KEIO UNIVERSITY
MARKET QUALITY RESEARCH PROJECT
(A 21st Century Center of Excellence Project)

KUMQRP DISCUSSION PAPER SERIES

DP2006-016

Barriers to Residential Mobility in Japan : Housing Equity and the Rental Act

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Abstract

The low residential mobility rate in Japan stems from several barriers to residential mobility. The present paper uses two waves of Japan household longitudinal data (Keio Household Panel Survey, KHPS) and estimates Cox's proportional hazard model to investigate the impact of the housing equity constraint and the Japan Rental Act on residential moves. Strong evidence for a negative impact on mobility resulting from both barriers is found. We also find that the implementation of an income tax deduction system for the carrying over of capital losses has increased residential mobility from owned houses.

JEL classification: R21, C41, G21, K21, H31
Keywords: Residential mobility, housing equity constraint, Japan Rental Act, hazard analysis, Japan

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Barriers to Residential Mobility in Japan:

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Japanese version: December 11, 2005
English version: March 14, 2006
First revision: April 20, 2006
Second revision: May 5, 2006
Third revision: June 5, 2006
Fourth revision: July 8, 2006
Fifth revision: August 31,2006
Sixth revision: August 31,2006

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* Previous versions of this paper were presented at the Public Economics Workshop of Keio University, the 2006 Japanese Economic Association Spring Meeting, the 2006 AsRES/AREUEA International conference in Vancouver and the International Conference on Real Estates and the Macroeconomy which was held in Beijing on July 24-25, 2006. The authors are grateful to the participants of those meetings for their valuable comments, especially those of Shinichiro Iwata, Siqi Zheng, Jacob Gyntelberg and John Quigley.

1. Introduction

Japan is a low residential mobility society. Between 1998 and 2003, the average annual residential mobility rate is 5.1 percent of all Japanese households[1]. The degree of residential mobility varies across countries[2]. Relatively high residential mobility rates are common among the U.S. and Canadian families; the residential mobility rate between 1995 and 2000 in the U.S. is 50.39 percent[3] while that between 1996 and 2001 in Canada is 41.9 percent[4]. In contrast, the Japanese mobility rate between 1998 and 2003 is 24.1 percent, which is less than half of that in the U.S. Recently, the Japanese rate even declined.

Well functioning housing markets in market economies allocate housing to households when they enter the market and determine housing equity, a very important component of household wealth. Residential mobility is an equilibrating factor to this allocating function of well-functioning housing markets. When institutional constraints or other barriers impede residential mobility, this allocating role of housing markets is disrupted. Countries with low rates of residential mobility should exhibit high price volatility and because of high transaction costs most households should not be expected to react at all to price changes immediately. In addition, low rates of residential mobility

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[1] This figure is based on the *2003 Housing and Land Survey of Japan*. The annual residential mobility rate between 1988-1973 was 8.1%, that between 1973-1978 was 7.5%, that between 1978-1982 was 6.8%, that between1982-1988 was 6.2%, that between 1988-1993 was 6.1% and that between 1993-1998 was 5.8%.

[2] Long(1991) analyzed residential mobility differences among developed countries. Strassmann(1991) analyzed housing market interventions and mobility by an international comparison. Angel(2000), Table A.25 (p.372) shows annual residential mobility rates as of 1990 among 53 major cities of 53 countries. Harsman and Quigley(1991), Table 1-5 shows annual residential mobility rates among European countries and the U.S.

[3] U.S. census 2000 analyzed by the Social Science Data Analysis Network http://www.censusscope.org/us/s48/chart_migration.html

can adversely affect economic growth as well (see, Englund and Ioannides(1993) and Hardman and Ioannides(1999)).

It is thought that the low residential mobility rate in Japan stems from several barriers to residential mobility[5]. In this paper, we investigate the impact of two barriers to residential mobility –the housing equity constraint and the Japan Rental Act. Over the last decade, Japan has seen a rise and fall in land and housing values that rivals that of any period in modern history. Many Japanese homeowners entered the late 1990s with low or negative housing equity, as a result of large nominal land and house price declines. We examine the extent to which low or negative housing equity impedes Japanese homeowners' mobility. We also analyze whether the implementation of an income tax deduction system regarding the carrying over of capital losses in Japan raises the residential mobility rates from owned houses or not. This system was devised to cope with housing equity constraints during periods of asset deflation, one of the legacies of Japan's burst asset bubble in the 1990s.

It has also been recognized that policy interventions in the rental housing markets in the form of the Japan Rental Act have substantial effects on rental households' moving behavior in Japan. Under the Japan Rental Act[6], the contract-renewal rent for an incumbent tenant may not exceed the market rent of comparable newly rented units. Though initial rents are determined freely in the rental-housing market, rent increases afterwards must go through the courts if the tenant does not accept the rent increases. Contract-renewal rents approved by the courts were in general lower than comparable market rents at the time when market rents increased markedly. The aim of this rent

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[4] Statistics Canada releases 2001 census mobility data.

[5] Examples of barriers to residential moves in Japan are high transaction taxes and realtors fee in

control is to protect tenants from eviction by economic pressure (See Iwata 2002, p. 126.). We examine the extent to which this contract-renewal rent control system impedes Japanese renters' mobility.

This is the first rigorous econometric study to analyze barriers to residential mobility focusing both on owner-occupied and rental housing markets in Japan based on household longitudinal data. It is essential to understand the impact of barriers on residential moves to formulate effective housing policy so that the Japanese housing markets function effectively. The unique aspects of Japanese owned and rented housing markets mentioned above together with the availability of the first Japanese household longitudinal data suitable to analyze Japanese housing markets have enabled us to analyze barriers to residential mobility unique to Japan. Our micro-data is based on the "Keio Household Panel Survey, KHPS" covering all Japan. In this research, the Cox's proportional hazard model is used to investigate the impact of barriers on residential moves.

The organization of the remainder of this paper is as follows: in Section 2, we briefly review the related research; in Section 3, we discuss the econometric model, the data and the variables; in Section 4, we present the estimation results about the impact of the housing equity constraint on residential moves based on the homeowner sample and in Section 5, we present the estimation results about the impact of the Rental Act on residential moves based on the renter sample, and; Section 6 offers some concluding remarks.

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addition to the equity constraint of home owners and Japan Rental Act.

2. Literature review

Residential moves are theoretically characterized as housing decisions reflecting the outcomes of lifetime inter-temporal dynamic utility-maximizing processes. Hardman and Ioannides (1995) theoretically analyzed the impact of moving costs and the interest rate on the optimal number of moves using an overlapping-generations model of the housing market. Hardman and Ioannides (1999) theoretically analyzed the steady-state properties of the free housing market and the restricted housing market under rent control using a two-sector general equilibrium overlapping-generations model in continuous time.

As for empirical studies of residential moves, Pickles and Davies (1991) developed a statistical modeling framework that treats housing careers as trajectories from a dynamic optimization process, by synthesizing concepts from a range of theoretical and empirical traditions. Davies and Pickles (1991) analyzed data on housing careers in Cardiff in the UK within the statistical modeling framework in Pickles and Davies (1991).

Henderson and Ioannides (1989) estimated a model of the joint tenure, length- of-stay and consumption-level choices of families in the housing market using the Panel Study of Income Dynamics (PSID) in the United States. Ioannides and Kan (1996) empirically analyzed the simultaneous decisions of residential mobility and housing tenure choice employing dynamic discrete choice models which condition households' decisions on their circumstances at every point in time during the length of the observation while accounting for individual heterogeneity based on PSID data. These empirical studies emphasize the simultaneity of residential mobility and housing tenure choice based on the inter-temporal dynamic theoretical framework.

[6] Iwata (2002) calls it the Japanese Tenant Protection Law(JTPL).

Several other empirical studies focused on either owned housing markets or rented housing markets and analyzed barriers to residential moves, ignoring tenure choice decisions. Chan (2001), Henley (1998), and Lee and Ong (2005) empirically analyzed the impact of equity constraints on residential moves based on owner-occupied samples. Stein (1995) theoretically analyzed the relationship between prices and trading volume in the housing market focusing on a minimum down payment requirement for the purchase of a new home. Henley (1998) investigated the impact of negative housing equity on residential moves using a single and competing risk discrete time duration model of residence duration based on a UK owner-occupied sample. He also assessed whether labor market flexibility is impaired by a stagnant housing market. Munch and Svarer (2002) investigated how rent control affects residential mobility in the Danish housing market applying a duration model based on renter samples. Gyourko and Linneman(1989) measured a household's annual benefit from rent control.

Although there are several empirical studies about barriers to residential moves based on Western data, for example, the U.S. and UK, very few studies exist based on non-western country data. The only exception may be Lee and Ong (2005), though they only focus on an owner-occupied sample in Singapore. Ours is the first non-western empirical study of barriers to residential mobility focusing both on owner-occupied and rental housing markets reflecting Japan's distinctive characteristics.

3. Cox's proportional hazard model, Data and Variables

3.1 Cox's proportional hazard model

It is assumed that each household decides its length of stay and the timing of moves based on the life-time utility-maximizing process.

In this paper, we apply Cox's proportional hazard model[7] in order to analyze the determinants of the timing of moves of owned houses and rented houses separately from the time that the household entered the current residence until 2005.

The hazard rate, $h(t)$, the probability that the residence spell ends at t given that they last at least until t, is denoted by:

$$h(t) = h_0(t)\exp(\beta_1 x_1 + \cdots + \beta_k x_k) \tag{1}$$

where $h_0(t)$ is the baseline hazard, which is determined solely by the length of stay. The effects of explanatory variables on hazard rate, which may vary over time and are represented by covariates, $x_1, \cdots, x_k$, are determined from the estimates of the parameters, β_i $(i = 1, \cdots, k)$. If β_i is positive, it means the corresponding x_i will increase the hazard rate and vice versa. The hazard rate is dependent upon house types at the beginning of the length of stay, individual and market or environmental factors.

