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THE SENSITIVITIES OF JORDAN HOUSING DEMAND TO MACROECONOMIC FACTORS: DEMAND SUPPLY ANALYSIS MODEL APPLICATION

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Abstract: *This paper summarizes the arguments and counterarguments within the scientific discussion on the issue mismatch between demand and supply of Jordan housing market. The main purpose of the research is systematization of the literary sources and approaches for solving the problem demand behaviour of Jordan housing market and its influencing factors with emphasis on macroeconomic variables on demand formula for the period between 2006 to 2019 indicates that the relevance of this scientific problem decision is that investigation The sensitivities of Jordan housing demand to macroeconomic factors. In the paper is carried out in the following logical sequence methodological tools of the research methods were. This research offers empirical estimates using the time series data from the current demand model for residential homes in Jordan. The study applied the (Janet and Lam 2012) model of general function of housing demand (Qd = f (G, H, D, t). Years of research data used from 2006 to 2019 of Jordan housing market statistic. The paper presents the results of an empirical analysis of Janet and Lam 2012 model which showed that the research empirically confirms and theoretically proves that demographic factors were statistically significant in most formulations, it had the wrong sign on its coefficient, indicated low impact on the amount of new construction activity completed for residential purpose. More important the study found that housing sectors related factors is the most significant variables in explaining the demand for new housing in Jordan and their present are relatively drive the new housing demand function, and housing suppliers may react to the demands of housing customers, issuing new building permit or complete licensed one when the price increase, in case of Jordan we found exactly the opposite; price increase and number of new building completed and new permit are declining and housing price increases. The results of the research can be useful for both decision and policy makers are engaged in housing sectors in developing policy and offer more affordable unit size.*

Keywords: housing demand, housing market, real estate price, demand forecast.

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1. Introduction

Housing has become a deep focus of city design and social and economic policy. The content and structure of housing delivery systems include the availability of housing for all (Tan, 2008). Multiple research studies have found owning a home provides benefits not just to individuals and families, and to societies. Given the advantages of house ownership and the incentive for individuals to own a house, affordability has now become a crucial challenge. (Quigley and Raphael, 2004) find that the concerns of individuals about the affordability of housing are focused on two key factors: (1) housing is the single largest expense variable in the budgets of most individuals and families, and (2) many metropolitan areas have seen a rise in housing prices and rents. (Quigley and Raphael, 2004) further argue that the topic of 'affordability' has become ambiguous because it covers a variety of concerns, including housing price, quality of housing, distribution of household income, borrowing power, etc.

According to (World Bank, 2018) Report, Jordan's housing demand aggressively increases fuelled by extremely fast populations increases, which in the last few years has resulted from a considerable flow of refugees, migrants, and workers; annual population growth between 2004 and 2015 was close to 6 percent, exceeding population estimates by nearly 30 percent. Jordan is predicted to host between 1.7 and 3.5 million new residents by 2030, with a population of at least 11.1 million and a maximum population of 12.9 million. Based on current family income and the emerging aspects of mortgage lending debts, household members below the 5th decile cannot afford to purchase a housing unit of more than JD25,000. Moreover, based on the current market prices in the main Jordanian cities, only 30 per cent of the population living can afford to purchase housing units over 100m2 without paying over 30 per cent of their annual income.

Attempts to examine the behaviour of the property sector in Jordan are very small due to lack of knowledge and experience. As a result, very little is learned about the production of the Jordanian housing sector. The need for such studies in developing countries is comparatively higher than other advanced studies, as housing issues are more severe, and resources are limited (Hunaiti, 1997). The main objective of this paper to study the current demand behaviour of Jordan housing market and its influencing factors with emphasis on macroeconomic variables on demand formula for the period between 2006 to 2019. The residential housing and commercial building is the main sectors in Jordan, despite the present of informal housing unite across the country our study will focus in residential housing, we will try to answer what are the main factors driving demand for new housing and their role in Jordan housing sector using macro demand model which contain, economics, demographic and housing related factors, shaping the fundamental sufficient housing policy for industry and policy makers which in turn will help to try to solve some of housing market problems.

2. Literatures Review

History of housing literature on the housing demand survey at (De Leeuw, 1971), that deals with the cross-sectional data studies only in the 1960s while (Fulpen, 1988), are extensively concerned with housing demand theoretical and empirical studies in the 1960s, 1970s and 1980s. this has been advanced in and (Donatos, 1995) and (Ge and Lam 2002. 63) reported that large volume of housing research in 80s and 90s. (Malpezzi and Mayo, 1987) are the only and most comprehensive literature survey in the developing countries in particular related to housing demand. The international literature offers empirical evidence on the property market in two categories.

