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Performance Assessment of PAK Policy in the Process of Housing Supply in Iran (Case Study: Isfahan province, 1992-2012)

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Abstract
PAK policy is one of the important policies that has been adopted in housing market during the two recent decades. It mainly focuses on saving, development and downsizing. Now given that housing can be considered both as a capital and an expendable property and it has unique characteristics such as heterogeneity, durability and spatial stability, the present paper investigated how this policy-making is effective on housing supply considering the above characteristics and by means of Lucas supply function. The results revealed that this policy cannot have the required efficiency in this sector despite high saving of households and decreased floor area of residential units. This is while housing supply has not been influenced by investment of the private sector and financial credits.

Key Words: PAK policy, Housing Supply, Heterogenity, Housing Investment, Opportunity Cost
JEL classification: R1, R31, R21, R14

1- Introduction

Owing to basic changes in macroeconomic policies, following economic adjustment systems, liberalization of the masonry price, and the relationship among the superior and inferior in construction industry with other industries, it is essential to have a comprehensive attitude towards housing sector. Policy-making in the housing sector in Iran has currently been exposed to fundamental modifications. The policies of this sector were unrelated to their sectoral nature in the first and second development plans and residential policies have been connected to financial, economic and physical possibilities and national production. Thus plans of the housing sector are not among the ones that the government can implement directly. Also development and downsizing of residential units were emphasized in this period. This is while the government has currently played a more prominent role with regard to housing affairs of the society and especially low-income classes.

If liquidity in housing sector is not accompanied by efficient planning for financing the housing production (towards national housing policy), not only it will not be led to mobility of other economic sectors but also it will create new problems for this sector. According to the existing information at the end of the 1980's simultaneous with the end of Iran-Iraq war, liquidity flowed from services and intermediary sector towards housing sector. But due to lack of an efficient policy to direct such capitals towards housing production, they were allocated for buying and selling of housing instead of production of housing which was led to increasing of housing price in the country.

The housing sector became prosperous again during the time period 2002-2004 and attracted small and disperse capitals. Increased price of land during this period had an ascending order and prices increased highly. Following increased price of land and housing and reduction of purchasing power, a relative stagnation governed the housing market in 2005. This is while at the end of 2005, prosperity and increasing of prices were observed again in this sector. Therefore, given to fluctuations of the housing sector, weak classes of the society will be the biggest susceptible class against this status which demand the necessity of government intervention and planning for them.

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.

2- Research literature

The non-government sector in the second development plan was consisted of three sub-sectors: free, supported and social.

Free housing does not have the standards of housing model and the government does not support it. The price of free housing is determined based on supply and demand law and market equilibrium. Indeed such housing is build by the private sector for high and moderate-income classes of the society.

Supported housing is built based on standards of consumption pattern and the government supports it to encourage the constructors. The government's support is in the form of subsidy payment for water, electricity and gas connection, duties and cheap loans.

Social housing is mainly related to social purposes and is produced based on acceptable minimums that are probably less than standards of consumption pattern. Young couples, low-income classes and households without male support who cannot buy house from the free market are beneficiaries of this kind of housing. These units are built in urban areas. After this period it was tried to decrease the floor area to its minimum value; minimize the cost through development; and solve the problems of people by their small saving and participation. This is referred to as PAC policy (Pourmohammadi, 2007).

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.

2-1 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 undurable 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).

2-2 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).

2-3 Evaluation of changing process of variables

2-3-1 Saving

The first major step in PAK policy was relying on people's saving to finance housing for low-income classes. Thus, low-income groups bought housing through saving one part of their revenues during a 5-10 year period in a bank account and receiving facilities. As saving is not possible for income deciles 1 to 4, only moderate income deciles were able to use it even if this policy was executed and housing demand of deciles 1 to 4 were still remained unanswered in the market. Implementation of this thought in short-term cannot have a considerable effect on housing market and thus cannot decrease demand supply gap.

