An Analysis of Relationship between Macroeconomic Variables and Metropolitan Housing Market in Iran in the Framework of a Dynamic Panel Data Model

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ABSTRACT

Considerable portion of housing sector from gross domestic product indicates relationship between housing sector and macroeconomics. This paper focuses on consumption demand of housing and variables that can affect it and represents a theoretical framework for changes of housing prices regarding variables such as income per capita, liquidity and land per capita, the present paper studies effectiveness manner of these variables on housing prices in metropolitans in Iran. The relationship among housing sector and above variables is evaluated in this paper using a dynamic panel data model and data of three cities of Tehran, Isfahan and Mashhad. Finally, it has been shown that changes of (urban) income per capita and liquidity can affect metropolitan housing prices by applying one-phase systematic Arellano-Bond GMM method in model estimation. Moreover, land supply limitation and decreasing process of urban land per capita in the selected metropolises have been effective on increasing process of urban housing prices given to population changes.

Keywords: metropolis, Urban Growth Boundary (UGB), non-tradable goods, liquidity, General Method of Moments (GMM) technique, GNP per capita, land per capita

1- INTRODUCTION

Housing is one of the important sectors of economy in all countries. Also it is the most expensive good that a household is forced to prepare it and housing affordability will be created in countries in which governments are not able to adopt a suitable policy in this regard. In addition, fluctuations of housing and land price have a direct impact on level of macro economy activities, because they affect consumption and investment simultaneously. Ultimately, housing is a good that price and equilibrium amount in it are obtained totally from intersection point of aggregate demand function and aggregate supply function and these functions are the result of aggregation of individual (and firm) supply and demand functions. Anyways its market has special characteristics and properties. Since housing sector constitutes an important section of economy not only its changes are effective on macro economy but also changes of macro economy affect housing sector extensively. Also, housing and land are immovable and non-tradable goods and it is not possible to control prices using levers such as imports due to its inherent characteristics in some grounds. This conceives possibility of intensification of increasing impact of liquidity or income on prices in housing sector. Finally, housing and land have characteristics that convert them into capital goods having output (property) and this will give special properties to demand in this sector. In this paper consumption demand of housing in Iran has been focused.
Record of attempts to explain housing price and especially urban land and its fluctuations is returned to the economy's Great persons from Ricardo to Marx, Marshall and Fone Newman. Primary theories such as Wingo (1961), Muth (1969) and Mills (1972) were focused more on the structure of urban land price. Effective factors on housing price have been classified in two groups in a classification: factors with short-term impact and factors with long-term impact. Factors with long-term impact determine movement path of prices during the time and factors with short-term impact are leaded to fluctuation of housing price around this long-term path.

2-1 Relationship between real income growth and housing price

Studies about housing market across the world show that income is the major factor and stimulus of increased housing price in long-term. This relation that is called long-term balanced relationship between housing price and income has attracted the most attention of researchers in this field. Recent studies about the relationship between income and housing price emphasize the difference between normal income and permanent income.

Mechanism of impact of real income growth on housing price is in the way that increased income enhances consumption demand of housing and therefore housing price is increased. Sutton (2002) illustrates that one percent increase in growth rate of gross national product could increase housing price between one to four percent. On the other hand, investment demand for housing is enhanced by increasing of income that is resulted in increasing of housing price.

Chen and Patel (2002) tried to give a model for changes of housing price in a research given to neoclassical approach. Recent studies usually assume that there is a permanent relationship between housing price and land with income. Renauld (1989) and Malpezzi (1999) have analyzed the relationship between price and income by settling a long-term balance between price \( P_e \) and income \( Y_c \).

\[
P_e/Y_c = k
\]

Where \( k \) is PIR or price income ratio but there is no reason that \( k \) is constant for all conditions of the market. Therefore, we can rewrite the equation as below. If \( t \) represents time, then we have:

\[
P_e/Y_c = k = Z\beta + e_t
\]