The first stream of research housing demand is treated as a composite good or service (i.e. time series macro for mula), while the second stream of research investigated demand in contexts of its individual characteristics of housing demand such as hedonic formula based on cross sectional dataset. According to (Halicioglu, 2007), overall housing demand is result of collective economic and demographic factors such (number of households, housing inventory, housing market consumptions, price index). In addition, there are three principal reasons for this literature's expansion as argued by (Malepezzi and Mayo, 1987), and a great many practical issues have led, first of all, to a number of alternatives when specifying economy-oriented housing models (e.g., correct price, volume, income, and functional form). Therefore, there is no generally accepted model. Secondly, housing markets are not homogeneous and display great diversity between countries or cities. Consequently, consensus among scientists on housing demand income and prices was weak. Last, governments also frequently play major roles in housing markets which requiring detailed information on the demand factors of housing.

Emerging economies need further housing analysis than developed countries because the rate of rapid urbanisation growth in developing countries is substantially greater than those of developed countries. In the context of developing countries housing research is tending to also be constrained in a limited number of countries, as suggested in (Malpezzi and Mayo, 1987). However, this reasonable volume of research indicates that patterns of housing demand between developing and developed countries are comparable. Exact estimates of housing demand elasticity were also helpful not just in housing prediction and regulations, as well as in studying numerous issues including the pressure of state taxes and cosmopolitan urbanisation. Given the dramatic empirical research, a projection differs enormously in response of demand to the changes in income and housing price.

Accordingly, (Halicioglu, 2007) suggested that this difference due to the application of multiple aggregated instated of micro households' observations in cross sectional analysis of housing demand. The purpose for using grouped data to provide mean of income as better proxy for long-term income than that project income of individual households. However, as (Polinsky, 1977) has pointed out that effect of using group data is to impart various aggregation biases in estimating the elasticities of housing demand. The use of micro-observations avoids these aggregation biases, but observations from single-year survey data make it difficult to derive the concept of permanent income, see (Lee and Kong, 1977). (Malpezzi and Mayo, 1987) reports that most income elasticities range between 0.5 and 1, and the median price elasticity is around -0.2 for the developing countries

The literature reviews by (Hashim, 2010) and (MacDonald, 2011) have identified many factors that influence housing price, some of which overlap. However, most of the works in literature look at the factors from the economic and planning points of view. At the same time, most of the data came from the reports that attempt to relate the trend of increasing housing price and economic variables. Information on the factors that influence housing price from the perspective of the private developer, how developers determine housing price, their strategies and their target markets is insufficient. This research will fill in the gap by examining the factors that influence the housing price and the strategies from the point of view of developers.