Percentage of housing finance by people and businesses *	Percentage of housing finance by government	Percentage of housing finance by banks	Total housing finance by banks, governments, people and businesses	People's savings plus savings businesses	Development funds to the housing sector	Bank credit for Building and Housing	Year
57/649	0/050	42/301	1032839/7	595421	518/7	436900	1994
58/471	0/054	41/475	1289925	754226	699	535000	1995
59/737	0/077	40/186	1950196/1	1164988	1508/1	783700	1996
54/688	0/139	45/173	2595792/9	1419578	3614/9	1172600	1997
58/093	0/126	41/781	3661028	2126810	4618	1529600	1998
60/083	0/123	39/794	3809605	2288915	4690	1516000	1999
64/767	0/080	35/153	4858730	3146855	3875	1708000	2000
58/820	0/114	41/066	6005943	3532696	6847	2466400	2001
64/540	0/055	35/406	7758669	5007434	4235	2747000	2002
72/715	0/071	27/214	8519961	6195321	6040	2318600	2003
70/331	0/030	29/638	14573313	10249605	4408	4319300	2004
-	-	-	-	-	4898	-	2005

Table 1: Housing finance (million rials)

Given to Table 1, it is observed that the highest financing has been provided by people and firms and then the banks among total housing financing by banks, the government, people and firms. Another issue that can be criticized in this policy is the double pressure imposed on the household during the saving period, because the purchaser from one side has to pay the cost of saving to purchase housing and on the other side pays the rental in this period. This increases

share of housing cost in household's expenses and doubles the pressure on educational and hygienic indexes of the household.

Experience of such policies indicated that stimulating demand creates price bubble in the market, decreases demand empowerment against supply and finally is led to market failure. Besides, it cannot be an appropriate policy to control the market. The housing market under such circumstances needs the government's plans to cover market failure in order to decrease demand supply gap through the policy of supporting supply sides.

2-3-2 Development

Supporting development of housing was another major element of PAK policy which was considered in agenda of various governments since the second to fourth development plans. But supporting development could not be resulted in mass-produced housing with high circulation owing to problems in purposes and planning. According to the existing definition, developer is referred to a person who builds more than ten residential units. As a result, unspecialized and nonprofessional developers were observed in this industry besides ---- housing projects and reduction of productivity in it. The result of unspecialized profession of such developers was public distrust in the process of housing production and construction in Iran in addition to decreased quality of production as well as wasting of national resources. The second problem about developers in PAK policy plan was the issue of ownership, as the government transferred the housing market to developers through assignment of property rights to them and granting housing facilities. The result was lengthening of housing assignments in Iran, because the profit of increased land price for developers was by far more than the profit of their construction and whatever the developer sold residential units at a later time, he/she earned more profit due to land inflation. This was an obstacle to change non-industrial production methods into industrial production methods with more quality and less time and cost of production.

2-3-3 Downsizing

The third element in PAK housing plan was downsizing policy. Previous governments had to adopt the policy of downsizing residential units imitating several European countries in order to prevent market failure and keep purchasers in the housing market, since the purchasers were not able to afford high cost of housing because of high share of land price in the cost price of housing as well as the existing bubble in housing market owing to demand stimulation policies against low supply of housing which was led to increased price of housing during several years.

2-4 Research background

2-4-1 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.

Shirkesh (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.

2-4-2 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.

3- Model explanation

3-1 Research domain

3-1-1 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.

3-2-2 Spatial domain

Spatial domain of this survey was Isfahan province.

3-2-3 Time domain

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

3-3 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:

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

(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):

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

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

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

(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.

$$\text{Ln}\, Q_t = \alpha_0 + \alpha_1 \text{Ln}\, K_t + \alpha_2 \text{Ln}\, \frac{W}{P} + \alpha_3 \text{Ln}\, \frac{V}{P}(r+\delta) + \alpha_4 \text{LnRC} + \alpha_5 \text{Ln}\, \delta + \alpha_6 \text{Ln}\, \frac{PM}{P} + \varepsilon_t \quad (9)$$

3-4 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.

