A SUSTAINABLE DEVELOPMENT EVALUATION MODEL OF REAL ESTATE BASED ON FUZZY PATTERN RECOGNITION

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ABSTRACT

On the basis of documents analysis, this article constructed the sustainable development evaluation model of real estate market from four aspects, including the harmonious development with local economy, reasonable prices, structural balance and financial coordination. Then we empirical studied the healthy development of Nanchang real estate market based on fuzzy pattern recognition model. The results showed the Nanchang real estate market is healthy from 2008 to 2010. Finally, This article presented some policy recommendations to promote sustainable and healthy development of the Jiangxi Province's real estate market

Keywords: *Impact Factor, Fuzzy Pattern Recognition Model, Real Estate Market*

1. INTRODUCTION

The real estate is both the basic social issues and the key areas of macroeconomic regulation and control, healthy and sustainable development of the real estate is not only the important material guarantee of constructing the harmonious society but also directly related to the development of the national economy. However real estate market in china exists many problems. for example, the real estate market is overheating, the development is not balanced, the price rises very rapid , the innovation of science and technology is very low zoology environment is destroyed serious, resource consumed intensity. This is not conducive to the sustainable develop of real estate industry. On the other hand, the central government approved "Poyang Lake Ecological Economic Zone Planning "On 2010 , this is the first national strategies development planning, is a great milepost of the Jiangxi development history. And Nanchang has also been listed as demonstration area of China's first batch of low carbon city .

From the sustainable and healthy development perspective of the real estate, literature review can be summarized as follows: First, from relationship between the real estate market and the harmonious development of local economy, foreign research can be divided into linear model and nonlinear model by the econometric model. Second, from the housing supply and demand balance and structural balance, on one hand, studied the relationship between contradiction of supply and demand and the prices from the total supply and demand on the other hand, from the point of supply and demand structure, studied purchase and transfer behavior By established the branch level housing model. Third, from the rationality of house price study angles is more, such as income, population, CPI, interest angle, More research is from the angle of the wealth effect based on " permanent income hypothesis "and "life cycle hypothesis " economic theory. Fourth, the coordination research about the relationship between the real estate market and finance market development is relatively rich, it not only relates to the interest rate, monetary policy, such as Murphy (1997), but also studied by the introduction of behavioral economics from the Expected and speculative perspectives. a large number of domestic research about the real estate market and the real estate industry pay more attention to the supply and demand in the real estate Markets, the development and investment in real estate, the development and management in real estate. The sustainable development study about the real estate is few recognized. More importantly,

the domestic researches are mostly discussed from the qualitative point.

This paper innovatively put forward a standard index system about evaluating healthy develope degree of the real estate market from the overall Situation of the sustainable and healthy develope and by setting a fuzzy pattern recognition model, quantitative studied the real estate market healthy level, it have an important reference value to the real estate market participants and policy makers.

2. THE CONSTRUCTION OF THE REAL ESTATE MARKET DEVELOPMENT INDEX SYSTEM

Sustained and healthy development of real estate industry refers to the development of the real estate industry to meet the modern generation's production needs without jeopardizing future generations demand for land and housing to produce and live. Real estate market development experiences and lessons around the world tell us that whether a region's real estate market is sustainable and healthy, first of all, the most important thing is to be coordinated with the regional economic development; secondly, whether the real estate market could continue should see whether the region's real estate prices affordable for residents. It's unsustainable if the property price is beyond the residents' affordability. Finally, it is attention to avoid excessive financial support to produce overheating in the property market, and a good real estate market should be good for the region financial development. To this end, this article to establish a health assessment index system of Jiangxi real estate market from four aspects.

The indicators of the real estate market cooperated develop with local economy. In order to find out whether the housing industry development in Jiangxi Province is cooperated develop with local economy. This article selects both the quantity and quality metrics. The quantitative indicator reflects the number of real estate itself and its share and level in the national economy and so on including the contribution rates, real estate investment growth rate /GDP growth rate and so on. The qualitative indicator is the description of the actual leading effect to the related industry and the indicator that whether its development is coordinated with national economic development.

The indicators of Balance of supply and demand and structure balance in the housing market an effective supply and demand indicators in the housing market should include the balance between total supply and demand and structural balance two

categories. Among them,the total balance indicators including supply and demand ratio, commercial housing vacancy rate. Structural balance is the low cost Housing Area residential area/residential Area And the ratio of various types of housing supply area.