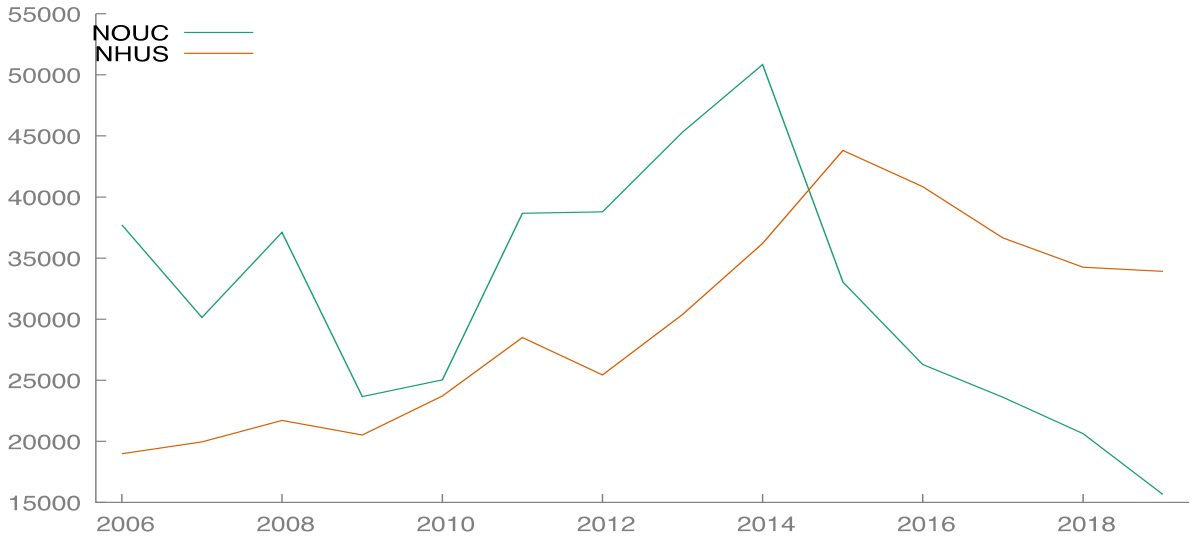


Figure 1. Jordan House Unit Completed and Sold 2006-2108

Source: Department of land and Survey

Above figure of supply and demand over the period of 2006 to 2019, financial crisis effect during 2008/10 than we can see their increase in both demand and supply, but the supply far exceed the this can be explained by the optimism of the impact of inflex of Syrian refugees which started sharply to decline in 2015/16 and only 16,000 units were completed in 2019 which less than 50% of annual estimate of 30,000 units.

3. Model formulation

According to (Janet and Lam 2012), the general function of housing demand can be formed as following.

$$Qd = f(G, H, D, t)\ t = 1, 2, 3, \quad (1)$$

Where Qd is the quantity demanded, G stands for macroeconomic variables such as gross domestic product, interest rate, H represents housing related variables such as prices, income, etc., and D is related to demographic variables such as population, growth rates, households, etc. Following the formulation of linear regression model, Eq. (1) can be expressed as follows:

$$Qd = a_0 + a_1 G_t + a_2 H_t + a_3 D_t + \varepsilon_t \quad (2)$$

4. Model formulation

The selection of the appropriate variables for the demand model of the Jordanian housing market is based on the empirical and conceptual framework, the nature of the case study market and limited by available data. The selected variables are divided into three categories; housing related, demographic, economic monetary shown in Table1 below.

Table 1. Demand Model Variables Description

Variables Category	Variables Code	Types	Variables
Demographic	NH	Explanatory	Number of Households
	PG	Explanatory	Population growth rate
Economic	GDP	Explanatory	Gross domestic product
	GDPC	Explanatory	GPD per capita
Housing Related	HPI	Explanatory	Housing price index
	HMR	Explanatory	House loans volume (residential mortgage)
	NBP	Explanatory	Number of new building permit
	Area	Explanatory	Total area of permit SQM
	NOUC	Dependent	Number of housing unit completed
	NHUS	Explanatory	Number of units sold
	m^2	Explanatory	Average unit size SQM
	UPP	Explanatory	Unit per building permit

Source: compiled by author.

The sources of data used in the model emanate from official statistics provided mainly by the department of statistics, central bank of Jordan and land survey and registration department the publisher of Jordan housing price index. The annual aggregate time-series data covers the period 2006-2019. The time span estimate was constraint by data availability. The hypothetical demand model proposed to be estimated for the Jordanian housing market will take the basic formulation:

$$NHUS = a_0 + a_1 NH + a_2 GDPC - a_3 HPI + a_4 HMR \quad (3)$$

These changes in the volume of new housing completions (NHUS) are expected to be positively related to changes in the number of households (NH), per capita national income (GDPC), and the amount of mortgage money advanced for lending (HMR). On the other hand, the volume of new housing completion should be negatively related to the housing price index (HPI). Because of the nature of the study area and the characteristics of the housing unit as a necessity and investment good in the economy, it will not be surprising to expect different magnitudes of some variables of the model than that of other experiences, reflecting the exact behaviour of the study area market. The analysis for the main variables of the demand model plotted against the time period indicates the presence of two main of structural form (Fig.1). The first is the linear positive form shown by the demographic NH, the per capita income (GDPC) and the housing price index (HPI) variables, and the second is the quadric form expressed by the volume of new housing construction (NHUC) and the sum of mortgage money lent to households (MHR). The form of the role of these variables hypothesizes a first assertion that these variations in data types which lead to a concern as to whether the visual appearance as seen in the data functional form will produce significantly different result from those predicted by the hypothetical assessment.? The estimation results of the model will remain to be seen in answer to such a query, taking into account that not only

