行政院國家科學委員會專題研究計畫成果報告

都市住宅之空屋移轉、住宅下濾及家戶遷徙現象

Urban Vacant housing Transfering, Housing Filtering, and Households Moving

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一、中英文摘要

本研究以實證資料探討住宅空屋之形成、消失及其移轉現象，並引用馬可夫矩陣運算(Markov process)推論住宅空屋鏈長度。由空屋之移轉，可以用予觀察家戶選擇住宅型態之轉變、下濾現象，以及在都市空間區位上之遷移。研究結果顯示，首次購屋之家戶其空屋移轉速度大於已購屋之家戶的換屋移轉速度。而經實證推論，家戶經由換屋，確可以提升其住宅消費之福利水準。此外，從家戶之區位遷移，顯示實證地區之家戶有遷往郊區，形成都市郊區化現象。

關鍵詞：住宅、空屋、馬可夫運算、下濾現象

Abstract

A Markov process was used to examine the housing transferring and to compute the length of housing vacancy chains. Empirical data were collected via home interview inquiring information of housing moving. We discussed the moving of vacancy chains between location regions, and discussed the vacancy transferring by housing types and by different levels of housing quality. The effects of the policies of housing subsidy provided by government were also evaluated. We concluded that the length of the vacancy chains of the first time homeowners were longer than the experienced homeowners. We also find the empirical evidence that households were benefited from housing transferring. Also, the directions of vacancy moving indicated that households were moving from central areas to outskirt areas and implying the occurring of the de-centralization in the study area.

Keywords: Housing, Vacancy, Markov chain, Housing filtering.

二、Background and Purposes

Housing filtering is one of the approaches to depict the housing transferring of households. The housing consumption utility increases when households moved into housing with higher quality. The original occupied housing became vacant and would be occupied by another household who lived in a house with lower quality. In additional to the discussions of housing consumption, during the process of transferring, the moving from the original location to another also indicates the changes of urban space structure. That also provides some observations to urban development: for instance, centralization or de-centralization.

A housing vacancy chain refers to the sequential transfer of vacant housing opportunities among housing sectors as households, by moving from one dwelling unit to another, cause vacancies to be transferred in the opposite direction (Emmi and Magnusson, 1992). The chain would be terminated when the final vacant unit is no more transferred. For example, the final vacant unit is demolished or occupied by a newly formed household. Literatures show that the change of the vacancy chains is significantly related to the household moving behavior (Hua, 1989; Hardman and

Ioannides, 1995). When household moves more frequently for any reason, the speed of housing transferring in the market increased and therefore the length of vacancy chains becomes longer, vice versa. On the opposite direction of vacancy transferring, the moving behavior also explains the phenomenon of housing filtering. Increasing in the length of vacancy chain also increases the speed of housing filtering. The social welfare could also be changed due to vacancy transferring. However, the change of social welfare depends on the factors that cause the transferring, including eco-social characteristics of household, and also including housing attributes and neighborhood environments as well. Increasing in family income increases the opportunity of moving to a higher quality housing. The upgrade in the housing quality also increases the housing filtering and benefit the living quality of social welfare. On the other hand, household who is downward moving or is forced to move because of frequently transferring in working location may have higher possibility than others to move. Though these circumstances increase the length of vacancy chains, the living welfare may not been increased.

To modeling the transferring chains of vacant housing units between sectors, a stochastic Markov Chain model can be used. It is assumed that the houses in a community can be classified into different sectors and each sector is assumed to be homogenious. In addition, the transferring probability between sectors is assumed to be 'stational', meaning unchanged in the transferring probability in long term. Emmi and Magnusson (1994) provides an Matrix of accounting framework for vacancy transfers. Elements in the matrix of vacancy transfers, V_{ij}^{t} for $i=1...n, j=1...n.$ denotes the number of vacancy transferring from sector *i* to sector *j*. V_{lj}^{c} for $l=1...l$ in the matrix of vacancy creations denotes the number of vacant housing generated in section *j*, such as new construction, household dissolution, and out-migration to outside of community, etc. On the opposite panel, V_{ik}^{a} for $k=1...k$ in the matrix of vacancy absorptions denotes the number of vacant unit disappeared in section *i*, such as demolition, household formation and in-migration from outside. The last panel is the null matrix and is denoted by V^{0}. Let

$$V_{i\bullet}=\sum_{j=1}^{n}V_{ij}^{t}+\sum_{k=1}^{k}V_{ik}^{a} \qquad (1.1)$$

and

$$V_{\bullet j}=\sum_{i=1}^{n}V_{ij}^{t}+\sum_{l=1}^{l}V_{lj}^{c}\ . \qquad (1.2)$$

