Research Paper

Investigating Iran Housing Market Cycles and Possible Scenarios in Short-Term and Midterm Horizon Using the System Dynamics

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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. The prices' shock causes problems on the demand side, particularly for vulnerable groups and on the supply side fluctuates investors' market confidence and risk. Under current conditions, also housing market remains in a deep stagnation. The present paper attempts to investigate causes of the problem and the housing market's future status using the dynamic system tools. In this study, after literature review the problem of the cause and effect model of the housing market has been outlined and the important and effective cycles have been specified. Then, using this model rate and accumulation model has been addressed and housing cycles have been specified in the simulation. In presenting scenario, also the status of parameters of Iran macroeconomic and sanctions is investigated. The result of presenting scenario shows that no sharp jump is predicted in housing price in future decade and in most scenarios the price is developed proportional to the inflation or less than it.

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1- Introduction

The problem of housing price shocks and its periodic fluctuations cause important and various problems at macro and micro-economic level and political, social and cultural problems. In macroeconomic, the price fluctuations reduce the purchasing power of vulnerable groups and increase the risk of investment and construction. At macroeconomic level, they cause non-
optimized distribution of resources and stagnation and boom periods interact with commercial periods of national economy. From social perspective, they also affect immigration, class gap and marginalization and also in labor market cause occupational insecurity for its partners. Also from social perspective, they affect discussion such as marriage and lifestyle. At political level, both in terms of the rights stipulated in the constitution on providing people with housing and advertising aspect, the fluctuations and problems caused by them affect people satisfaction and dissatisfaction and pressure on government.

2- Academic background

Fluctuation in housing price is a known phenomenon and most of studies have sought to understand high fluctuations in housing price. (2007) have presented a theoretical model for housing demand, under conditions of uncertainty that emphasizes the role of expectations on housing price and expected profit on housing demand. Muth (1988) presented a model for housing demand function and housing flow (housing newly built). Paterba (1984) has considered gross investment supply for housing based on q theory in long time as a positive function of housing real price. Barton Smith (1976) has presented a model to investigate the sensitivity of housing supply to price changes. Salo (1994) has obtained housing supply equation from a producer profit maximization process and consider cycle the effect of uncertainty of sales time on increased costs and also consider cycle limitation of land. Ronald Shone (2002) in Economic Dynamics addressed phase diagrams and their application in the economy and also different models of supply and demand. John Sterman (2000) in his book has presented a model of fluctuations, boom and stagnation in real estate market. In fact, with reference to historical data from commercial periods of US real estate market during cycle 1830 to 1933, a model has been presented for training commercial behavior cause and effect structure of real estate markets on the border limited. Also the process of setting prices has been described by a dynamic system view.

Shirin Bakhsh (1996) designed a model to estimate housing demand, supply and investment. He considered a household income, housing credit, a household asset and housing prices as factors affecting demand. Jalal Naeini and Noghani Ardestani (2003) have investigated mutual effect of housing price index as the most important disposal income of individuals in Iran on fluctuations in production, as well as its response to monetary shocks and how to use assets' value in making monetary policies in Iran. Based on their findings, the share of money volume (liquidity) in long term is more than other variables in explaining changes in housing prices. The model of housing prices' cycle in Iran has been developed by Mashayekhi et al. (2019). The purpose of this model was to show oscillatory behavior, cycle simulation of personal and property (not leased) housing prices and construction based on supply and demand. Hamta et al. (2010) in a paper have investigated factors affecting housing prices in Tehran by the system dynamics approach to predict the price of housing. These have divided the factors into two categories: Internal and external-sectorial factors affecting the price of housing. These factors and their effects on each other are outlined in causal cycle Figure, and accordingly flow Figure and additional relationships between variables among variables have been derived. In Shakib Taheri model the whole housing market with the population are modeled. In this model, capital demand has been modeled using fuzzy theory and mathematical programming that has also been used in this study (Taheri, 2010). Due to dynamic hypothesis of this study there is no need for modeling as large as Taheri modeling.
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 2020
  - In the third cycle, the year after hyperinflation in 2015
  - In the first cycle, the year after hyperinflation in 2002 as well as 2001
In the second cycle, two years after the relative hyperinflation in 2008 as well as 2007, 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 severe 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 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 du cycle 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 ducycle 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.

