INTERNATIONAL JOURNAL OF ACADEMIC RESEARCH IN ECONOMICS & MANAGEMENT SCIENCES

OPEN ACCESS JOURNAL

Vol 3, Issue 1, (2014) E-ISSN: 2226-3624

Evaluation of the Effect of Investment Opportunity Cost on the Process of Housing Supply in Iran (Case Study: Isfahan province, 1992-2012)

Masoud Sadeghi
Department of Economics, University of Isfahan (Iran)
Email: Masoud35ir@yahoo.com

Iman Keyfarokhi
(Corresponding Author)
Ph.D. Student in Economics, University of Isfahan (Iran)
Email: I.Keyfarokhi@gmail.com

Salman Gharakhani
M.A in Economics, University of Isfahan (Iran)
Email: Salman.gh1368@gmail.com

To Link this Article: http://dx.doi.org/10.6007/IJAREMS/v3-i1/598 DOI:10.6007/IJAREMS/v3-i1/598

Published Online: 02 January, 2014

Abstract

Factors such as workforce wage, construction materials price, and financial credits and so on influence the supply of residential units in the housing market. Unique characteristics of housing such as durability, heterogeneity and immovability are effective on supply. Besides, housing has capital quality as well as the consumption quality. In this study it was tried to insert investment like other production factors in the production function. Also, this function has been estimated for different regions of Isfahan province in order to consider unique characteristics of housing. The results obtained from estimation of supply function in different regions in the province revealed that housing supply in these regions is mostly influenced by land supply and supply has a low elasticity in comparison with wage, credits and housing price.

Keywords: Housing Supply, Heterogenity, Housing Investment, Opportunity Cost

JEL classification: R1, R31, R21, R14

Introduction

Housing supply is applied to the number of residential units that developers provide for customers with different prices and considering other stable factors for personal use, renting and real estate. Factors such as workforce wage, construction materials price, financial credits and so on are effective on supply of residential units. But the important point that makes housing supply different from supply of other goods is its unique features. Housing is a durable good and productions of previous periods can affect the process of housing supply

too. Therefore, supply of residential units is not restricted only to productions of one period. Also housing is heterogenous and residential units with similar production costs have different prices because of this feature. This price difference in similar residential units is due to the accessibility level and their neighborhood. Spatial stability is another feature of housing which causes housing to be an immovable good and affects its supply process. Another important point that should be referred is capital quality of housing beside its comsumption quality. Due to this feature, markets such as gold market, automative market and foreign exchange market are considered along side of this market for investment. Any investment in this section is regarded as ignoring production in other sectors.

Since investment in each sector has a kind of opportunity cost, investors consider their own return on investment in different economic sectors and choose their composition of incvestment given to its type. If return on investment is higher than other sectors, the investor will have tendency to invest in that sector.

Investment has been considered not only in production function in this report given to the modern proposed theories in the housing market and using Locus supply approach as well as adjustment costs but also it is effective on decision making for investment by inserting it in the opportunity cost model.

In the following theoretical principles are first mentioned that include research literature, theory and background. The second section is related to model explanation. Model estimation and data analysis are stated in section three. And finally results and conclusion are represented in the last section.

Research literature

Primarily, performance of a market is determined based on the existing goods in it. Therefore, in order to become familiar with housing market it is necessary to know its characteristics (Yazdani, 2002). Housing supply will be discussed after becoming familiar with housing as a good.

Characteristics of housing market

Primary needs of humans can be classified into three classes of food, clothing and housing. Each of these groups has special characteristics that should be considered in policy-makings, planning and decision-makings. The housing sector that provides security and shelter for people has certain characteristics which play an important role in the related analyses and it is not possible to make a proper decision without considering them. Some characteristics of housing market will be mentioned in this section.

- Durability: From one aspect goods can be divided into two classes of durable and nondurable goods. Durable goods can maintain their value under inflation conditions and housing is one of such goods. Durability of housing means that if a residential unit is maintained properly, it can be used for long periods. On the other side, durability of the residential unit and the necessity to maintain it requires a cost known as maintenance cost that the owner pays it. It is clear that the residential unit will be destroyed more rapidly and its life is decreased if adequate financial resources are not allocated for maintenance costs (Khalili Araghi, 2013). Durability in economics means that its current inventory will have an important effect on the production process (Rafiei, 2004). Another considerable point is that housing services are separate from its inventory which is created from land, labor and construction materials and its maintenance is proposed at the reconstruction level. Housing services are considered

in the consumer market. Thus, they are regarded as the consumption factor from which utility is obtained (Ethna Ashari, 2008). Housing inventory market, therefore, that is more affected by the quality of durability should be separated from housing service market.

