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How to make the decision to get married and settle down in the speculative housing market?

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ABTRACT: To obtain the stable family life and then settle down is the most important decision during the stage individuals pass through from childhood to their retirement years as a member of a family. Increased housing price and unchanged wage level lead to lack of affordability for many families. This study applies econometric method of Nested Logit model to construct the individuals' sequential decision process by the three level sequential housing choice model. The questionnaire whose survey consists of family type and real estate characteristics in this study is designed to collect the information required for the choice model, and Random Utility theorem is applied to model how the family makes the decision to get married and settle down. The demonstrative result shows that family's tenure decision is significantly affected by occupied duration. Property type decision is significantly influenced by gender and educational level of the household heads. Family type decision is correlated with household size, marriage status of the person who is financially responsible for the family, and occupied duration. It concludes that individual's social and economic attributes determine the decision of family type, and then he/she takes a decision between rent and buy, and finally determines the property type.

KEYWORDS: Settle down; Housing market; Housing price; Nested Logit model; Family type

I. INTRODUCTION

When individuals make the decision to afford to buy their homes, they will consider the housing characteristics, such as housing price, location and transportation accessibility. The decision to afford to buy a home is also affected by individual characteristics such as individual economic capability level and the preferences. In previous studies related to housing choice, most examined the relationship between household heads and demographics variables, such as population and age distribution, for the purpose of construct household formation theory. These variables related to housing attributes were seldom considered in the past literatures. This study investigates how individual makes the sequential decision to settle down and implements the questionnaire survey for information collection and demonstrates the sequential decision for the individual to settle down by applying Nested Logit model in the speculative housing market. Additionally, this study tests the statistical significance of variables individuals consider when making the decision to afford a home.

This study concentrates its attention on how the individuals live in HsinChu City in Taiwan make the decision to settle down in the speculative housing market. Thus, this study adoptsHsinChuCityas the study area for the reason that it attracts the young adults to reside with released ample employment opportunities from Science Industry Park. Individuals live in HsinChu City are defined as the population of this study, thereby excluding temporary residents and vacant houses.The remainder of this paper is organized as follows. Section II introduces a literature review. Section III presents the proposed model and data analysis. Section IV gives conclusions.

II. LITERATURE REVIEW

Most of reviews on housing choice took interest on decision in response to ethnicities (e.g., black and white) ([4], [7]Kain and Quigley [4]; Painter, Gabriel and Myers [7]).[4]used survey data from a sample of a residential market in St. Louis to investigate the effects of racial discrimination on housing demand. By choosing independent variables, such as household income, educational level of household heads, years of employment of household heads, number of family members in the work force, age and gender of household heads, household size and family patterns, their study applied the multiple regression model to determine the impact of races on residential characteristics and residential forms. It concluded that three variables including housing income, educational level of household head and household size significantly affected the decision on residential location of the household. [4]found that the costs of owning or

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renting a house in area was dominated by black were more expensive than the area was dominated by white and they indicated that racial discrimination had a significant impact on the decision to make for housing tenure and property type.

Ben-Akiva and Bowman[1] presented the integrated discrete choice model system of a household's residential location choice and its members' activity and travel schedules. The residential location aggregate alternatives were defined by 787 traffic analysis zones. The model was conditioned by the household's choice of tenure (rent vs. own) and building structure (detached single unit vs. other), which impact the quantity and price of housing stock available to the household in each zone. Their demonstrated result statistically invalidated the anticipated hierarchy of Nested Logit model in which the daily activity pattern was conditioned on the residential choice. Instead, it suggested a daily pattern hierarchy and the details of the activity schedule were conditioned on the residential location. Knapp, White and Clark [5] considered household and site characteristics as the independent variables in the model of intra-MSA and inter-MSA mobility. Households were assumed to choose a single type of move, intra-MSA or inter-MSA, while simultaneously choosing a central city or suburban destination. The result demonstrated that the Nested Logit model was appropriate on both theoretical level and empirical research. The data were drawn from 1990 Public Use Micro data Samples of the U.S. Census of Population and Housing. As developed by Hunt [3], the full information maximum likelihood procedure was applied to estimate their model which contained a degenerate branch, required normalization upon the top level scale parameter. The study adopted the parsimonious structure with respect to household characteristics including family income, age, and the racial and ethnic variables.Cho [2] explored the plausible variables that influence choices in Chongju housing market. A joint model of tenure and dwelling type was estimated with the multinomial Logit framework. The data set for the analysis was an assembly of information on the individual choices of tenure and property type, the demographic and socioeconomic backgrounds of households, and the characteristics of neighbourhoods and dwelling units. The study used 785 observations to analysis the choice behaviour. The housing choice model in the study was estimated for three sample cases.