The indicators of rationality of real estate price. In general, the reasonable price should meet three aspects: (1) commercial housing must reflect its value as the price determined by the value and reflect the value. (2) The price of commercial estate should be adapted to the level of consumption of social development. (3)The commercial house price changes with supply and demand, that is, market is efficient. For these reasons, this article chooses the price-to-income ratio, rent-to-sell ratio, real estate price growth rate/ the real GDP growth as the representative indicators. The indicators of the real estate market cooperated with financial market develop. The characteristics and the important role of the real estate must be linked closely with the financial sector. Complement of estate and finance are important pillars of modern economy. This article chooses the total of real estate loans/total loans by financial institutions, the size of its own funds/the size of bank credit in real estate as the representative indicators.

Chart1: The Real Estate Market Development Index System

	Index
Coordinated with local economy	*Housing industry's contribution rate*
	Real estate investment growth rate/GDP growth rate
Price reasonableness	*Premium growth rate/ GDP growth rate*
	Real estate price's growth rate/ GDP growth rate
	Price-to-income ratio
	Rent-to-sell ratio
Structure balance	*Supply and demand ratio*
	Housing vacancy rate
	Low-cost housing area residential area/residential area
Coordinated with finance	*Total of real estate loans/total loans by financial institutions*
	Size of its own funds/ size of bank credit

3. THE BASIC PRINCIPLE

Fuzzy Pattern Recognition model can reflect the changing process of the real estate market . The specific thought as follows: First of all, to sum up all the indicators of healthy development of the real estate market then formed a index system, and draw

a feasible indicator standard; Then to compare the studying on indicators with the standardized index system; At last, according to the subordination

principle, studying the distribution probability of the actual level of real estate market in the standard system.

3.1 Index Matrix

Set N objects to be identified by the C-level, Each object has a M characteristics of the indicators, The actual measure index matrix can be concluded:

$$\chi = \left(\chi_{ij} \right), i = 1, 2, \cdots, m; j = 1, 2, \cdots, n. (1)$$

In the formula (1), χ_{ij} means the actual value of index I to the object J Similarly, if N objects based on M index features are identified by C level standard value, the standard value matrix is:

$$Y = \left(y_{ih} \right), i = 1, 2, \cdots, m; h = 1, 2, \cdots, c. (2)$$

In the formula (2), y_{ih} means the standard value of index I in H-level. Usually, standard value of an indicator is arithmetic progression.

3.2 Relative Membership Matrix

The electrode is the key of collection device, as the experimental object is free white mice, requiring electrodes to be light, strong, convenient for placing so as to make the experimental acquisition of EEG signals with good signal to noise ratio and stability.

The electrode is mainly composed of three parts:

micro thruster, microelectrode and micro drive.

Micro thruster's overall structure is mainly divided into three parts: the main body, drive, connecting.

The main part is mainly composed of 1mL plastic syringe plastic pipe, drive part is mainly composed

of screw and the matched nut, the connection part connects the driving part with microelectrodes to drive the microelectrode to move up and down.

Generally speaking, the indicators dimensions are different, so it is necessary to take process for Normalization in recognition of N objects. When

processing dimensionless to the measurement matrix X, the following principles shall be observed: the indicator of the larger number and the higher the level is adopt formula (3), the indicator of the smaller the number and the higher level is adopt formula (4); Then the relative membership matrix R

of the actual measurement matrix X be figured out .

$$R = \left(\gamma_{ij} \right), 0 \le \gamma_{ij} \le 1, i = 1, 2, \cdots, m; j = 1, 2, \cdots, n. (3)$$

$$\gamma_{ij} = \begin{cases} 1, & y_{ic} \le \chi_{ij} \\ \dfrac{\chi_{ij} - y_{i1}}{y_{ic} - y_{i1}}, & y_{ij} \le \chi_{ij} \le y_{ic} \\ 0, & \chi_{ij} \le y_{i1} \end{cases} \quad (4)$$

$$\gamma_{ij} = \begin{cases} 1, & \chi_{ij} \le y_{ic} \\ \dfrac{\chi_{ij} - y_{i1}}{y_{ic} - y_{i1}}, & y_{ic} \le \chi_{ij} \le y_{i1} \\ 0, & y_{i1} \le \chi_{ij} \end{cases} \quad (5)$$

In the formula (4) and (5), y_{i1}, y_{ic} mean the first and C-level standard values of index I. similarly, the standard relative membership matrix .S can be determined by formula (6) and (7).

