Housing Affordability: A study of real estate market in Iran

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Abstract

In this paper by means of a simple system dynamics model, we analyze the dynamics of housing affordability in the context of real estate market of Iran. To do this we define an affordability index according to Iran's economic situation and show that in the absence of effective financial infrastructures, this index declines over time. To confront this problem, we analyze supply-side and demand-side housing policies. Moving into industrial methods of construction and increasing the volume of the construction loans are among supply-side housing policies. Also focusing on macroeconomic policies to reduce economic fluctuations and risk of investments in other markets is among demand-side housing policies.

Keywords: Affordability, Real Estate Market, Owner-Occupied Market, Saving, Perceived Accessible Loan, Purchasing Power, System Dynamics Modeling

1. Introduction

According to current national data and from a macroeconomic viewpoint, the construction and real estate sector is one of the most important sectors of the national economy. Nearly 120 industrial activities (businesses) are related directly or indirectly to this sector. Housing market consumes about 50 percent of final goods produced in Industrial sector (Khiabani, 2004). Thus, it is obvious that there is a significant nexus between this market and other sectors especially industrial sectors. In developing countries, however, this interaction seems more important. Furthermore, an economy at the early stages of its growth owes much to construction activities, while in other stages of growth, will in turn be influenced by the economic growth.

In Iran, housing market always acts as a "buffer" for the economy. In the periods when other sectors suffer depression, this sector absorbs capital surplus and passive assets and preserves the economy from depression. In three recent decades, between 3 to 9 percent of GDP (Gross Domestic Product) of Iran was produced from this sector and in average since 10 years ago, this share has reached 4.5 percent annually (CBI, 2003; Khiabani, 2004). Although this figure is not meaningfully conspicuous, but after service sector, the main investment comes from housing sector, another implication of its importance.

Many surveys and articles have been published in this field in Iran. The goal of this paper is not to focus on all aspects of this market, but just put an emphasis on demand side (as a view of households) and studying the effects and side effects of policies implemented in this market on households.

On demand side, there are many influential parameters such as relative price of houses, the expectation of future changes in price, national income, liquidity, credit market of house, rate of return of current assets in economy, and population that affect demand for houses or investment for buying a house. Among these items, population and immigration are main factors of increasing demand in recent years in Iran. Unfortunately due to disequilibrium in demand and supply of housing market, there exists an excess demand which leaves many households homeless. This disequilibrium may result from inappropriate policies and decisions implemented in this market in recent years.

In reality, the most important factor for a household is its purchasing power. Thus, financing the purchase decision is of paramount importance. Some studies have shown that a house is a luxury good (or even necessity) with positive income elasticity. Thus an increase in household income leads to increase in its demand. Therefore, in a macro level taking the inelastic supply of houses, an increase in the real income of all households, highly correlated to national income per capita, can lead to an increase in real value of houses (Khiabani, 2004-Autumn). Assume a person, who in a general framework of optimization, not only is "willing" to buy a house, but also regarding the capital market as perfect, is "able" to do so. He can finance this purchase by his savings plus present income and his future incomes transferred to present in the form of loans

and installment plans. Therefore, the purchasing power depends on past savings, present income, and the ability to borrow regarding the future incomes.

In Iran, the main share of financial resources for buying a house is households' savings, while a small part is provided by loans from banks or loans from other sources. This reveals significant shortcomings of financial intermediaries in Iran. If somebody has enough current income without any considerable savings, he/she will not be able to buy a house in the current system. Financial systems in Iran lacks appropriate structures and mechanisms such as long-term loans and commensurate support which may help households to finance their purchase decisions and buy houses more easily with lower financial pressures.

2. Problem Definition

According to the aforementioned discussion and current deficiencies, the main purpose of this paper is studying affordability in housing market by means of System Dynamics modeling (our focus is on owner-occupied market and we exclude renters).We used a model by Mashayekhi (2009) that describes the dynamics of supply and demand in housing market based on a stock-flow structure with System Dynamics approach. Moreover we considered a parameter which is defined by ratio of number of occupied houses (stocks) that is equal to number of owner families and the number of homeless families. This parameter guides us to the correct perception of housing purchasing power of household and therefore the concept of affordability. In this paper, in addition to stock-flow structure of demand side and also supply side in housing market, we used this structure for the price of houses. Most influential factors that were mentioned in introduction session are stock of savings, average income of a household, accessible loan from banks, the growth of population and even the growth of GDP.

This dynamic modeling is somehow the simulation of current housing market in owner-occupied market in Iran. We can observe the number of households that are able (not willing) to buy a house, according to the dynamic structure in three aspects of housing market (supply, demand, and price) and also existing financial system of funding in housing market (that is more related to the households' savings instead of loanable funds markets) in the long term. Furthermore this study can help decision makers to better understand the effects of their policies on purchasing power of people. The concept of affordability is very useful in making sense of defects in structure of housing market in Iran.

3. Literature Review

There are so many articles analyzing dynamics of housing market (Wheaton William C., 1999; Blank, 2009; G. Meen, 2000); but the main purpose in these articles is recognition of CPM (cycle-producing mechanisms) and oscillating behavior of this market. Most approaches are based on econometric and mathematical analysis and rarely on System Dynamics Modeling. The prediction and studying of housing market behavior is so complicated and complex that preclude

proposing a theoretical framework for analyzing it (Blank, 2009). On the contrary, System Dynamics tool is so helpful for understanding of complex models in real world (Forrester, 1991).

Based on mathematical approaches, there is a variety of articles in analyzing dynamics of housing market. An example is an analytical article presented by Poterba (1984) who expresses the modification mechanism of market based on shocks in demand side, showing that the price increases and leads to short-time profits in construction side (Supply), that naturally increases the rate of construction and results in accumulation of supply (excess supply). This accumulation will decrease the price and finally balance supply and demand. This approach was completed by G. Meen and M. Andrew through 1990 to 2006 and was tested on data of England and USA housing market. Also in a study, G. Meen observed the correlation among price of house, rate of construction, cost of construction, and interest rate with econometrical approaches (VAR and VECM) and considered the modification mechanism of market and effects of important factors on supply, demand, and price (G. Meen, 2000). Wheaton (1999) built his famous stock-flow model to study the cyclical behavior of price in the office rental market and showed that the supply lag is the main factor causing cycles in housing market behavior.

Also in Iran, there are some useful studies in this field. For instance in a study the relation between house price and macroeconomic parameters (e.g. oil price oscillation, growth rate of money supply, supply fluctuation …) was considered (Khiabani, 2004). But the basis was mainly on mathematical tools.

The patterns introduced here are based on stock-flow structure of housing market presented by Mashayekhi (2009). In this paper by means of a simple system dynamics model, a cycle-producing mechanism in the owner-occupied real estate market was addressed. This mechanism is based on accumulation of supply and demand which arises from specific stock-flow structure of a durable-goods market like the owner-occupied market.

In our paper we used the dynamic modeling of supply, demand and price of house, and also defined the concept of affordability that has not been used in this way previously in any System Dynamics papers. Affordability is an index that shows the performance of housing market. It is defined in such ways as the ratio of household’s income to rent in rental market, or the ratio of price of house to accessible loan for buying house in owner-occupied market (Quigley, et al., 2004).

Although all of these definitions should be considered on their own merits and are useful in their own contexts, but we defined a new ratio (the number of families owning a house to homeless families) which is more applicable to infrastructural foundations of housing and financial markets in Iran. In the following section we will discuss this further.