3.2 Data and hypothesis

3.2.1 Explanation of the length of stay data

As residential moves and the resulting length of residence decisions are outcomes of dynamic optimal consumer decisions, we need information at every point of time when residential moves occurred. In this paper, we adopt the following research strategy to construct variables in order to fully make use of the retrospective nature of the Keio Household Panel Survey, KHPS, for analysis of dynamic household behavior. The

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[7] Moridaira and Sumita (2001) used the Cox's proportional hazard model to analyze the rating transition

KHPS started to collect data from 2004. The first wave of the KHPS was conducted in January, 2004 and the second wave of the KHPS was conducted in January, 2005. As the KHPS has not only current information, but also past information of the household, by using past information, we constructed a retrospective panel data as follows.

Explanations of the observation period, length of residence spell and residential moves are summarized in Figure 1. The observation period is from January, 1980 to January, 2005. We interrupt the panel in January, 2004 and look back at the point in time when the residential move decisions were made, meaning at the beginning of the current residence spell. Then we look forward until the end of the panel data. We define households that moved between January, 2004 and January, 2005 as complete residential spell samples. The residential spells not completed by the end of the period covered by the panel are treated as incomplete. This research strategy is a usual one for retrospective panel data. That is to say, we can capture the propensity to move at every point of time even if we only have two waves. For example, if some households move out of the previous residence in 2002, this aspect is captured in our data as the entering year of the current residence spell of this household. This household is assigned to the complete residence spell sample if it moves during year 2004, but joins the incomplete residence spell sample if it does not move in 2004. Moreover, though we define complete residence spell samples as households that moved between January, 2004 and January, 2005, there are no problems to adopt the hazard model in order to analyze the residential moves. The reason is that we can capture the characteristics of the highly (low) mobile households that may have short (long) length of stay at one residence as our definition of complete and incomplete residence spells without loss of generality.

matrix. Kiefer (1988) presents a useful survey of economic duration data and hazard functions.

< Figure 1 around here >

We divided the whole sample between households in the rented sector and in owner occupation because characteristics of barriers to residential moves are quite different between the two sectors. The final samples we used are presented in Table 1 after excluding samples with missing observations. The total number of owner occupiers in 2003 was 425, of which 13 households (3.1%) moved during 2004. Of these 13 households, 10 moved to owned housing and 3 households moved to rented housing. The total number of renters in 2003 was 152, of which 43 households (28.3%) moved during 2004. Of these 43 households, 24 moved to owned housing and 19 moved to rented housing.

The average length of residence spell (*spell*) of moved households from owned housing is 11.9 years (Table 3) and that from rented housing is 6.9 years (Table 4). The average age of household head from owned houses that moved is 52.8 years old (Table 3) and that from rented houses is 40.6 years old (Table 4).

< Table 1 around here >

Theoretically, residential moves are determined by life-cycle factors over the whole life of households. In addition, there exist several institutional barriers to residential moves. Residential moves are determined by socioeconomic factors at the time of move and their past histories and their future expectations, financial asset position, changing liquidity constraints, price of each tenure, rate of change of housing prices of each tenure, and institutional barriers. In the following section, we examine determinants that influence residential moves in Japan such as household attributes, housing attributes, labor market conditions, borrowing situation (only for the case of moves from owned houses), the tax system (establishment of a tax system regarding the carry over of capital losses, only for the case of moves from owned houses), the Japan Rental Act (only for the case of moves from rented houses) and regional characteristics.

3.2.2 Determinants of residential moves in Japan

Variables we used as determinants of residential moves in Japan are presented in Table 2.

As for household attributes, we use the income and financial asset information at the beginning of the current residence (information about the previous residence for complete spell samples) as income related variables. These variables are observed only at the time of move to the current residence. This is converted to real terms by using the deflator such that the average of the whole country in 2000 becomes unity. Those variables are time-invariant covariates because of the limitation of data, as we only have this information at the beginning of the residence spell. These variables should be used as time-varying variables if such data is available. In that case, the higher the income becomes and the larger the financial asset becomes, it is expected that the resulting residential mobility rate becomes higher.

. As for other household attributes, we use the age of the head of the household. We also use the square of the household head's age to capture the nonlinear effects to the hazard rate. We also use the number of household members in each year from the beginning of the residence spell.

We also use the cross terms of those variables. That is to say, the interactive term of the age of the head and housing age, the interactive term of the age of the head and the income at the beginning, the interactive term of the age of the head and the financial asset at the beginning, the interactive term of the age of the head and the number of household members.

As for housing attributes, we use the prices of owned housing and rented housing. These prices are constructed from prefectural data from 1980 to 2004. Housing service price per unit of owner-occupied housing is constructed as follows:

$$nominal\ housing\ service\ price\ per\ unit\ of\ owner\ occupied\ housing$$
$$= (i + \tau - \pi)P$$

where i is the mortgage rate, τ is the effective property tax rate, π is the expected rate of housing price inflation, and P is the asset price of owner-occupied housing.

For the mortgage rate we use the average interest rates on loans and discounts of domestic banks from the *Finance and Economic Statistics Monthly* of the Bank of Japan. Mortgage interest rates are a national series. The owner-occupied housing asset price is taken from the *Annual Report on the Borrowers Survey of House for Installment Sale* issued by the Government Housing Loan Corporation (GHLC). The housing asset price data reflects the prefectural average purchase price for ready-built houses purchased by those who borrow funds from the GHLC. The effective property tax rate is calculated based on Seko (2003). Although the standard property tax rate is 0.014, the effective property tax rate is much lower than 0.014, as the property tax assessment value is lower than the market value. As the *Summary Report on Prices, etc. of Fixed Assets (Land)* of the Ministry of Public Management, Home Affairs, Posts and Telecommunications reports the unit property tax assessment price per square meter of both land and structure for each prefecture in every year, we obtain the unit property tax assessment price per square meter of house by summing them up. We obtain the unit market price of the house per square meter of floor space from the GHLC data. Finally, we obtain the effective housing property tax rate by multiplying the ratio of the unit property tax assessment price to the unit market price of the house by the standard tax rate of 0.014. The effective housing property tax rate thus varies by prefecture and year. As for the expected rate of real housing price inflation, it is calculated as $(P_t - P_{t-1})/P_{t-1}$ where P_t is the price in year *t*. Finally this nominal housing service price per unit of owner-occupied housing is converted to real terms by using the CPI such that the average value throughout Japan in 2000 is unity.

We also use each component of the above owner-occupied housing service price separately. That is to say, we use the asset price of owner-occupied housing and the expected rate of house price inflation as two separate terms instead of using the housing service price per unit of owner-occupied housing. As for the expected rate of housing price inflation, we use two specifications. One is the static expectation, that is to say, the expected rate of housing price inflation in the next year is assumed to be equal to that in this year. This expectation hypothesis is taken for its simplicity. The other is the backward looking expectation, meaning that the household is assumed to use the price appreciation from the previous few years as a basis for forecasting future housing price movements. We use as the backward looking expectation the following distributed lag formula based on Fisher's short-cut method[8] in which effects of past appreciation declined linearly as the backward looking expectation.

$$\sum_{i=0}^{m} \frac{m+1-i}{(m+1)(m+2)/2} x_{t-i} \tag{2}$$

where x_t is the rate of housing price change in year *t*. We set *m* to be 3, because we need to keep a sufficient number of observations.

As for rents for rented housing, except in section 5.3.2 we used the price index for rental housing in the CPI excluding imputed rent in each prefectural capital. This is converted to real terms by using the CPI such that the average value of the entire country in 2000 is unity. We use the expected rate of rent inflation. We use the same two specifications as housing price cases – the static expectation and the backward looking expectation. The length of the distributed lag *m* is 3.

We also use the number of rooms as housing attributes.

Residential moves are also expected to correlate with labor market conditions. We use regular employment, self-employed and family employee dummy variables as dummy variables to capture the history of the household head.

In the case of residential moves from owned housing, we find that owner-occupied households were unable to sell and down-trade or move to rental houses, because they were locked into their owned houses even if they were unsatisfied. When Japan shifted from the asset price bubble period to sharply declining prices in the early 1990's, many households were trapped by their mortgages and low or negative net equity. We constructed the following variables to analyze the impact of the housing equity constraint on residential moves. We constructed the Loan to Value Ratio variable (*LTV*), that is to say, the ratio of loans outstanding to purchase price because households residing in owned housing may borrow their housing purchase funds.

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[8] See Dhrymes(1971) for details.

$$LTV = \frac{mortgage\ loan\ outstanding}{housing\ \ price}$$

The denominator, *housing price,* is calculated based on the purchase price at the beginning of the residence spell. When households purchase both land and structure, the *housing price* is the total sum. The housing price appreciation rate is calculated assuming that it is equal to the average detached house price appreciation rate in each prefecture where each household resides. Finally, housing price in each subsequent year after the beginning of the residence spell is calculated by adjusting the purchase price at the beginning of the residence spell with the housing price appreciation (or depreciation) rate in each subsequent year. *Mortgage loan outstanding* is calculated assuming the repayment amount in each year is equal to the repayment in January, 2005, based on the information about the loan outstanding and repayment amount as of the second wave of the KHPS (January, 2005), because in Japan equal monthly payments including interest is the major repayment method. In addition, the average repayment period on Japanese housing loans is fairly long (about 20 to 25 years), so that almost all households entering their residence with loans after 1980 still have loans as of 2005. That is to say, *mortgage loan outstanding* in each year after entering the current residence= loan outstanding as of January, 2005 + repayment amount as of January, 2005 $\times$ length of the residence spell in each year. We set *LTV* at zero for households that did not borrow funds.