III. MODELS AND DATA

The NLM is the one providing the availability for gathering similar alternatives into a group under the consideration of hierarchy and sequence for the individual decision. By gathering similar alternatives into one nest, the NLM considers the relevance among the alternatives within one nest to relax the assumption linked with the IIA of the MLM.Typically, the elemental alternatives represent the alternatives individuals are directly faced with in choice situations. The branches of the model then define groupings of elemental alternatives that are assumed to be more or less similar in terms of having the same error variances in their utility functions. The NLMtypically provides atwo-step estimation procedure to estimate parameter. The definition of the inclusive value I is shown in Equation (1).

$$I = \ln[\sum_{n=1}^{M} \exp(V_n)]$$

Where V_n is the indirect utility of alternative n.

IV. EMPIRICALRESEARCH

Two sequential decision processes applies to describe how individual makes the decision to get married and settle down. The *F-P-T*model, in which "*F*"is the "family type decision" at the top level of the tree,"*P*" is the "property type decision "at the middle level, and "*T*"is the "housing tenure decision", which is at the bottom level is established to show the property type decision's priority. The other *F-T-P* model indicates the individual to make the decision on housing tenure and then determines the property type choice sequentially. This study assumes that family type choice is determined at the top level of the three-level tree in these two models and further estimates the coefficients of the independent variables and investigates the applicability of the sequential decision under consideration.

The variables used in this study can be classified into housing attribute variables and household characteristic variables. Definition of the variables is as follows.

A. Housing attribute variables

(1). *AREA*: It indicates the total floor area of the home. The unit is square meters.(2). *ROOMS*: It indicates the number of rooms inside the house the respondent's family choose to live. The unit is number of rooms.(3). *YEARS*: It indicates

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the occupied duration since the respondent and his or her family have lived in their house. The unit is year.(4). *TENURE*: The questionnaire asks respondents what is their decision to buy (it is indicated by 1) or rent (it is indicated by 0) a home to which they afford.(5). *P-TYPE*: The respondents are asked what is the property type to which they afford, apartment(it is indicated by1) or townhouse(it is indicated by 0).

B. Household characteristic variables

(1). *POP1*: It indicates how many total family members who have a moderate-income does it have? The unit is person.(2). *POP2*: It indicates the how many total family members does it have? The unit is person.(3). *INCOME*: It indicate show much total monthly income does their family earn? It is transferred to either low-income (it is indicated by 0)or high-income (it is indicated by 1).(4). *AGE*: It indicates the age of the household head. The unit is year.(5). *SEX*: It indicates the sex of the household head. Male is indicated by0 and female is indicated by 1.(6).*EDU*: It indicates the education level of the household head. It is divided into low education level (including not educated, elementary school, middle school, and senior high school) which is indicated by 0 and the high education level (including colleague and above) which is indicated by1.(7).*CONU*: It indicates the marital status of the household head. Married is indicated by0 and un-married is indicated by1.(8).*F-TYPE*: The family type in this study is divided into either a nuclear family which is indicated by1 or a non-nuclear family which is indicated by 0.

Assuming that the individual's family type is given[1], then property type decision and house tenure decision are to be considered sequentially. Based on this assumption, this study established the *F-P-T* models (Table 1). The analytic result of table 1demonstratesthat the explanatory variable occupied duration (*YEARS*) only has a significant effect on house tenure(*TENURE*) fornuclearfamilies, but it has not significant effect for non-nuclear families. The model for a non-nuclear family to make the decision to afford the townhouse has good fitness whose ρ^2 .is equal to 0.78. The remained models' ρ^2 are all less than 0.6, indicating a lack of fitness; however, the expected hit rate of prediction for three models exceeds 80% (Table 1).

Table 1 The *F-P-T* model and estimated coefficients for the explanatory variables of the house tenure decision model (the bottom nest layer)

	Nuclear family		Non-nuclear family	
	Apartment	Townhouse	Apartment	Townhouse
Independent variables	Buy a Home	Buy a Home	Buy a Home	Buy a Home
CONSTANT	-2.4685**	-2.8804	-2.0172	-82.0867
YEARS	1.0060**	1.5452*	0.9589	27.5932
number of observations	101	85	15	54
LogL0	-59.6219	-28.7146	-8.6987	-8.5542
LogL	-34.6865	-12.2819	-6.2063	-1.9095
χ^2	49.8706	32.8652	4.9848	13.2892
ρ^2	0.4182	0.5722	0.2865	0.7767
degree of freedom	1	1	1	1
hit rate of prediction	82.18%	95.29%	80.00%	98.15%

Data sources: study collated.
Note: * indicates significance <1%, ** indicates significance <5%; this coefficient significantly differs from 0.