$V_{i\bullet}$ and $V_{\bullet j}$ represent the sum of vacant units absolved in sector *i* and generated in sector *j*, respectively. The equilibrium on every housing sector can be expressed by

$$V_{i\bullet}=V_{\bullet j}\text{, for all } i=j. \qquad (2)$$

Equation (2) simply describes the balance of the amount of inflow and out-flow of vacant housing in each sector. That implies the total amount of vacant housing generation equals the total amount of depletion. That is $\sum_{l=1}^{l}V_{lj}^{c}=\sum_{k=1}^{k}V_{ik}^{a}$, for all $i=j$. Let q_{ij} denotes the transferring probability when vacant unit disappears from sector *i*, it can be computed by

$$q_{ij}=V_{ij}^{t}\ /V_{i\bullet}. \qquad (3)$$

All the elements of q_{ij} form the transition matrix, $Q=\{q_{ij}\}$. Given the assumption of stationarity of the transferring probability over time period, *t*, the matrix of opportunity multipliers (M) can be defined by

$$M=\sum_{t=0}^{\infty}Q_{t}\ . \qquad (4)$$

That is,

$$M=(I-Q)^{-1}. \qquad (5)$$

Elements in the matrix of opportunity multipliers, denoted as m_{ij}, can be used to predict the vacancy opportunity created in

sector *j* after the vacancy transfer chain initiated in sector *i*. The sum of opportunity multipliers over sectors with vacancy chain initiated in sector *i*, $\sum_j m_{ij}$, is used to define the length of vacancy chain from sector *i*. The longer vacancy chain illustrates the higher opportunity of vacancy transferring

三、 Findings and Discussion

The empirical data that used in this study was collected via a survey in Tainan city and adjacent areas. Data we collected includes information of moving motivations, socio-economic characteristics of household, and the housing attributes of current and also previous dwelling units. All the households sampled in our survey are currently house owners.

To identify the depletion of vacant housing, couples of assumption had been made according to the survey data. Firstly, we define the survey area, including Tainan city and adjacent areas, as the community. When household migrated from outside of the community, the vacancy chain is terminated. Also, the vacancy chain stopped when occupied by a newly formed family. Secondly, we presumed that a dwelling unit with building age over 30 years old would be deteriorated, and hence would be demolished. Moreover, when household decide to keep the previous dwelling unit vacant for any reason, e.g. for investment, the vacancy chain also stopped.

The length of vacancy chains were computed by different ways of classifying the housing sectors. We compared the vacancy chains by regions of the study area, by housing quality, and comparing the effects of policies of housing subsidies. We classified the study area into three regions according to the land use development. The 'Central Region' is located at the city center and is the earliest and most developed area in Tainan. Most of the land use in this area is for business and commerce. Buildings in this area are mixed up with new and old buildings. The 'Urban Region' is the areas next to the Central Region and mostly located on the east, west and north side of the Central Region. Land use in this area is more residence and some industrial use. The rest areas are located on the outskirt of city, and are classified as the 'Rural Region'. Land use are mostly agriculture and more rural area. When examining the matrix of opportunity multiplier in Table 2-3, it can be seen that most of the vacancy transfers occurred inside the regions, meaning people moves mostly inside the same area. The opportunity multipliers are 1.72, 1.58 and 1.21 for Central, Urban and Rural regions, respectively. When comparing the transferring multipliers off diagonal, it can be seen that the multipliers of vacancy transferring from Rural areas to Central and Urban regions (0.45 and 0.39) are higher than the vacancy transferring in the opposite direction (0.19 and 0.16). This implies households are moving outward to outskirt of city. This implies that the urban boundaries are expending and also increasing the vacancy in central areas. These evidences might indicate the occurring of de-centralization in Tainan.

Another topic of this study is to compare the housing vacancy chains by housing types. We grouped the housing into two categories: the single unit housing and multiple units housing. We find that the first-time owners have longer vacancy chains than the experienced owners. That implies the first-time owners have higher opportunity to move. The lengths of vacancy chains were 2.232 and 2.735 for the first-time owners, and were 1.881 and 1.829 for the experienced owners. This is consistent to our current knowledge that the first-time owners, who were originally renters, would have higher propensity to buy a dwelling unit comparing to the current housing owners. It can also be seen from the table that the vacancy chains transferring inside sectors were much higher than transferring between sectors. That means the opportunity of housing vacancy transferred from single unit to another single unit (or within multiple units) is larger than the opportunity to transfer cross sectors. This is true no matter the situation of housing owners to be the

first-time owners or the experienced owners. The evidence also confirms our knowledge that households are subjected to the preference of currently occupied housing type. However the opportunity multipliers of the cross sectors for multiple-unit occupants to move to the single unit housing is a little higher than the opportunity to move on the opposite direction.

