Journal of Applied Science and Agriculture, 10(6) April 2015, Pages: 58-67

AENSI Journals

JOURNAL OF APPLIED SCIENCE AND AGRICULTURE

ISSN 1816-9112

Journal home page: www.aensiweb.com/JASA

Investigating cause of the housing market recession in Iran and the ways to get out of it with a combination method of dynamic systems and fuzzy logic

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ARTICLE INFO

Article history:
Received 11 November 2014
Received in d form 21 December 2014
Accepted 25 January 2015
Available online 25 February 2015

Keywords:
The housing market recession, systematic analysis, dynamic systems, fuzzy logic

ABSTRACT

Housing is one of the important sectors of any economy. Given the lack of risk of the value of assets decline and the possibility of great numbers investment, investment in housing is attractive for the majority of Iranians. However, over the various periods of time the housing sector has suffered from devastating shocks in the sector of supply and demand as well as the rental market which has influenced people's daily life. In the current conditions, the housing market remains in deep recession. The present study aims to investigate the causes of the problem and the way getting out of it using combination of dynamic systems and fuzzy logic tools. This study examines the cycles affecting the housing market, and using the fuzzy logic it determines and prioritizes the important indicators in this area. The findings suggest that the housing market recession is influenced by three general factors in Iran: the housing market developments (supply and demand), macroeconomic developments and the external environment, and the factor of expectations.

To Cite This Article: Hamed Dehghan Tazarjani and 2Mehdi Khajehzadeh Dezfooli., Investigating cause of the housing market recession in Iran and the ways to get out of it with a combination method of dynamic systems and fuzzy logic. ***J. Appl. Sci. & Agric.,*** *10(6): 58-67, 2015*

INTRODUCTION

By the definition, a set of components that have a meaningful relationship (Synergistic) together in order to fulfill the objective can be called a system. Have a systematic thinking means to see related collections as a system with the features mentioned. Therefore, definition of systematic thinking means the process of understanding the components relationship between in a whole. Having such an approach we can understand the comprehensive, actual and root causes and the long and short term effects of the issues and by the understanding we could be able offering the short and long term effective solution.

The systematic view on events in the late 1950s was developed by Forrester. Of the advantages of this approach can be referred to the capability of responding to the complex and nonlinear behaviors of systems, the ability to entering human behavior and will in the models, finding the emergent relationships between the components of an issue.

On the other hand we know that the housing sector has been facing with many problems in Iran. Applicants' low purchasing power, lot of units without customer, the price bubble in the housing especially in large cities, the intense cycles of the supply and demand sector and less on mortgage and rental markets, supply more than demand, a large number of unfinished projects are examples of the problems in this field.

It seems that the lack of a systematic view and the lack of dynamic understanding of the housing market among activists, policy-makers and actors in the housing market have greatly damaged the sector. Accordingly, in this study we purpose to look at the housing sector with a systematic view and raise the issues in the housing market with the combination of both dynamic systems and fuzzy logic and then rank the affecting factors in this area. So circles of influence will be drawn and then using the circles, the oscillatory behavior of the housing market would be analyzed.

The time of investigating the housing market in this study is from 1994-2014 which seems a good time due to the fact that four periods of boom and recession can be found in this time.

1- Investigating the current situation:

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Because of the importance of the housing sector, many studies have been conducted on this section. Many books, articles and theses have studied the housing sector and frequent models have been extracted. Based on these studies, the most important current challenges in the housing market of Iran from the perspective of economic and investment that should be taken into consideration by policymakers are as the following:

- Applicants' low purchasing power
- Lots of units without customer
- The price bubble of the housing especially in large cities
- Intense cycles on the supply and demand sectors and less on the mortgage or rental market
- Supply more than need and abnormal construction, a large number of unfinished projects where there is neither the investment by investors to be completed nor purchasing by purchasers that will lead to the dream of national capitals.

Further explanation would be presented for the current problems in the following contents:

A- Low purchasing power:

Purchase mortgage loan has had a sharp decline than the early 70's and it has been declined from 50 m^2 on average in 1994 in Tehran, to about 10 m^2 at the end of 2014, declined. To make the purchasing power of the mortgage loan equal to its best years, it should be increased to 5 times more than the current value (i.e. from 35 million tomans to reach 175 million tomans). There not the possibility to pay such a loan to public. Housing price growth has been greater than all the economic indicators in this period and it has led to form the price bubble on it. In 1994, the middle class of the society has the ability to pay the loan installments of 2.5 million tomans for housing, but now, there is no possibility to pay the loan installments of 175 million tomans.