We also constructed three *LTV dummies*. *LTVD0* is zero for households with no loan and unity for households with loans. *LTVD1* is zero for households with no loan or positive housing equity with loans of less than the *housing price* and unity for households with negative housing equity, that is *LTV* > 1. *LTVD2* is zero for households with no loan, unity for households with positive housing equity with loans, and two for households with negative equity. *LTV* and *LTV dummies* are theoretically expected to have a negative effect on residential moves.

We have constructed the dummy variable to represent the “establishment of an income tax deduction system regarding the carrying over of capital losses for specific houses in January 1, 2004” in the case of residential moves from owned housing. This tax deduction dummy variable is 1 if this system is applicable to the household and is zero otherwise. The details of this tax deduction rule are as follows: When the household sells its housing after owning housing more than five years, if its loan outstanding is greater than the selling price (we denote its difference as A) , or if the purchase price of new owned housing is greater than the selling price of the previous owned housing(we denote its difference as B), the smaller amount of either A or B will be deducted from the income for three years, beginning in the tax year following the purchase. To be eligible the annual income of the household in the selling year must be less than 30,000 thousand yen to apply for this tax deduction. This tax deduction rule is applicable, even if the household moves to rented housing if all other conditions are met. It is theoretically expected that this tax deduction dummy has a positive effect on residential moves.

The reasons why this tax deduction system was implemented are as follows. Since 1986, Japan has experienced a sharp rise and fall in land and housing values that rivals that of any period in modern history. Many Japanese homeowners entered the late 1990s with low or negative housing equity, as a result of large nominal land and house price declines. In Japan, housing finance is based on non-recourse loans. That is to say, in asset deflation periods, borrowers have to take all risks stemming from the decline in collateral values in the form of real estate and they cannot move to a different residence without fully repaying the borrowed amount (=principal plus interests). This income tax deduction system was established in 2004 to address the problems of those borrowers and enable them to move to another residence including rented houses.

In Japan, there exist several other housing related tax subsidies as follows:

As for Income tax, the marginal tax rates as of 2006 are 10-37%. Imputed income on owner-occupied housing is not taxed. As for capital gains, nominal gains are taxed on a realization basis. A taxpayer's own residence is exempted from capital gains tax if certain conditions are met. Tax rates differ depending on length of ownership: 15% of taxable capital gains income for more than 5 years ownership and 30% for less than 5 years ownership. Property taxes are not deductible. Interest payments on housing loans are deductible although the total amounts are not large. Interest income on housing-related saving is tax-exempt up to a certain limit. Partial tax credit for recent home-buyers also exists.

As for property taxes, the tax rate is 1.4% (ceiling rate is 2.1%) of assessed market value. Assessed market value has been far lower than actual market value in general until the bubble burst in the 1990s.

In 2003, the ratio of the total amount of housing related subsidies to government annual expenditure in Japan was only 0.8 percent. In contrast, this ratio in the U.S. was 5.9 percent. When we compare the ratio of the sum of housing related national budget and housing related subsidies to government annual expenditure in both countries, it was only 2.1 percent in Japan, in contrast it was 7.5 percent in the U.S.

In the case of residential moves from rented housing to rented housing, we find the contract-renewal implicit rent control system stemming from the Japan Rental Act impedes Japanese renters' mobility. We constructed the following variable (*dirc*) to analyze the impact of the implicit subsidy given by the Japan Rental Act on residential moves. We constructed *dirc* as the ratio of the implicit subsidy given by the Japan Rental Act to the contract-renewal rent. That is to say,

$$dirc = \frac{the\ implicit\ subsidy\ by\ Japan\ Rental\ Act}{the\ contract - renewal\ rent}$$

The denominator, the contract-renewal rent, was estimated based on the 2004 and 2005 KHPS rent information, because we do not have information about the contract-renewal rent before 2004. The numerator, the implicit subsidy by Japan Rental Act is the difference between the market rent predicted for that household's contract-renewed housing unit and the actual contract-renewal rent paid on that unit. These rents are supposed to have the same values for two years because in general the rental contract period in Japan is two years. Regarding whether the implicit subsidy by Japan Rental Act impedes residential mobility or not, we set the implicit subsidy to zero if the estimated difference becomes negative. Although the *dirc*, the Japan Rental Act's implicit subsidy rate, is at a first glance similar to the rent control measure adopted in the rent control researches conducted by Munch and Svarer (2002) and Gyourko and Linneman(1989), ours is quite different, because we have to define and identify the implicit contract-renewal rent. That is to say, the Japan Rental Act's rent control effect is implicit and not explicitly identified as the direct rent control system adopted in western countries. We define the contract-renewal rent in a specified year as the rents paid by households that entered the current residence before the specified year. See Appendix for details of the data construction of *dirc*. It is theoretically expected that this Japan Rental Act's implicit subsidy measure has a negative effect on residential moves.

We have constructed the regional dummy by dividing Japan into 8 regions to capture regional differences.

< Table 2 around here >

3.2.3 Descriptive statistics as of 2004 classified by movers versus nonmovers

In this section, we discuss the major characteristics of descriptive statistics of time variant variables. Table 3 shows the descriptive statistics of owned housing in 2004 classified by movers versus nonmovers. For the household characteristic variables, average age of the household head (*age*) of mover sample (52.8 years old) is higher than that of nonmover sample (47.4 years old). The size of the household (*fsize*) is similar for both samples.

As for the *LTV*, since the movers have a smaller *LTV* (27.8%) than nonmovers (36.7%), we can see that households with smaller loans relative to their house price tend to move. This tendency is similar to findings in U.S. studies (see, Chan, 2001). The ratio of households eligible for the income tax deduction regarding the carrying over of capital losses among movers is 30.8%, while that for nonmovers is 51.2%. When we delete the residence requirement of residing in owned housing for more than five years before selling, this ratio increases to 46.1% for movers and 63.8% for nonmovers. The same ratios among households having loans are 66.7 % for movers and 79.9% for nonmovers. The reason why the ratio of eligible households is higher for nonmovers may be that nonmovers face various other barriers to residential moves even if they are eligible for the income tax deduction system. Finally, for the household head's employment condition, the ratio of regular employed households is 92.3% for movers, and 86.7% for nonmovers.

These results suggest that households in which the household head enjoys regular full-time employment tend to move more often.

< Table 3 around here >

Table 4 summarizes the descriptive statistics of rented housing in 2004 classified by movers and nonmovers. In this table movers sample are further classified into two categories, that is, movers to owned housing and to rented housing.

For the household characteristic variables, age of the household head (*age*) has a similar value in both samples. Regarding the size of the household (*fsize*), in contrast to households living in owned house, the average size of the mover household (4.8 persons) is higher than that of the nonmover sample (4.4 persons).

Regarding housing characteristic variables, nonmovers live in smaller houses (3.7 rooms). Movers live in larger houses (movers: 4.5 rooms, movers to owned house: 4.6, movers to rented house: 4.3 rooms)

Households with more family members tend to move, especially among household that moved to owned house. They tend to move to larger houses than their current residence.

< Table 4 around here>

We further subdivide the households that moved from rented housing into the households that moved from rented house to rented house. Table 5 shows the descriptive statistics of the sample in 2004. In this table, we classified the households by implicit subsidy rate due to the Japan Rental Act, *dirc*, defined above. We defined the households who have positive *dirc* as the rent controlled households, and the households with zero *dirc* as the uncontrolled rent household. The proportion of Japanese rent controlled households among all households in Table 5, i.e. 43.9 percent, is higher than that in New York City (Gyourko and Linneman, 1989, Table 1), i.e. 35.1 percent, Among rent controlled households, the average ratio of subsidy (*dirc*) caused by rent control for nonmover households (8.4%) is bigger than that for mover households (4.1%). This means that rent controlled nonmover households enjoy an implicit subsidy due to the Japan Rental Act.

< Table 5 around here>

4. Barriers to residential moves from owned houses: Housing equity constraint

4.1 Estimation results of the hazard function for residential moves from owned housing

Estimation results of the hazard function for residential moves from owned housing is presented in Table 6. Four estimation results I, II, III, IV are presented. Three models a, b, c were tried for each of the four estimations. In result a, we used the *LTV*. In result b, we used the *LTVD0 and LTVD1*. For result c, we used the *LTVD2*.

In Models I, II, and III, we include the time invariant income and financial asset variables at the beginning of the residence spell. Although the coefficients of these variables were expected to be positive and significant if these variables truly capture the correct measures, the estimation results run counter to our expected results. In all models, coefficients of income are negative and insignificant, and those of the financial asset negative and significant in model I. The reason why the coefficients of these variables become negative and significant or insignificant may be stemming from the large measurement error contained in these variables. That is to say, respondents may answer incorrectly, citing the remaining amount of financial assets after paying out the house purchase loans[9]. Moreover, income at the beginning of the residence spell was also not correctly answered because of memory lapses. For these reasons, income and financial asset variables are excluded in model IV.

In Model (I,a,b,c), we used housing service price per unit of owner-occupied housing as the owner-occupied price variable *opi*. This variable was insignificant in all cases. In other models, we used real owner-occupied asset price and its appreciation rate. However, coefficients of the owner–occupied housing price variable (*hp*) are not significant at all.

On the other hand, rent related variables are significant in several models. In almost all models the coefficients of the real rent index (*rent*) are positive and significant. Especially, when both rent and real rent distributed lag (*rentgsc3*) are included, both coefficients tend to become significant simultaneously, except for model IVa.

As for the variables related to LTV, in all models the coefficients of *LTVD0* are negative and significant, though *LTVD1* are not. We used both *LTVD0* and *LTVD1* together in the same model in order to check the nonlinear effects of equity constraints. It is clear from these results that when positive LTV exists, the hazard rate for residential moves decreases regardless of positive or negative housing equity. In all models, except for model IIc, the coefficients of *LTVD2* are also negative and significant at the 5% significance level. These results also reflect the housing equity constraint, that is to say, credit constraints impede residential moves in Japan.