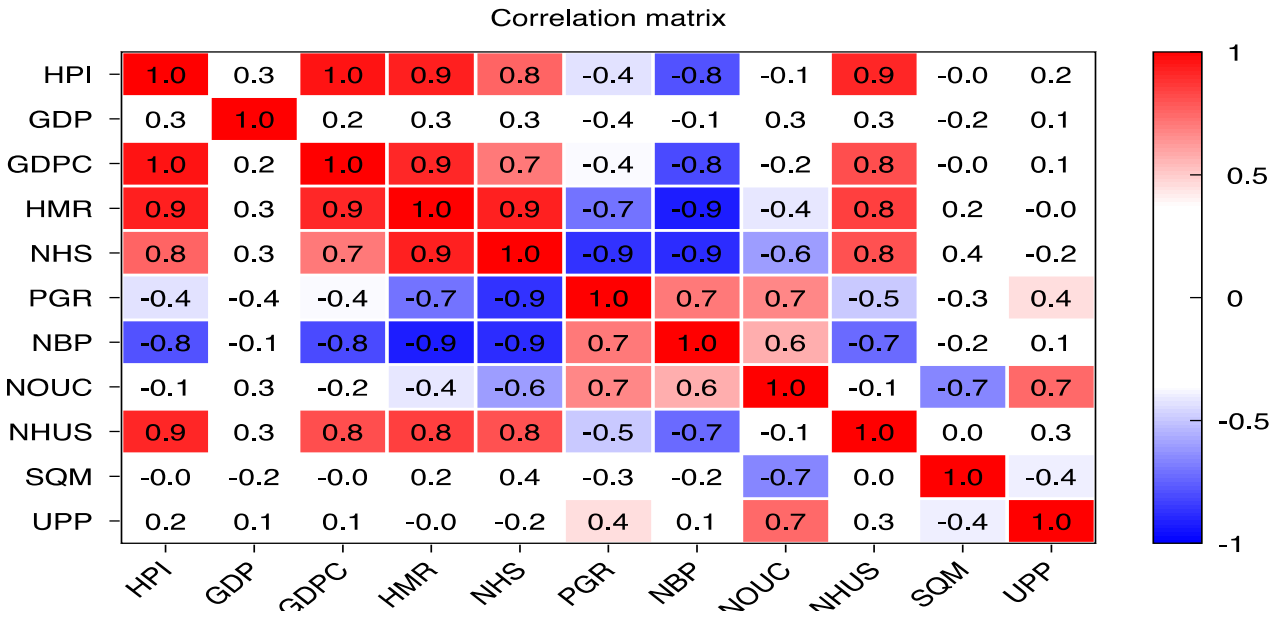
the model variables have different functional shape over the estimation period, but also that their values have increased or decrease differently. Estimation and Results

Result of estimating of the demand for new housing units, NHUC is the dependent variable.

Model Variables:

- GDPG, DPC, HPI, HMR
- HMR HPI, NHUS
- m^2, UPP, NBP
- NHS, NHUS, GDPC
- GDP, HPI, NHS, NHUS, m^2, UPP

5. Result and Discussion



Source: compiled by author.

Figure 2. Variables Correlation Matrix

Table 2. Model 1 OLS, using observations 2006-2019 (T = 14)

Dependent variable: NOUC, HAC standard errors, bandwidth 1 (Bartlett kernel)

	Coefficient	Std. Error	t-ratio	p-value	
const	−3600.28	10042.9	−0.3585	0.7282	
GDP	2721.37	1228.55	2.215	0.0540	*
GDPC	−0.665292	6.89833	−0.09644	0.9253	
HPI	1141.75	232.620	4.908	0.0008	***
HMR	−18434.1	2242.51	−8.220	<0.0001	***

Table 2 (cont.). Model 1 OLS, using observations 2006-2019 (T = 14)

Mean dependent var	31893.36	S.D. dependent var	10014.46
Sum squared resid	2.29e+08	S.E. of regression	5046.871
R^2	0.824172	Adjusted R^2	0.746026
F(4, 9)	23.03932	P-value(F)	0.000095
Log-likelihood	−136.1436	Akaike criterion	282.2873
Schwarz criterion	285.4826	Hannan-Quinn	281.9915
rho	−0.515862	Durbin-Watson	2.808732

Source: compiled by author.

White's test for heteroskedasticity - Null hypothesis: heteroskedasticity not present

Test statistic: LM = 8.6077 with p-value = P(Chi-square(8) > 8.6077) = 0.376462.