- Heterogeneity: Two residential units are not totally similar even if they are located in one block. In other words, residential units are heterogeneous and each residential unit has its unique characteristic. Generally, such characteristics or differences of residential units can be divided into two parts of internal characteristic such as number of bedrooms, the performed designs, heating and cooling systems, light, etc and peripheral characteristics such as closeness of the workplace, educational and administrative centers and the city center, width of lane, etc (Pourmohammadi, 2007). This is one of the important characteristics of housing that illustrates its multidimensionality. Accordingly, housing is not a service or good; rather it is a set of goods and services that are combined together and are regarded under the unitary name of housing. Such combined goods and services can be summarized in the form of three groups of physical services, environmental services and accessibility (Khalili Araghi, 2013).

Heterogeneity of housing creates complexities in the construction market among which increased cost of gathering information and transaction cost can be referred. Also it is led to Ricardian rent which can be observed in land. Through this heterogeneity designers can act freely in housing design and price determination without changing the production cost (Abolghasemi, 1999).

- Stable supply of residential units in short-term: One of the most important characteristics of housing market that has a considerable role in creating the price cycles and bubbles in the housing sector is existence of time interval since decision making for construction until supply of new residential units. This is due to long process of construction and completion of the residential unit. Given to this characteristic it can be inferred that supply of residential unit is stable in short-term. Through this factor the supply side does not have adequate time for reaction after a shock is created in the demand side and as a result prices are increased considerably. As it was mentioned earlier, slow performance of supply side of housing towards fluctuations of the demand side is led to severe imbalances in the housing market (Khalili Araghi, 2013).

Effective factors on housing supply

A) Housing price: Increased housing price is led to increased revenue of housing developer and the profit obtained through this. Profit increase will enhance more motivation for production and as a result more supply of newly-built residential units (Khalili Araghi, 2001). Dipasquale and Wheaton concluded that long-term increasing of housing price will be led to permanent increasing of new construction. Also, according to them price levels are resulted in new construction only if new prices dictate a housing inventory level that is higher than the current inventory level.

B) Land: A high portion of costs are allocated to land as one of the major factors in housing production. It has extensively been tried in recent years to model the housing supply directly. Theoretical basis of most of such researches originates from two sources of investment and urban space. The distinguishing feature of these two methods is related to inserting the land and its behavior as production data in supply of new residential units. In studies based on

investment theories, unique characteristics of land market as one of the most important factors of production have not been considered; while the land market has been considered in analyses of the performed researches based on urban space theory. It seems that insertion of land in urban space theory is due to limitation and probable effects of it on supply of residential units (Khalili Araghi, 2013).

C) Manpower and wages: Housing sector is one of the widely-used economic sectors that contains a high level of employment in comparison with other sectors (Nematpajuh, 1999). One of the most important reasons is relative cheapness of workforce with regard to capital in housing production. Similarly, regarding the manpower and construction materials it is expected that there is a high sensitivity between demand for such factors and price, since prices are determined in the market and are changed with price changes.

The effect of real wage on production and supply is uncertain and shows a dual probability for the slope of short-term supply function. Firms try to increase production at present time (short-term) in order to provide their current demand by increasing of prices of goods and thus hire new force. On the other hand, given to the long-term viewpoint of the firm and considering investment in the model, the firm wants to invest more to increase long-term production and provide demand in successive periods because it believes that price is a total sign for future price and long-term demand of its good. Given to negative sign of production function with regard to the investment rate and due to existence of production costs, increasing of investment means to ignore the current production and transferring such resources for investment that its effect is determined in successive periods considering financial resources limitation and so on. Therefore, production decrease or low increasing of production is expected under such conditions from this viewpoint. Since two reactions affect production in opposite directions slope of the supply curve depends on resultant of these two effects. For instance, this means to relinquish construction of single unit and multi-story buildings and build towers in the building sector (Khalili Araghi, 2001).