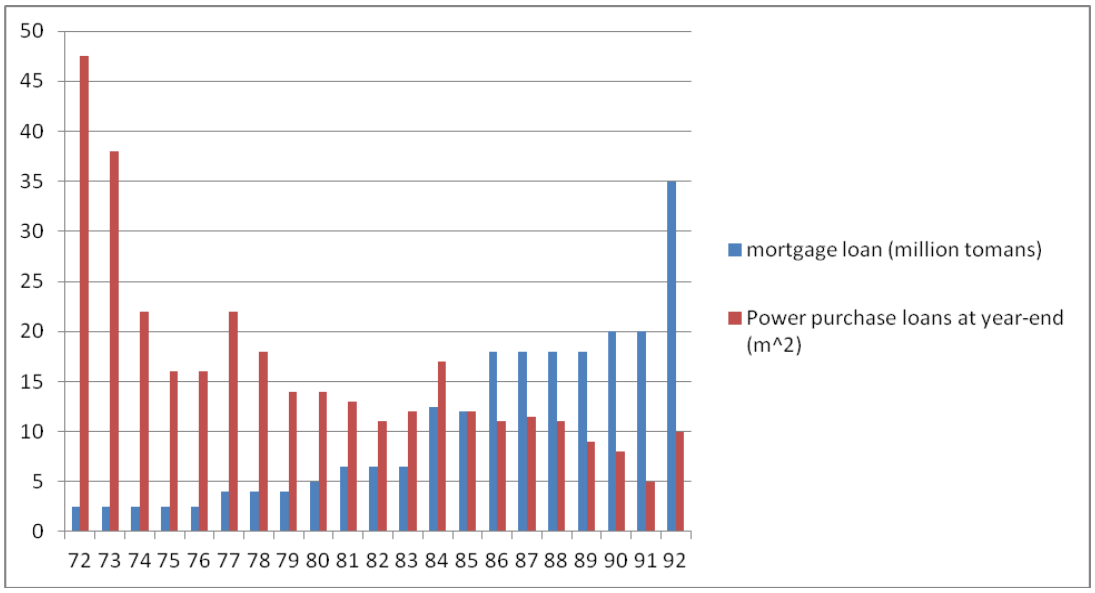

Fig. 1: Investigating the status of the purchasing power of mortgage loan in different years

B- Lots of units without customer:

Despite the two to three times increase of the buildings area under construction in Tehran and all over the country during the past few years, the real rate of inflation-adjusted investment with constant prices show much less growth. Nominal amount of Rial investment has had great growth that has taken place in the shadow of inflation and growth of prices. It can be argued that due to the construction costs jump over the last two years in the shadow of the high inflation, many manufacturers do not have the necessary funds for the construction and this has led to reduce the speed of construction.

On the other hand, the recession created in the sector of demand has led sales and pre-sales to experience a severe decline and the resource injection reduces by the purchasers. These two factors have caused the amount of investment in the real price to show little growth despite a sharp increase in the area. The above items finally mean that a wave of projects semi-construction building is being created across the country that leads to lock the capitals on the construction.

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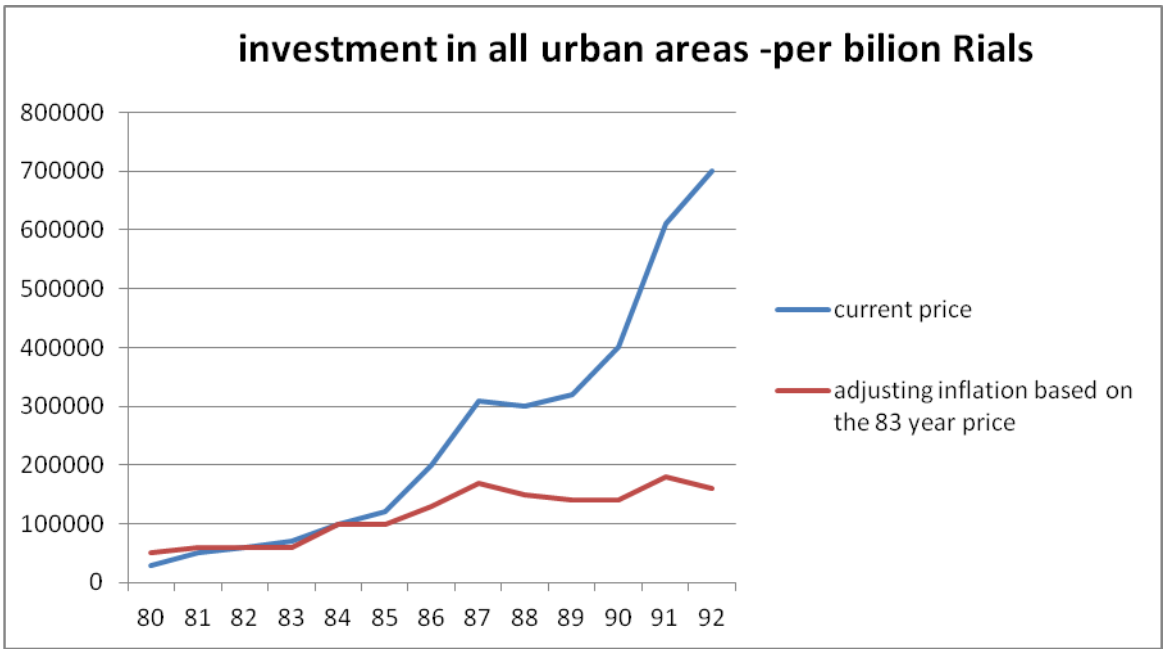