Model 1 shows that 82% of the variance in the dependent variable is explained by the variations in the basic explanatory variables of the hypothetical model namely, the economic factor GDP, the per capita income, the housing price index HPI, and the housing mortgage advanced variable HMR. The housing price index and housing mortgage factor is significantly successful, but HMR, GDPC has the wrong expected sign on its coefficient; negative sign instead of a positive one. In addition, multicollinearity problem may exist because of high correlation between the explanatory variables HMR and GDPC 0.90%.

Table 3. Model 2 OLS, using observations 2006-2019 (T = 14) Dependent variable: NOUC

	Coefficient	Std. Error	t-ratio	p-value	
const	−10497.0	14081.0	−0.7455	0.4731	
HMR	−18833.6	3397.84	−5.543	0.0002	***
HPI	1163.41	313.870	3.707	0.0041	***
NHUS	0.0928991	0.452712	0.2052	0.8415	

Mean dependent var	31893.36	S.D. dependent var	10014.46
Sum squared resid	3.17e+08	S.E. of regression	5631.177
R^2	0.756779	Adjusted R^2	0.683813
F(3, 10)	10.37164	P-value(F)	0.002057
Log-likelihood	−138.4149	Akaike criterion	284.8297
Schwarz criterion	287.3860	Hannan-Quinn	284.5931
rho	−0.033394	Durbin-Watson	1.882002

Source: compiled by author.

Excluding the constant, p-value was highest for variable 9 (NHUS)

Model 2 shows the results of estimating the hypothetical model having dropped the GPD and GDPC variable to avoid problem of multicollinearity since this variable fails also in the significance test (t). and adding the number of house unit sold NHUS, the outcome did not improve, but still the HMR factor has the wrong sign.

Table 4. Model 3 OLS, using observations 2006-2019 (T = 14)Dependent variable: NOUC

	Coefficient	Std. Error	t-ratio	p-value	
const	42693.5	16415.1	2.601	0.0265	**
m^2	−250.980	80.9063	−3.102	0.0112	**
UPP	3979.25	878.615	4.529	0.0011	***
NBP	2.05240	0.524830	3.911	0.0029	***

Mean dependent var	31893.36	S.D. dependent var	10014.46
Sum squared resid	1.51e+08	S.E. of regression	3887.343
R^2	0.884094	Adjusted R^2	0.849322
F(3, 10)	25.42549	P-value(F)	0.000054
Log-likelihood	−133.2266	Akaike criterion	274.4531
Schwarz criterion	277.0094	Hannan-Quinn	274.2165
rho	0.520066	Durbin-Watson	0.947136

Source: compiled by author.

Model 3 experimenting with the use of the housing variables, the SQM and unit per permit UPP as well as numbers of new building permit NBP are significant in explaining the changes in the dependent variable which improve to reach 88%. The negative sign of SQM indicate that demand will decrease once the size of unit increases which is logical, as the price increase this might be better explained that customers demand smaller size housing unit which they can affords.

Table 5. Model 4 OLS, using observations 2006-2019 (T = 14)Dependent variable: NOUC

	Coefficient	Std. Error	t-ratio	p-value	
const	42759.9	11110.8	3.849	0.0032	***
NHS	−0.0304493	0.00498456	−6.109	0.0001	***
NHUS	1.42994	0.352322	4.059	0.0023	***
GDPC	−2.25409	4.48716	−0.5023	0.6263	

Mean dependent var	31893.36	S.D. dependent var	10014.46
Sum squared resid	2.61e+08	S.E. of regression	5112.068
R^2	0.799555	Adjusted R^2	0.739421
F(3, 10)	13.29633	P-value(F)	0.000799
Log-likelihood	−137.0609	Akaike criterion	282.1217
Schwarz criterion	284.6780	Hannan-Quinn	281.8851
rho	0.200918	Durbin-Watson	1.496009

Source: compiled by author.

Excluding the constant, p-value was highest for variable 3 (GDPC)

Model 4 show the importance of demographic and housing variables in the demand function. Number of households and sold unite is statistically significant, explaining about 80% of the variations demand, but surprisingly the NHS and national income per capita have the wrong negative sign.