D) Construction materials: Another major input of production is construction materials and price changes have a considerable effect on construction costs of housing. Also construction materials have the highest portion in housing foreign exchange intensity. It is necessary to utilize local construction materials instead of the imported ones in order that development in the housing sector is effective on the economic growth. In economic analyses construction materials in the housing sector are divided into two sections: metallic section such as major products of steel and steel mill and non-metallic section such as non-metallic minerals including brick, cement, plaster, etc. Demand for construction materials such as metallic or non-metallic is enhanced through prosperity in the housing sector. Increased demand for construction materials increases construction costs that affect the price of built residential units. Domestic production and imports level are other issues related to construction materials. Thus, tariff polices affect construction materials importation such as iron and cement and as a result construction costs. Another aspect that is considerable in evaluation of the construction materials sector as well as the active manpower in the production sector of intermediary inputs of housing sector is the employed technology in construction given to the rules and culture of people, climatic conditions and so on. On the other side, modern approaches in building the residential units such as lightweight or methods to increase resistance against earthquake are also effective on the type and degree of demand for different construction types (Khalili Araghi, 2000).

E) Housing credits: Construction in the housing sector has value-added and considerable advantages from one side and requires various inputs and high construction cost on the other

side. It seems reasonable that financial markets participate in providing the financial resources of housing construction and enjoy the obtained profit through attracting deposits of individuals and transferring them to constructors. Generally, it can be argued that production is increased if credits in the housing sector are enhanced and there is a coherent and powerful market for construction of new residential units. This increase is more tangible especially in the development sector. There are different methods to finance housing that include primary and secondary mortgage markets, bonds or metric purchasing of residential units, microfinancing and so on that are referred to as financing in the housing sector in housing economics literature (Khalili Araghi, 2013).

Investment in housing production

Investment in any manufacturing activity means to purchase tools and equipments in order to create productive capacity (Farhang, 2011). In the housing sector it means to add to the inventory of residential units. In this section division of investment into two elements is important in investment analysis. The housing sector from one hand demands for tools and equipments that are used in construction and from the other hand, product of the housing sector that is a building is faced with demand as a property. In this case, housing is regarded as a capital good and the purpose is to use its services. To put it differently, a kind of investment demand is considered; hence two separate elements are conceivable for the housing sector: the production and investment sector in housing and the real estate or service sector of residential units (Khalili Araghi, 2013).

Research background

Internal studies

Abbasi (2013) evaluated effective factors on housing supply in his M.A thesis in which three hypotheses were tested. First, increased tax rate of building permit was studied. Through output data of the related software he concluded that tax rate of building permit is effective on housing supply. Negative sign of the estimated coefficient shows that increased tax rate can decrease housing supply. Then he studied granting of bank facilities and their effectiveness on supply of residential units. The related statistics reveal that this effectiveness is rejected and the estimated coefficient is negative. He believes that high profit of repayments is the cause of this negative sign.

Shirkosh (2011) studied implementation of sales tax policy in the housing market in a report entitled "studying tax burdens of housing market in Iran" using data of the time period 1990-2007. Such kind of tax is used to control mercantile in this sector. In order to realize this and specify tax burden of housing supplier and applicant and effectiveness of the policy on preventing housing price increase due to merchantistic demand the supply and demand function of housing in Iran is estimated and tax elasticity of each one is calculated. The obtained results indicate high sensitivity of supplier and low sensitivity of the consumer with regard to the price. Also, high inflation effects of tax burden policies were figured out.

Najafi (2005) performed a survey entitled "studying the effective factors on housing supply" and investigated the effective factors on housing supply in urban areas in Iran by emphasizing the land price. The effective factors on housing supply and demand were studied in this regard. To this end, first effective factors on housing supply and demand were specified and then they were divided into price and non-price factors using the existing statistics and information to be evaluated. Then all viewpoints about land were studied and the land market and a sample of rent seeking were explained in detail. Afterwards, reasons of the

government's intervention in the land market were stated. The survey shows that government policies have not modified the housing market in any period and even they have worsened it off in some instances.

