therefore, if there is an appraisal set A which has n real estate units $A_1, A_2 \cdots A_n$. There are m factors affecting the price respectively. We define the matrix, $J = \begin{bmatrix} j_{11} & j_{12} & \dots & j_{1m} \\ j_{21} & j_{22} & \dots & j_{2m} \\ \dots & \dots & \dots & \dots \\ j_{n1} & j_{n2} & \dots & j_{nm} \end{bmatrix}$, $X = \begin{bmatrix} x_1 \\ x_2 \\ \dots \\ x_m \end{bmatrix}$, $I = \begin{bmatrix} 1 \\ 1 \\ \dots \\ 1 \end{bmatrix}$.

Matrix J is S_n , which is the attribute differences between one real estate unit and the standard unit. Matrix X is an $m \times 1$ attribute coefficient matrix. Matrix I is an $n \times 1$ constant column vector. Thus, the adjustment coefficient matrix S is

$$S = JX + I, \quad S = \begin{vmatrix} j_{11} & j_{12} & \dots & j_{1m} \\ j_{21} & j_{22} & \dots & j_{2m} \\ \dots & \dots & \dots & \dots \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ j_{n1} & j_{n2} & \dots & j_{nm} \end{vmatrix} \times \begin{bmatrix} x_1 \\ x_2 \\ \dots \\ x_m \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix} = \begin{bmatrix} s_1 \\ s_2 \\ \dots \\ s_n \end{bmatrix}$$

From the formula above, S_1 is the adjustment coefficient of the subject real estate unit A_1 referring the standard real estate unit. Similarly, S_n is the adjustment coefficient of the n^{th} real estate unit.

CASE ANALYSIS

After the theories of unity valuation have been introduced, we will use the housing transaction data from Central District of Shenzhen to employ a unity valuation analysis in order to test the validity and practicability of the approach.

First of all, according to the principles of identifying the appraisal sets of similar real estate units, the residential ordinary properties in the Central District which building age is less than 10 years are considered to be in the same appraisal set. For ordinary units, we construct the system of adjustment coefficients from building, community and set gradually.

Taking a community area within an appraisal set as an example. The community is consisted of four buildings. For each building, there are 28 floors and 6 households on each floor. Firstly is to establish the adjustment coefficients within a building. Table 1 shows the transaction prices and some attribute information of some of the apartments in building No 1. In order to ensure the price information to be comparable, all prices in Table 1 have been adjusted to the December, 2011 level.

Table 1.Attribute and 1 fice Data of a Community.				
Room No	Floor	Layout	Time-adjusted Price (Yuan/m ²)	Gross Area
16E	16	Е	37671	123.67
25B	25	В	37486	123.66
6E	6	E	35929	123.67
7F	7	F	35139	177.44
10A	10	А	35968	168.78
13C	13	С	36058	86.97
9F	9	F	35953	177.44

Since there are sufficient trading data and comprehensive attributes in this building, we can apply a hedonic price model to determine the adjustment coefficients of the building. According to our research results, the building is a high-rise residential building with ordinary real estate units. The layout distributions on each floor are consistent and each apartment layout has a fixed position, size and orientation. Therefore, the layout variable can replace those three variables. By setting the time revised price as independent variable and the floor, layout variables to be dependent variables for multiple regression analysis, the regression results of linear model are listed in Table 2.

Table 2.Results	of Multiple	Regression	Analysis.

Variable	Coefficient	s.d	t	Sig.
Constant	33044.1		52.120	.000
Floor No	192.3	.829	6.120	.000
Layout D	1801.5	.459	3.516	.002
Layout C	1491.6	.380	3.095	.006
Layout E	1640.694	.310	2.400	.027
Statistics	F 13.278	Sig.	0.000	R^2 0.858

The regression results show that the price difference on floor variable is 192 Yuan. Apartment layouts A, B, F are at similar price levels. Compared with the layouts A, B and F on the same floor, layout C is 1492 Yuan higher, layout D is 1802 Yuan higher and layout E is 1640 Yuan higher. Thus, it is reasonable to choose the layout C on the 14^{th} floor as the standard unit. Then the prices of each unit can be calculated by the regression results and the adjustment coefficients between each unit and the standard unit are determined. Some of the adjustment coefficients are indicated in Table 3.