Where \( Z \) is market conditions' vector, \( \beta \) is corresponding parameters' vector and \( e \) is error term. This stable relation and balance is often modified by factors like lack of supply or increasing of capital demand or shocks due to policies of the government. Chen and Patel used neoclassical approach for better understanding of effective factors on \( k \) according to which demand for land and housing is a function of factors including population, income, housing price and accessibility of substitutes. On the other side, housing supply in short-term has no elasticity but it is a function of factors like housing price, cost of construction, cost of land and interest rate in long-term. Thus, they have usually considered housing price as a function of income and beside factors like cost of construction and interest rate. This approach is observed in many studies including Holly and Jones (1997), Drake (1993) and Malpezzi (1999) too. Chen and Patel recommended the below model according to this approach:

\[
\text{Ph}_t = \alpha_0 + \alpha_1 P_y + \alpha_2 Hc + \alpha_3 \text{cc} + \alpha_4 M_{st} + e_t
\]

So income (\( P_y \)) beside factors such as cost of construction (\( \text{cc} \)) is effective on housing price. But they refer that housing market is often faced with capital demand too that is dependent on money stock level. If money stock is enhanced, people will have more money and could receive a loan for investment in housing market more. Hence, the model could be modified as below:

\[
\text{Ph}_t = \alpha_0 + \alpha_1 P_y + \alpha_2 Hc + \alpha_3 \text{cc} + \alpha_4 M_{st} + e_t
\]

That \( M_{st} \) is money stock.

Chen et al (2007) studied the deviation between income and housing price using the same model in another research. Deviation between these two variables has been identified in different countries. If this deviation is in the form of more increasing of housing price with regard to income, it will create housing affordability. These researchers explained and interpreted this deviation based on creating distinction between two kinds of demand for housing- residence services demand and capital demand- and believed that change of income just explains one part of housing price changes. They concluded that role of liquidity is stronger in short-term behavior of housing price but at last long-term behavior is returned to income factor generally. Housing price deviations
from income are resulted from short-term increasing of capital demand due to increased money stock and liquidity growth. Therefore, the government must avoid unsuitable monetary policy although they conclude exiting long-term balance and increased ratio of housing price to income is temporary.

It has been referred in the recent research that the theory regarding permanent income hypothesis suggests housing consumption in each special period is a function of income average in the current period.

2-2 Relationship between liquidity and housing price

Dutch disease is usually used to explain this relationship. Primarily Dutch disease refers apprehensions due to occurrence of anti-industrialization phenomenon that was created after discovering natural gas reserves at the end of the 1950's and beginning of the 1960's in Netherlands.

Total form of Dutch disease formation is as below:
- Discovering natural resources or creating a new prosperous and exporting activity
- Increasing foreign exchange income, increasing home currency value
- Increasing relative price of non-tradable goods and increasing cost price of exporting goods
- Reduction of production, employment and increasing of unemployment

Summarily it could be said that Dutch disease has been leaded to stagnation and worsening of trade in oil states and gives rise to transfer from tradable goods to non-tradable goods. Severe increasing of oil incomes is leaded to enhancement of home currency value and relative prices of non-tradable goods will be increased. Increasing demand about non-tradable goods increases prices and thus price of this group of goods with regard to tradable goods is increased and profitability in such activities with regard to tradable goods sector is enhanced by increasing of prices. When profitability in non-tradable goods sector is increased, resources are transferred from tradable sector to non-tradable sector and also to tradable sector having resources (like oil).

Price of non-tradable goods is increased by increasing of liquidity principally because it is not possible to import such goods in order to increase their supply and decrease their prices. This is while production of such goods inside the country is faced with limitations. For example countries with natural limitation of land supply cannot solve such limitation through import but countries having command limitation of land supply can increase supplying of such non-tradable goods by removing these limitations.

2-3 Relationship between land shortage and housing price

Generally there are two kinds of limitation for land supply: natural limitation and governmental or command limitation that includes limitations due to land use rules. Natural limitation has a positive significant relationship with land price (Rose, 1989). Also limitations that are executed through zoning and determining boundary of cities are leaded to increase land and housing price (Pollakowski and Wachter, 1990).