4- Model estimation

4-1 Results of model estimation

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	

Table 2 : the results of estimating the model for Isfahan province

متغیر	LK_T	LPW	LD^e	LPV	LCR_T
LK_T	1	-0.83526	-0.13574	-0.18521	-0.39766
LPW	-0.83526	1	0.190198	0.109611	0.56111
LD^e	-0.13574	0.190198	1	0.12777	0.014583
LPV	-0.18521	0.109611	0.12777	1	-0.68691
LCR_T	-0.39766	0.56111	0.014583	-0.68691	1

Table 3: Correlation test for model variables in Isfahan province

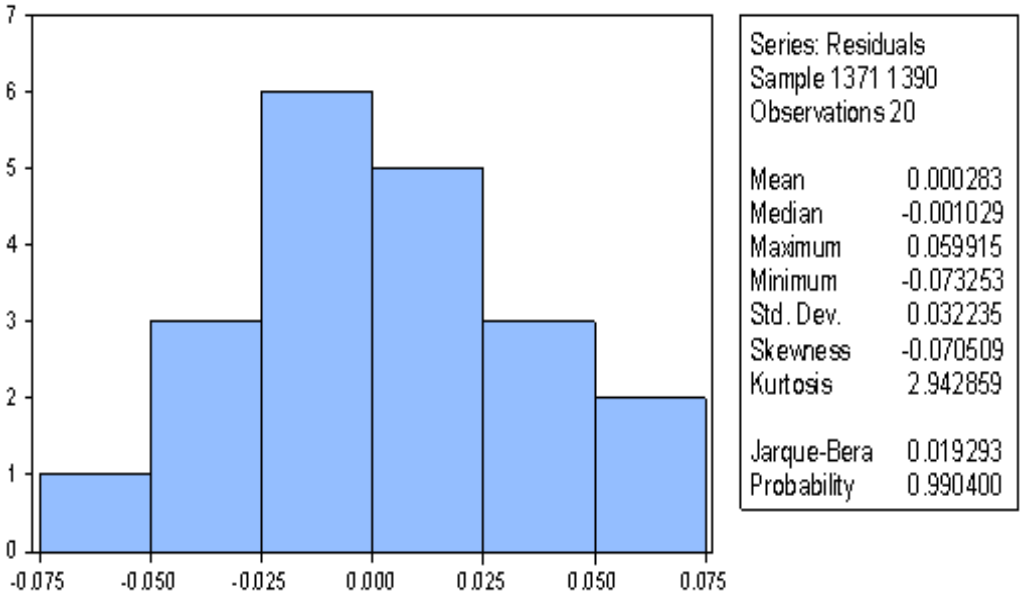

Figure 5 Test of normality for the error terms in the model Isfahan province

4-2 Data analysis

Table 2 showes the results of estimation related to housing supply function for 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 AR (1). 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 peakedness 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. The coefficient estimated for Isfahan province is equal to 0.49. The estimated coefficient for this variable in the model is significant.

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. 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. estimated coefficient for this variable is negative.

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. 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.

5- Conclusion

It seems that the PAK policy which has had an extensive focus on downsizing has not decreased the considerable role of land in housing supply and a major portion of expenses of this sector has been allocated to it. Share of other expenses such as manpower salary has been decreased due to major share of land in expenses of this sector, so housing supply does not show any tangible change with regard to changes of wages. Therefore, policy-makings must be directed in a way to decrease major share of land in expenses. Suppliers in housing sector have not sold their prepared residential units because of process of increased price of land in Isfahan province. They are waiting for more increasing of prices in future periods. Hence, decreased share of land in determining the housing price can supply empty residential units at the market and decrease excess demand. In this way it can prevent formation of price bubble in the above market. Development and downsizing were the other two policies through which low quality residential units in contrast with the Iranian culture were supplied at the market. Major investors of this sector have had lower tendency to invest due to presence of developers. Low share of credits in housing supply showed that bank credits have not influenced the housing supply and hence have not attracted the investors in this sector towards unofficial markets with high repayment rate for financing. Financing through credits with high repayment rate has increased expenses. Prosperity in this sector is more affected by demand and it is resulted in low sensitivity of suppliers towards repayment rate which imposes a heavy burden upon the family shoulders so that the household's saving does not afford it. This saving beside other expenses has imposed a high pressure on households and thus, housing cost share has been increased seriously.

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