$$S = \left(S_{ih} \right), 0 \le S_{ih} \le 1, i = 1, 2, \cdots, m; h = 1, 2, \cdots, c. (6)$$

$$S_{ih} = \begin{cases} 1, & y_{ih} \le y_{ic} \\ \dfrac{y_{ih} - y_{i1}}{y_{ic} - y_{i1}}, & y_{ic} \le y_{ih} \le y_{ic} \\ 0, & y_{ih} = y_{i1} \end{cases} \quad (7)$$

$$S_{ih} = \begin{cases} 1, & y_{ih} \le y_{ic} \\ \dfrac{y_{ih} - y_{i1}}{y_{ic} - y_{i1}}, & y_{ic} \le y_{ih} \le y_{i1} \\ 0, & y_{ih} \le y_{i1} \end{cases} \quad (8)$$

In the formula (7) and (8), y_{i1} y_{ih}, y_{ic} represent the first, H-level and C-level's standard values of index I.

3.3 Exceeding Weight Matrix

In fuzzy set theory, membership is defined as Weight. To normalize the matrix R by columns and

$$w1 = \frac{\gamma_{ij}}{\sum\limits_{i=1}^{m} \gamma_{ij}}$$

to make to get the matrix W1 which is called the exceeding weight matrix and it satisfied

$$\sum_{i=1}^{m} w_1, i = 1, 2, \cdots, m; j = 1, 2, \cdots, n$$

Then to amend the weight by putting into expert

weight: $W_2 = \left(\chi_1, \chi_2, \cdots \chi_i \right), i = 1, 2, \cdots, m.$

Finally, the weight is

$$W = w_1 \times w_2 = \frac{\gamma_{ij}}{\sum\limits_{i=1}^{m} \gamma_{ij}} \left(\chi_1, \chi_2, \cdots \chi_i \right). (9)$$

3.4 Fuzzy Pattern Recognition Matrix

To recognize n objects by the C-level standard value based on m index features, then the fuzzy pattern recognition matrix is

$$U = \left(U_{hj} \right), h = 1, 2, \cdots, c; j = 1, 2, \cdots, n. (10)$$

In formula (10), u_{hi} is the object J's relative membership degree under the standard value of H-level indicator, satisfied。

$$0 \le u_{hi} \le 1, \sum\limits_{h=1}^{c} u_{hj} = 1. (11)$$

3.5 Theoretical Model

According to the determined study:

$$\gamma_{ij}, s_{ih}, w_{ij}, u_{hj}, i = 1, 2, \cdots, m; j = 1, 2, \cdots, n; h = 1, 2, \cdots, c$$

the object J's best relative membership degree under the standard value of H-level indicator can be figured out through formula (12).

$$u_{hj} = 1 \left/ \sum\limits_{k=1}^{c} \left[\frac{\sum\limits_{i=1}^{m} \left(w_{ij} \left| \gamma_{ij} - s_{ih} \right| \right)^p}{\sum\limits_{i=1}^{m} \left(w_{ij} \left| \gamma_{ij} - s_{ih} \right| \right)^p} \right]^{\frac{2}{p}} \right.$$

(12)

in formula (12), P refers to distance parameter. And Formula (12) is the model of Fuzzy Pattern Recognition theory. At this point,

$$U = \left(u_{hj} \right)_{is}$$

called the optimal fuzzy pattern recognition matrix.

3.6 The Application Principle of the Theory Model

To identify formula (12), the value of K's range is kinetic and should make the decision after comparing the object J's M in dexes in matrix R with matrix R. Suppose the value of relative membership degree of object J's M indexes is

$$\gamma_j, \gamma_j = \left(\gamma_{1j}, \gamma_{2j}, \cdots, \gamma_{mj} \right)^T. (13)$$

To compare each value of relative membership

degree of index I $(i = 1, 2, \cdots, m)$ in matrix R with each value of standard relative membership degree Of index I in matrix S can get the bottom degree

a_{min} and the top degree a_{max}。

$$s_i = \left(s_{i1}, s_{i2}, \cdots, s_{ic} \right)^T. (14)$$

At this point, the full form of the model of fuzzy pattern recognition theory is:

$$U_{hj} = \begin{cases} 1, & h = a_{min} = a_{max} \\ 1 \left/ \sum \left[\frac{\sum\limits_{i=1}^{m} \left(w_{ij} \left| \gamma_{ij} - s_{ih} \right|^p \right)}{\sum\limits_{i=1}^{m} \left(w_{ij} \left| \gamma_{ij} - s_{ik} \right|^p \right)} \right]^{\frac{2}{p}} \right. \\ 0, & h \le a_{min} \quad h \succ a_{max} \end{cases}$$

(15)

If $u_{hj} = \max\limits_{1 \le h \le c} \left(u_{hj} \right)$ (the principle of maximum membership degree), then recognize the object J Into class $L \left(1 \le l \le c \right)$.