Land shortage increases housing price because of two reasons according to Ricardian rent theory (Peng and Wheaton, 1994):
1- reduction of new constructions because of increased land price as one of production inputs
2- increasing of investment demand in land and housing market

Experimental studies show that constraints or natural shortage of urban land increases housing price. Most evidences are based on simple cross-sectional models that have compared housing price in metropolises. But there is no research that shows time path or a precise mechanism regarding determination manner of housing price on the basis of land supply. There are two approaches in this regard (Peng and Witon, 1994):
1- Land shortage is leaded to reduction of housing construction and therefore volume of existing houses could not grow consistent with housing demand. As a result, housing price is increased. Myopic behavior of builders of dwelling-houses has been considered in this explanation.
2- Expected land shortage increases housing price directly that is leaded to capitalization of land. Issue of forward thinking expectations has been considered in this explanation.

Both theories predict that prices would be higher if there are land supply constraints but they explain the mechanism and impacts of this issue on housing production through various methods. Peng and Witon (1994) showed that housing price was increased in Hong Kong by increasing of the government constraints about land supply when other factors gave rise to stagnation of housing market. Several studies have been conducted for
Asian countries like Hong Kong, Singapore, Taiwan and Japan that are faced with natural limitation of land supply. These study the role of urban lands management in land and housing price. Of course, cities have reached to a stabilized situation in terms of population and extent for developed countries in which population growth phenomenon has come to an end but some developing countries are still faced with population growth and this gives a special importance to urban land policy of the government in establishment or elimination of housing problem while creating the need and demand for land (Mostafa Morsi El Araby, 2003).

Therefore real income growth, liquidity, population growth, interest rate and land supply limitation are factors and variables of macro economy which determine housing price.

3- THE MODEL

Impacts of land shortage on housing price and mechanism of such impact were considered before. It is tried in this section to represent a relationship between urban housing price and land per capita in exogenous hypothesis of new land supply while offering a theoretical framework for fluctuations of urban land price.

Here $P$ is average price of land in city, $M$ is urban income per capita and $L/N$ is urban land per capita. Land price elasticity is shown with $\eta_L$ and its income elasticity is shown with $\eta_I$.

In the base year $x_0 = \frac{L_N}{N}$ shows consumption/demand of land per capita, $M_0$ shows income per capita and $P_0$ shows land price. After a period income per capita is reached to $M$, population is reached to $N$, total urban land is reached to $L$ and price is reached to $P$. Land is assumed as a normal good for which demand is increased by increasing of income and it is decreased by increasing of price. At the same time, land is regarded without substitute goods.

However, aggregate behavior in certain cases could be occurred in a way in which it is pretended that an individual consumer has created it providing it is assumed that indirect utility functions of individual consumers are in Goreman form:

$$v_i(p_m^i) = a_i(p^i) + b_i(p)m_i$$

Thus, it is possible to replace a representative consumer for individual consumers that total income of this representative consumer is reached to $M_N$ from $N_0M_0$ after one period. In this state and using Roy union it has been shown that marginal propensity to consume is fixed and independent. If for more simplification it is assumed that there exists a moderate consumer whose demand is enhanced by increasing of income per capita (moderate) as the above manner and stability of other conditions by assuming that its price elasticity is $\eta_m$. Then:

$$\eta_M = \frac{dx}{dM} \frac{M}{x}$$

As a result

$$dx = \eta_M \frac{dM}{M} * x$$

Consequently total demand is reached to the below amount after increasing of income per capita.