External studies

Hilber (2010) evaluated the relationship between housing supply and social capital in an article entitled "studying the effect of social capital on housing supply". He perceived that there is a positive relationship between personal ownership of housing and investment on social capital. The results revealed that the issue of social capital is led to restrictions in housing flexibility.

Young and Kim (2010) performed a research about elasticity of supply for housing. According to them, heterogeneity of housing makes housing planning more complex. This research was performed based on an estimation method that is classified according to methods such as reduction of model estimation, construct approach and error correction model and finally they obtained the results through changing of data estimation methods. These results that are obtained from extensive studies about numerous countries show that the number of empirical studies related to housing construction has been decreased with regard to those of changing the housing through reconstruction and maintenance and one reason can be lack of micro data.

Albert Size (2010) performed a study entitled "studying the effect of geographical factors on housing supply" and investigated the effect of different regions on development of housing construction. He concluded that development of housing construction in a region depends highly on the situation of that region and degree of elasticity of supply in different regions can be a reason for this issue.

In a survey entitled "is reduction of tax burden increases housing supply?" Malpezzi (2002) investigated the relationship between housing supply and subsidy payment to the developers. He showed that population structure, civilization and population growth are important factors in housing supply. Moreover, implementation of tax cut policy neutralizes housing supply increase through replacement of subsidized housing by those supplied by the private sector and this it is not led to housing supply increase. It was referred too that changing this variable does not have a considerable effect on supply increase or decrease given to low sensitivity of housing supply towards tax burden of housing.

Model explanation

Research domain

Thematic domain

Given to unique characteristics of housing and the effective factors on its supply and that housing has capital quality besides consumption quality determining a production function for this good requires much attention, because this function should contain all such characteristics. The exploited supply function can explain the process of housing supply through choosing a suitable production function by considering all characteristics totally. Estimating housing supply function through considering its capital quality was the thematic domain of the present survey.

Spatial domain

Spatial domain of this survey was Isfahan province although it was tried to evaluate this province by separation of rural and deprived urban areas as well as urban areas and suburban

areas. This classification was done in order to insert the heterogeneity feature. Rural and deprived urban areas have low access. By urban areas we mean those areas that are closer to the city center and density of residential units in this area is high. By suburban areas we mean those areas that are far from the city center and are located at suburbs. Therefore, degree of access for each area will be different. Given that this survey was conducted at provincial level the area that is closer to the average state should be specified and then the results should be analyzed. Through this the effect of empty houses and special markets on housing supply are considered in analysis of the results.

Time Domain

The current survey was conducted during the time period 1992-2012.

Model presentation

The profit function is first constituted and then demand functions of inputs are obtained by derivation of the profit function to obtain housing supply function. Supply function is obtained by inserting demand functions of input in production function. Investment in the selected model has been considered like other production factors in the production function. Regarding capital stock it must be pointed out that degree of the utilized land to construct residential units has been used in this report. In Lucas model K is the capital stock that is used for production in previous and future periods. That part of capital stock that has been used in previous periods and it has become unusable due to depreciation and destruction is not regarded as capital stock. It is considered as depreciated capital. Even despite such attitude towards land, it is perceived that land foreign exchange intensity has been used in previous periods and is not usable for current periods unless that group of depreciated units for which depreciation rate has been considered. So that part of the existing land is regarded as the capital stock. According to Lucas supply function, production function is a function of three factors of capital, workforce and investment.

$$Q_t = F(K_t, L_t, I_t) \quad (1)$$

Having generalized this theory for housing production function, we will have

$$Q_t = F(K_t, L_t, I_t, M_t, Cr_t) \quad (2)$$

In the above relation Cr_t, M_T, I_t, L_t and K_t are capital (land), manpower employed in the housing sector, investment in the housing sector, construction materials and credits of this sector respectively.