4. Structure of the Model

4-1-Causal loops

In this section we describe the causal loops for the proposed model. As mentioned before, there are many definitions of affordability in the literature which cannot be applied for the current model due to infrastructural differences between Iran's financial markets and intermediaries and those of developed countries. By providing home-seekers with 25-year to 30-year loans, the financial intermediaries of developed countries play an integral role in helping the homeless people finance their housing demand. Therefore, such indices as "the ratio of median family income to the income required to qualify for a conventional mortgage on the median valued house sold" or "the ratio of 25 percent of median monthly income to the payment" (John M. Quigley and Steven Raphae, 2004) are of little relevance to Iran's situation. Iranian home demanders pay the major proportion of the price from their pocket, and there is only a very small portion available for loans.

Herein, we simply define affordability as *the ratio of households who own a house to homeless households*. Again, for sheer simplicity, we assume that every household can be the owner of only 1 house, thus yielding affordability as the ratio of occupied stock to homeless families (in the stock-flow model we omit the unit inconsistency of homeless families with occupied stock of homes by entering a mediating multiplayer and therefore making affordability dimensionless).

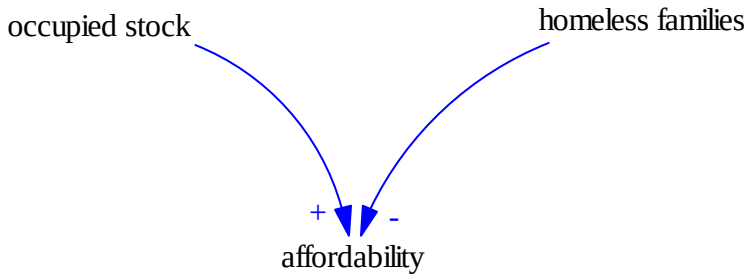

Figure 1

In Mashayekhi's model (2009), the homeless families are assumed constant and the effect of population growth has not been considered. However, homeless families increase as the population grows. Also the number of occupied stock depends on demand and sales of vacant stock:

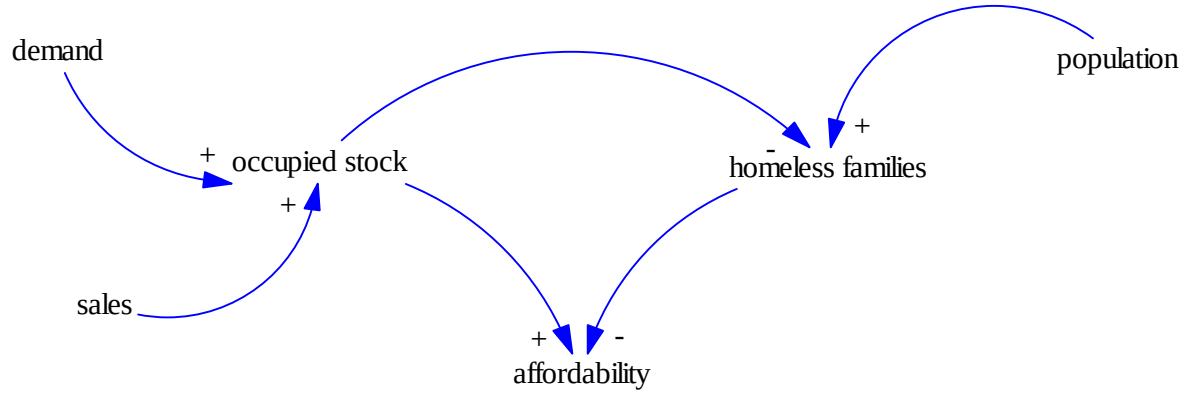

Figure 2

Moreover, the demand depends on price, homeless families and the affordable price.

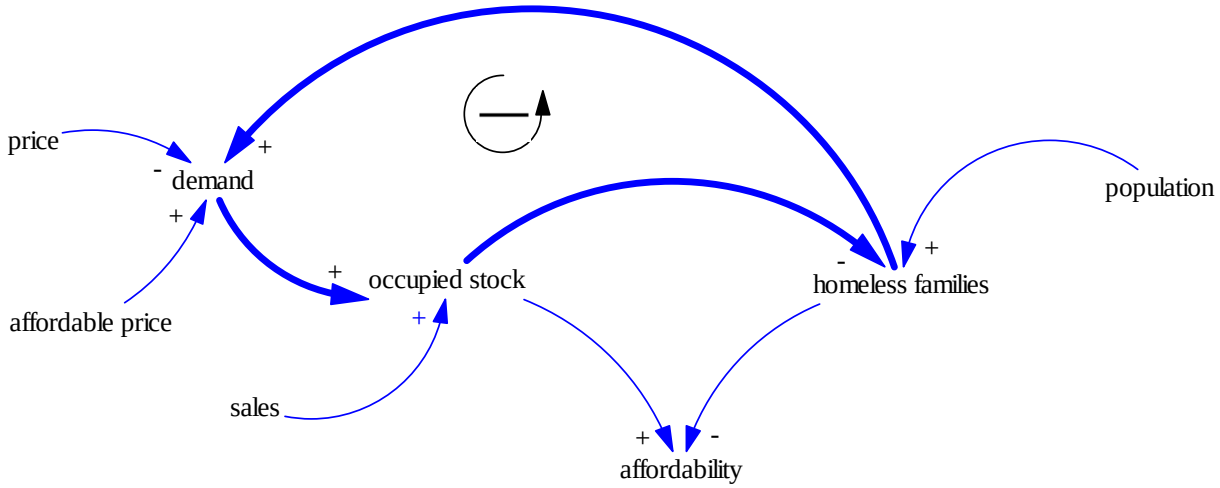

Figure 3

Now, to be more specific, we should discuss the "affordable price" variable a bit further. In Mashayekhi's model a factor was defined, normal price that people use as a yardstick against which the prices can be compared and it was assumed constant for simplicity (Mashayekhi, et al, 2009). However, this price cannot be constant and is a function of savings of household and the amount of loan it considers to be accessible for it. To put it another way, households compare house prices with the price that is *affordable* for them. This is a key element in deciding whether to buy a house or not. The buying decision can be made only after the comparison of house value with the affordable price for the homeless family justifies it.

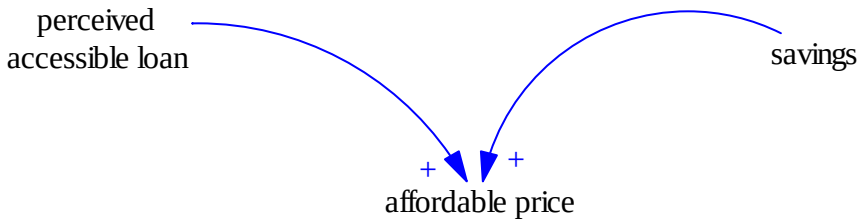

Figure 4

The amount of household savings depends on their income. Households often spend a portion of their income and save the rest. (In macroeconomics literature, the portion of the household's income which is saved is called Marginal Propensity to Save (MPS).)