4. DEMONSTRATION ANALYSIS

4.1 Building Evaluation Index System

Through the real estate market analysis and generalization, the health of the real estate market Development is divided into five levels: health, relatively health, normal, ill health and extremely unhealthy situation. And assign the value of all indexes and the weight through expert investigation, expert grading method. Like chart 2.

Chart 2 The Indicators Of Real Estate Health Development

Index	■	▲	●	★	◆	▼
Restate contribution rate	0.15	0.20	0.25	0.30	0.35	10
Real estate investment growth rate/GDP growth rate	1	1.5	2	2.5	3	5
Premium growth rate/ GDP growth rate	1	1.5	2	2.5	3	5
Real estate price's growth rate/ GDP growth rate	0.5	1	1.5	2	3	15
Price-to-income ratio	5	7	9	11	13	20
Supply and demand ratio	0.5	1	1.5	2	2.5	10
Housing vacancy rate	0.05	0.1	0.15	0.25	0.35	15
Low-cost housing area residential area/residential area	0.20	0.15	0.1	0.075	0.05	5
Total of real estate loans/total loans by financial institutions	0.05	0.1	0.15	0.2	0.3	5
Size of its own funds/ size of bank credit	4.5	3.5	2.5	1.5	0.5	10

■ EXPRESS HEALTH   ▲ EXPRESS RELATIVELY HEAL
● EXPRESS NORMAL   ★ EXPRESS ILL HEALTH
◆ EXPRESS EXTREMELY UNHEALTHY ▼ EXPRESS EXPERT WEIGHTS

4.2 Data Collection and Model Processing

The data in this article is collected through a variety of ways includes collecting statistical yearbooks of Jiangxi Province, statistical yearbooks of the city, visiting the relevant departments and field trips and so on to get 2008-2010 years' related Data of the real estate market and combined it with established index system to deal with the health of real estate during 2008-2010 years by the method of fuzzy pattern recognition model.

Chart 3. The Related Data Of Indicators In 2008-2010

INDEX	NC	JJ	GZ	SR	XY	JX
HOUSING INDUSTRY'S CONTRIBUTION RATE	0.13	0.07	0.14	0.15	0.05	0.10
	0.11	0.06	0.11	0.12	0.04	0.08
	0.09	0.04	0.11	0.09	0.03	0.06
REAL ESTATE INVESTMENT GROWTH RATE/GDP GROWTH RATE	2	-0.6	1.7	2.51	0.32	1.95
	1.63	2.53	0.69	0.59	0.27	1.21
	1.15	-0.4	2.27	0.27	0.08	0.81
PREMIUM GROWTH RATE/ GDP GROWTH RATE	0.72	0.11	0.3	0.07	0.01	-0.2
	0.95	0.27	0.92	2.52	2.0	1.65
	1.47	0.27	1.91	2.30	2.4	2.1
REAL ESTATE PRICE'S GROWTH RATE/ GDP GROWTH RATE	0.22	-0.6	0.2	-1.9	0.58	0.18
	0.89	10.3	1.4	1.53	-0.1	1.32
	1.15	0.004	0.92	1.58	0.71	0.82
PRICE-TO-INCOME RATIO	8.24	4.49	7.54	3.91	4.52	6.59
	8.03	8.67	8.69	4.36	3.99	7.46
	9.09	7.24	8.11	6.86	4.38	6.09
SUPPLY AND DEMAND RATIO	0.99	0.97	0.98	0.89	0.67	0.92
	0.77	0.73	0.76	0.80	0.69	0.74
	0.74	0.77	0.75	1.10	0.61	0.72
HOUSING VACANCY RATE	0.05	0.03	0.03	0.09	0.08	0.13
	0.03	0.01	0.02	0.06	0.09	0.06
	0.06	0.10	0.02	0.05	0.06	0.10
LOW-COST HOUSING AREA RESIDENTIAL AREA/RESIDENTIAL AREA	0.06	0.14	0.05	0.13	0.02	0.05
	0.08	0.04	0.11	0.03	0.04	0.05
	0.07	0.10	0.08	0.11	0.06	0.06
TOTAL OF REAL ESTATE LOANS/TOTAL LOANS BY FINANCIAL INSTITUTIONS	0.02	0.03	0.05	0.11	0.03	0.02
	0.02	0.01	0.05	0.02	0.02	0.02
	0.02	0.01	0.02	0.02	0.02	0.02
SIZE OF ITS OWN FUNDS/ SIZE OF BANK CREDIT	1.00	4.60	2.94	4.81	2.43	2.94
	1.11	5.18	2.92	3.20	2.00	2.54
	1.20	15.2	3.29	3.46	1.12	2.67