Purpose of the firm is to maximize financial value of net revenues:

$$V(0) = \int_0^{\infty} e^{-rt} (P.F(K_t, L_t, I_t, M_t, Cr_t) - W_t L_t - V_t I_t - P_M M_t - r_t Cr_t) \quad (3)$$

Where W shows workers' wage, V shows return on investment, P shows the price of construction materials and r shows rate of interest. The necessary condition for concave production function is that:

$$F(K\theta, M\theta, L\theta, I\theta, Cr\theta) \geq Q.F(K_0, L_0, I_0, M_0, Cr_0) + (1+\theta)\, F(K_1, L_1, I_1, M_1, Cr_1)$$

If the present value of net revenues is maximized, we have:

$$P.F_L(K, M, L, I, Cr) = W$$

$$P.F_K(K, M, L, I, Cr) = (V - P.F_1)(r + \delta)$$

$$P.F_M = PM$$
$$P.F_{Cr} = r$$

(4)

Here, δ shows depreciation rate of housing. Assuming that the production function is homogeneous and of degree 1, the demand function of housing inputs can be represented as below:

$$L_t = K_t D_1\left(\frac{W}{P}\right)$$
$$M_t = K_t D_2\left(\frac{P_m}{P}\right)$$
$$Cr_t = K_t D_3\left(\frac{r}{P}\right)$$

(5)

Demand function of investment is exploited as the following by using the above relations and by means of the first relation for function (F):

$$P\left\{F\left(D_1\left(\frac{W}{P}\right), D_2\left(\frac{P_m}{P}\right), D_3\left(\frac{r}{P}\right), \frac{I}{K}\right) - D_1\left(\frac{W}{P}\right).\frac{W}{P} - D_2\left(\frac{P_m}{P}\right).\frac{P_m}{P} - D_3\left(\frac{r}{P}\right), \frac{r}{P}\right\} \quad (6)$$

Therefore, demand function of investment can be exploited as the following:

$$I_t = K_t D_2\left(\frac{W}{P}, \frac{P_m}{P}, \frac{r}{P}, \frac{V}{P}, r, \delta\right) \quad (7)$$

Given to the above relations, short-term supply function is obtained as below:

$$Q_t = K_t F[L, D_1\left(\frac{W}{P}\right), D_2\left(\frac{W}{P}, \frac{P_m}{P}, \frac{r}{P}, \frac{V}{P}, r, \delta\right), D_3\left(\frac{P_m}{P}\right), D_4\left(\frac{r}{P}\right)]$$

In the above relation D_1, D_2, D_3 and D_4 are demand functions or final productivity of workforce, investment, construction materials and credits.

$$\text{Ln } Q_t = \propto_0 + \propto_1 \text{Ln } K_t + \propto_2 \text{Ln } \frac{W}{P} + \propto_3 \text{Ln } \frac{V}{P}(r+\delta) + \propto_4 \text{LnRC} + \propto_5 \text{Ln } \delta + \propto_6 \text{Ln } \frac{PM}{P} + \varepsilon_t \quad (9)$$

Housing supply should be estimated in different urban areas. In responding to the question whether it is possible to add these functions horizontally and obtain total supply function it must be mentioned that these functions can be added horizontally when housing is considered homogenous. This characteristic has especially been regarded in the current survey. Thus, total supply function cannot be obtained by obtaining the supply function of different urban areas. The best strategy is to choose the area that is closer to the average state among various areas and estimate the supply function. This will solve the problem of price aggregation, because some weights should be determined for price in this regard. Now given that the heterogeneity feature is more affected by accessibility and type of neighborhood, degree of accessibility and neighborhood among the residential units will be close to each other by focusing on an area.

Introduction of variables employed in the model

- Housing supply: In the proposed model in previous section Q is representative of housing supply. The required information about this variable was collected from Statistical Center of Iran and abstract of comprehensive housing plan in Isfahan province. Total architectural area supplied to the market as housing supply was used to estimate the supply function in this survey.