To help our understanding on the housing filtering, and find out the change of the social welfare that benefited from housing transferring, we re-classified the housing sectors by housing quality. However, the housing quality is complex and is composed by a bundle of housing attributes, such as the building materials, space design, location and neighborhood environment, etc. Housing quality also varies by household depending on the propensity of housing consumption. Ratcliff (1949) Fisher and Winnick (1951) clammed that the variety of housing quality can be determined via the housing price. Rosen(1974) proposed a theoretic framework illustrating that the explicit housing price is an envelope of implicit prices of housing attributes. In terms of showing housing quality, we used the housing price as the overall indicator for classification. Three levels were grouped according to our empirical collection. The highest housing quality level is defined to be the dwelling units with housing price higher than NT$8,000,000. The moderate level were defined to include housing with price between NT$4,000,000 to NT$8,000,000, and the lowest level were lower than NT$4,000,000. Table 4 shows the results and comparing by with or without housing subsidy policies.

We find that the high quality housing had higher opportunity of vacancy transferring. The lengths of multipliers were 2.23 and 2.29. Those were higher than the other two categories. Once again, we find that the opportunity of vacancy transferring inside sectors were higher than the opportunity of transferring between sectors. Furthermore, the opportunity of inside transferring in low quality housing was the highest. The multiplier is 1.71 for household received housing subsidies and is 1.73 for household without subsidies. The opportunity of inside transferring decreases when housing quality increases. This implies that households who originally living in high quality level housing were more ‘stable’ than households in moderate and low quality levels, and hence have less propensity of moving. On the other hand, households in low quality level were more likely to move. Reasons are partly because of the lower price of low quality housing and/or partly because of the propensity of transferring to better quality housing. This can be verified from comparing the opportunity multiplies in the off-diagonal in the matrix. For example the opportunity multipliers of transferring from lower levels to higher levels were 0.57, 0.53 and 0.65. All the values are larger than the multipliers on the opposite transferring directions, which were 0.05, 0.06 and 0.39, respectively.

To help households to own the housing and also to help the builders to sell the newly constructed dwelling, Several housing policies with total subsidy of NT$150 billions were provided to the housing market. The first policy was to help households with lower family income to buy their first dwelling unit. The amount of mortgage was 2.2 millions with mortgage interest rate at 5.075% for 30 yeas. The second policy was to help the family with head having occupation of blue-collar to buy the housing. The amount of mortgage was 1.6 millions with the same interest rate and years as the first policy. However, our empirical results appear no significant difference to the change of the length of vacancy chains. That demonstrates that only limited household were actually benefited from the subsidy policies, since more than 80% of households were owners (Chen, 2001). Hence, the proposed housing subsidy policies did not have significant help to push the housing transferring.

四、References

1. Forrest,R.and A. Murie,1994, "The dynamics of the owner-occupied housing market in Southern England in the late 1980s:a study of new

building and vacancy chains", *Regional Studies*.28(3):275-289.

2. Galster, G.,1996, "William Grigsby and the analysis of housing sub-markets and filtering", *Urban Studies*.33(10):1797-1805.
3. Hua, C.I.,1989," "Linking a housing vacancy chain model and a behavioral choice model for improved housing policy evaluation", *Annals of Regional Science*.23:203-211.
4. Marullo,S.1985, "Housing opportunities and vacancy chains", *Urban Affairs Quarterly*.20:364-388.
5. Emmi, P.C., 1990, "Testing the assumptions underlying residential vacancy chain models- a comment", *Scandinavian Housing and Planning Research*.7:55-56.
6. Emmi, P.C. and L. Magnusson, 1992, "Issues in the use design of residential vacancy chain models", *The National Swedish Institute for Building Research*.
7. White H. C., 1971, "Multipliers, vacancy chains and filtering in housing", *Journal of the American Institute of Planners*.37:88-94.
8. Watson,C. J., 1974, "Vacancy chains, filtering, and the public sector", *Journal of the American Institute of Planners*,Chicago.40(5):346-352.
9. Wheaton,W.C.,1990, "Vacancy, search, and prices in a housing market matching model", *Journal of Political Economy*.98:1270-1291.