Regarding household characteristic variables, the coefficient of the age of the household head (*age*) is negative and the coefficient of the square of the age (*age2*) of the household head is positive. This means that the hazard rate increases as the age of

[9] This point was suggested by Michio Naoi.

the household head increases. The coefficient of the regular employment dummy is positive and significant. Thus, regularly employed households move more frequently.

As for the tax deduction dummy variable (*year2004*), the different models yield different results. In Models (IIb,c), (IIIa,b,c), and (IVb,c), the coefficients of the tax deduction dummy are positive and significant at the 10% significance level. When we delete the residence requirement of residing in owned housing for more than five years before selling them and construct a new tax deduction dummy variable, the coefficients of this new deduction dummy become positive and significant in almost all models. This means that the residence requirement of more then 5 years severely reduces the number of eligible households.

In summary, the coefficients of the *LTVD0 and LTVD2* show significant and negative signs in almost all models. It means that as the *LTV* becomes larger, the hazard rate becomes smaller. As for price variables, rent has a larger effect than owned housing price on the hazard rate. As the age of the household head increases and the ratio of regular employment increases, the hazard rate becomes larger.

< Table 6 around here >

< Table 6 (continued) around here >

4.2 Analysis of settle down probability by Kaplan-Meier method: Effect of the establishment of the tax deduction system regarding the carrying over of capital losses for specific houses

We examined the effect of the establishment of the tax deduction system about the carrying over of capital losses for specific houses on residential moves by calculating the settle down probability by the Kaplan-Meier method without using explanatory variables.

Figure 2 presents the settle down probability classified by tax deduction dummy variable (*year2004*). We reject the null hypotheses of no distinction between two groups at the 1% significance level, because the Log rank test statistic is 8.44. It is clear from the graph that the settle down probability declines after seven years have passed. This means that this tax deduction system promotes residential moves.

< Figure 2 around here >

5. Barriers to residential moves from rented housing: Japan Rental Act

5.1 Estimation results of the hazard function for residential moves from rented housing

Estimation results of the hazard function for residential moves from rented housing are presented in Table 7. In Model (I), we use the housing asset price of owned housing (*hp*) and the rent index (*rent*). For the expected rate of inflation, growth rates of housing asset price and rent index are used. In Model (II), we use the distributed lag formula as the expected rate of price and rent change. In Model (III) and (IV), income and financial asset variables are deleted. Price variables of model (I) are used for model (III), and those of model (II) are used for model (IV).

Although the coefficients of the price variables were not significant, the coefficients of the real rent index were positive and significant in almost all models and those of the expected rate of the real rent appreciation were negative and significant in almost all models. This means that the hazard rate will increase when the rent level is high, but will decline when a future real rent increase is anticipated. It may be because under the current Japan Rental Act, tenants prefer residing in the same dwelling so that they can continue to enjoy below market-level rents. The contract-renewal rent control system thus seems to impede Japanese renters' mobility.

The coefficients of the regular employment dummy *regy* show the similar results as the residential moves from owned housing. As the ratio of regular employment increases, the hazard rate from rented housing increases. The coefficient of the age of the head ($age, age2$) is not significant which is different from the case of owned housing.

The coefficient of the interactive term of the age of the head and the building age (age_hagey) is negative and significant. It means that as the household head becomes older and the dwelling becomes older, the residential mobility rate declines. This finding is consistent with our observation that the second hand housing market in Japan is not active. We should improve this situation through housing policies such as favorable tax and/or housing finance systems.

< Table 7 around here >

5.2 Estimation results of the hazard function for residential moves from rented housing to owned housing

Table 8 presents the estimation results of the hazard function for residential moves from rented housing to owned housing. Models (I, II) include the income and financial assets at the beginning of the residence spell, but models (III, IV) do not include those variables. Similar reasons as in section 4.1 may apply for the negative and significant coefficients of financial assets and/or income at the beginning of the residence spell. For almost all estimated results, the coefficients of rent-related variables $(rent, regtgr, rentgsc3)$ are not significant, which is different from the results in Table 7. As for households that move from rented housing to owned housing, the major determinant of residential moves regarding housing characteristics seems to be the total floor space of the housing. This effect is captured by the number of rooms. Our findings indicate that as the total number of rooms increases, the mobility to owned housing increases. In this case, the contract-renewal rent control law does not seem to impede Japanese renters' mobility.

The coefficient of the interactive term of the age of the head and the building age (age_hagey) is negative and significant in this case too. As the ratio of self-employment (*selfy*) increases and as the number of household members (*fsize*) increases, the mobility rate in this case decreases.

< Table 8 around here >

5.3 Estimation results of the hazard function for residential moves from rented housing to rented housing

5.3.1. Estimation results of the hazard function for residential moves from rented housing to rented housing based on aggregate rent index

Table 9 presents estimation results of the hazard function for residential moves from rented housing to rented housing using aggregate rent index which is prefecture-specific and year-specific. Models (I, II) include the income and financial assets at the beginning of the residence spell, but models (III, IV) do not include those variables.

The coefficients of rent related variables ($rent, regtgr, rentgsc3$) are significant, which is quite different from the results in Table 8. The contract-renewal rent control system seems to impede Japanese renters' mobility in this case.

When we compare the results of Table 9 with those of Table 8, it is clear that the contract-renewal rent control system seems to seriously impede Japanese renters' mobility within the rented market. This is not the case for mobility from rented housing to owned housing.

As the ratio of regular employment *regy* increases, the hazard rate increases as in the other cases.

The cross term with household head age and building age (age_hagey) does not affect the mobility rate in this case. Rather, job category is more important for mobility within the rental housing market.

< Table 9 around here >

5.3.2. Estimation results of the hazard function for residential moves from rented housing to rented housing based on the Japan Rental Act's implicit subsidy measure

In this section, we examine whether the Japan Rental Act system truly impedes residential moves from rented housing to rented housing using the Japan Rental Act's implicit subsidy measure. It is a more direct analysis of the Japan Rental Act's effect than the analysis in section 5.3.1, because we explicitly distinguish the contract-renewal rent and the market rent by KHPS data and analyze the Japan Rental Act's effect based on the Japan Rental Act's implicit subsidy measure, *dirc*, constructed from them (see, section 3.2.2 for details about *dirc*). The mean of *dirc* is 0.032 and the standard error of it is 0.07.

Table 10 presents estimation results of the hazard function for residential moves from rented housing to rented housing using the Japan Rental Act's implicit subsidy measure (*dirc*). Models (I, II) include the income and financial assets at the beginning of the residence spell, but models (III, IV) do not include those variables.

The coefficients of the Japan Rental Act's implicit subsidy measure *dirc* are negative and significant, although marginally at the 20% level. In light of the estimation results in section 5.3.2, we conclude that the contract-renewal rent control system's implicit subsidy impedes Japanese renters' mobility in this case.

As the price of owned houses *hp* increases, the hazard rate decreases. It may be because the market rent of the newly rented units will correspondingly increase reflecting heated housing market situations and so it will impede residential moves. Incumbent tenants prefer to stay in the same rented housing paying the lower contract-renewal rent.

As the ratio of regular employment increases, the hazard rate increases as in the other cases.

The cross term with household head age and building age (age_hagey) does not affect the mobility rate in this case. Rather, job category *regy* is a more important factor determining mobility within the rental housing market.

<Table 10 around here >

6. Conclusion

The present paper uses two waves of Japan household longitudinal data (the Keio Household Panel Survey, KHPS) and estimates the Cox's proportional hazard model to investigate the impact of both the housing equity constraint and the Japan Rental Act on residential moves. We find strong evidence that both of these factors impede mobility.

As for residential moves from owned housing, we find that the establishment of the income tax deduction system regarding the carrying over of capital losses has increased residential mobility. In addition, we find that if the length of residence requirement is deleted from the tax deduction eligibility criteria, residential mobility increases.

As for rented housing, there is strong evidence that the present Rental Act impedes mobility. In order to promote greater mobility, a policy promoting fixed rental terms would be effective.

In the case of residential moves from rented housing to owned housing, as the age of the household head increases and the building age increases, the mobility rate decreases. It means that for aged people it is difficult to move from old and bad quality houses, so housing policy aimed at stimulating the secondhand housing market such as favorable housing tax and finance systems should be devised to cope with the aging Japanese society.

Future housing policy in Japan should focus on enhancing the residential mobility rate, because it is necessary to limit housing price volatility in Japan.

Appendix: Construction of variables in the estimation of the hazard function

We will explain the variables construction.

CPI by region: We have constructed the regional CPI by multiplying the CPI in every year (from 1980 to 2004, country average =100) by CPI excluding imputed rent (2000=100) and adjusted it such that the average value becomes unity.

Income at the beginning of the residence spell (real), *incomp*: We have divided the nominal income of KHPS by regional CPI.

Financial outstanding assets at the beginning of the residence spell (real), *finw* : We have divided the financial assets of KHPS by regional CPI.

Age of the household head, *age*: We have subtracted the length of the residence spell from the age as of the second wave of the KHPS (2005).

Number of household members, *fsize*: We have added the number of born children to the number of household members at the beginning of the residence spell.

Regular employed dummy, *regy*: We have constructed this dummy variable from the questionnaire administered to the main respondent and spouse.

Self employed dummy, *selfy*: We have constructed this dummy variable from the questionnaire administered to the main respondent and spouse.

Family employee dummy, *famy*: We have constructed this dummy variable from the questionnaire administered to the main respondent and spouse.

Job change dummy, *changey*: We have constructed this dummy variable from the questionnaire administered to the main respondent and spouse.