[1] This study is aimed at how individual makes the decision to settle down. Most young adults in Taiwan make the sequential decision between property type and housing tenure after marriage.

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Table 2 shows the explanatory variables used for housing type decision are sex (*SEX*)and education level of household head (*EDU*), housing area (*AREA*),and occupied duration (*YEASR*). Adding the inclusive value at the bottom level, analytic result shows that the estimated coefficients of the inclusive value IV_1 for the two models are -115.8756 and -0.5328. As the coefficients of the inclusive value are both out of range of 0-1, two models fail to explain individual's decision sequence.

Table 2 The *F-P-T* model and the estimated coefficients for the explanatory variables of the property type decision model (the middle level)

Independent variables	F-P-T model (the second level)	
	Nuclear family	Non-nuclear family
	Apartment	Apartment
CONSTANT	-197.3194**	453.1776**
SEX	58.2105**	176.0356**
EDU	48.5019**	36.4051**
AREA	-4.2164**	-8.7200**
YEARS	176.3849**	1.3526**
IV_1	-115.8756**	-0.5328**
number of observations	186	69
LogL0	-128.2364	-36.1275
LogL	-0.1767E-11	-0.4529E-12
χ^2	256.4727	72.2549
ρ^2	0.5119	0.6524
degree of freedom	5	5
hit rate of prediction	96.77%	94.20%

Data sources: study collated.
Note: * indicates significance <1%, ** indicates significance <5%; this coefficient significantly differs from 0.

The explanatory variables of the top level in the Table 3including significant variables of the number of household members who have a moderate income (*POP1*), total members of the family (*POP2*), marital status of household head (*CONU*) and statistically insignificant variable occupied duration (*YEARS*)are used to explain the sequential decision in this study. The result of Table 3 shows that the coefficient of inclusive value IV_2 =0.0015 and the top level model has a good fitness; furthermore the hit rates of prediction all exceed 90%.
This model assumes that when individuals make the decision to settle down, given their family type choice, their housing tenure decision is prior to property type decision. The result of Table 4 shows that individuals make the property type decision under the condition that family type decision and housing tenure decision are determined. The explanatory variables in this step are based on the previous definition of statistically significant variables including sex (*SEX*) and education level of household heads (*EDU*), housing area (*AREA*) and occupied duration (*YEARS*).

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Table 3 The *F-P-T* model and the estimated coefficients for the explanatory variables of family type decision model (the top level)

Independent variables	F-P-T model
	Nuclear family
CONSTANT	12.3606**
POP1	-3.3270**
POP2	-2.9338**
CONU	-3.1610**
YEARS	-0.4699E-01
IV_2	0.1613E-02*
number of observations	255
LogL0	-148.8800
LogL	-59.9134
χ^2	177.9330
ρ^2	0.5975
degree of freedom	5
hit rate of prediction	91.37%

Data sources: study collated.
Note: * indicates significance <1%, ** indicates significance <5%; this coefficient significantly differs from 0.

Table 4 *F-T-P* model and estimated coefficients for the explanatory variables of housing type decision model (the bottom level)

	Nuclear family		Non-nuclear family	
	Buy a Home	Rent a Home	Buy a Home	Rent a Home
Independent variables	Apartment	Apartment	Apartment	Apartment
CONSTANT	15.9717**	-91.2237**	12.4427**	132.6402*
SEX	2.7288**	-59.6478**	2.5031*	-23.4551**
EDU	2.6666**	-26.2921**	2.0257	-34.7079**
AREA	-0.3373**	3.4538**	-0.2519**	-0.8961*
YEARS	-0.2002	-25.4989**	-0.1921**	-24.5641*
number of observations	149	37	63	6
LogL0	-103.2487	-20.5272	-29.1760	-3.8191
LogL	-17.3262	-0.5335E-12	-6.5409	-0.4874E-12
χ^2	171.8450	41.0544	45.2701	7.6381
ρ^2	0.8321	0.5852	0.7758	0.6731
degree of freedom	4	4	4	4
hit rate of prediction	95.30%	97.29%	96.83%	96.47%

Data sources: study collated.
Note: * indicates significance <1%, ** indicates significance <5%; this coefficient significantly differs from 0.