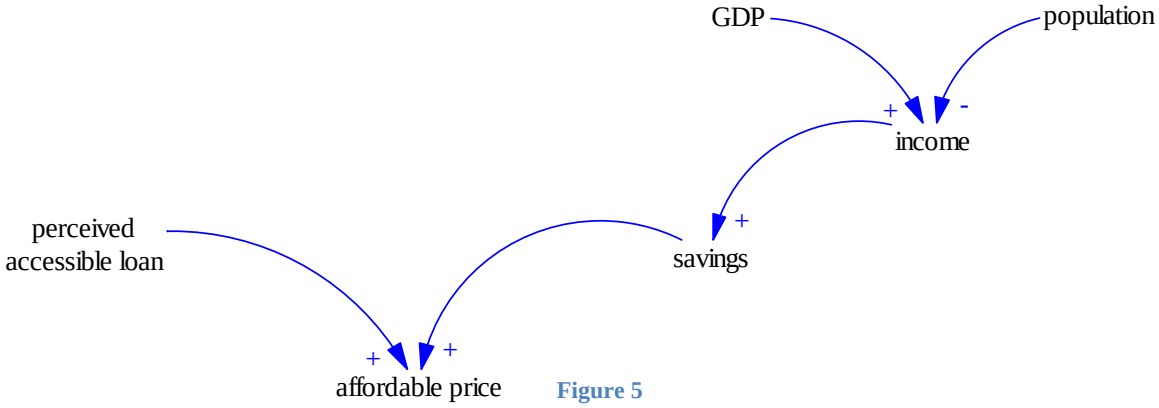

Figure 5

Higher prices indicate higher accessible loans from banks. Banks usually guaranty a constant percent of the house's price to lend. This equals 30 percent in Iran (loan to value or LTV = 0.3) meaning that the homeless family can only borrow 30 percent of the house's value from banks. The positive loop below implies that other things equal, the higher the value of a house, the higher the accessible loan from banks resulting in higher perceived accessible loan.

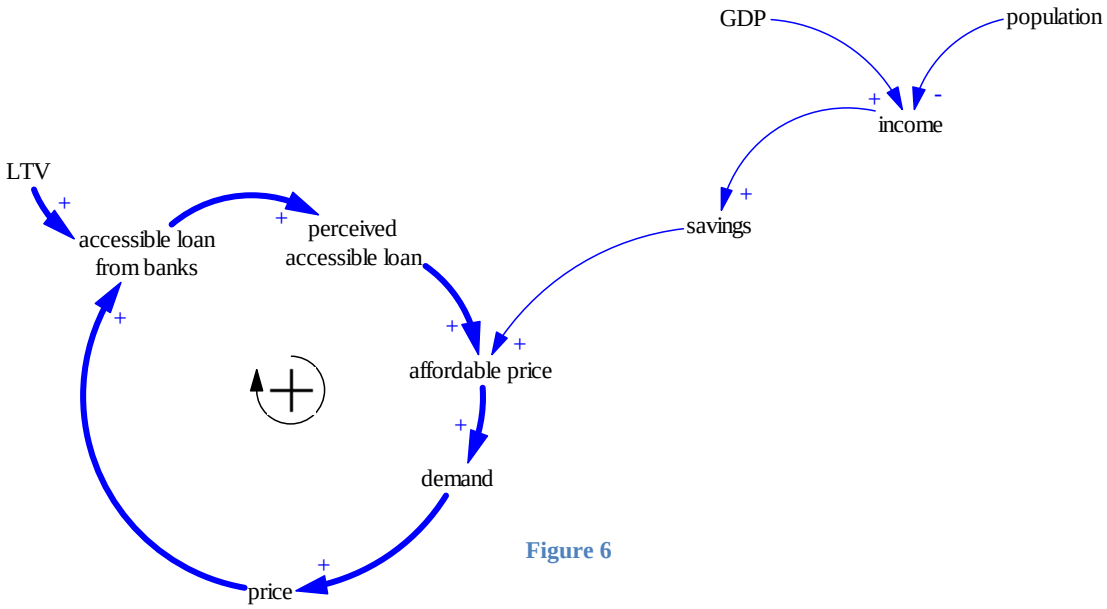

Figure 6

But here also a negative loop exists. Higher loans require higher installments. The homeless family does not consider a house purchase merely with regard to its ability to borrow, but it also takes into account its income. The higher the ratio of payment/income is, the less the homeless will perceive the proposed loan from banks accessible. This will mediate the effect of

aforementioned positive loop on the affordable price, resulting in a decrease in demand stemming from the difference between the value of the house and affordable price of homeless families.

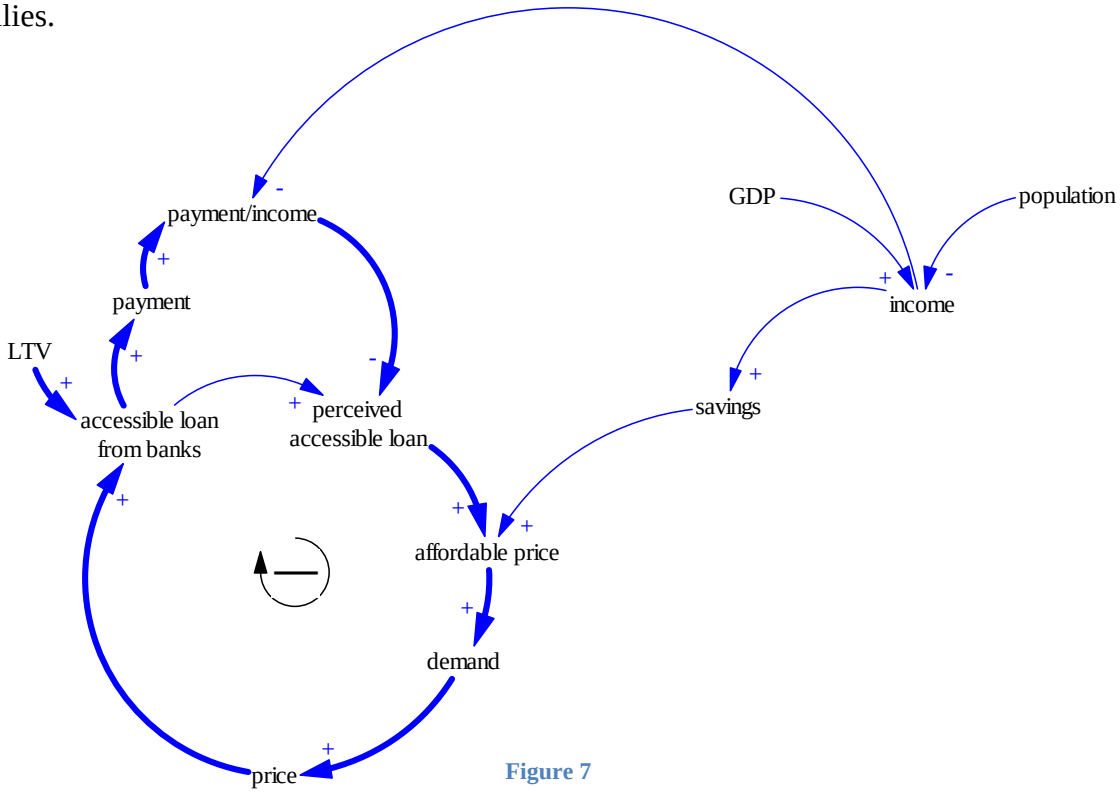

Figure 7

The famous two-looped supply-demand model can be traced in this market as well.

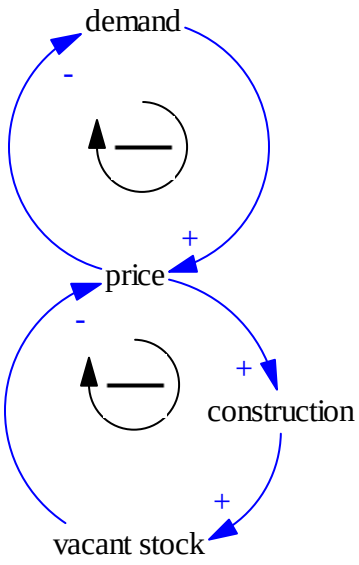

Figure 8

By the increase of vacant stock and demand, sales will mount till the demand is fulfilled.