The tax deduction system regarding the carrying over the capital losses for specific houses dummy, *year2004*: When the annual income at the beginning of the residence spell (=2004) is equal to or less than 30,000 thousand yen and having loans, and the length of the residence spell before the residential moves is larger than 5 years, this dummy variable is 1 and zero otherwise.

Predicted values of the contract-renewal rent, $\hat{r}_{cit}$: In order to predict the contract-renewal rent in year *t*, samples of households that live in rental house in *t-1* are collected. Rent per month of these households in *t-1* is assumed to be equal to the contract-renewal rent in *t*. Logarithms of the rent is regressed on the number of rooms of the house, age of the house, regional dummies, and time dummies that represent the year the household moved into the present rental house. The model is estimated by least absolute deviation method. By using this estimated model, predicted contract-renewal rent $\hat{r}_{cit}$ in *t* is calculated. These rents are changed to have the same value for two years reflecting the Japanese rental contract system, that is, rent contracted in *t-1* continues at the same level in the next year *t*. The estimation results of this model are presented in Table 11.

Predicted value of the market rent, $\hat{r}_{mit}$: Logged rent per month is regressed on the number of rooms, age of the house, regional dummies, and annual dummies. This model is estimated for the grouped samples of households moving into the present house between 1980-1984, 1985-1989, 1990-1994, 1995-1999, and 2000-2004. Estimation results of these models are tabulated in Tables 12-16. By using these estimates, market rents are predicted for all households living in rental housing.

The implicit subsidy by Japan Rental Act: This is calculated by $\hat{r}_{mit} - \hat{r}_{cit}$ and identified by setting it as zero if the estimated difference becomes negative.

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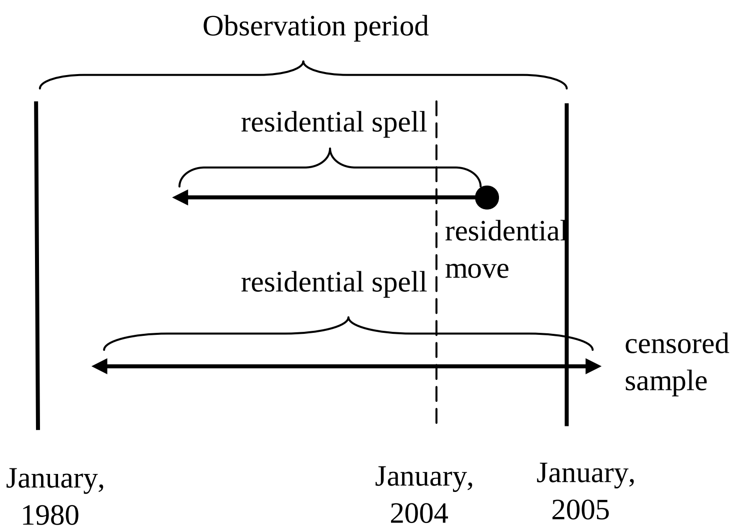


Figure 1: Explanation of the data set

Table 1: Number of households who moved during 2004

	Number of Households	(%)
(Owned housing)		
Owner occupiers	425	
Movers	13	(3.1)
to owned housing	10	(2.4)
to rented housing	3	(0.7)
(Rented housing)		
Renters	152	
Movers	43	(28.3)
to owned housing	24	(15.8)
to rented housing	19	(12.5)
Total number of movers	56	(9.7)
from owned	13	(2.3)
from rented	43	(7.5)

Note 1: These numbers are after excluding samples with missing observations
2: % represents the ratios within each category, except the last category, which represents the ratios within the total number of households 577.

Table 2: Variables and definitions

Variables	Definitions
event	1: household moved during 2004
spell	length of the years the household have lived in the present house.
Household Characteristics	
incomp	real income at the beginning of the current residence (ten thousand yen, in 2000 price)
finw	real financial asset at the beginning of the current residence (ten thousand yen, in 2000 price)
age	age of household head
age2	square of movage
fsize	number of household members
age_inc	moveage times incomp
age_finw	moveage times finw
age_fsize	moveage times fsize
Housing Characteristics	
opi	real housing service price per unit of owner-occupied housing (ten thousand yen, in 2000 price)
hp	real owned detached house price (ten thousand yen, in 2000 price)
hpgr	growth rate of real owned detached house price
hpgsc3	distributed lag of growth rate of real owned detached house price (eq.(2),m=3)
rent	real rent index (2000 =100)
rentgr	growth rate of real rent index
rentgsc3	distributed lag of growth rate of real rent index (eq.(2),m=3)
rooms	number of rooms
age_hagey	age times housing age
Labor market(h.h.'s labor status)	
regy	1: regular employment
selfy	1: self-employed
famy	1: family business(employee)
changey	1: h.h. have moved to the other job.
Loan (only samples which moved from owned housing)	
LTV	Loan to value ratio
LTVD0	1: LTV > 0, 0 : LTV=0
LTVD1	1: LTV>1, 0: LTV<=1
LTVD2	0: LTV=0, 1: 0<LTV<1, 2: LTV>=1
Tax system (only samples which moved from owned housing)	
year2004	1: if the tax deduction system regarding the carrying over of capital losses for specific houses in Januray 1, 2004 is applicable.
Japan Rental Act (only samples which moved from rented housing to rented housing)	
dirc	(market rent－contract-renewal rent)/contract-renewal rent. If the numerator takes negative value, this variable is set as zero.
Regional dummies	
rg1	1: Hokkaido area
rg2	2: Tohoku area
rg3	3: Kanto area
rg4	4: Chubu area
rg5	5: Kinki area
rg6	6: Chugoku area
rg7	7: Shikoku area
rg8	8: Kyushu area

Table 3 : Descriptive statistics of owned housing classified by mover versus nonmover sample in 2004

	Whole sample			Movers			Nonmovers		
Variable	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.
spell	425	10.7	6.1	13	11.9	7.9	412	10.7	6.0
age	425	47.6	10.9	13	52.8	16.8	412	47.4	10.6
fsize	425	5.6	2.0	13	5.4	2.3	412	5.6	2.0
opi	425	-37.408	341.3	13	27.078	110.8	412	-39.443	345.9
hp	425	3376.8	545.0	13	3254.0	628.8	412	3380.7	542.6
hpgr	425	0.005	0.08	13	-0.021	0.06	412	0.006	0.08
hpgrsc3	425	-0.005	0.03	13	-0.009	0.02	412	-0.005	0.03
rent	425	97.76	4.98	13	98.74	3.34	412	97.734	5.02
rentgr	425	-0.003	0.01	13	-0.003	0.01	412	-0.003	0.01
rentgrsc3	425	0.002	0.01	13	0.001	0.00	412	0.002	0.01
rooms	425	5.821	1.72	13	5.154	1.91	412	5.842	1.71
regy	425	0.868	0.34	13	0.923	0.28	412	0.867	0.34
selfy	425	0.169	0.38	13	0.154	0.38	412	0.170	0.38
changey	425	0.040	0.20	13	0.077	0.28	412	0.039	0.19
LTV	425	0.364	0.43	13	0.278	0.39	412	0.367	0.43
LTVD0	425	0.635	0.48	13	0.462	0.52	412	0.641	0.48
LTVD1	425	0.059	0.24	13	0.077	0.28	412	0.058	0.23
LTVD2	425	0.694	0.58	13	0.538	0.66	412	0.699	0.57
year2004	425	0.506	0.50	13	0.308	0.48	412	0.512	0.50
with loan	270	0.796	0.40	6	0.667	0.52	264	0.799	0.40

Table 4: Descriptive statistics of rented housing by mover status in 2004

Variable	Whole sample			Movers			to owned housing			to rented housing			Nonmover		
	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.
spell	152	7.2	4.7	43	6.9	3.9	24	7	3.4	19	6.8	4.6	109	7.3	4.9
age	152	39.5	10.3	43	40.6	10.3	24	40.1	6.4	19	41.2	13.9	109	39.1	10.3
opi	152	7.1	320.7	43	55.5	149.7	24	32.9	128.5	19	84.0	172.3	109	-12.0	365.7
fsize	152	4.5	1.9	43	4.8	1.8	24	4.9	1.7	19	4.6	2.0	109	4.4	2.0
hp	152	3509.6	615.1	43	3637.2	549.0	24	3764.6	532.0	19	3476.3	540.9	109	3459.3	634.6
hpgr	152	0.005	0.060	43	-0.003	0.049	24	0.006	0.049	19	-0.015	0.048	109	0.008	0.064
hpgrsc3	152	-0.007	0.025	43	-0.008	0.020	24	-0.008	0.023	19	-0.008	0.015	109	-0.006	0.026
rent	152	96.7	5.277	43	96.2	5.099	24	94.6	4.425	19	98.1	5.345	109	97.0	5.351
rentgr	152	-0.003	0.007	43	-0.005	0.006	24	-0.005	0.005	19	-0.004	0.008	109	-0.003	0.007
rentgrsc3	152	0.002	0.007	43	0.001	0.007	24	0.000	0.006	19	0.002	0.008	109	0.002	0.008
rooms	152	3.9	1.1	43	4.5	1.5	24	4.6	0.8	19	4.3	2.0	109	3.7	0.9
regy	152	0.921	0.271	43	0.977	0.152	24	1.000	0.000	19	0.947	0.229	109	0.899	0.303
selfy	152	0.178	0.383	43	0.116	0.324	24	0.083	0.282	19	0.158	0.375	109	0.202	0.403
changey	152	0.092	0.290	43	0.047	0.213	24	0.000	0.000	19	0.105	0.315	109	0.110	0.314

Table 5: Descriptive statistics of rented housing to rented housing by mover status in 2004