- Housing price: One of the important variables employed in this model is housing price. The data related to this variable was obtained from the abstract of comprehensive housing plan in Isfahan province. Current prices should be converted into fixed prices by means of price index and inflation rate given that such data are based on current prices.
- Financial credits: Another variable employed in the model is banking facilities. Developers construct buildings and supply them to the market through banking loans. As most of these loans are granted by Bank Maskan, the number of loans paid by this bank was used in the present report. All information in this section was received from website of the Central Bank. It should be pointed out that the data was at national level not at provincial level. To obtain the number of loans paid in this province, total number of loans in the country was multiplied by population ratio of the province and the result can be an approximation of the number of loans paid across the province. This value was inserted in the model considering the population of areas under study.
- Opportunity cost: As it was mentioned in previous sections, opportunity cost arising from ignoring the production in other sectors can have an effective role in housing supply given to capital quality of this good and existence of competitive markets. Saving rate of profit in banks can be an important variable in this section. Indeed this variable can be a substitution for opportunity cost of investment in the above sector. It is worth mentioning that the statistics were obtained from website of the Central Bank and where there were several rates, their average was used.
- Workforce wage and construction materials price: The statistics related to these variables were obtained from website of the Central Bank and Isfahan Municipality. However, some data was not present and they were replaced using data mining techniques. In order to utilize the variables, real wage that is obtained from dividing the nominal wage by housing price should be used. Nevertheless, growth rate of labor force and construction materials price will be measured with regard to the inflation rate.
- Depreciation rate: Variable of depreciation coefficient is used to show that part of investment that replaces the destructed units. The estimated coefficient for this variable shows change in supply of residential units in lieu of changing the depreciation coefficient.

Model estimation

Results of model estimation

Table 4-1

Results of Model Estimation For Rural and Deprived Urban Areas

Variable	Coefficient	t-	Prob.
C	-0.161687	-	0.2095
DLK_1	0.726984	7.237758	0
LPW	-0.004854	-	0.8108
LD^e	-0.211425	-	0.0962
LPV(-1)	-0.014411	-	0.333
$DLCR_1$	0.066783	2.113932	0.0529
R-squared		0.889437	
Adjusted R-squared		0.84995	
Prob(F-statistic)		0.000003	
Prob(LM)		0.31	
ADF(Resid)		-4.30027	

Table 4-2

Results of Model Estimation For Urban Areas

Variable	Coefficient	t-	Prob.
C	1.62596	0.590449	0.565
LK_2	0.818558	2.474545	0.0279
LPW	-0.058406	-0.95189	0.3585
LD^e	-0.017933	-	0.8982
$DLCR_2$	0.06431	1.269329	0.2266
LPV(-1)	-0.033571	-	0.0428
MA(3)	-0.999982	-	0
R-squared		0.931899	
Adjusted R-squared		0.900468	
Prob (F-statistic)		0.000001	
Prob (LM)		0.0529	
ADF(Resid)		-3.21019	

Table 4-3

Results of Model Estimation For Suburban Areas

Variable	Coefficient	t-Statistic	Prob.
C	3.239826	2.291746	0.0393
LK_3	0.651299	4.022596	0.0014
LPW	-0.064105	-1.876296	0.0832
LD^e	-0.052952	-0.507897	0.62
LPV(-1)	-0.012437	-0.669874	0.5147
$DLCR_3$	0.023244	0.566718	0.5806
MA(1)	0.475398	1.7199	0.1092
R-squared		0.924686	
Adjusted R-squared		0.889926	
Prob(F-statistic)		0.000001	
Prob(LM)		0.41	
ADF(Resid)		-3.99392	

Table 4-4
Results of Model Estimation For Isfahan Province

Variable	Coefficient	t-Statistic	Prob.
C	4.976217	1.981814	0.0709
LK_T	0.492198	1.937313	0.0766
LPW	-0.07796	-1.812187	0.095
LD^e	-0.01749	-0.172799	0.8657
LPV(-1)	-0.053681	-0.932125	0.3696
LCR_T	0.025904	0.383106	0.7083
AR(1)	0.493855	1.923389	0.0785
R-squared		0.910716	
Adjusted R-squared		0.866074	
Prob(F-statistic)		0.000012	
Prob(LM)		0.5783	
ADF(Resid)		-3.563626	

Data analysis

Tables 4-1, 4-2 and 4-3 show the results of estimation related to housing supply function for rural and deprived urban areas, urban areas and suburban areas. Also Table 4-4 displays the results of model estimation in Isfahan province. Estimation was conducted through least squares method. First order difference of variables was used in these models to prevent spurious regression in some cases. Auto-correlation among error terms was eliminated using MA (3), AR (1) and MA (4). Results obtained from LM test illustrate that there is no correlation among the error terms. Also correlation among the variables was eliminated through the obtained results of correlation coefficient among variables. Normality of error terms was evaluated by means of coefficients of skewness and kurtosis and the statistic related to normality test of error terms. Finally, stationary of error terms for model co-integration was investigated by means of unit root test. The obtained results of this test indicate stationary of error terms at level 5%. Similarly, coefficients of determination above 80% illustrate proper selection of the variables employed in the model so that the obtained results of statistic *f* for each model reveal significance of coefficients simultaneously.