$$x_{11} = x_0 + dx = \frac{L_N}{N_0} (1 + \eta_M \frac{dM}{M})$$

Now because price is reached to $P$ from $P_0$, if

$$\eta_P = -\frac{dx}{dp} \frac{P}{x}$$

Then

$$dx = -\eta_P \frac{dp}{P}$$

As a result, demand is reached to $x_{12}$ after these two changes:
\[ x_{12} = x_{11} + dx = x_{11} - \eta_x \frac{dP}{P} x_{11} \]

\[ = \frac{L_0}{N_o} (1 + \eta_M \frac{dM}{M})(1 - \eta_x \frac{dP}{P}) \]

\[ = \frac{L_0}{N_o} (1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \eta_M \eta_x \frac{dM}{M} \frac{dP}{P}) \]

\[ = \frac{L_0}{N_o} (1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P}) \]

As a result
\[ x_{12} = \frac{L_0}{N_o} (1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P}) \] (6)

The last term at the right side in differential limit is small in comparison with other terms and it has been disregarded. Previous terms show land demand average (demand per capita) by assuming moderate consumer.

Total land demand in case of population stability is equal to:
\[ X_{12} \times N_o = L_0 (1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P}) \] (7)

This is total demand (in case of population stability) in new price and income. Population growth should be regarded to obtain new total demand. If it is assumed that added population exactly follows preferences model and income and as a result the same demand model, then total new demand is:

Total new demand:
\[ = L_0 (1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \frac{dN}{N}) \]

\[ = L_0 (1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \frac{dN}{N}) \]

Again very small terms in comparison with other terms are disregarded (we can show these small terms by a term such as $\epsilon$. Anyway no change is created in major conclusion of this section).

But in balanced price, such demand level is equal with total land supply in the city (total residential urban land) which is shown with L. It is important to consider the issue that supplying a good, service or resource must be determined in endogenous form and in relation with variables such as price, average cost, demand level and etc. But these variables are not effective here and about urban land based on assumption and an administrative decision determines total supply which is not influenced by such variables practically. Therefore, exogenous variable L is used to determine it. Indeed it is assumed that amount of land supply has no subordinate relationship with a special quantitative variable and according to assumption it is determined exogenously and commandingly (if this assumption is put aside and it is supposed that supplying new land has more or less a competitive market and the city is developed without a serious limitation, naturally other variables like cost or cost price of adding each square meter of new land in the city are inserted in the model by considering cost of creating installations and necessary urban servitudes and etc). Then:

\[ L = L_0 \left(1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \frac{dN}{N}\right) \] (8)

As a result
\[ \frac{L}{L_0} = 1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \frac{dN}{N} \]
Or
\[1 + \frac{dL}{L} = 1 + \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \frac{dN}{N}\]

And finally
\[\frac{dL}{L} = \eta_M \frac{dM}{M} - \eta_x \frac{dP}{P} + \frac{dN}{N}\]

Anyway relation (9) is integrated to reach the intended relation, thus:
\[\int \frac{dL}{L} = \eta_M \int \frac{dM}{M} - \eta_x \int \frac{dP}{P} + \int \frac{dN}{N}\]

Then the below relation is obtained by necessary replacements:
\[LnP = \frac{\eta_M}{\eta_x} LnM - \frac{1}{\eta_x} Ln(L/N)\]

As it is expected this relation shows that there is a direct relationship between average price of land and urban income per capita \(M\) and there is a reverse relationship with urban land per capita (that is an index for land shortage). Meanwhile, nominal urban income per capita is rewrites here in the form of the product of an index of liquidity by real urban income per capita that is leaded to insertion of liquidity variable in the equation. Therefore, the following functional relation could be represented for urban land price:

\[P = P(M, L/N)\]

On the other side, as we know price and equilibrium amount are totally obtained from intersection point of aggregate demand function and aggregate supply function that these functions are the result of aggregation of individual (and firm) supply and demand functions and each one is the result of utility optimization, return or profit maximization. Thus, price always reflects unique status of preferences, risks, returns, costs and finally incomes.