Variables	Whole Sample			Mover						Nonmover					
				Controlled			Uncontrolled			Controlled			Uncontrolled		
	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.	Obs	Mean	S.D.
spell	123	7.0	4.9	15	6.5	4.4	4	8	5.8	39	7.4	5.0	65	6.9	5.0
age	123	39.5	11.01	15	40.1	12.51	4	45.5	20.0	39	41.18	11.70	65	38.0	9.50
fsize	123	4.5	2.01	15	4.6	2.06	4	4.8	2.22	39	4.3	1.76	65	4.5	2.15
opi_r	123	3.356	350	15	67.282	188	4	146.6	83	39	55.9	146	65	-51.7	454
hp	123	3454.6	612	15	3559.6	573	4	3163.8	240	39	3560.4	583	65	3384.8	647
hpgr	123	0.005	0.06	15	-0.007	0.04	4	-0.046	0.05	39	0.007	0.07	65	0.010	0.06
hpgrsc3	123	-0.006	0.03	15	-0.010	0.01	4	-0.004	0.02	39	-0.008	0.03	65	-0.004	0.03
rent	123	97.2	5.38	15	97.9	5.58	4	98.9	5.01	39	96.0	5.26	65	97.7	5.43
rentgr	123	-0.003	0.01	15	-0.004	0.01	4	-0.007	0.01	39	-0.004	0.01	65	-0.002	0.01
rentgrsc3	123	0.002	0.01	15	0.002	0.01	4	-0.001	0.01	39	0.000	0.01	65	0.003	0.01
dirc	123	0.032	0.07	15	0.041	0.04	4	0.000	0.00	39	0.084	0.10	65	0.000	0.00
rooms	123	3.7	1.13	15	4.1	1.85	4	4.8	2.75	39	3.615	0.75	65	3.677	0.94
regy	123	0.911	0.29	15	0.933	0.26	4	1.000	0.00	39	0.846	0.37	65	0.938	0.24
selfy	123	0.203	0.40	15	0.200	0.41	4	0.000	0.00	39	0.205	0.41	65	0.215	0.41
changey	123	0.106	0.31	15	0.067	0.26	4	0.250	0.50	39	0.179	0.39	65	0.062	0.24

Table 6 : Estimation results of Cox's proportional hazard model for the households moved from owned housing

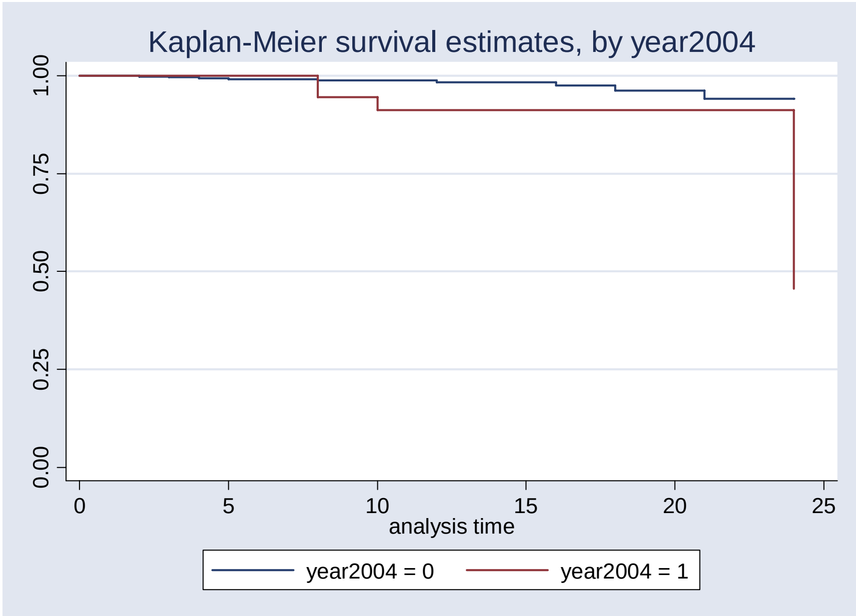
Variable	Ia		Ib		Ic		IIa		IIb		IIc	
	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z	Coef.	z
incomp	-0.001	-0.83	0.000	-0.26	-0.001	-0.68	-0.002	-0.23	-0.003	-0.38	-0.003	-0.42
finw	-0.009	-2.78 ***	-0.008	-2.6 ***	-0.009	-2.75 ***	-0.020	-1.14	-0.020	-1.19	-0.019	-1.13
movage	0.149	3.64 ***	0.136	3.34 ***	0.146	3.52 ***	-0.671	-1.98 **	-0.697	-2.04 **	-0.733	-2.1 **
movage2							0.007	1.98 **	0.007	2.06 **	0.007	2.08 **
fsize	-0.051	-0.21	-0.047	-0.21	-0.034	-0.15	-0.753	-1.15	-0.826	-1.32	-0.937	-1.44 +
age_inc							0.000	0.26	0.000	0.51	0.000	0.49
age_finw							0.000	0.46	0.000	0.58	0.000	0.43
age_fsize							0.019	1.26	0.021	1.35	0.023	1.49 +
opi	0.000	0.06	0.000	-0.05	0.000	0.06						
hp							0.001	0.62	0.001	0.64	0.001	0.61
hpgr							-4.371	-0.56	-2.204	-0.29	-3.472	-0.46
hpgrsc3												
rent	0.120	1.38	0.124	1.52 +	0.119	1.42	0.160	1.15	0.221	1.56 +	0.196	1.41
rentgr							-57.88	-1.92 *	-59.45	-1.93 *	-64.23	-2.09 **
rentgrsc3												
rooms	-0.401	-1.19	-0.388	-1.13	-0.452	-1.33	-0.441	-1.23	-0.445	-1.21	-0.559	-1.51 +
age_hagey	-0.002	-1.74 *	-0.002	-1.69 *	-0.002	-1.65 *	-0.002	-1.35 +	-0.001	-1.1	-0.001	-1.1
regy	2.003	1.62 +	1.938	1.56 +	2.027	1.63 +	2.345	1.8 *	2.518	1.81 *	2.646	1.86 *
selfy	-0.298	-0.21	-0.087	-0.06	-0.147	-0.1	-1.548	-0.67	-1.147	-0.52	-1.311	-0.57
changey	1.607	1.2	1.946	1.41	1.643	1.22	1.896	1.25	1.968	1.24	1.787	1.15
LTV	-0.891	-0.63					-1.996	-1.42				
LTVD0			-1.858	-1.62 +					-2.640	-2.1 **		
LTVD1			0.872	0.59					-0.191	-0.11		
LTVD2					-0.981	-1.11					-1.932	-1.83 *
year2004	1.037	1	1.669	1.35	1.383	1.23	1.833	1.41	2.601	1.67 *	2.378	1.6 +
rg1	-0.044	-0.03	-0.183	-0.14	-0.120	-0.09	0.964	0.45	0.783	0.35	0.714	0.32
rg3 (reference)												
rg4	1.943	1.67 *	1.921	1.62 +	1.994	1.67 *	2.664	1.65 *	2.880	1.74 *	3.042	1.82
rg5	1.198	1.08	1.254	1.11	1.147	1.03	1.620	1.12	1.602	1.09	1.516	1.04
rg7	0.800	0.57	0.979	0.7	0.873	0.63	1.315	0.73	1.414	0.77	1.382	0.75
rg8	-2.096	-1.01	-2.398	-1.14	-2.220	-1.06	-7.501	-1.18	-8.782	-1.41	-8.922	-1.35
No. of household	425		425		425		425		425		425	
No. of event	13		13		13		13		13		13	
No. of obs.	4261		4261		4261		4261		4261		4261	
Log likelihood	-33.2		-31.9		-32.7		-25.8		-24.3		-24.9	

Note: Significance level; ***:1%, **: 5%, *:10%, +:15%

Table 6 (continued): Estimation results of Cox's proportional hazard model for the households moved from owned housing