Land inventory variable that is inserted in LK form has a consistent relationship with housing supply. In other words, land supply increase in each period will be led to housing supply increase and intensity of its increase is different given to various areas. These coefficients for rural and deprived urban areas, urban areas and suburban areas are equal to 0.72, 0.85 and 0.65 respectively. Given to the obtained coefficients, role of land in urban areas is more than other areas. Therefore, it is predicted that verticalization in such areas is more in order to decrease the extensive role of land. Also the estimated coefficient for Isfahan province is equal to 0.49. All estimated coefficients for this variable are significant in all models.

Another variable is the price of other factors such as workforce wage and construction materials price that if they are increased, production costs will be enhanced. Hence, such increase will have a negative effect on housing supply. It is necessary to compare increasing of these variables with housing price increase. In the event that growth rate of wages' increase is more than the housing price, it can have a negative effect on housing supply and in the opposite state if other factors remain stable, motivation for production increase will be enhanced. To this end, ratio of wage to housing price was used in the model. Due to high co-

linearity between wages and the construction materials price, one of these variables was used. Variable of index of wages was used in the simple form of PLW. The estimated coefficients for rural and deprived urban areas, urban areas and suburban areas are equal to -0.05, -0.058 and -0.064 respectively. Perhaps low effectiveness of this variable on housing supply can be due to the role of land in housing supply. A considerable portion of production costs has been allocated to land as one of production inputs besides its capital quality and even the growth speed of land price is more than the housing price. For this reason, housing suppliers do not sell housing to consumers because of land price increase in each period. Moreover, they do not offer it to the market to gain more profit through land price increase. Also the estimated coefficients for this variable are not significant at the provincial level.

Variable LPV is the real profit rate in other sectors. Indeed this variable indicates opportunity cost of investment in this sector that is inserted in the model by one period of lag. All estimated coefficients for this variable in different areas are negative. Absolute value of these coefficients for rural and deprived urban areas, urban areas and suburban areas are equal to 00.014, 0.012 and 0.0 respectively. This coefficient was significant only for urban areas.

Negative sign of coefficient of the opportunity cost that is the marginal cost of investment confirms existence of internal adjustment costs and their role in investment. Although production is increased by investment increase but financial and physical limitations, increased new financial demand and credits in the banking system as well as increased demand for other inputs with increasing marginal costs enhance banking rates of interest and interest rate of the unofficial market. The result is negative effect on production. Negative effect of the investment cost on providing the investment resources adjusts the effect of price increase of building to some extent in terms of creating motivation for more production and increasing of investment. Therefore if coefficients are significant, the obtained results indicate that housing supply will be responded through reduction of empty houses and increasing of housing price. The next action is to expedite the completion of residential units and making new investments. Housing developers know that increased supply of residential units in this period prevents irregular increasing of housing price from one side and even it might decrease it. From the other side, presence of new investors will be led to increased investment in this sector which enhances demand for inputs. This is accompanied by increased price of inputs and decreases investment in this sector in course of time. Through this awareness developers do not construct buildings; they increase the investment and production only if this process continues in future periods. Considering this issue and investors' prediction of future status of housing price and investment it is expected that investors consider the expected opportunity cost in their decision-making. For this reason this variable was inserted in the model with one period of lag.

Another variable employed in the model is the number of loan payments that is in the simple form of LCR. First order difference of this variable has been used in all models because of the non-stationary problem. Coefficients of this variable are positive and are only significant for rural and deprived urban areas in the estimated model. The estimated coefficients for rural and deprived urban areas, urban areas and suburban areas are equal to 0.066. 0.064 and 0.023 respectively. Also this coefficient was negative for Isfahan province and is not significant. Insignificance of this coefficient in other estimated models indicates that payment of the loans could not have a tangible change in the process of housing supply. This is due to low portion of banking credits in providing the production costs which has directed the developers towards unofficial markets for housing finance. Another important

point is that the increasing rate of land price as the most important input is higher than the increasing rate of this variable and for this reason this sector has not been successful in financing of housing costs.