First individual firm that maximize the profit, is studied at supply side. Housing market is a competitive market and firms which construct and supply housing could be regarded as price taker in both input and output markets by considering this point and also as a simplification assumption. Or in other words, prices of factors (inputs) and housing are considered endogenous for individual firms. If it is assumed that technology of these firms is in the way that maximization is possible or in other words second order condition is feasible, it is possible to write factor demand function and supply of output (housing) just in terms of output (housing) and factors' prices (land price, construction and interest rate). Supply function of housing output by a firm is as below:
\[q^s = S(P, C, PL, I)\]

Where \(P\) is housing price
\(C\) is construction cost (price)
\(PL\) is land price

And \(I\) is interest rate (or capital rent price) that almost represents financing cost. Of course the following functional relation is represented for urban land price in terms of income and land per capita:

\[PL = PL(Y, L/N)\]

The represented supply function is homogenous of zero degree as it is referred in production theory in micro economy. Supply of the firm is increased by increasing of housing price and it is decreased by increasing of inputs prices. Finally, substitution matrix is symmetrical negative semi-definite generally.
But this function only shows housing supply by a firm and not the whole industry supply or aggregate supply. If market is assumed in the form of perfect competition as it has been mentioned and firms are assumed more or less similar for simplification in terms of technology (or cost function), industry supply function (aggregate supply) is horizontal in the competitive market and quantity of demand in balanced price just determines amount of supply and number of firms theoretically. Therefore, (total) aggregate supply could be shown given to simplification assumptions as below that n shows balanced number of firms.

\[ Q^S = n^* S(P, C, PL, I) \]

The same process should be conducted at demand side. Here demand consists of consumption and capital demand. We focus individual consumption demand in this survey that is the product of utility maximization process (consumer behavior theory). It is possible to consider a consecutive individual direct utility function by suitable assumptions on preferences that shows individual's utility in the form of a function of housing consumption and other goods (or the remaining money). Then housing demand is a function of the household budget (individual) and housing price and price of other goods (for example in the framework of inflation index) theoretically. It should be regarded that inserting price of other goods usually depends on existence of substitution (or complementary) relationship between two goods while such relationship is not conceivable about housing as it has been mentioned. Thus, it is avoided to insert inflation in the model.

Indirect utility function of individual consumers is considered in Gorman form in order to help aggregation and consequently marginal propensity to consume in each certain price is independent of consumer's income level and is fixed among all consumers. Then if we consider a consumer household that has an income equal to average income of the household, the household's demand will be as below:

\[ q^d = D(P, Infl, M) \]

Also it is possible to insert wealth and interest rate in the above relation which is not considered given to lack of credible data in this survey and many other studies.

As it was mentioned earlier, it must be considered that some arrangements should be regarded in order to reach aggregated consumption from individual consumption because consumer's behavior theory gives individual consumer demand and there would be no limitation regarding aggregate behavior generally. Aggregate behavior in certain cases may be occurred in a way that it seems a representative individual consumer has created it. Therefore, it is assumed that indirect utility function of all consumers has Gorman shape:

\[ v_i(P, m_i) = \alpha_i + b(p) m_i \]

Then it is possible to state housing consumption demand as below given research background:

\[ Q^D = D(P, N, M, W, I) \]

Where

\[ Q^D \] is total housing demand (representative consumer)

P is housing price

M is income per capita

W is wealth

I is real interest rate

And N is population.

Although aggregate demand of population N is not necessarily N times of demand of an average individual (or household) with an income equal to average income of population but certainly this relationship between total demand and demand of a supposed consumer with an income equal to average income is a helpful assumption and approximation that is converted into a precise assumption by Gorman shape assumption for indirect utility. By considering this assumption (approximation) and omitting variables without statistics total consumption demand is:
\[ Q^D = N \ast D(P, M) \]

Now we can equate aggregate demand and supply:

\[ Q^D = Q^S \]

Thus

\[ n \ast S(P, C, PL, I) = N \ast D(P, Y) \]