Fig. 2: The amount of investment in total urban areas in terms of billions of Rials

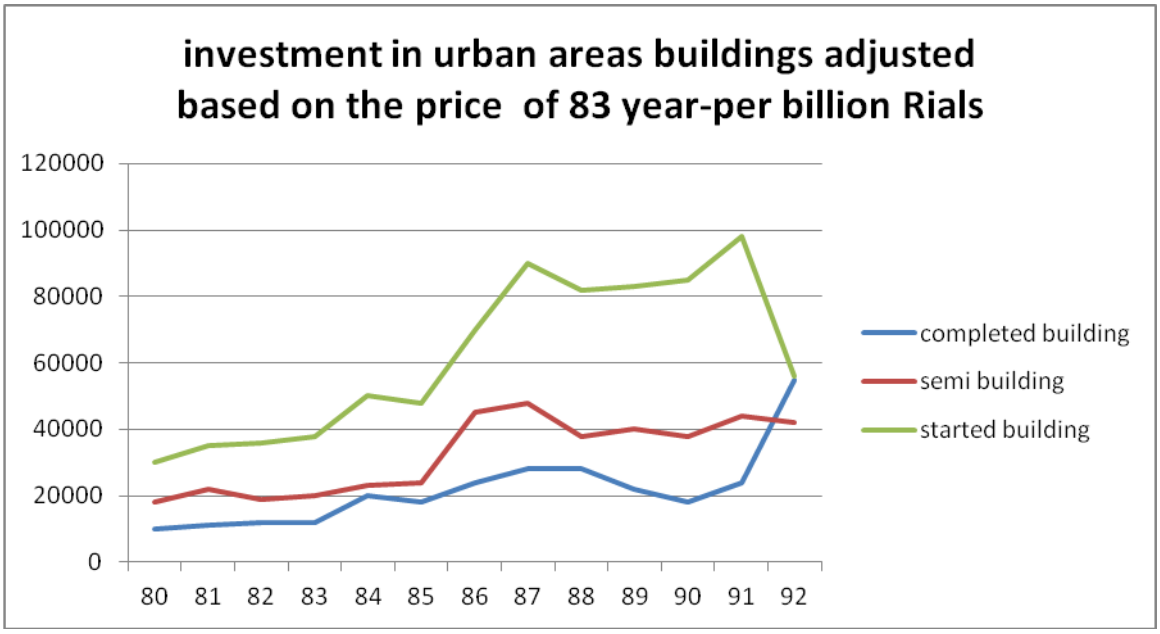

Fig. 3: The total amount of investments made in buildings of urban areas in terms of billions of Rials, adjusted based on prices in 2005

C- Intense cycles on the supply and demand sectors and less on the mortgage or rental market:

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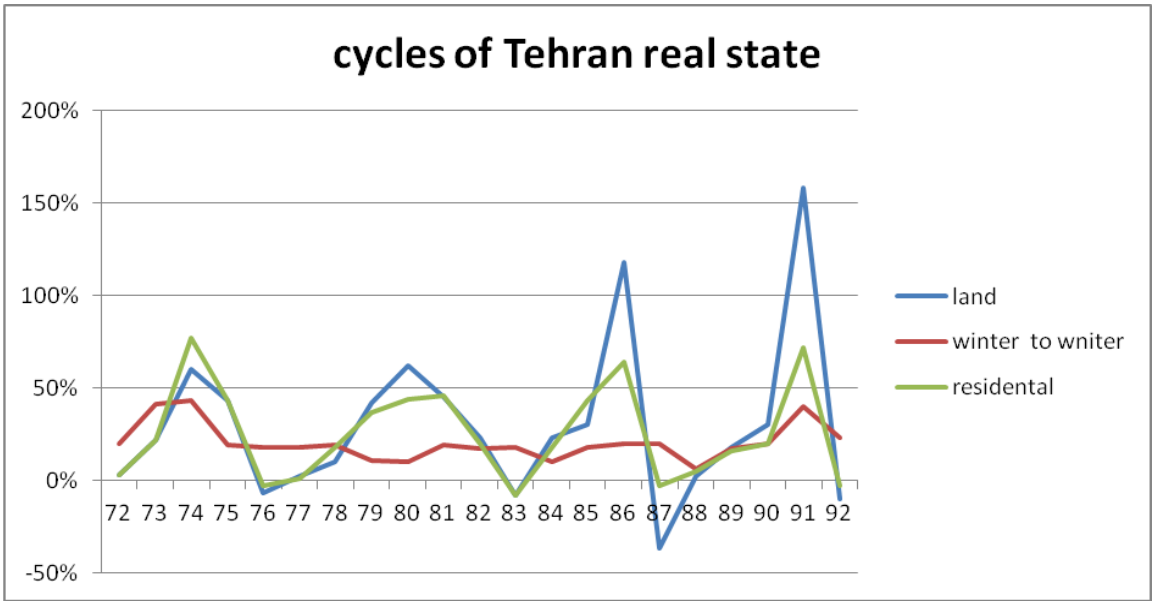