Table 6. Model 5 OLS, using observations 2006-2019 (T = 14) Dependent variable: NOUC

	Coefficient	Std. Error	t-ratio	p-value	
const	57663.4	13887.7	4.152	0.0043	***
HPI	−60.4957	120.923	−0.5003	0.6322	
GDP	3091.37	880.154	3.512	0.0098	***
NHS	−0.0217292	0.00458747	−4.737	0.0021	***
NHUS	0.818981	0.308244	2.657	0.0326	**
m^2	−107.002	69.0173	−1.550	0.1650	
UPP	1954.68	924.712	2.114	0.0724	*

Mean dependent var	31893.36	S.D. dependent var	10014.46
Sum squared resid	56720342	S.E. of regression	2846.560
R^2	0.956495	Adjusted R^2	0.919205
F(6, 7)	25.65007	P-value(F)	0.000198
Log-likelihood	−126.3672	Akaike criterion	266.7345
Schwarz criterion	271.2079	Hannan-Quinn	266.3204
rho	−0.320060	Durbin-Watson	2.332533

Source: compiled by author.

Excluding the constant, p-value was highest for variable 1 (HPI)

Model 5 and 6 is statistically the best estimate of the demand so far. The four explanatory variables GDP, NHUS and UPP are statistically significant each with the expected sign, and NHS with wrong expected sign, this model, although does imply some standard demographic and economic variables, was able to explain about 96% of the demand variations which is the highest in all models except model 6 which the explanatory variables collectively estimated demand for housing by 97.5%.

Table 7. Model 6 OLS, using observations 2006-2019 (T = 14)

Dependent variable: NOUC, HAC standard errors, bandwidth 1 (Bartlett kernel)

	Coefficient	Std. Error	t-ratio	p-value	
const	34749.8	25256.3	1.376	0.2626	
HPI	−511.000	500.385	−1.021	0.3823	
GDP	3146.69	976.181	3.223	0.0485	**
NHS	−0.0178057	0.00907440	−1.962	0.1445	

Table 7 (cont.). Model 6 OLS, using observations 2006-2019 (T = 14)

NHUS	0.895004	0.461549	1.939	0.1478	
m^2	−160.125	37.3179	−4.291	0.0233	**
UPP	2214.16	624.445	3.546	0.0382	**
GDPC	3.28708	6.54526	0.5022	0.6501	
HMR	7525.28	6565.47	1.146	0.3349	
PGR	138849	128932	1.077	0.3604	
NBP	2.29550	0.806904	2.845	0.0654	*

Mean dependent var	31893.36	S.D. dependent var	10014.46
Sum squared Resid	32459396	S.E. of regression	3289.346
R^2	0.975103	Adjusted R^2	0.892114
F(10, 3)	797.5373	P-value(F)	0.000066
Log-likelihood	−122.4602	Akaike criterion	266.9205
Schwarz criterion	273.9501	Hannan-Quinn	266.2698
rho	−0.558938	Durbin-Watson	2.925669

Source: compiled by author.

6. Conclusion

The demographic factor NHS expressed by the number of households did turn out to be a significant factor in the demand model for Jordan. Although it was statistically significant in most formulations, it had the wrong sign on its coefficient, indicated low impact on the amount of new construction activity completed for residential purpose. In this situation where population growth is reached the highest in all time to 6% between 2006 and 2019, this result surprisingly not predicted. One of the explanations that the national GDP growth and income growth did not support these sectors and affordability of buying the current housing unit stock very weak despite the increase in the number and volume of residential mortgages which turn out to be significant factors in models 1and 2 but with wrong sign on its coefficient.

Changes in the price factor HPI does also play a significant role in the Jordan housing market between 2006 and 2019. The coefficient of this variable was significant in the general model 1 and 2, while in some other formulations had a significant positive coefficient instead of a negative one as expected. This result emphasis on the view that housing market demand in a developing country, valued most and considered to be important durable goods needed households regardless of the price movement upward and in some situation described as low risk investment for individual who expected the price to increase in the future. Finally, another important finding that indicated by model 3 which house unit characteristic such as space dimension SMQ, unit produced by one permit licenses UPP variables, turn out to be significant positive coefficient. One explanation for this positive implication that increase the unit per permit will reduce the cost and market price, and for developer who produce house unit size range between 120m^2 to 170m^2 created mis match between demand and supply. This supported by the data in which found that sales unit increased in the past five years (form inventory) and did not increase the new building permit as one expected, until the supply side react to the reality problem will prissiest.

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resources: Ibrahim Tahat; software: Ibrahim Tahat; supervision: Ibrahim Tahat; validation: Ibrahim Tahat; visualization: Ibrahim Tahat; writing- original draft: Ibrahim Tahat; writing - review & editing: Ibrahim Tahat.

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