Now it is possible to write housing price \( P \) in the form of a function from other existing variables in the above union. What is important is that \( n \) is not number of firms of an independent variable; rather it is a function of demand and mainly \( N \) population (or household). But ratio of \( N/n \) is a fixed amount in case of stability of other conditions. Consider this mental experiment to demonstrate the above claim. Suppose that only population is doubled by fixedness of other conditions. It is clear that if all other conditions, i.e. income per capita, prices and construction costs, preferences and etc are fixed, consumer demand \( q^d \) of a representative with an income equal to fixed income per capita and total demand \( Q^d \) is doubled by doubling of population in static balance. Total supply should exactly be doubled for the balance of supply and demand. Because other conditions that determine optimal amount of production and supply of each individual firm \( q^s \) are fixed the above amount remains fixed and it is necessary to double the number of firms \( n \) for doubling of total supply. Hence, ratio of \( N/n \) would be fixed as before. Generally as the last simplification assumption the above ratio is regarded fixed so that both are omitted from the model as variables and a fixed amount replaces their ratio in the above relation.

Now, by replacing land price using previous functional relation and breaking income per capita into two variables of real income per capita \( y \) and liquidity and land per capita of the same year and previous amounts of these variables that \( k_{ij} \) and \( k_{il} \) refer to lead and lag. Moreover, housing price in each year is correlated with the price of previous years and \( k_{il} \) refer to these lags. Microfit software makes it possible to select a model using one of these four criterions of balanced \( R^2 \), Akaeic (AIC), Shawartz-Byzin (SBC) and Hanan-Queen (HAC) that number of its lags is optimal in comparison with other models.

### 4-Model Estimation

The following dynamic panel model is considered in the framework of macro economy to study housing price for Iran's metropolises in long-term:

\[
P_{i,t} = \alpha_0 + \alpha_t + \alpha_i + \sum_{h=1}^{n} \beta_{i,h} X_{i,t} + \sum_{h=1}^{n} \sum_{j=-k_{i,j}}^{k_{i,j}} \sum_{l=1}^{k_{i,l}} \gamma_{i,j} X_{i,t-j} + \phi_{i,l} P_{i,t-l} + \varepsilon_{i,t}
\]

Among advantages of using panel data we can refer to increasing of the sample volume, reduction of collinearity, increasing of efficiency, reduction of estimation bias, controlling sample heterogeneity, limiting variance dissimilarity, possibility of separating economic impacts and studying balance dynamisms.

Housing price is considered as a function of real urban income per capita and liquidity and land per capita of the same year and previous amounts of these variables that \( k_{ij} \) and \( k_{il} \) refer to lead and lag. Moreover, housing price in each year is correlated with the price of previous years and \( k_{il} \) refer to these lags. Microfit software makes it possible to select a model using one of these four criterions of balanced \( R^2 \), Akaeic (AIC), Shawartz-Byzin (SBC) and Hanan-Queen (HAC) that number of its lags is optimal in comparison with other models.

\[
X = [Y, M, \frac{L}{N}]
\]

\( i \) is metropolises' figure (Tehran, Isfahan, Mashhad) and \( t \) is time's figure and \( \alpha_0 \) is common for all years and all cities.
\( \alpha_t \) is for year \( t \) and is common for all cities.

\( \alpha_i \) is for city \( i \) and is common for all years. This term is individual impacts related to each city.

\( Y \) is real income per capita
\( N \) is population
\( M \) is liquidity
\( L/N \) is urban land per capita

\( \varepsilon_{it} \) is error term. Normality test of error terms, lack of autocorrelation among error terms, variance dissimilarity test and codified test were conducted to recognize model explanation and it was assured that classic hypotheses were satisfied.