Variable	IIIa Coef.	IIIa z	IIIb Coef.	IIIb z	IIIc Coef.	IIIc z	IVa Coef.	IVa z	IVb Coef.	IVb z	IVc Coef.	IVc z
incomp	-0.002	-0.18	-0.004	-0.45	-0.004	-0.43						
finw	-0.024	-1.33	-0.023	-1.47 +	-0.023	-1.39						
movage	-0.660	-1.91 **	-0.634	-1.83 *	-0.686	-1.96 **	-0.809	-2.25 **	-0.716	-2.02 **	-0.791	-2.2 **
movage2	0.007	1.83 **	0.006	1.72 *	0.007	1.85 *	0.010	2.67 **	0.008	2.4 **	0.009	2.59 **
fsize	-0.977	-1.47 +	-1.113	-1.67 *	-1.183	-1.74 *	-0.685	-1.16	-0.743	-1.2	-0.812	-1.32
age_inc	0.000	0.22	0.000	0.56	0.000	0.49	0.000	0.4	0.000	0.7	0.000	0.51
age_finw	0.000	0.68	0.000	0.87	0.000	0.7	0.000	-2.36 **	0.000	-2.32 **	0.000	-2.49 **
age_fsize	0.024	1.55 +	0.026	1.65 *	0.028	1.75 *	0.019	1.26	0.019	1.21	0.021	1.36
opi												
hp	0.001	1.07	0.002	1.12	0.001	1.05	0.001	1.1	0.001	1.11	0.001	1.1
hpgr												
hpgrsc3	-21.96	-1.06	-18.86	-0.93	-19.610	-1	-18.33	-0.96	-16.50	-0.88	-17.04	-0.93
rent	0.308	1.49 +	0.422	1.82 *	0.370	1.72 *	0.246	1.41	0.294	1.63 +	0.278	1.56 +
rentgr												
rentgrsc3	-93.90	-1.61 +	-107.4	-1.71 *	-108.0	-1.74 *	-74.167	-1.45 +	-79.21	-1.5 +	-82.05	-1.54 +
rooms	-0.417	-1.15	-0.435	-1.12 *	-0.567	-1.48 +	-0.62	-1.63 +	-0.585	-1.43	-0.713	-1.78 *
age_hagey	-0.002	-1.44 +	-0.001	-1.22 *	-0.001	-1.16	-0.003	-2.22 **	-0.002	-1.96 **	-0.002	-2.03 **
regy	2.632	1.9 *	2.981	1.97 **	3.042	1.96 **	2.599	1.98 **	2.609	1.92 *	2.756	1.97 **
selfy	-1.080	-0.48	-0.609	-0.28	-0.743	-0.33	-0.995	-0.45	-0.555	-0.25	-0.652	-0.29
changey	1.657	1.09	1.758	1.12 **	1.470	0.95	2.144	1.45 +	2.308	1.54 +	2.015	1.37
LTV	-2.503	-1.71 *					-2.503	-1.69 *				
LTVD0			-3.036	-2.36 **					-2.682	-2.29 **		
LTVD1			-0.207	-0.11					-0.152	-0.09		
LTVD2					-2.307	-2.01 **					-2.040	-1.99 **
year2004	1.954	1.47 +	2.631	1.7 *	2.442	1.64 *	1.725	1.35	2.328	1.62 +	2.203	1.57 +
rg1	1.881	0.73	1.105	0.44	1.179	0.46	1.429	0.62	0.789	0.34	0.860	0.37
rg3 (reference)												
rg4	3.009	1.76 *	3.123	1.87 *	3.412	1.99 **	2.804	1.76 *	2.478	1.66 *	2.776	1.82 *
rg5	2.254	1.36	2.112	1.34	2.029	1.28	1.907	1.34	1.503	1.1	1.539	1.13
rg7	1.603	0.82	1.445	0.78 *	1.527	0.79	1.454	0.76	1.399	0.74	1.362	0.72
rg8	-6.690	-1.07	-7.862	-1.33	-8.104	-1.28	-11.396	-2.08 **	-10.982	-2.09 **	-11.747	-2.14 **
No. of household	425		425		425		425		425		425	
No. of event	13		13		13		13		13		13	
No. of obs.	4230		4230		4230		4230		4230		4230	
Log likelihood	-25.40		-23.67		-24.46		-26.65		-25.29		-25.91	

Note: Significance level; ***:1%, **: 5%, *:10%, +:15%



Note：Result of log-rank test $P(\chi_1^2 > 8.44) = 0.0037$

Figure 2: Settle down probability estimated by Kaplan Meier method classified by year2004 dummy

Table 7: Estimation results of Cox's proportional hazard model for the households moved from rented housing

	(I)			(II)			(III)			(IV)		
Variables	Coef.	z		Coef.	z		Coef.	z		Coef.	z	
incomp	0.005	1.13		0.007	1.44	+						
finw	-0.025	-2.62	***	-0.025	-2.46	**						
age	-0.089	-0.5		-0.105	-0.58		0.009	0.05		0.025	0.15	
age2	0.001	0.47		0.001	0.58		0.000	0.23		0.000	0.13	
fsize	-0.749	-0.97		-0.949	-1.19		-0.206	-0.29		-0.267	-0.36	
age_inc	0.000	-0.84		0.000	-1.14		0.000	1.09		0.000	1.16	
age_finw	0.0003	1.58	+	0.0003	1.47	+	-0.0002	-4.35	***	-0.0002	-4.28	***
age_fsize	0.015	0.79		0.021	1.03		0.001	0.08		0.003	0.16	
hp	0.000	0.16		0.001	0.98		0.000	0.14		0.001	0.97	
hpgr	4.529	1.34					4.516	1.31				
hpgsc3				6.917	1.06					6.221	1	
rent	0.133	2.12	**	0.251	3.05	***	0.129	2.15	**	0.244	3.05	***
rentgr	-65.80	-2.69	***				-58.81	-2.57	**			
rentgsc3				-99.22	-2.81	***				-94.31	-2.77	***
rooms	0.461	2.62	***	0.503	2.85	***	0.491	2.88	***	0.535	3.14	***
age_hagey	-0.002	-2.63	***	-0.002	-2.7	***	-0.002	-2.96	***	-0.002	-2.99	***
regy	2.311	2.14	**	2.266	2.09	**	2.357	2.19	*	2.343	2.17	**
selfy	-0.415	-0.58		-0.463	-0.65		-0.392	-0.56		-0.448	-0.63	
famy	-1.506	-0.86		-1.561	-0.9		-1.279	-0.73		-1.645	-0.95	
changey	0.497	0.59		-0.313	-0.33		0.768	0.96		0.155	0.18	
rg2	-0.223	-0.17		0.211	0.17		-0.280	-0.21		0.348	0.28	
rg3 (reference)												
rg4	-1.101	-1.47	+	-1.010	-1.25		-0.711	-1.05		-0.487	-0.69	
rg5	-0.766	-1.37		-0.383	-0.69		-0.377	-0.72		0.007	0.01	
rg6	0.749	0.64		0.768	0.65		1.308	1.23		1.405	1.32	
rg7	-2.089	-1.68	*	-2.543	-2.01	*	-2.024	-1.68	+	-2.387	-1.99	**
rg8	-1.111	-1.38		-0.791	-0.92		-0.923	-1.18		-0.585	-0.7	
No. of household	152			152			152			152		
No. of events	43			43			43			43		
No. of obs.	936			930			936			930		
Log likelihood	-102.0			-102.4			-106.3			-106.3		

Note: Significance level, ***: 1%, **: 5%, *: 10%, +: 15%

Table 8: Estimation results of Cox's proportional hazard model for the households moved from rented housing to owned housing

Variables	(I) Coef	z	(II) Coef.	z	(III) Coef.	z	(IV) Coef.	z
incomp	0.012	0.86	0.019	1.29				
finw	−0.073	−2.02 **	−0.062	−1.96 *				
age	1.387	1.72 *	1.081	1.42	1.096	1.67 *	1.159	1.83 *
age2	−0.023	−1.96 *	−0.018	−1.69 *	−0.017	−1.76 *	−0.018	−1.87 *
fsize	−4.937	−2.03 **	−4.683	−2.02 **	−2.845	−1.28	−2.606	−1.25
age_inc	0.000	−0.72	0.000	−1.14	0.000	0.96	0.000	0.99
age_finw	0.001	1.74 *	0.001	1.65 *	−0.0003	−2.81 ***	−0.0003	−2.7 ***
age_fsize	0.115	1.93 *	0.110	1.92 *	0.064	1.13	0.058	1.1
hp	−0.002	−1.52 +	−0.001	−0.96	−0.002	−1.47	−0.001	−1.06
hpgr	5.570	0.89			7.940	1.34		
hpgsc3			4.569	0.35			5.297	0.45
rent	−0.202	−1.24	−0.124	−0.61	−0.142	−1.07	−0.084	−0.51
rentgr	−98.92	−1.75 *			−82.99	−1.71 *		
rentgsc3			−104.4	−1.16			−76.4	−1.07
rooms	0.550	1.34	0.593	1.47	0.597	1.79 *	0.690	2.05 **
age_hagey	−0.005	−2.72 **	−0.005	−2.98 ***	−0.006	−2.9 ***	−0.006	−3.15 ***
selfy	−1.881	−1.65 *	−1.575	−1.37	−1.856	−1.71 *	−1.749	−1.65 *
rg3 (reference)								
rg4	−1.903	−1.42	−1.783	−1.23	−1.625	−1.33	−1.233	−0.99
rg5	−1.477	−1.52 +	−1.021	−1.08	−1.150	−1.25	−0.685	−0.78
rg6	6.457	1.88 *	5.955	1.79 *	7.742	0.47	7.574	0.49
rg8	−0.074	−0.05	0.662	0.39	0.361	0.28	0.775	0.56
No. of household	133		133		133		133	
No. of events	24		24		24		24	
No. of obs.	906		900		906		900	
Log likelihood	−34.03		−34.98		−36.91		−38.20	

Note: Significance level, ***: 1%, **: 5%, *: 10%, +: 15%

Table 9: Estimation results of Cox's proportional hazard model for the households moved from rented housing to rented housing based on aggregate rent index

Variables	(I) Coef.	z		(II) Coef.	z		(III) Coef.	z		(IV) Coef.	z	
incomp	0.008	1.38		0.009	1.51							
finw	−0.033	−2.35	**	−0.029	−2.28	**						
age	−0.321	−1.31		−0.408	−1.51	+	−0.235	−1		−0.279	−1.09	
age2	0.003	1.19		0.004	1.48		0.002	1.05		0.003	1.2	
fsize	−0.755	−0.79		−0.759	−0.79		−0.149	−0.2		−0.018	−0.02	
age_inc	0.000	−0.52		0.000	−0.49		0.000	2.57	**	0.000	2.72	***
age_finw	0.001	2.01	*	0.0005	1.97	**	−0.0002	−2.4	**	−0.0001	−1.88	*
age_fsize	0.016	0.66		0.016	0.65		0.000	0.01		−0.002	−0.1	
hp	0.000	−0.39		0.001	0.52		0.000	−0.2		0.001	0.85	
hpgr	2.716	0.57					1.415	0.3				
hpgsc3				13.837	1.55	+				10.763	1.39	
rent	0.197	2.1	**	0.421	2.89	***	0.137	1.61	+	0.360	2.7	***
rentgr	−86.22	−2.29	**				−83.48	−2.4	**			
rentgsc3				−155.7	−2.71	***				−152.6	−2.82	***
rooms	0.204	0.78		0.267	1.03		0.304	1.17		0.361	1.38	
age_hagey	0.000	0.38		0.001	0.57		0.000	0.11		0.000	0.32	
regy	2.196	1.81	*	2.129	1.73	*	1.941	1.66	*	1.793	1.53	+
selfy	−1.215	−1.07		−1.414	−1.24		−0.755	−0.7		−1.043	−0.98	
famy	−0.871	−0.41		−1.303	−0.61		−1.039	−0.5		−1.821	−0.83	
changey	0.354	0.36		−0.778	−0.67		1.023	1.13		0.153	0.15	
rg2	−0.436	−0.26		0.467	0.28		0.623	0.38		1.523	0.96	
rg3 (reference)												
rg4	−1.029	−0.92		−0.702	−0.58		−0.093	−0.1		0.452	0.44	
rg5	−0.453	−0.47		0.242	0.23		0.284	0.35		1.161	1.27	
rg6	−0.194	−0.12		−0.759	−0.47		1.750	1.18		0.885	0.57	
rg7	−0.862	−0.54		−1.690	−1.03		−0.281	−0.2		−0.887	−0.6	
rg8	−1.784	−1.28		−1.865	−1.21		−1.284	−0.9		−1.094	−0.73	
No. of household	128			128			128			128		
No. of events	19			19			19			19		
No. of obs.	901			895			901			895		
Log likelihood	−44.25632			−43.0681			−47.9286			−46.413		