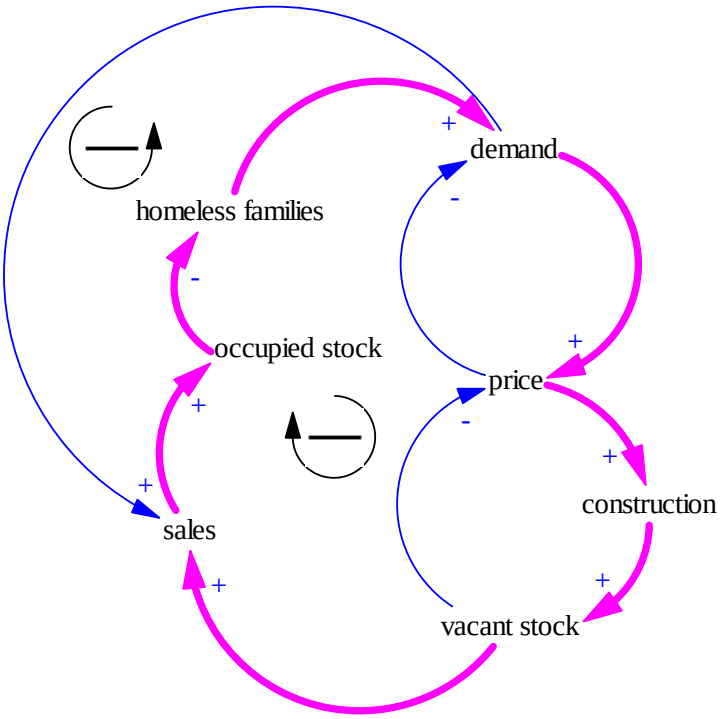

Figure 9

The overall causal loops of the model are as follows:

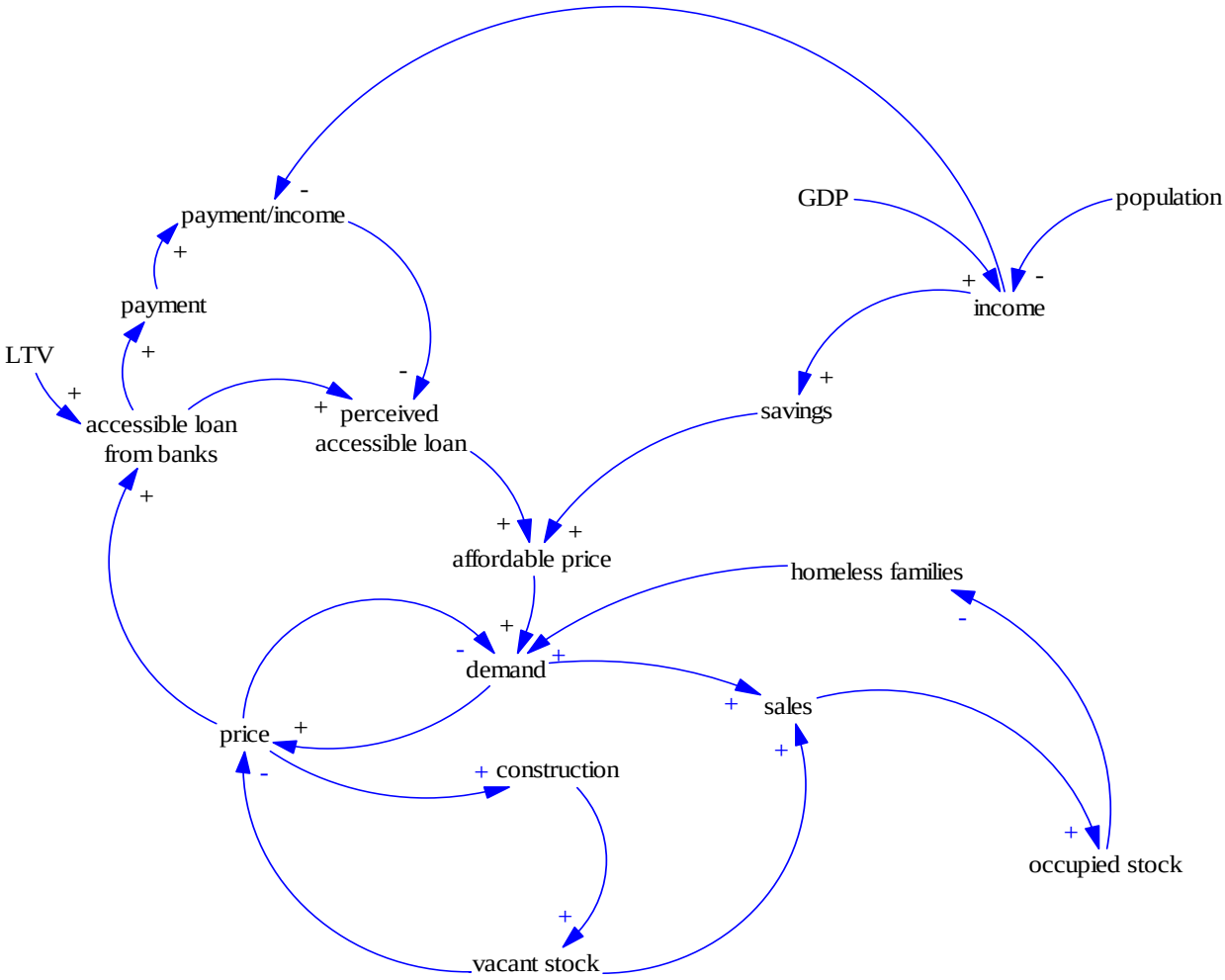

Figure 10

4-2-The stock-flow diagram

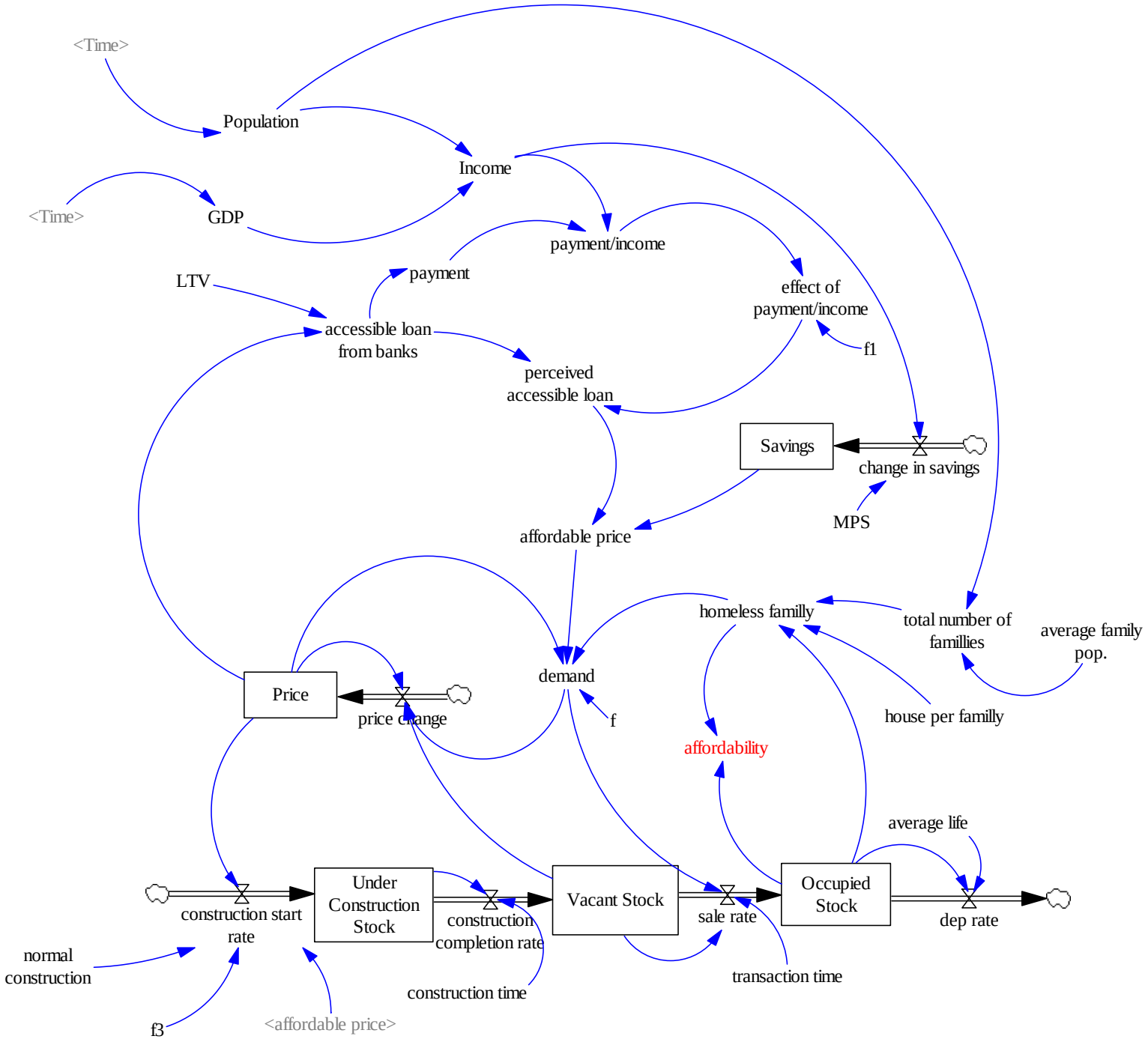

Figure 12

4-3-Observing the behavior of key variables of the model

As below, the affordability index for Iran undergoes a descending trend. To give an account of this, we should ponder upon the dynamics of occupied stock and homeless families.

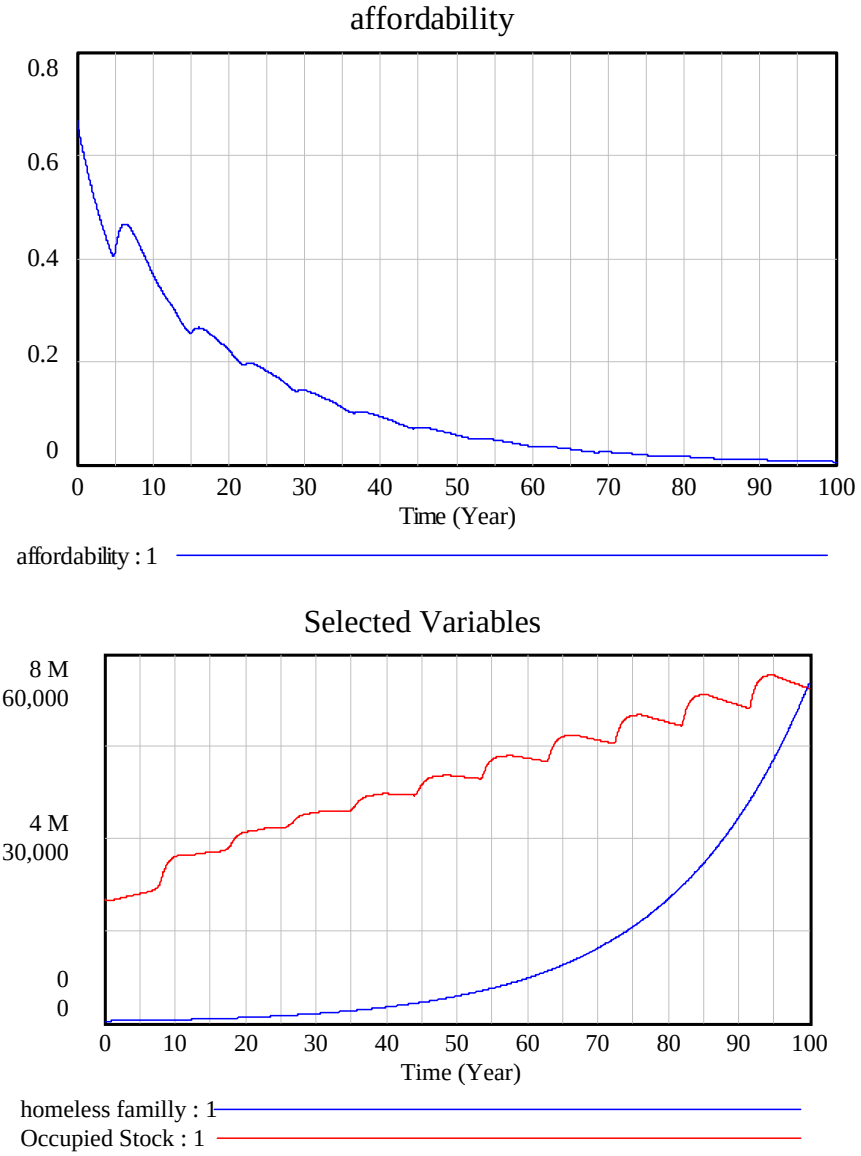

Figure 13

As we can see, homeless families grow exponentially, and occupied stock though having cyclical fluctuations also increases but at a rate lower than that of homeless families. That is why the affordability index falls to zero through the years.

To see the behavior of homeless families, we should study the variables “total number of families” and “occupied stock”. Total number of families is a function of population growth which had an ascending pattern through the past 30 years.

The occupied stock coming from Mashayekhi's model is highly influenced by the oscillations of the market, but has an overall soaring trend due to higher rate of sales than depreciation of the occupied stock.

The behavior of some other key variables of the model is as follows:

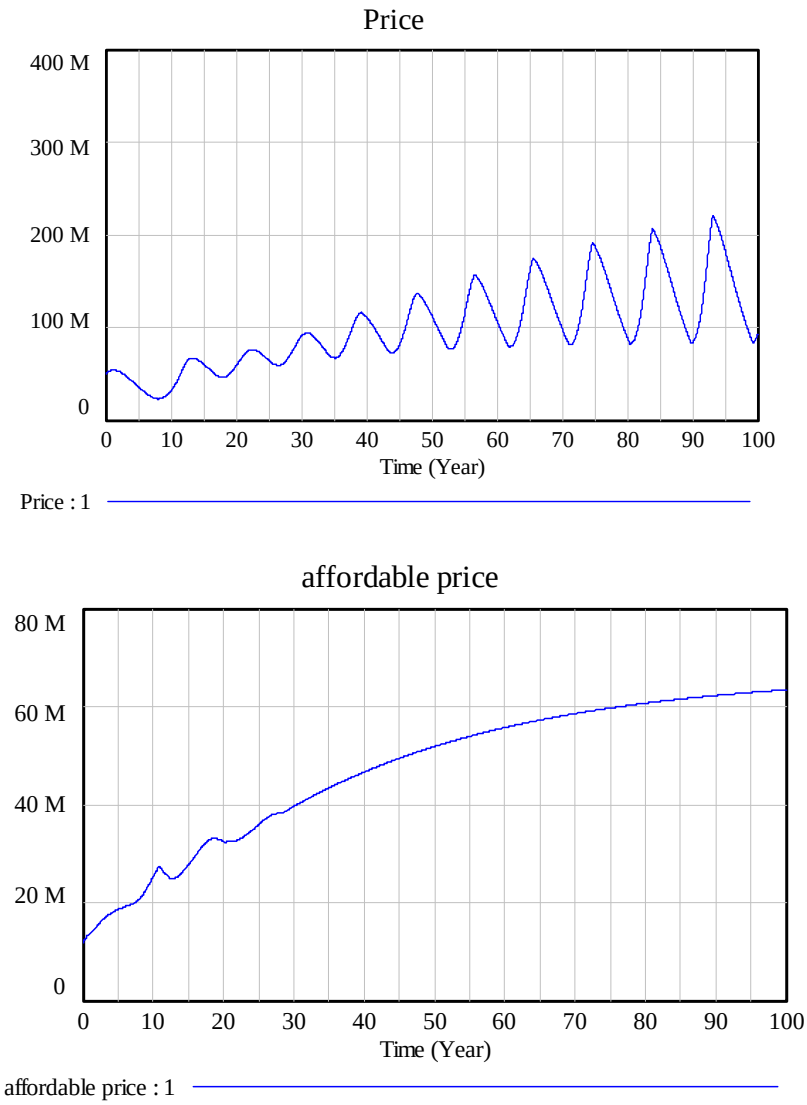

Figure 1143

As we see, as long as the positive loop dominates, the affordable price grows, but the overall behavior of the variable is goal-seeking due to the decisive effects of the negative loop discussed earlier. At a point in time, the perceived accessible loan falls to zero and the whole amount of money the homeless can pay comes from his savings. Thus the affordable price curve and the savings curve conjoin.

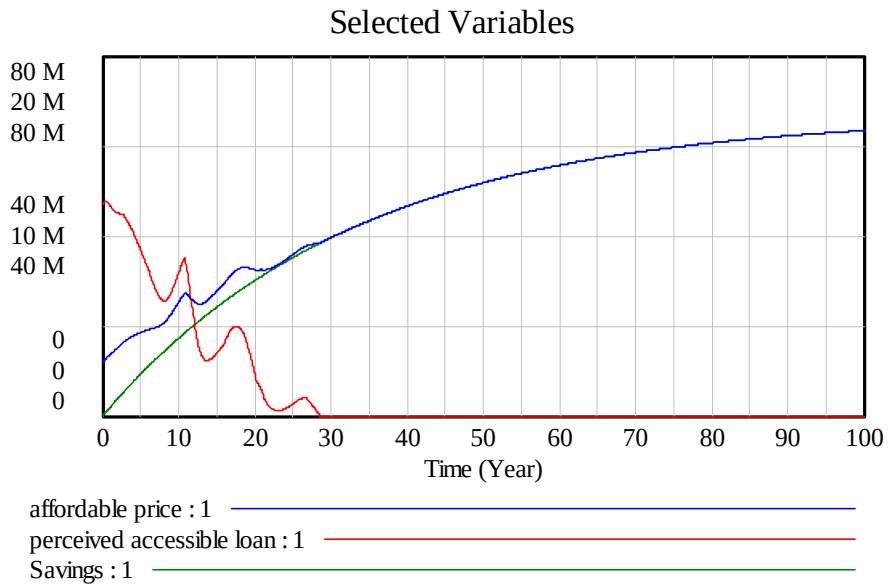

Figure 15

5. Validation of the Model

In this section we are going to test our models. Structure assessment, Dimensional consistency, extreme conditions and behavior reproduction are used to validate our model.

Structure assessment test ask whether the model is consistent with knowledge of the real system relative to the purpose. Structure assessment focuses on the level of aggregation, the conformance of model to basic physical realities such as conservation laws and the realism of decision rules for agents. For example as you can see in figure (15), in our model all real variables such as population, price, savings and demand should not be negative, as they are not. In addition to that, as we mentioned, decision rules for a household to buy a house is consistent with reality of decision making in Iran. Moreover in building our model, it is considered that all variables are meaningful and have real world meaning.

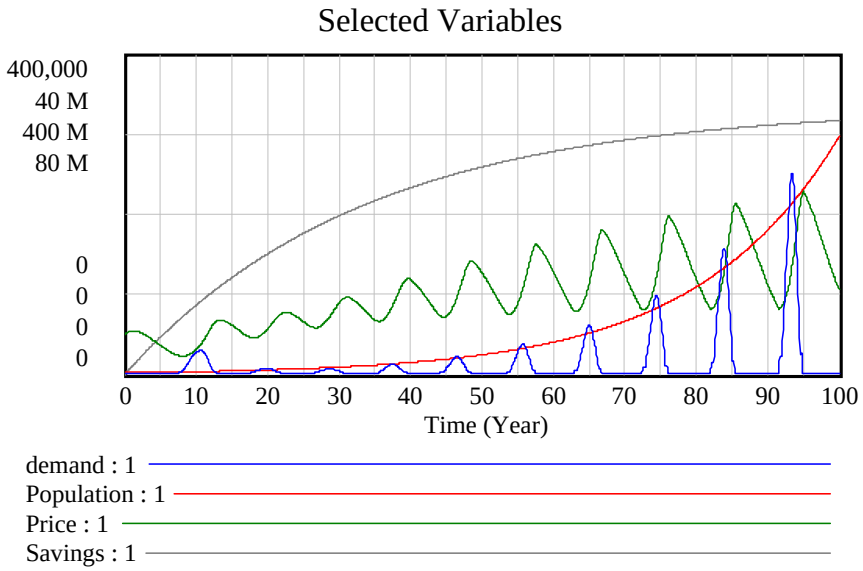

Figure 16

Dimensional consistency is one of the most basic tests. Vensim provides automated dimensional analysis. For this, we specified units of measure for each variable as we were building the model. However, a model that generates no error messages when dimensional consistency check is run does not necessarily pass the test. Every equation must be dimensionally consistent without the inclusion of arbitrary scaling factors that have no real world meaning. To identifying such fudge factors we inspect the equations directly. For example:

p

Models should be robust in extreme conditions. This means that under extreme conditions, model should behave in a reliable fashion. In our model, for example, if the population equals to zero, it is expected that we have no demand, and all variables remain in their initial values. For instance by running the model with population=0 price remains at the level of 50M units and price change rate is zero.

In the case that GDP is zero and all population have no income, because in Iranian society households' savings cover the majority of cost of housing, it is expected that no one has purchasing power to buy a house and price remains in its initial level and demand will be zero.