Fig. 4: The housing market cycles of Tehran

The horizontal axis is the year. The vertical axis represents the growth in housing prices in Tehran in the winter of the desired year than the winter of previous year, and in other words, the point to point inflation shows the average price of the previous year winter to winter. For example, this chart shows that the average price of housing in 2013 in Tehran has increased 73% than in the winter of 2012. The price growth of old houses and lands in this time has been 157%. So this diagram shows the nominal price of housing, since the period of time has been considered winter to winter. Inflation is nearly equivalent to the annual inflation in the housing.

Charts are drawn based on seasonal average inflation that is extracted from the data of statistics center, and they don't show the growth and decline within the year or the peak and price floor growth in the year. If there is monthly data on housing prices, the best way is to draw the point inflation of February to February, that unfortunately, except the inflation across the country, the data will not be published for the housing sector. For general inflation to be presented for the housing in the period of time similar to the transformation drawn, the growth of consumer price index (CPI) has been drawn in the figure in the winter to winter (point to point of winter to winter) period of time. The consumer seasonal price index is extracted of the Central Bank statistics.

- Heavy recession has been occurred after the year with the highest inflation of each cycle or near it:

In the fourth cycle, the year after hyperinflation in 2013

In the third cycle, the year after hyperinflation in 2008

In the first cycle, the year after hyperinflation in 1996 as well as 1995

In the second cycle, two years after the relative hyperinflation in 2003 as well as 2002, in total the slowest decline and recession has been related to the second cycle.

The year with the highest inflation in each year in each period of boom has usually taken place after a period of the low initial boom. While the capital outflow from the housing and negative factors of recession, has been rapidly expanded after the initial onset of the recession. In other words, after the sever boom, the housing market can quickly achieve its recession depth, while the mobilization of financial resources to purchase and overcome finished goods inventory deposited on the market as well as the effect of positive factors of price growth are time-consuming, a considerable time spent on equipping and planning by buyer groups, that's why the process of growth price in the housing market and the return of boom periods is time consuming. Housing supply is inelastic in the short term, thus it does not help reducing inflation in the short term of sever boom. Gradual stretching of the housing supply and construction shows itself in the medium term that is estimated in about two years.

- *Cause and effect dynamic model:*

Dynamic Integrated Model of housing is drawn as the following. Figure is composed of five cycles that the proposed policies will be presented based on the cycles. Recession and boom in the housing sector is started from the demand section and then is transmitted to supply section and the boom of supply section activates the second cycle and influences the first cycle. More description of the model is that if the market conditions are in a good and desired status like the factor of purchasing power and expectations, the market will experience actual demand. The actual demand will cause the increase of transactions and

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consequently the boom of market and due to the low elasticity of housing supply to demand in the short term this increase of the demand leads to increase the price. This increase of the price in turn leads to the improvement of expectations among people and an increase of demand. Cycle one is a synergistic cycle that reinforces and supports itself. This increase of demand will encourage suppliers to build housing that is presented in the increase of demand for building permit. Then after a while about six months later the construction is started and in nearly two years the construction of houses is to be completed. But the demand for building is affecting the speed of construction and during the recession period the speed of construction will be reduced. The new-built house is then marketed on the manufacturer's decision, in which the factor of expectations is effective as well. If the vendor predicts a severe price jump, the housing will not be marketed. At last, the increase in supply will lead to a drop in prices and, affecting the factor of expectations, it would be followed by the demand reduction. As it seems clear, at the beginning the first cycle dominates the second cycle, but after a while the second cycle outreaches the first cycle and it will prevent rising of prices.

Cycle three is on the rising cost of land and this aggravating cycle causes the high growth of the land price during the period of boom, as well as the land price drop in the period of recession.

Cycle four addresses the behavior of investors group in the housing market. Observing positive signs of housing market the group begins to purchase and they usually mortgage or rent the purchased unit. The group is the most important housing supplier for tenants. This group collects fund in the periods of recession and observing the signs of boom they begin to purchase. The investor group is a beneficial and useful group which continuous presence should be considered by the policymaker.