Similarly, we apply the same approach to establish the adjustment coefficients between buildings in a community and between communities within the appraisal set. Based on these adjustment coefficients, as the real estate units within an appraisal set are similar real estate units, the weight values should be set equal to 1. Then, it is accessible to employ the mass appraisal approach to assess the 11206 real estate units in this appraisal sub-division.

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Table 5.Examples of Aujustment Coefficients of Dunuing No.1.				
Room No	Floor	Layout	Adjustment Coefficient	Gross Area
16E	16	Е	1.0567	123.67
25B	25	В	1.0592	123.66
6E	6	E	1.0028	123.67
7F	7	F	0.9623	177.44
10A	10	А	0.9785	168.78
13C	13	С	1.0363	86.97
9F	9	F	0.9731	177.44

In order to test the validity of the model, IAAO Standards (2010) are used to test the appraisal results. The total number of testing sample is 1579 and the results are shown in Table 4.

From Table 4, we can see that the results of ratio studies meet IAAO standards. The difference between the appraisal results and the market prices are less than 2%. The dispersion of results is also low. Moreover, PRD result shows that each type of appraisal results is consistent.

Table 4.R	atio	Anal	lysis.
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Туре	Central Tendency	COD	PRD	
IAAO Standards	0.90-1.10	5-10	0.98-1.03	
(2010)				
Results	0.982	6.0	1.008	
Conclusion	Results meet IAAO Standards			

CONCLUSION

Based on the characteristics of China's real estate market, this paper comes up with the theory of unity valuation and then establishes the unity valuation model. In addition, the transaction data of Central District of Shenzhen were used to carry out the model application and ratio analysis. The results prove that the unity valuation model in this study is accessible. At present, this model has been adopted in the field of tax-based assessment of real estate in Shenzhen which results have been applied to the real estate transaction tax collection and management. Overall, the social effect is satisfactory which dispute rate is below 1%.

Although the application results have confirmed the validity of the model, it is still necessary to pay attention to the premise and hypothesis. As is mentioned above, this model assumes that the prices of similar real estate units within an appraisal set are interconnected. If there is a large fluctuation occurred in the real estate market, it may break the current relationship between prices. At this stage, the system of adjustment coefficients needs to be revised and even reconstructed. In addition, if there is a substantial change taking place at housing attributes, such as the landscape of a unit disappears due to the occlusions. At this point, adjustments need to be made as well.

Although this model is built based on the characteristics of the real estate

market in China, it does not mean that the application of the model is only effective in China. For real estate markets where sales comparison approach is applicable, the unity valuation model is also accessible and rapid with a prosperous application.

REFERENCES

- Gloudemans, R.J. (1999). *Mass appraisal of real property*, Chicago press, Illinois, 35-37.
- International Valuation Standards Committee (2007). International valuation standards 2007, London.
- Ji, Y.C. and Fu, C.R. (2005). "Mass appraisal: the tax-based assessment of ad-valorem tax." *Appraisal Journal of China*, 11, 5-9.
- Kauko, T. and Damato, M. (2010). "Mass appraisal methods: An international perspective for property valuers." *International Journal of Housing Policy*, 10(1), 102-107.
- Kauko, T. and Damato, M. (2008). Mass Appraisal Methods, Wiley-Blackwell, US.
- Peterson, S. and Flanagan, A. (2009). "Neural network hedonic pricing models in mass real estate appraisal." *Journal of Real Estate Research*, 31(2), 147-164.
- Song, Y.F. and Chang, L. (2009). "Research on mass appraisal system based on the taxation of real properties." *Value Engineering*, 2, 53-5.
- The Appraisal Foundation. (2006). Uniform standards of professional appraisal practice, Washington, D.C..
- The Technical Standards Committee (2013). Standard on mass appraisal of real property, Chicago.
- Woolery, A. and Shea, S. (1985). *Introduction to computer-assisted valuation*, Oelgeschlager, Gunn & Hain, Miami.
- Zhou, S.M. (2005). "The tax-based assessment methods in the collection of property tax." *Appraisal Journal of China*, 3, 8-12.