NOTE:THE FIRST ROW OF DATA EXPRESS THE RESULTS IN 2008;
THE SECOND ROW OF DATA EXPRESS THE RESULTS IN 2009;
THE THIRD ROW OF DATA EXPRESS THE RESULTS IN 2010;

The following is to analyze the related data of indicators of the health of the real estate market in Jiangxi province. Standard index matrix Y can be concluded from chart 5, and actual measurement matrix X can be concluded from chart4. According to formula (4) and (5), matrix X can turn into relative membership matrix R, and then Y and turn into S according to formula (7) and (8). At last, to normalize the matrix R by columns and amend the weight to figure out matrix W.

$$R = \begin{bmatrix} 0 & 0.075 & 0.235 & 0.26 & 0.511 & 0.12 & 0.033 & 0.033 & 0 & 0.65 \\ 0 & 0 & 0 & 0 & 0.28 & 0.135 & 0.167 & 0 & 0 & 0 \\ 0 & 0.635 & 0.455 & 0.168 & 0.3889 & 0.125 & 0 & 0.222 & 0 & 0 \\ 0 & 0 & 0.65 & 0.592 & 0.233 & 0.3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.7 & 0.084 & 0 & 0.055 & 0.033 & 0.444 & 0 & 0.69 \\ 0 & 0 & 0.55 & 0.128 & 0.136 & 0.11 & 0.167 & 0.444 & 0 & 0 \end{bmatrix}^T$$

$$S = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0.25 & 0.25 & 0.25 & 0.2 & 0.25 & 0.25 & 0.167 & 0.167 & 0.2 & 0.25 \\ 0.5 & 0.5 & 0.5 & 0.4 & 0.5 & 0.5 & 0.333 & 0.556 & 0.4 & 0.5 \\ 0.75 & 0.75 & 0.75 & 0.6 & 0.75 & 0.75 & 0.667 & 0.833 & 0.6 & 0.75 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}^T$$

$$W = \begin{bmatrix} 0 & 0.0017 & 0.0053 & 0.0176 & 0.0461 & 0.0054 & 0.0022 & 0.0075 & 0 & 0.0293 \\ 0 & 0.0017 & 0.0053 & 0.0176 & 0.0461 & 0.0054 & 0.0022 & 0.0075 & 0 & 0.0293 \\ 0 & 0.0159 & 0.0114 & 0.0126 & 0.039 & 0.0063 & 0 & 0.0056 & 0 & 0 \\ 0 & 0 & 0.1831 & 0.5000 & 0.0263 & 0.0169 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.0174 & 0.0063 & 0 & 0.0027 & 0.0025 & 0.0111 & 0 & 0.0344 \\ 0 & 0 & 0.0179 & 0.0125 & 0.0179 & 0.0027 & 0.0163 & 0.0145 & 0 & 0 \end{bmatrix}$$

After calculating, for j=1, $a_{min}=1, a_{max}=3$;

j=2, $a_{min}=1, a_{max}=2$; j=3, $a_{min}=1, a_{max}=3$;

j=4, $a_{min}=1, a_{max}=3$; j=5, $a_{min}=1, a_{max}=3$;

j=6, $a_{min}=1, a_{max}=3$. Order P=2, then plug them into formula (15) to calculate each five market

Samples by euclidean distance to get the optimal fuzzy pattern recognition matrix $U_{5\times6}^{2010}$。

$$U_{5\times6}^{2010} = \begin{bmatrix} 0.0324 & 0.3006 & 0.0673 & 0.0979 & 0.0655 & 0.1613 \\ 0.1073 & 0.6994 & 0.3362 & 0.2413 & 0.1605 & 0.4909 \\ 0.8603 & 0 & 0.5965 & 0.6608 & 0.7740 & 0.3478 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}^T$$