Analytical results of Table 4indicate that sex of household heads (*SEX*) and housing area (*AREA*)used by all the models significantly affects the property type decision. Whereas education level (*EDU*) is only significant in the model of a non-nuclear family who buys home, and occupied duration(*YEARS*) is only significant in the model of a nuclear family who buys home. The likelihood ratio ρ^2 ofthe four models all exceed 0.7 implies that these models provide good availability to explain individuals sequential decision with *F-T-P* three level tree. The hit rates of prediction of these

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four models are all larger than 90% leads to the conclusion that they can properly forecast the *F-T-P* sequential decision for the individuals.

This study calculates the inclusive value IV_1 of the bottom level and applies it into the middle level of the three level tree. In addition to the occupied duration (*YEARS*) shown in Table 5, the inclusive value IV_1 is added as an explanatory variable. Analytical result indicates that the coefficients of IV_1 values are 0.0274 and 0.0282, both ranges between 0 and 1, suggesting that the *F-T-P* nested structure is available to represent individual's sequential decision to settle down. The likelihood ratios ρ^2 for nuclear and non-nuclear families are both close to 0.6, and hit rates of prediction are larger than 90%.

Table 5*F-T-P*model and the estimated coefficients for the explanatory variables of house tenure decision model (the middle level)

Independent variables	F-P-T model (the second level)	
	Nuclear family	Non-nuclear family
	Buy a Home	Buy a Home
CONSTANT	-2.3102**	-2.5525
YEARS	1.2737**	1.2524*
IV_1	0.2745E-01**	0.2873**
number of observations	186	69
LogL0	-92.7969	-20.3853
LogL	-38.5103	-8.1406
χ^2	108.5731	24.4567
ρ^2	0.5850	0.6006
degree of freedom	2	2
hit rate of prediction	93.01%	94.20%

Data sources: study collated.

Note: * indicates significance <1%, ** indicates significance <5%; this coefficient significantly differs from 0.

This study adopts two-step estimation approach to calculate the two inclusive values in *F-T-P* three level tree. The same explanatory variables as used in the *F-P-T* three level tree for the top level are applied to investigate the influence on the individual's sequential decision from the number of household members have a moderate income (*POP1*)and total population of household (*POP2*), marital status of household heads (*CONU*) and occupied duration (*YEARS*).Analytic results of Table 6 shows that the coefficient of the inclusive value IV_2 is 0.7020, which is distributed between 0 and 1, suggesting that the top nest level is available to represent individual's sequential decision to settle down, and the hitrate of prediction is above 90%.

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Table 6*F-T-P* model and the estimated coefficientsfor the explanatory variables of family type decision model (the top level)

Independent variables	F-T-P model
	Nuclear family
CONSTANT	15.0812*
POP1	-3.3649**
POP2	-0.9758**
CONU	-3.0258**
YEARS	-0.9477**
IV_2	0.7020**
number of observations	255
LogL0	-148.8800
LogL	-60.0668
χ^2	177.6262
ρ^2	0.5965
degree of freedom	5
hit rate of prediction	90.9803%

Data sources: study collated.
Note: * indicates significance <1%, ** indicates significance <5%; this coefficient significantly differs from 0.

V. CONCLUSION

The demonstrative result shows that the *F-T-P* model that individual makes the decision and then to decide to live in the apartment or to live in the townhouse is proofed to be appropriate.

1. Only occupied duration would affect housing tenure decision. Furthermore, the income level of the family and floor area of the home are insignificant explanatory variables for housing tenure decision. Individuals tend to make the decision to buy their home as occupied duration increases.

Individuals in HsinChuCitymake the decision to rent a home as a temporal consideration for the purpose to buy it. To buy a home is not only for the satisfaction from desire for the shelter, but also for the reduction from poverty to become rich.

2. For factors affecting choice of housing type, households headed by females with high education levels accept apartment-type housing more readily than male household heads, and households headed by females with high education levels tend to occupy much shorter duration than male household heads. This study concludes that the choice probability in the future is greater for living in apartments than those living in a townhouse.

3. Family type level of the three-level tree shows that independent variables including the total members of a family, income level of the family, marital status of the household head, the number of household members earning an income and occupied duration are statistically significant. Many of the individuals who live with non-nuclear family are native inhabitants in HsinChu City. However, the proportion of on-nuclear family tends to decline gradually for the reason that individual in this family mostly inherited the previous generation's home as growth in the previous generation dissolution as well as rise of the household formation from next generations.

4. Both the *F-P-T*model and the *F-T-P*model have very high hit rates of predictions, however the latteris more appropriate to represent the sequential settled down decision for the family to make than the other model.

Accordingly, individuals first determine their family type, then make the decision of housing tenure, and finally decide what housing type of home they would live in.

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