Research on Dynamic Monitoring and Early-warning in Real Estate Market

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ABSTRACT

Dynamic monitoring and early warning for China's regional real estate market is complexity, and difficulty, uncertainty, this article is based on several analytical theory of real estate market, put forward a scheme of dynamic monitoring and early warning technology of the real estate market, and applicated to dynamic monitoring system in the real estate market in Jiangsu Province, through data simulation, resulted in improvements comparison in timing sequence of regions and lateral correlation of regions, it has a good application value.

INTRODUCTION

China's real estate market has gained a strong development momentum, growing faster speed to become a pillar industry of the country in a very short time, with a high degree of concentration of wealth, resource -intensive, policy fluctuate frequently, significant regional differences and other distinctive characteristics. For reason of analytical research lagging, almost nobody can give a precise predication. Currently, the real estate market to a certain extent still government-led market, the analysis reports based on the existing real estate market data is inconsistent with society and the public senses, and even odds. Main reason is that the lack of housing market data collection, statistical sampling errors and discrepancies in data, analysis of theoretical research is insufficient. Although many scholars, institutions raised some real estate market analysis and forecasting methods, but due to many factors, acceptance of the results is not high, it rarely cited academically.

In the long run, only the establishment of the real estate market data base is completed, index system established, analytical methods at multiple levels may be empirical and corrected, the real estate market analysis and early warning can be persuasive. Therefore, with guide of analytical theory, such as principal component analysis theory, Analytic Hierarchy Process, Hedonic Pricing Method, establish the rule of real estate market analysis data collected, establish a centralized data system, launched on the basis of professional analysis and forecasting and early warning analysis for the government to stabilize the market and prevent risk for society, rational cognitive judgment of the public real estate market, provides an important source of changes in the real estate market information to public and researchers.

PRINCIPLES AND APPLICATIONS

Principles component analysis. Principles component analysis prompted by Karl Parson in 1901, expanded by Hotelling in 1933, was widely application in many area analyses; its core thought is drop dimensions, with loss less information of situation. Multiple indicators converted into a small comprehensive index of multivariate statistical methods, thus reducing both the complexity of the analysis, it is easy to get the key issues, better reveal the essence of the problem. Liu (2004), Kong (2009) Guo (2007) have used the theory to analysis real estate price relationship with other economic factors.

Hedonic method. According to it, the principle that the price of a property depends on its characteristics and location. Only when changing in property prices with similar characteristics from one period to another can raise the changing in the property market. For the heterogeneity of properties traded in the real estate market, the implementation of the hedonic method includes a number of characteristics on property price, through econometric equations specified for each elementary area relatively homogeneous and for each type of property. China index Research Institute (2005) through Hedonic model, development a set of indicators to construction china real estate market index system, and use it to warn early real estate market changes.

Simple method. This traditional method analysis the simple average, weighted average or median of real estate prices during a given period. Monitoring such indexes does not allow to distinct between price and quality changes. However, the real estate transactions over time can bias the price trends, especially when transactions relate to different ranges of properties between one period and another. This method is used in our country and some other countries, such as Germany, Australia, its simplicity and it does not require detailed data on the characteristics of real estate.

Other methods. A lots of methods are introduce to real estate market analysis, and give different views of market, for example, among them, Johnny and Wong (2006) use analytic hierarchy process (AHP), Zhou et al. (2009) use real coding based on Accelerating Genetic Algorithm (RAGA) and Projection Pursuit Classification (PPC), Nur and Rochin (2012)use Autoregressive integrated moving average(ARIMA) to study phenomenons of real estate market.

REAL ESTATE MARKET DATA FOR DYNAMIC MONITORING MODEL

Real estate market development involves many other aspects, political, legal,

economic, financial, geographical, social, environment, technology and more. There are many administrations involved in supervision and management, real estate market information is rich and diverse, easier to provide support for a variety of academic perspectives, but on the whole, still lack basic information, classification is not clear, indicators chaos, the correlation between the information is difficult to construct. According to tracking development of the industry, longtime observers of the changing demands of the market, urban and rural construction departments in Jiangsu Province facilitate goal of "gather real estate market information periodically from provincial cities, approach proper analytical model dynamic monitoring and analysis the real estate market".