Similarly, the optimal fuzzy pattern recognition matrix in 2008, 2009 are follows:

$$U_{5\times6}^{2008} = \begin{bmatrix} 0.0555 & 0.0522 & 0.1075 & 0.0807 & 0.0468 & 0.1356 \\ 0.1532 & 0.0807 & 0.3632 & 0.1861 & 0.0707 & 0.4585 \\ 0.5513 & 0.5920 & 0.5293 & 0.4605 & 0.2932 & 0.4059 \\ 0.2400 & 0.5446 & 0 & 0.2727 & 0.5892 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}^T$$

$$U_{5\times6}^{2009} = \begin{bmatrix} 0.0753 & 0.0459 & 0.0173 & 0.0393 & 0.0747 & 0.0939 \\ 0.2285 & 0.0704 & 0.0579 & 0.0847 & 0.1630 & 0.4666 \\ 0.6962 & 0.1173 & 0.9248 & 0.4664 & 0.6244 & 0.4396 \\ 0 & 0.2038 & 0 & 0.4096 & 0.1379 & 0 \\ 0 & 0.5626 & 0 & 0 & 0 & 0 \end{bmatrix}^T$$

5. CONCLUSION

To analyze matrix $U_{5\times6}^{2008}$, $U_{5\times6}^{2009}$, $U_{5\times6}^{2010}$ according to the principle of maximum membership degree. In 2008, in five cities, only Xinyu was in ill health situation, although Nanchang, Jiujiang and Shangrao were in normal situation, the possibility of ill health respectively accounted for 24%, 54%, 27.27%; Ganzhou had the highest healthy level in five cities; As a whole, the real estate of Jiangxi province was normal and the distribution chance was 45.85%. in 2009, Jiujiang was in the ill health situation, Nanchang and Xinyu has improved the healthy level of the real estate market . It is worth mentioning that compared with in 2008 , the health distribution in Jiujiang had significant because the large fluctuation between deep pricing cut in 2008 caused by financial crisis and quick recovered in 2009 which led to the data of inputted the model occurred exception, so the value can not be judged. In 2010, compared with 2008, 2009, as a whole, the healthy level had improved in Jiangxi province , and all five cities were precise as the level of health were above the normal level.

It can be drawn from three matrix comparison that the health of the real estate had improved in Jiangxi Province in three years. It appropriate reflects the reaction of Jiangxi real estate market to macro-market in recent 3 years. Some problems in real estate market had appeared in 2008 because of financial crisis and had produced an amount of bubbles. In 2009 and in 2010, the real estate market recovered quickly and the healthy level improved because the effect of policy. In 2008-09 Ganzhou and Shangrao city were inconsistent with other three cities in changing directions maybe because of the heterogeneity of the real estate region.

REFERENCES:

[1] Aart Kraay, "Household Saving in China", *The World Bank Economic Review*, Vo1.14, No.3, 2000,pp.545-570.

[2] Annamariam, Lusardi, "The Importance of the Precautionary Saving", *American Economic Review*, Vo1. 88, 1998,PP449-453.

[3] Wang min, Gao guang-hong, "A Miniaturized System for Neural Signal Acquiring and Processing", Chinese Journal of Biomedical Engineering (English Edition), *Biomedical Engineering* , vol.17, no.3, 2008,pp.114-119,.

[4] Wang min, Zhang xiao, Zhang chunfeng, "An Analog Front End For Recording Neuronal Activity in Freely Behaving Small Animals", Chinese Journal of Biomedical Engineering (English Edition), *Biomedical Engineering*, vol.16, no.12, 2007,pp.138-141.

[5] R. P. Bagozzi, "On the concept of intentional social action in consumer behaviour", *Journal of Consumer Research*, Vol.27, No.3, 2000, pp. 388.

[6] E. A. Baryla, L. V. Zumpano, "Buyer search duration in the residential real estate market: The role of the real estate agent", *Journal of Real Estate Research*,Vol.10, No.1, 1975, pp.1-13.

[7] J. D. Benjamin, P. T. Chinlo, "Pricing, exposure and residential listing strategies", *Journal of Real Estate Research*, Vol. 20, No.1/2, 1985, pp. 60-74.

[8] M. S. Bergen, Dutta and O. J. Walker, "Agency relationships in marketing: A review of the implications and applications of agency related theories", *Journal of Marketing*, Vol. 56, No.3, 1992, pp. 1.

[9] M. Glower, P.H. Hrndershott, "The determinant or realtor income", *Journal of real estate research*, Vol. 3, No. 2, 1988, pp. 53-68.

[10] E. Garbarino, M.S. Johnson, "The different roles of satisfaction, trust, and commitment in customer relationships", Journal of Marketing, Vol. 63, No. 2, 1999, pp. 70-87.