Equation (4-1) is a dynamic panel explanation, because amount of dependent variable is affected by its lags. Existence of special fixed impacts for each city in this dynamic model gives rise to bias in fixed estimators that its amount is inclined towards zero by increasing of the panel's time period (Nickell, 1981 and Bond, 2002). Time dimension in this panel is 32. Thus, the created bias by fixed effects estimators could be relinquished. However, this problem has been avoided using systematic GMM estimator represented by Arellano and Bover (1995) and Blundell and Bond. This method enhances Arellano and Bond's estimator (1991) for those states that coefficient of lag is large and number of time series' observations is small. Two-phase systematic GMM estimator method has been used in this survey to estimate equation (4-1). Therefore, ado file of STATA software prepared by Roodman (2006) was applied.

according to model estimation results (in table 1), coefficient lag of Housing price is equal to 2.169504 that shows housing price is affected much by the amount of its previous period.

Coefficient growth of liquidity is equal to 0.000721 which shows positive impact of liquidity on housing price and illustrates that manifestations of Dutch disease have been appeared clearly in Iran's economy.

Gross domestic product per capita coefficient is equal to 0.0002497 which shows positive impact of income on housing price and illustrates income is an important factor and stimulus of increased housing price as housing market studies across the world indicate.

Land per capita coefficient is equal to -2750.838 that shows negative impact of land per capita on housing price. Estimation results of one-phase Arellano-Bond method by considering half-year impacts show that housing prices have no significant difference in the first and second half-years.

5- CONCLUSION
Results obtained from this survey indicate effectiveness of macro economy variables including income per capita and liquidity beside converse impact of land per capita on housing price in the selected metropolises. It is necessary to pay attention to the point that bigness and smallness of coefficients has no relationship with elasticity and it is intelligible regarding bigness and smallness of variables, because linear model has been used in this survey.

In addition to impact of income per capita variable which is expected, impact of liquidity variable on housing price in Iran has been shown in this survey again. Apart from occurrence of Dutch disease in national economy in recent years and the source and reasons of liquidity growth, based on the results of the present survey, this variable is an effective factor on housing price in Iran's metropolises which emphasizes destructive role of some economic policies on housing price.

Finally we must refer decreasing process of land per capita in all selected metropolises in this survey and its impact on increasing process of housing price in Iran's metropolises. As survey results reveal there is a reverse relationship between metropolitan housing price and urban land per capita that is related to legal and governmental limitations which are adopted to develop cities.
Figure(s) and Table(s)

Diagram of land per capita in cities

```
.xtabond HP 1 deltam gdppc, lags(2) robust artests(2)
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<table>
<thead>
<tr>
<th>Arellano-Bond dynamic panel-data estimation</th>
<th>Number of obs = 93</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group variable (t): state</td>
<td>Number of groups = 3</td>
</tr>
<tr>
<td>Wald ch2(2) = 131834.30</td>
<td></td>
</tr>
</tbody>
</table>

| Time variable (t): time                   | Obs per group: min = 31 |
|------------------------------------------| avg = 31 |
|                                          | max = 31 |

One-step results

| D. HP          | Coef. | Robust Std. Err. | z   | P>|z| | [95% Conf. Interval] |
|----------------|-------|------------------|-----|-----|----------------------|
| HP             | 2.169504 | 0.030104        | 72.68 | 0.000 | 2.163604 - 2.175405 |
| L20            | -1.254501 | 0.071191      | -176.22 | 0.000 | -1.268454 - 1.240548 |
| D.            | -2750.838 | 1474.165       | -1.87 | 0.062 | -5640.148 - 138.4716 |
| deltam        | 0.000721 | 0.001139       | 6.01 | 0.000 | 0.000486 - 0.000959 |
| D.            | 0.0002497 | 0.000241   | 10.37 | 0.000 | 0.0002025 - 0.0002969 |
| _cons         | -3.726727 | 2.623631     | -1.42 | 0.155 | -8.868949 - 1.415494 |

Arellano-Bond test that average autocovariance in residuals of order 1 is 0: 
H0: no autocorrelation z = -1.34 Pr > z = 0.1811

Arellano-Bond test that average autocovariance in residuals of order 2 is 0: 
H0: no autocorrelation z = 1.54 Pr > z = 0.1233

Table 1: Estimation results of one-phase Arellano-Bond method

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