Note: Significance level, ***: 1%, **: 5%, *: 10%, +: 15%

Table 10 : Estimation results of Cox's proportional hazard model for the household moved from rented housing to rented housing based on the JTPL's implicit subsidy measure

Varialbes	(I) Coef.	z		(II) Coef.	z		(III) Coef.	z		(IV) Coef.	z	
incomp	0.005	0.86		0.005	0.8							
finw	-0.033	-1.85	*	-0.032	-1.81	*						
age	-0.296	-1.28	#	-0.293	-1.29	#	-0.292	-1.23		-0.297	-1.28	
age2	0.003	1.50	+	0.003	1.5	+	0.004	1.55	+	0.004	1.61	+
fsize	-0.309	-0.38		-0.300	-0.37		-0.071	-0.09		-0.068	-0.08	
age_inc	0.0000	-0.22		0.0000	-0.15		0.0001	2.41	**	0.0001	2.49	**
age_finw	0.0005	1.40	#	0.0005	1.35	#	-0.0002	-2.89	***	-0.0002	-2.92	***
age_fsize	0.003	0.14		0.003	0.13		-0.005	-0.21		-0.004	-0.21	
hp	-0.002	-2.20	**	-0.002	-2.24	**	-0.001	-2.04	**	-0.001	-2.12	**
hpgr	1.476	0.32					0.249	0.05				
hpgrsc3				2.260	0.28					3.178	0.41	
dirc	-7.214	-1.34	#	-7.121	-1.34	#	-7.078	-1.34	#	-6.954	-1.33	#
rooms	0.448	1.67	*	0.455	1.69	*	0.561	2.14	**	0.569	2.15	**
age_hagey	0.000	-0.54		0.000	-0.48		-0.001	-0.9		-0.001	-0.85	
regy	2.077	1.69	*	2.094	1.7	*	2.126	1.71	*	2.152	1.71	*
selfy	-0.542	-0.54		-0.572	-0.57		-0.284	-0.29		-0.339	-0.35	
famy	-0.801	-0.41		-0.849	-0.43		-0.823	-0.43		-0.917	-0.47	
changey	1.311	1.33	#	1.265	1.3	#	1.764	1.95	*	1.761	1.97	**
rg2	-0.807	-0.57		-0.822	-0.59		-0.010	-0.01		-0.075	-0.06	
rg3 (reference)												
rg4	-1.315	-1.24		-1.360	-1.26		-0.765	-0.79		-0.816	-0.84	
rg5	-1.001	-1.09		-0.966	-1.05		-0.403	-0.51		-0.391	-0.49	
rg6	0.018	0.01		0.086	0.05		2.167	1.58	+	2.138	1.56	+
rg7	-0.709	-0.51		-0.752	-0.53		-0.515	-0.39		-0.615	-0.46	
rg8	-2.693	-1.93	*	-2.760	-1.96	*	-2.417	-1.78	*	-2.507	-1.84	*
No. of household	123			123			123			123		
No. of events	19			19			19			19		
No. of obs.	847			841			847			841		
Log likelihood	-48.6			-48.5			-51.1			-50.9		

Note: Significance level, ***:1%, **:5%, *:10%, +: 15%, #: 20%

Table 11: Hedonic estimation results of the contract-renewal rent
Dependent variable = rent in 2003

Variables	Coef.	t	
rooms	0.100	9.14	***
hageyn	-0.011	-9.79	***
rg1	-0.495	-10.02	***
rg2	-0.474	-8.06	***
rg4	-0.248	-5.84	***
rg5	-0.199	-5.84	***
rg6	-0.593	-10.13	***
rg7	-0.439	-7.12	***
rg8	-0.467	-13.05	***
yrst1982	0.263	1.44	
yrst1983	-0.473	-2.53	**
yrst1984	-0.027	-0.15	
yrst1985	-0.227	-1.18	
yrst1986	0.026	0.15	
yrst1987	-0.118	-0.70	
yrst1988	-0.286	-1.63	
yrst1989	0.217	1.43	
yrst1990	0.147	0.94	
yrst1991	0.005	0.03	
yrst1992	0.151	0.94	
yrst1993	0.125	0.80	
yrst1994	0.050	0.33	
yrst1995	0.030	0.21	
yrst1996	0.178	1.20	
yrst1997	0.190	1.32	
yrst1998	0.259	1.81	*
yrst1999	0.144	1.00	
yrst2000	0.218	1.53	
yrst2001	0.289	2.06	**
yrst2002	0.210	1.49	
yrst2003	0.205	1.46	
cons	3.947	27.21	
Nob	942		
Pseudo R2	0.1907		

Note: Estimation method is least absolute deviation method
Significance level: ***:1%, **:5%, *: 10%

Table 12: Hedonic estimation results of the market rent

Dependent variable = rent of the household moved in between 1981-1984.

Variables	Coef.	t	
rooms	0.216	0.84	
hagey	-0.033	-1.54	
rg2	0.872	1.42	
rg4	0.885	1.48	
rg5	0.154	0.2	
rg6	-0.610	-0.68	
rg8	-0.288	-0.39	
yrst1982	0.058	0.08	
yrst1983	-0.968	-1.49	
yrst1984	-0.276	-0.36	
cons	3.794	4.54	***
Nob	28		
Pseudo R2	0.4505		

Note: Estimation method is least absolute deviation method
Significance level: ***:1%, **:5%, *: 10%

Table 13: Hedonic estimation results of the market rent

Dependent variable = rent of the household moved in between 1985-1989.

Variables	Coef.	t	
rooms	-0.049	-0.71	
hagey	-0.007	-1.36	
rg1	-0.397	-1.38	
rg2	0.041	0.12	
rg4	-0.384	-1.39	
rg5	-0.030	-0.16	
rg6	-0.955	-4.2	***
rg7	-0.172	-0.83	
rg8	-0.302	-1.46	
yrst1986	-0.017	-0.07	
yrst1987	0.243	0.97	
yrst1988	-0.229	-0.87	
yrst1989	0.387	1.68	
cons	4.172	13.35	***
Nob	63		
Pseudo R2	0.3443		

Note: Estimation method is least absolute deviation method
Significance level: ***:1%, **:5%, *: 10%

Table 14: Hedonic estimation results of the market rent

Dependent variable = rent of the household moved in between 1990-1994.

Variables	Coef.	t	
rooms	0.157	3.97	***
hagey	-0.019	-3.87	***
rg1	-0.048	-0.36	
rg2	-0.556	-3.03	***
rg4	-0.116	-0.69	
rg5	-0.206	-1.73	*
rg6	-0.613	-3.33	***
rg7	-0.738	-4.68	***
rg8	-0.368	-2.99	***
yrst1991	-0.195	-1.44	
yrst1992	0.070	0.47	
yrst1993	-0.075	-0.53	
yrst1994	-0.181	-1.46	
cons	3.995	24.51	***
Nob	110.000		
Pseudo R2	0.339		

Note: Estimation method is least absolute deviation method
Significance level: ***:1%, **:5%, *: 10%

Table 15: Hedonic estimation results of the market rent

Dependent variable = rent of the household moved in between 1995-1999.

Variables	Coef.	t	
rooms	0.049	1.84	*
hagey	-0.005	-1.78	*
rg1	-0.356	-2.95	***
rg2	-0.425	-3.15	***
rg4	-0.264	-2.88	***
rg5	-0.195	-2.59	**
rg6	-0.430	-2.75	***
rg7	-0.255	-2.11	**
rg8	-0.471	-5.44	***
yrst1996	0.091	0.93	
yrst1997	0.191	2.09	**
yrst1998	0.308	3.46	***
yrst1999	0.097	1.06	
cons	4.040	31.75	***
Nob	269		
Pseudo R2	0.1181		

Note: Estimation method is least absolute deviation method
Significance level: ***:1%, **:5%, *: 10%

Table 16: Hedonic estimation results of the market rent

Dependent variable = rent of the household moved in between 2000-2004.

Variables	Coef.	t	
rooms	0.113	9.15	***
hagey	-0.015	-10.06	***
rg1	-0.537	-9.6	***
rg2	-0.502	-7.32	***
rg4	-0.317	-6.18	***
rg5	-0.197	-4.43	***
rg6	-0.521	-6.74	***
rg7	-0.442	-5.74	***
rg8	-0.506	-11.18	***
yrst2001	0.065	1.34	
yrst2002	-0.010	-0.21	
yrst2003	0.003	0.06	
yrst2004	-0.010	-0.17	
cons	4.174	70.26	***
Nob	543.000		
Pseudo R2	0.193		

Note: Estimation method is least absolute deviation method

Significance level: ***:1%, **:5%, *: 10%