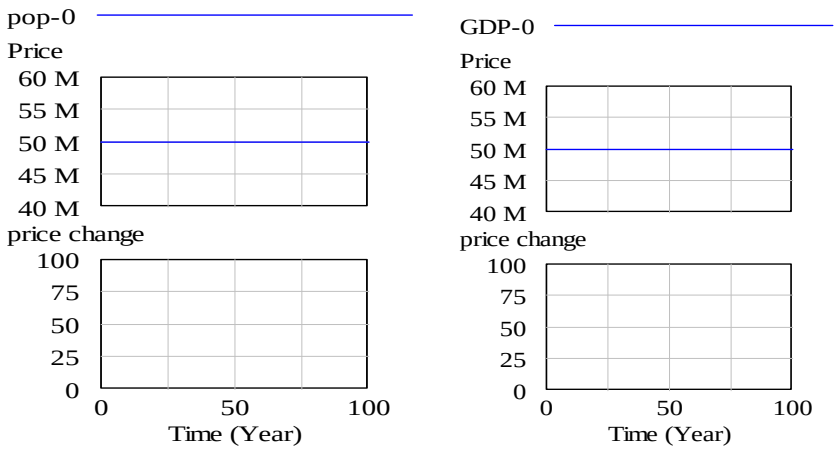

Figure 17

From a behavioral reproduction point of view, our model reflects the real behavior of Iran's housing market. As mentioned previously, behavior of housing price follows divergent oscillatory pattern.

Also under construction stock has significant role in describing of oscillatory behavior of the housing market. One positive shock in demand triggers increasing in the price and this makes new constructions profitable and increases new constructions. As a result supply goes up and

housing market returns to equilibrium. Figure (17) illustrates the real price of houses and under construction stock simultaneously.

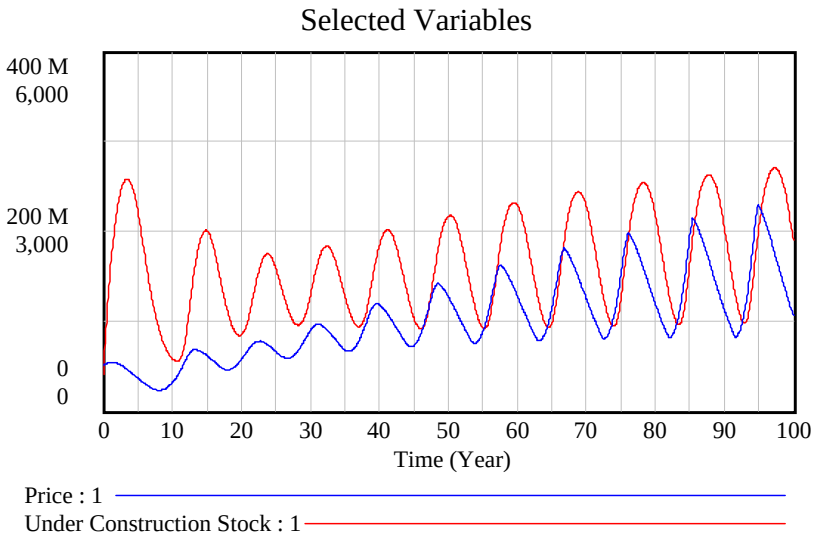

Figure 18

The most important variable of our model is Affordability Index. As you can see, Affordability Index decreases over time and that is compatible with reality in Iran which purchasing power of households in Iran has decreased.

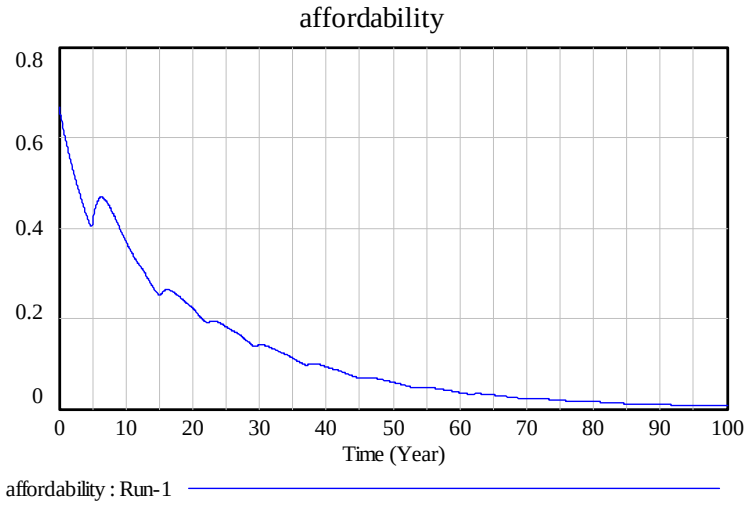

Figure 19

6. Policies Making

Policy making in housing market can be divided into two broad categories: demand-side housing policies and supply-side housing policies. Today in most developed countries, supply-side policies have significant importance. According to supply-side policies, the underlying

cause of increasing in the housing price is a weak response of new constructions to changes in the price and causes inequalities in housing market against shocks of demand side. In the proposed model, it is assumed that the rate of new constructions is determined by normal construction which is normal production capacity of the society and assumed constant. Based on the price this capacity can be goes up by 200%. This assumption is consistent with traditional construction in Iran which its construction capacity is not compatible with needs. Moving into industrial methods of construction can be effective in reducing the construction costs and cost price. Also another effective policy can be increasing in the volume of home loans. Increasing the volume of the construction loans raises the capacity of constructors to cover their construction costs and increases normal construction capacity of the society.

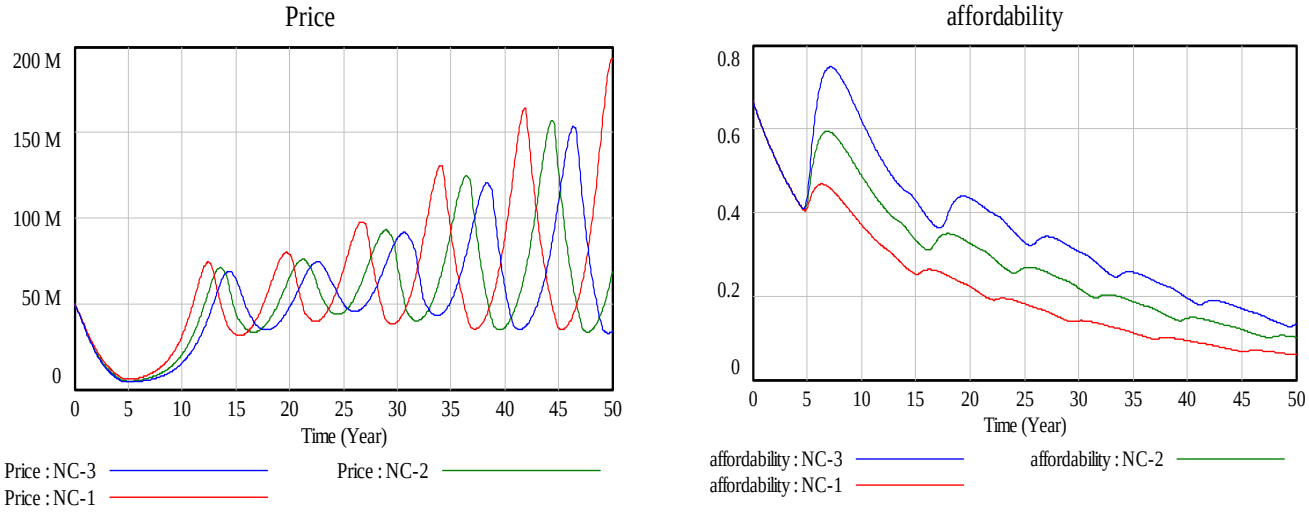

Figure 19

As shown in figure (19) due to different quantities of 1000 (NC-1), 2000 (NC-2) and 3000 (NC-3) for normal construction, purchasing power of households goes up and fluctuations of price are reduced.

In addition to supply-side policies, demand-side policies have great importance and should be notified by Iranian policy makers. Under conditions such as:

a) Economic fluctuations and high risk for investment in other sectors of economy
b) The weakness of stock market which is a useful tool to absorb public investments
c) Dominance of the state in most economic activities

Housing market is a suitable market for investment and these situations make home-owner families richer and homeless families poorer.