Real estate market monitoring focused on property types are generally divided into newly-built commercial housing, housing stock (housing), the transaction is divided into sale and lease, associated with monitoring financial flows, finance, tax, land, population and employment-related information.

In this one, newly built commercial housing construction, transaction monitoring is the key to forecast the real estate market. Especially, cities in Jiangsu Province have 37 new commercial housing online filing systems, under this situation, access transaction data, analysis real estate market monitoring of key indicators, is feasible and necessary. Development of the Chinese real estate market is not a long time, not much information accumulates, not deeply theoretical study, etc. All these factors are taken into account. Simple method based on statistical theory is used as the principal of real estate market analysis in Jiangsu Province.

Data model. For needs of analysis, establish newly-built commercial housing market data collection model as shown in Figure 1, it is made of enterprise information (Department Enterprise information), real estate project information (Project Base information), pre-selling permit information, house unit (building table) information, house units transaction information (Building Trade Info).



Figure 1.Newly-built commercial housing market data collection model.

Collected data items. In corresponding to data collection model described above, design a set data items as list in Table 1 to Table 5. Table 1 descripts department or enterprises (response for managing real estate project). Table 2 descripts basic information of real estate projects (Project Base information). Table 3 descripts pre-selling permit information. Table 4 descripts information of new built houses for selling (building table information). Table 5 descripts every transaction about houses (building trade information).

Table 1.Department of Enterprise mormation.				
NO.	Code	Item name		
1	101	Organization Code		
2	102	Department/Enterprise Name		
3	103	Registered Area		
4	104	Qualification Grade		

Table 1. Department or Enterprise Information

Table 2.ProjectBase Information.

NO.	Code	Item name	
1	101	Project Code	
2	102	Organization Code	
3	103	Project Name	
4	104	Floor Space Used	
5	105	Get Mode	
6	106	Get Time	
7	107	Land Expenses	
8	108	Floor Space Built	
9	109	Total Investment	
10	110	Capital Source	
11	111	Build Property	
12	112	Project Purpose	
13	113	Project Begin Time	
14	114	Project End Time	
15	115	Project Principal	
16	116	Area Class	
17	117	Project belong to area	
18	118	Project Address	

Data item "Project belongs to area" is used as a classification of Administrative Division. "Project Purpose" is respectively represented "residential", "office", "commercial", "other".

The Table 3 is about of Pre-selling Permit Information.

	Table 3.Pre-sellin	g Permit Information.	
	NO.	Code	Item name
-	1	101	Permit Code
	2	102	Project Code
	3	103	Floor Space Sell
	4	104	Floor Space Sell Residential House
	5	105	Presell Number
	6	106	Permit Dispense Date
	7	107	Open Quotation Date
	8	108	Average Price

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PresellPermitStatus

NO.	Code	Item name
1	101	The House ID
2	102	Project Code
3	103	Permit Code
4	104	Building Code
5	105	Cell Code
6	106	Unit Room Code
7	107	Structure
8	108	Unit Type
9	109	Floor Space Built
10	110	Floor Space Dwell
11	111	Hold Unit Price
12	112	House Purpose
13	113	House Business Property

Table 4.BuildingTable Information.

In this table, data item "House Purpose" use the specific code of "Project Purpose" in Table 2, "House Business Property" means that building belongs to what property, such as "economic functional house", "ordinary commodity house", "high-grade commercial house (villa)", etc.

Table 5.BuildingTrade Information.

NO.	Code	Item name	
1	101	The House ID	
2	102	Contract Code	
3	103	Current Status	
4	104	Bargain On Sum	
5	105	Contract Time	
6	106	Status Change Time	

This table record all houses transactions data, item "Current Status" refers an house's transaction status: "sellable", "sold", "prohibit sell", "sold and recorded".

Indicators design. We design a set of real estate market monitoring indicators based on this data collection model. Some key indicators are listed in Table 6.

Table o.Keal Estate Market Monitor Indicators

NO.	Supply indicator	Sales indicator	Digestion indicator
1	Approved sale of commercial housing area	Registered sold area	Supply - Sales ratio
2	Approved sale of commercial house units	Registered sold units	Destocking cycle
3	Commercial housing total sellable area	Average price of transactions	
4	Commercial house sellable units		

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