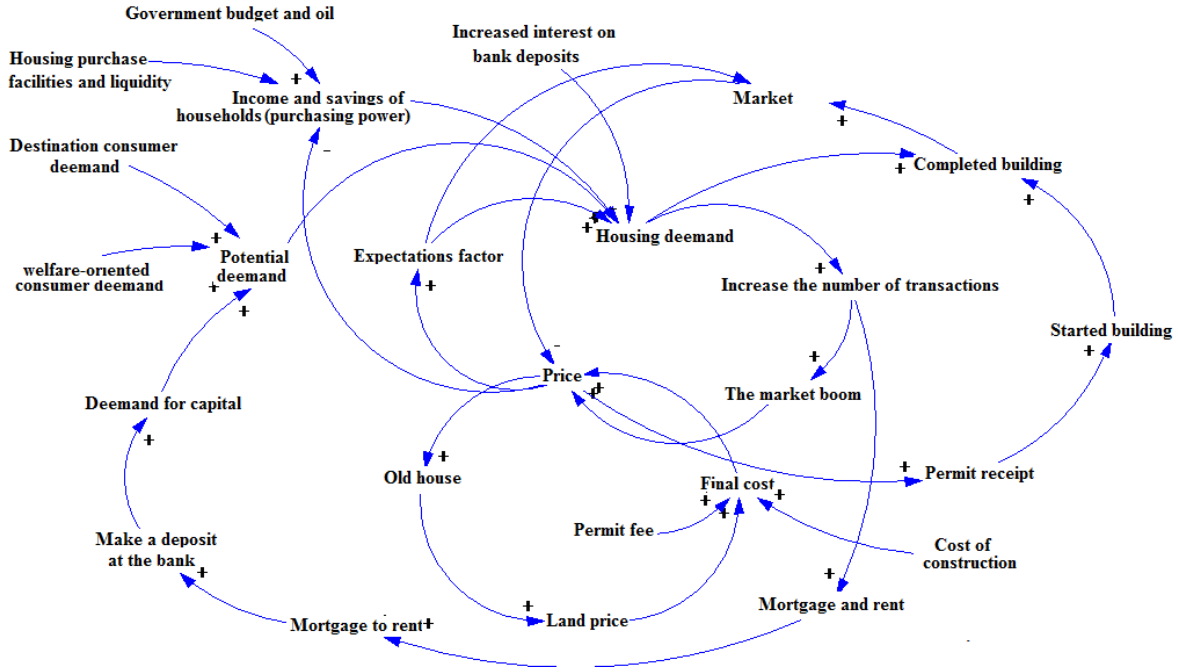

Fig. 5: The effect and effective cycles in the housing market

- *Theoretical framework of ranking effective factors:*

There are different models for ranking and prioritization of factors in various studies that the most famous is the family of multi-criteria decision making models (MCDM). Multi-criteria decision-making techniques are divided into two categories of multi-objective decision making (MODM) and multi attribute decision making (MADM) models. Multi-objective decision making models are employed for designing while multi-criteria decision making models are used to select the top option (Asgharpour, 2005). The group multi-criteria decision-making techniques have a wide range of applications in the literature by topic and they provide managers and decision makers with multidimensional assessment of the options (Rajiv Khosla *et al*, 2007). The multi-criteria decision making models includes various techniques such as TOPSIS and AHP, and because of applicability, they are very useful so that today their use has been speeded up in all academic fields and disciplines.

TOPSIS technique is one of the known classical MCDM techniques first introduced by Huang *et al*. The underlying logic of TOPSIS is the definition of ideal solution and anti-ideal solution. The ideal solution is a solution that maximizes the positive criteria and minimizes the negative criteria. In short,

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the ideal solution includes all the best values of the criteria available, while the anti-ideal solution is a combination of the worst values of the criteria available, the optimal option is an option that has the shortest distance from the ideal solution and the longest distance from the anti-ideal solution. Since the TOPSIS is a known method for classical MCDM problems, many researchers use it to solve the issues of ranking and prioritization. Application of TOPSIS method takes place because of four following advantages:

- Have a valid argument that explains the selection logic well.
- Calculate the numerical value for the best and worst alternative
- Have a simple computational process that is easily programmable spreadsheets.
- Multi-functional alternatives in criteria (it's imaginable at least in two dimensions) (Ion *et al*, 1981 and also Li *et al*, 2007)

In fact, TOPSIS is an applied method that compares alternatives with respect to their amounts of data in each criterion and the weight of the criterion. (Cheng 2002)

According to the comparative simulation conducted by Zanakis *et al* (1998), among the eight methods of compensatory models group of multi-criteria evaluation, the method of TOPSIS has the lowest defect ranking the alternatives.

However, in many cases there may not be the possibility to measure with any specific degree of accuracy. Therefore, there can be the lack of accuracy of information obtained. It should be noted that the problem is not lack of knowledge information but lack of uncertainty in the information. Such uncertainty can be formulated with non-random intervals. In fact, these uncertainties can be easily modeled by fuzzy sets.

Fuzzy Logic method was introduced for the first time in 1965 by Professor Lotfi Zadeh. There are many inexact concepts around us that are daily expressed in the form different words. Pay attention to this statement: "the weather is good ", no quantity is considered for the good weather to be able measuring that, but this a qualitative sense. Fuzzy logic is a new process that replaces the practices which requires sophisticated mathematics to design and model a system using linguistic values, and knowledge of the expert. (Professor Lotfi Zadeh who is known as Zadeh the world of science) argues that human has not many accurate information entries, but is able to do an adaptive control widely (Zadeh, 1975). In fact, fuzzy logic provides a simple way for reaching a definitive and certain conclusion on the basis of incomplete, erroneous, ambiguous input information. Fuzzy logic includes a wide range of theories and techniques (Yen and Langari, 1999).