Continuous growth in real volume of the money is one of the effective measures to increasing in housing prices during 1992-2007. According to studies conducted by Khiabani (2004), a 1% increase in real volume of the money leads to 0.86% increase in real house prices but a 1% increase in real volume of the money leads to 0.75% increase in new constructions. According to this reality that the number of under construction houses is only 3% of houses stock, it can be concluded that this continuous in real volume of the money led to significant increase in housing demand versus supply. In the proposed model, growth rate of GDP is less than growth rate of populations (0.02 versus 0.05). If we change the growth rate of GDP into 0.06, it can be seen that not only there is no significant change in affordability index but also fluctuations in the price increase and maximum level of the prices rise.

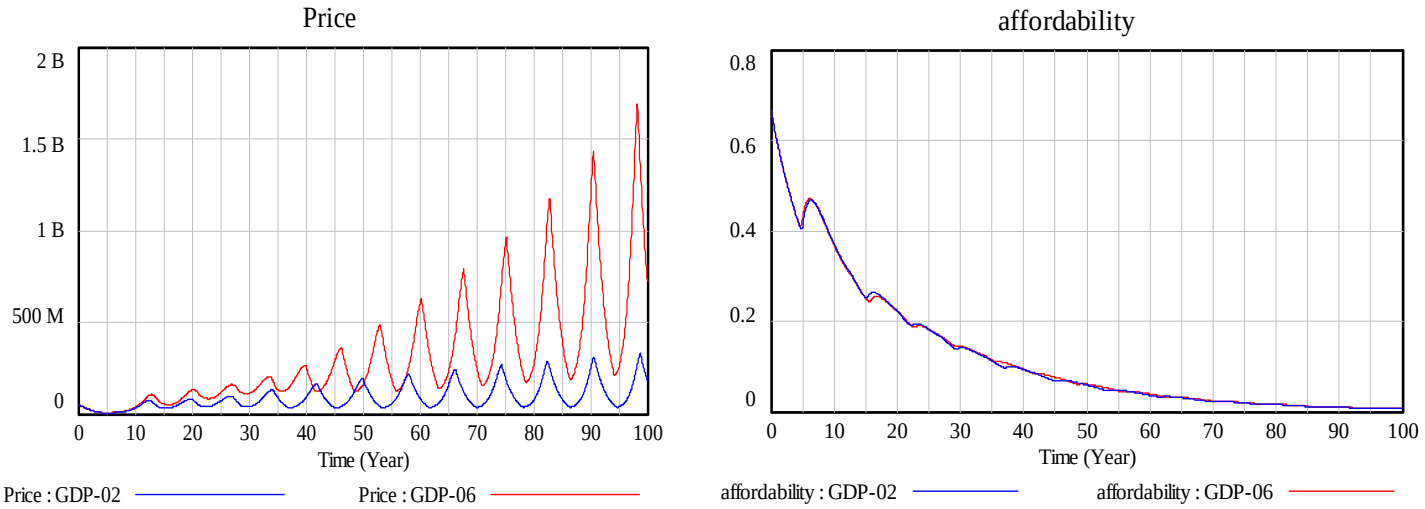

Figure 20

As you can see, macroeconomic policies have significant role to reduce the growth of house price level in Iran. In order to realization of accessibility of all households to houses with acceptable quality level and affordable prices, in addition to financial policies we need to bring macroeconomic policies with focusing on sustainable economic growth to our attention.

7. Concluding Remarks

In this study we tried to present a model to describe accessibility of Iranian households to houses. We used a model which has been presented in a paper by Mashayekhi (2009) that describes the dynamic behaviors of supply and demand of housing market based on stock-flow structure with System Dynamics approach. Based on our study these results are obtained:

- Without speculation demand, lack of supporting financial structures in Iran for buying real estate, strengthens fluctuations in the price and increases housing price over time. Although purchasing power of people increases but the growth rate of housing price is more than its growth and as we saw before affordability index decreases.
- From policy making point of view, we showed that supply-side housing policies such as increasing in construction loans, promotion of industrial methods of construction and reducing construction costs raise the construction capacity of the society and recover the balance between supply and demand.
- Also it has been illustrated that in lack of proper financial markets, increasing in real volume of the money reinforces the fluctuations of price in housing market and increases the demand for houses. This issue makes it clear that we must consider macroeconomic policies as long-term solutions to resolve the problem.

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Appendix: Equations of the Model:

(01) accessible loan from banks= LTV*Price

(02) affordability= Occupied Stock/homeless family

(03) affordable price= perceived accessible loan+Savings

(04) "average family pop."= 4

(05) average life= 50

(06) change in savings= MPS*Income

(07) construction completion rate= Under Construction Stock/construction time

(08) construction start rate= normal construction*f3 (Price/affordable price)

(09) construction time= 2

(10) demand= homeless family*f (Price/affordable price)

(11) dep. rate= Occupied Stock/average life

(12) "effect of payment/income"= f1("payment/income")

(13) f([(0,0)-(2,1)],(0.00611621,0.995614),(0.0733945,0.986842),(0.171254,0.991228),(0.324159,0.969298),(0.452599,0.934211),(0.587156,0.881579),(0.685015,0.807018),(0.746177,0.736842),(0.868502,0.631579),(0.972477,0.491228),(1.0948,0.381579),(1.21713,0.245614),(1.30887,0.162281),(1.37615,0.118421),(1.49847,0.0570175),(1.60856,0.0307018),(1.71254,0.0175439),(1.81651,0.00438596),(1.92049,0.00438596),(1.99388,0))

(14) f1([(0,0)-(1,1)],(0,1),(0.0978593,0.973684),(0.146789,0.960526),(0.214067,0.907895),(0.324159,0.75),(0.422018,0.442982),(0.538226,0.236842),(0.642202,0.114035),(0.752294,0.0701754),(0.801223,0.0438596),(0.896024,0.0175439),(1,0))

(15) f3([(0,0)-(4,2.5)],(0,0.0109649),(0.110092,0.0219298),(0.318043,0.0328947),(0.623853,0.109649),(1.05199,0.252193),(1.45566,0.438596),(1.737,0.712719),(1.98165,1.01974),(2.15291,1.34868),(2.36086,1.62281),(2.53211,1.78728),(2.83792,2.07237),(3.11927,2.24781),(3.40061,2.39035),(3.57187,2.42325),(3.74312,2.44518

),(3.90214,2.47807),(3.95107,2.48904))

(16) GDP= exp(0.02*Time)*1e+012

(17) homeless family= total number of families-Occupied Stock/house per family

(18) house per family= 1

(19) Income= GDP/Population

(20) LTV= 0.3

(21) MPS= 0.4

(22) normal construction= 3000

(23) Occupied Stock= INTEG (sale rate-dep rate,20000)

(24) payment= accessible loan from banks*0.1

(25) "payment/income"= payment/Income

(26) perceived accessible loan= accessible loan from banks*"effect of payment/income"

(27) Population= exp(0.05*Time)*200000

(28) Price= INTEG (price change,5e+007)

(29) price change= 0.0875*Price*LN((10+demand)/(0.01+Vacant Stock))

(30) sale rate= min(demand, Vacant Stock)/transaction time

(31) Savings= INTEG (change in savings,0)

(32) total number of families= Population/"average family pop."

(33) Under Construction Stock= INTEG (construction start rate-construction completion rate,600)

(34) Vacant Stock= INTEG (construction completion rate-sale rate,150)