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The following formula is used to simulate the behavior of the demand for capital. Expectation and Caught liquidity has been placed in the variable \( x \) and the variable \( y \)

\[
f(x, y) = \frac{1}{1 + e^{-2.9791(x-0.9287)}} \times \frac{1}{1 + e^{-4.5829(y-0.0725)}}
\]

For modeling housing prices following formula is used:

\[
\text{land price}/4 + \text{materials}
\]

For modeling the relationship between housing demand and supply the following formula is used:

\[
0.022 \times \text{Tehran population} + \text{ABS}(0.06 \times \text{price increasing} \times \text{Tehran population}) + \text{ABS}(0.0025 \times (\text{sanction} + \text{inflation} + \text{gdp} \times 5.09) \times \text{Tehran population}
\]

The following formula is used for modeling of expectations:

\[
\text{IF THEN ELSE}(\text{inflation} \leq 40, (\text{price}/\text{last price}) \times (\text{price}/\text{manufactucycle cost}), (\text{price}/\text{last price}) \times ((\text{price}/\text{manufactucycle cost}) \times 1.5)
\]

\[
\text{Fig2: The Causal Model of Housing Market}
\]
Validation of the model

To verify the model, the model variables should show reasonable behavior and Figures represent the behavior of the model in the real world. The following Figures have been obtained by formulations done that their rational and expected behavior is observed.
**Fig4:** Simulation of Housing Prices

**Fig5:** Simulation of Land Prices
As it is observed, the model behavior is closely related to the behavior of the main variables of housing market in the last twenty years. Other variables of the model also showed rational and expected behavior.

Expectations' factor has been developed du cycle housing prices' growth years, and du cycle housing stagnation years has been declined.
Ducycle demand stagnation years, in purchase sector demand boom is observed in lease sector. Ducycle boom years in housing purchase sector the opposite namely stagnation in lease sector is observed.
Fig10: Simulation of Total Supply

Fig11: Simulation of Total Demand
Scenarios presentation
In the next ten years, due to demand reduction and housing supply increase observing a sharp rise in prices and large bubbles is not expected anymore. So it is expected that the growth of housing prices in Tehran is less than the rate of inflation. The only factor that can change the conditions somewhat is macroeconomic conditions, policies of expansion and contraction of the government and sanctions' conditions. Therefore, in future scenario presenting, developments that may arise in the behavior of the government and sanctions' status are investigated.

Table 1: Scenarios

| Status of exchange rate | liquidity | Status of sanctions | economic growth | numbers |
|-------------------------|-----------|---------------------|-----------------|---------|
| Exchange rate stability | Growth commensurate with economic growth and average past years | Based on The continuation of sanctions | 3% | Scenario 1 |
| Exchange rate increase  | Growth commensurate with economic growth and average past years | Based on The continuation of sanctions | 3% | Scenario 2 |
| Exchange rate stability | Growth commensurate with economic growth and average past years | Based on Gradual lifting of sanctions | 5.2% | Scenario 3 |
| Exchange rate increase  | Growth commensurate with economic growth and average past years | Based on Gradual lifting of sanctions | 5.2% | Scenario 4 |
| Exchange rate stability | Growth commensurate with economic growth and average past years | Based on rapid removal of sanction and Increase productivity | 6% | Scenario 5 |
Fig 12: Simulation of Housing Prices in the Future

Fig 13: Simulation of Land Prices in the Future

Fig 14: Simulation of Capital Demand in the Future
Scenario 1: If by the presence of sanctions rational policies are made to organize the business status along with controlling liquidity growth and exchange rate, housing market will have a slow status over the next decade and will continue its slow growth less the rate of inflation.

Scenario 2: If the sanctions are continued and no certain determination is found to organize the industry status and economic growth, housing market after cross-sectional growth moves toward a deep stagnation.

Scenarios 3 and 4: In the case of sanctions' gradual resolving, since it is not expected macroeconomic variables in the two scenarios have significant differences, the market behavior in the two states is closer together and it is expected housing market price is about inflation rate, and in boom period is increased slightly more than annual inflation.

Scenario 5: Due to desirable economic growth in this state, appropriate business environment and the absence of intensified inflation, influx of applicants will not been observed and companies and individuals are trying for their money circulation in their working area and so do not think about preserving their purchase power by attending housing market. Under economic stability conditions, the lack of excitement in the market and lower wash cycle liquidity in long time to the two previous scenarios housing market will have relative boom and because of desirable income status of applicants, they attempt to buy comfortably.

Conclusion
In general in the country, then intensified overtaking of housing supply to demand will be seen that this will lead to less use of investments done in housing sector and the sector stagnation. Also growth rate of housing price in future will be about inflation rate or lower and the country housing market is changing seriously from production-oriented and a seller's market to market-oriented and a buyer market.

The status of housing market as described above is predicted. The only factor that can change the market status is macroeconomic status and monetary and fiscal policies of the government that has been addressed in the scenario presented.

Future suggestions
According to dynamic structure and intensifying cycles seen in housing market, this tool can also be used in various research in other sectors of housing. For example, we can address using
dynamic system tool to analyze how to create the effects of empty houses in Tehran and/or the effects of immigration and population change of consumption demand on housing market. Also using a combination of the two methods of dynamic system and fuzzy theory in housing market is recommended. Large sectors of housing market, including investment system in housing production, the behavior of builders, buyers and applicants have modeling capability by fuzzy theory as a complement to dynamic modeling.

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