In this regard, the present study uses the technique of TOPSIS in a fuzzy environment in order to prioritize the factors affecting the housing market recession in Iran.

In classical TOPSIS method for ranking the options and determining the weight of each of the criteria detailed and specific numerical values are used. But there is not always the possibility for investors to express their thoughts and decisions accurately and quantitatively, thus they use the linguistic variables to reflect their opinions as good, bad, weak, etc. In such cases, taking advantage of the theory of fuzzy sets, we can express the views and evaluate opinions of decision makers. TOPSIS algorithm is of the efficient algorithms in the group of multi-criteria decision making issues problems in which the elements of decision making matrix or the weight of criteria or both of them are expressed by linguistic variables.

The important point in the process of rating factors is that measures of the model are expressed as mental, qualitative and verbal variables. This method of assessment may be criticized for the two following reasons: firstly, these practices ignore the uncertainty associated with individuals' judgments and secondly subjective judgment, choice and evaluators' preference have a great impact on the results of these methods. (Ching Torng *et al*, 2005). Therefore, the inherent ambiguity and uncertainty governing the planning and decision-making requires methods that provide the possibility of review and mathematical formulation of inaccurate and unwell concepts of the definition. But as mentioned the theory of fuzzy sets as fuzzy as a mathematical theory for modeling and mathematical formulating logic of existing ambiguity and inaccuracy in human cognitive processes are considered as very efficient and useful tools. Fuzzy sets theory provides tools by which the way of human reasoning and decision making can be mathematically formulated and uses the mathematical models as in various fields of science and technology (Taheri 1997). Taking advantage of fuzzy concepts, evaluators can use verbal expressions as phrases in natural language dialog to assess the effective factors, and associating the phrases with appropriate membership functions, they can apply more convenient and more accurate analyses of the rates and criteria (Sayyadi Toranlou *et al*, 2009).

2- Review TOPSIS method and fuzzy computation:

In a multi-criteria decision making problem with m options and n criteria and according to the use of triangular fuzzy numbers in various stages of decision-making, the following options are used to rank the options (Mohammad Ataei, 2011):

Step 1: Decision matrix formation:

In the first step, we make a decision matrix due to the criteria and options:

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$$\tilde{D}=\begin{bmatrix}\tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n}\\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n}\\ \vdots & \vdots & \ddots & \vdots\\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn}\end{bmatrix} \quad (1)$$

Where $\tilde{x}_{ij}$ the triangular fuzzy numbers are related to i[th] option according to the j[th] criterion and i = 1, 2, ... , m and j = 1, 2, ... , n.

If the number of decision-makers is K persons and fuzzy ranking of the k[th] decision maker for i = 1,2, ..., m and j = 1,2, ..., n is in the form of the triangular fuzzy number $\tilde{x}_{ijk}=(a_{ijk}, b_{ijk}, c_{ijk})$ the fuzzy combination ranking of decision makers' comments that is $\tilde{x}_{ij}=(a_{ij}, b_{ij}, c_{ij})$ options can be obtained according to the following equations:

$$a_{ij}= Min_K\{a_{ijk}\}$$
$$b_{ij}=\frac{\sum_{k=1}^{K} b_{ijk}}{K}$$
$$c_{ij}= Max_K\{c_{ijk}\} \quad (2)$$

Table 1: Relationship between triangular numbers with verbal variables

triangular numbers according to verbal variables	Linguistic variables
(3،1،1)	Very weak
(1،3،5)	Weak
(3،5،7)	Average
(5،7،9)	High
(7،9،9)	Very high

Step 2: Determine the weight matrix of criteria:

If we consider the fuzzy matrix $\tilde{W}=[\tilde{w}_1, \tilde{w}_2, \dots, \tilde{w}_n]$ as the weight matrix of criteria and also each of the $\tilde{w}_j$ to be triangular fuzzy numbers as $\tilde{w}_j=(w_{j1}, w_{j2}, w_{j3})$, and if decision makers' minimum is equal to k and the importance coefficient of K[th] decision maker is as triangular fuzzy number $\tilde{w}_{jk}=(w_{jk1}, w_{jk2}, w_{jk3})$ for j = 1, 2, ..., n, the fuzzy combination ranking $\tilde{w}_j=(w_{j1}, w_{j2}, w_{j3})$ can be obtained using the following equations:

$$w_{j1}= Min_K\{w_{jk1}\}$$
$$w_{j2}=\frac{\sum_{k=1}^{K} w_{jk2}}{K}$$
$$w_{j3}= Max_K\{w_{jk3}\} \quad (3)$$

Step 3: Scale down the decision matrix:

In this step, to scale down the fuzzy decision making matrix the linear scale conversion is used to make different options comparable with each other. The elements of scaled down decision matrix for positive and negative criteria can be calculated in order in the following equations:

$$\tilde{r}_{ij}=(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*})$$
$$\tilde{r}_{ij}=(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}})$$
$$c_j^*=Max_i c_{ij}$$
$$a_j^-=Min_i a_{ij} \quad (4)$$

Due to the above steps, the scaled down fuzzy decision matrix is obtained as the following:

$$\tilde{R}=[\tilde{r}_{ij}]_{m\times n} \quad ,i=1,2,\dots,m \; ; j=1,2,\dots,n$$
$$\tilde{R}=\begin{bmatrix}\tilde{r}_{11} & \tilde{r}_{12} & \cdots & \tilde{r}_{1n}\\ \tilde{r}_{21} & \tilde{r}_{22} & \cdots & \tilde{r}_{2n}\\ \vdots & \vdots & \ddots & \vdots\\ \tilde{r}_{m1} & \tilde{r}_{m2} & \cdots & \tilde{r}_{mn}\end{bmatrix} \quad (5)$$

Where, m and n respectively indicate the number of options and criteria.

Step 4: Obtain a weighted decision matrix:

Weighted decision matrix is calculated multiplying the importance coefficient of each of the criteria by the fuzzy scaled down matrix, and its calculation method for Positive and negative criteria is as the following, respectively:

$$\tilde{v}_{ij}=\tilde{r}_{ij} \cdot \tilde{w}_j=(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}) \cdot (w_{j1}, w_{j2}, w_{j3})= (\frac{a_{ij}}{c_j^*} \cdot w_{j1}, \frac{b_{ij}}{c_j^*} \cdot w_{j2}, \frac{c_{ij}}{c_j^*} \cdot w_{j3}$$
$$\tilde{v}_{ij}=\tilde{r}_{ij} \cdot \tilde{w}_j=(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}) \cdot (w_{j1}, w_{j2}, w_{j3})= (\frac{a_j^-}{c_{ij}} \cdot w_{j1}, \frac{a_j^-}{b_{ij}} \cdot w_{j2}, \frac{a_j^-}{a_{ij}} \cdot w_{j3} \quad (6)$$

Where, $\tilde{w}_j$ the importance coefficient is the i[th] criterion.

According to the above contents, we will have:

$$\tilde{V}=[\tilde{v}_{ij}]_{m\times n} \quad ,i=1,2,\dots,m \; ; j=1,2,\dots,n$$
$$\tilde{V}=\begin{bmatrix}\tilde{v}_{11} & \tilde{v}_{12} & \cdots & \tilde{v}_{1n}\\ \tilde{v}_{21} & \tilde{v}_{22} & \cdots & \tilde{v}_{2n}\\ \vdots & \vdots & \ddots & \vdots\\ \tilde{v}_{m1} & \tilde{v}_{m2} & \cdots & \tilde{v}_{mn}\end{bmatrix} \quad (7)$$

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Step 5: Determine the positive ideal and negative ideal solutions:

Positive and negative ideal solutions are defined as the following, respectively,:

$A^*=\{\tilde{v}_1^*, \tilde{v}_2^*,\ldots, \tilde{v}_n^*\}$

$A^-=\{\tilde{v}_1^-, \tilde{v}_2^-,\ldots, \tilde{v}_n^-\}$ (8)

Where$\tilde{v}_i^*$, the best value of i criterion among the options as well as $\tilde{v}_i^-$the worst value of i criterion is of all the options available. In fact, this step seeking to find the best and the worst possible option.

Step 6: The distance from the fuzzy positive and negative ideal solutions:

These distances are calculated according to the following relations:

$S_i^*=\sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^*)$, *i=1,2,…,m*

$S_i^-=\sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^-)$, *i=1,2,…,m* (9)

Therefore, the distance of two triangular fuzzy numbers (a_1,b_1,c_1) and (a_2,b_2,c_2) from each other is calculated as the following:

$$d_v(\tilde{M}_1,\tilde{M}_2)=\sqrt{\frac{1}{3}[(a_1-a_2)^2+(b_1-b_2)^2+(c_1-c_2)^2]} \quad (10)$$

Step 7: Calculate the similarity index:

The similarity index can be calculated according to the following equation:

$$CC_i=\frac{S_i^-}{S_i^-+S_i^*} \quad (11)$$

Step 8: Ranking of options:

The options are ranked according to the values of CC_i in this step. So that the options that their similarity index value is greater would have better ranks.

3- Method and results of the study:

As we know, the present study aims to identify and prioritize factors affecting the housing market to be out of recession. Thus, in line with the research purposes, after reviewing existing models in the housing market and drawing dynamic circles with a systematic view, the effective factors were identified and then classified in three general categories of (macroeconomic developments and external environment, developments in the housing market (supply and demand), the expectations of the parties). Finally, the factors and components were measured through questionnaires and obtaining elite opinions, by linguistic variables.