Housing price is another variable that is inserted indirectly in the model but is among the major variables. Given that this variable was inserted in the denominator of real wage and opportunity cost, the obtained elasticity for this variable is equal to sum of the estimated elasticity for opportunity cost and wage variables considering the logarithmic form of the model. The obtained results in the current survey like all conducted studies in this field indicate that there is a positive relationship between housing price and housing supply. The distinguishing feature of this model with other models is that housing price variable was inserted indirectly in the model. Depreciation coefficient variable was used to show that part of investment which replaces the destructed units. The estimated coefficient for this variable reveals change in supply of residential units in lieu of change in depreciation coefficient.

Conclusion

Housing supply lacks elasticity with regard to changes of workforce wage that can be due to lower growth of workers' wage in comparison with the growth of housing and land prices. High number of unskilled workers in Isfahan province has intensified this issue. Stagnation of this above market and transferring the capital and liquidity towards other sectors are other considerable factors. However, low growth rate of wages in comparison with the growth rate of housing price increases developers' motivation to construct new buildings. Low portion of financial credits in this sector and low growth rate of financial credits in comparison with production costs have been led to low sensitivity of supply with regard to such credits. Developers in this sector provide their financing through the unofficial markets because of loan payment limitation in this sector. Supply changes in Isfahan province are more affected by value of supply. Undoubtedly, a major portion of changes in the housing supply is affected by land supply policies. This has been led to inelasticity of supply with regard to price. Low elasticity of housing supply with regard to opportunity cost and real profit rate in other sectors illustrates that investment in this sector is not highly affected by prosperity or recession of competitive markets such as the automative market, foreign exchange market and gold market. Obtained results of estimating the housing supply function in different areas indicate high sensitivity of supply of residential units than land supply which is observed more in urban areas.

Given that people with moderate income do not have personal automobile, they intend to dwell in areas near the city center because of facilitation in transportation. High sensitivity of housing supply than land supply has been resulted in execution of verticalization and minimization policies in these areas. Higher sensitivity of housing supply than the real profit rate in other sectors in urban areas demonstrates higher sensitivity of investment in housing market of urban areas. Given that consumers in rural areas provide their own housing, there is no clear boundary between supply and demand. Housing in such areas has consumption quality more and for this reason elasticity of housing supply in comparison with real interest rate is low. Therefore, investors in this sector pay more attention to areas closer to city center. On the other hand, the residential units supplied in rural areas have a low quality level. They are naturally built with lower production costs, so value of financial credits for housing finance in rural areas is more than other areas. Consequently, supply of residential units in such areas has a higher sensitivity towards financial credits.

References

Abolghasemi, F. (1999). *Aristocratic supply function of analysis and estimation of residential units in time period 1967-1998 (Case study: Tabriz)* (Master's thesis, University of Isfahan)

Baltaji, H. (2013). Econometrics. Tehran: Nei publications

Henderson, J; Quant, R. (2011). *Theory of microeconomics*. Tehran: Rasa publications

Khalili Araghi, M. (2013). *Housing economics*. Tehran: Tehran University

Khalili Araghi, M. (2009). *Explanation of mutual relations of housing sector and other economic sectors*. Ministry of Housing and Urban Development

Khalili Araghi, M. (2001). *Housing supply function in Iran*. Journal of Economic Researches, 57, pp. 21-29

Najafi, B. (2007). *Evaluation of effective factors on housing supply in urban areas*. Journal of Housing Economics, 37 & 38

Narimani, A. (2012). *Applied econometrics*. Tehran: Naghus publications

Nematpajuh, A. (1999). *Housing supply in urban areas in Iran.* Journal of Housing Economics, 25

Pourmohammadi, M. (2007). *Housing planning*. Tehran: SAMT publications

Rafiei, M. (2004). *Investment in housing in different regions of Iran*. Journal of Housing Economics, 34

Seifoddini, F. (2007). *Specialized dictionary of urban and regional planning*. Tehran: Ayeej publications

Shirkesh, M. (2011*). Studying tax burdens on housing market in Iran (1990-2007)* (Master's thesis, Ashrafi Esfahani Institute of Higher Education)

Yazdani, F. (2004). *Housing capital market, grounds and frameworks*. Journal of Housing Economics, 34