Table 1: identified risks in investing in high-tech projects

Factor - impact	
Macroeconomic developments and the external environment	Government revenue
	Price of oil per barrel
	Bank deposit interest
	Individual investment in the non-housing sector
	The amount of liquidity
	Favorable business conditions
	The implementation of targeted subsidies plan
	Inflation rate
	price of exchange
Developments in the housing market (supply and demand)	Total actual demand
	Total demand for capital
	The total potential demand for capital
	Total potential consumer demand
	Welfare-oriented consumer demand
	Frugal consumer demand
	Total supply
	The numbers of units just beginning to be built
	The number of semi-finished units
	The number of completed empty units
	Permit (legal regulations)
	The amount of direct and indirect loans for housing
	The cost of materials
	Rental charge per meter
	Building cost per meter
	The price per meter of land
	The price per meter of old houses
	The final total price per meter of land and building
Expectations of the parties	Rumors and expectations factor
	Housing attractiveness for construction

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Table 2: The values obtained ideals

(1,1,1)	Positive ideal
(0.111,0.111,0.111)	Negative ideal

In the next step information obtained from the questionnaires were extracted and after entering the data into EXCEL software and implementing fuzzy TOPSIS algorithm, the following results were extracted:

Table 3: The results extracted from the questionnaires

Title	Fuzzy average of experts' opinions	Distance from positive ideal	Distance from negative ideal	Similarity index	Ranking
Government revenue	(1,5/870,9)	0.551	0.601	0.522	8
Price of oil per barrel	(1,5/870,9)	0.551	0.601	0.522	8
Bank deposit interest	(1,6/478,9)	0.538	0.622	0.534	5
Individual investment in the non-housing sector	(1,4/666,9)	0.583	0.564	0.491	19
The amount of liquidity	(1,6/043,9)	0.547	0.607	0.526	7
Favorable business conditions	(1,5/783,9)	0.553	0.598	0.519	9
The implementation of targeted subsidies plan	(1,4/533,9)	0.588	0.56	0.487	20
Inflation rate	(1,5/2,9)	0.568	0.579	0.505	15
price of exchange	(1,5/266,9)	0.566	0.581	0.506	14
Total actual demand	(1,6/826,9)	0.532	0.635	0.544	4
Total demand for capital	(1,7/345,9)	0.524	0.655	0.555	3
The total potential demand for capital	(1,4/466,9)	0.59	0.559	0.486	21
Total potential consumer demand	(1,6.261,9)	0.576	0.615	0.516	10
Welfare-oriented consumer demand	(1,5.435,9)	0.562	0.587	0.511	11
Frugal consumer demand	(1,5.2,9)	0.568	0.579	0.505	15
Total supply	(1,6.478,9)	0.538	0.622	0.534	5
The numbers of units just beginning to be built	(1,5.066,9)	0.572	0.575	0.501	16
The number of semi-finished units	(1,5.2,9)	0.568	0.579	0.505	15
The number of completed empty units	(1,6.304,9)	0.541	0.616	0.532	6
Permit (legal regulations)	(1,5.066,9)	0.572	0.575	0.501	16
The amount of direct and indirect loans for housing	(1,7.345,9)	0.524	0.655	0.555	3
The cost of materials	(1,5,9)	0.573	0.573	0.500	18
Rental charge per meter	(1,5.066,9)	0.572	0.575	0.501	16
Building cost per meter	(1,5,9)	0.573	0.575	0.501	17
The price per meter of land	(3,6.913,9)	0.408	0.651	0.615	2
The price per meter of old houses	(1,6.261,9)	0.576	0.615	0.516	10
The final total price per meter of land and building	(3,6.913,9))	0.408	0.651	0.615	2
Rumors and expectations factor	(3,7.087,9)	0.404	0.657	0.619	1
Housing attractiveness for construction	(1,5.066,9)	0.572	0.575	0.501	16

In the final stage using the method of fuzzy mean and above information, ranking of three main categories was done and the following results were obtained:

Table 4: Ranking the mother of three categories:

Ranking	Similarity index	Distance from negative ideal	Distance from positive ideal	Fuzzy average of experts' opinions	Title
2	0.605	0/651	0.425	(3,6.913,9)	Macroeconomic developments and the external environment
1	0.621	0/661	0.402	(1,7.174,9)	Developments in the housing market (supply and demand)
3	0.588	0/617	0.432	(1,5.956,9)	Expectations

Conclusion:

This study it was attempted to identify the factors affecting the housing market recession with a systematic view and determine the impacts of these factors on each other with an analysis of dynamic systems. Then these factors were prioritized using fuzzy TOPSIS method based on linguistic variables. The findings suggest that the housing market recession in Iran is influenced by three general factors of the housing market developments (supply and demand), macroeconomic developments and the external environment, and expectations factor. Each of the factors has sub-criteria that were noted in detail.

Among the general factors, the factor of housing market developments (supply and demand) with a similarity index of 0.621 has the first priority. That means this factor plays the biggest role in the events

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in the housing sector. Macroeconomic factors and the external environment with a similarity index of 0.605 and the factors related to the expectations with a similarity of 0.588 are the next priorities, respectively.

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