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FINNISH HOMES – THROUGH PASSAGES OR TRAPS?

Residential mobility and housing choice in Helsinki.*

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ABSTRACT: This is a study on housing choice and mobility in the Helsinki metropolitan area which consists of several submarkets differing by tenure type, form of finance and allocation principles. For empirical analysis, we have constructed a data set so that we have household and housing information on a sample of Helsinki residents at two points of time. First, we describe housing conditions and present simple demand for dwelling size models estimated first from the whole data set and then from some subsets of it. We also use a model where the the probability of owning vs. renting, and the demand for dwelling size for owners and renters are jointly estimated by the maximum likelihood method. Next, we turn our attention to mobility. After providing information on average mobility rates, we present results of transition rates from each subsector of the housing market to another. Finally, we present the results of a logit model of residential mobility (move or stay model).

KEY WORDS: Housing Demand; Residential Mobility; Tenure Choice

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TIIVISTELMÄ: Tutkimuksen aiheena ovat asuntovalinnat ja liikkuvuus Helsingin seudun asuntomarkkinoilla, jotka koostuvat useista hallintamuodoltaan, rahoitustavaltaan ja asukkaiden valintamenettelyltään poikkeavista osamarkkinoista. Tutkimuksen empiiristä analyysiä varten olemme konstruoineet kotitaloustason otoksen niin, että meillä on samoja talouksia koskevat tiedot kahdelta ajankohdalta. Kuvaamme ensin asunto-oloja ja estimoimme pinta-alakysynnän malleja sekä koko aineistosta että sen osalohkoilta. Esitämme myös suurimman uskottavuuden menetelmällä estimoidun hallintamuotovalintaa ja samalla pinta-alakysyntää koskevan mallin tuloksia. Muuttukäyttäytymistä kuvaamme ensin koko ainestoa ja sen osamarkkinoita koskevilla muuttalttiustiedoilla "mistä minne" - asetelmassa. Lopuksi esitämme logit -tyyppisen muuttamisen todennäköisyysmallin tuloksia.

AVAINSANAT: Asuntopalvelujen kysyntä; Muuttokäyttäytyminen asuntomarkkinoilla; Hallintamuodon valinta

CONTENTS

1. INTRODUCTION

The purpose of this paper is to report results on residential mobility and housing choice in Helsinki. Both in describing housing conditions and mobility, and in tentative modelling work of this study, we pay attention to the various segments of the Helsinki housing market. Namely, in addition to two basic tenures (owning and renting), there are both publicly and privately financed and regulated alternatives in both tenures. Furthermore, there is a somewhat separate segment called the HITAS-sector which consists of housing built on publicly owned and rented land since the late 1970s. Finally, the privately financed owner-occupied sector is divided into one family houses and condominiums in multi-storey buildings. The latter buildings are joint stock companies so that the owner of a condominium owns the shares related to it.

From the consumer or household view-point the different segments of the Helsinki housing market are not perfect substitutes. On the contrary, there are non-neutralities due to tax treatment of housing, rent and price controls and various forms of non-price allocation mechanisms.

To give some insight to the elements involved, consider the tenure situtation. The share of owner-occupied housing in Helsinki metropolitan area was 40 per cent in 1960 and 60 per cent in 1989. Post-war rent control or rent regulation (only during 1963-67 rents were unregulated) and the emergence of public rental housing and related queueing systems have affected rental market developments. Regulated financial markets until late 1980s and tax advantages to owner-occupiers have affected both credit availability and the user cost of owner-occupied housing. In publicly financed owner-occupied housing access to this sector and housing size has been dependent on income and family size much in the same way as applied in public rental housing. Selling prices of publicly financed and HITAS owner-occupied housing in the second hand market have been regulated to initial construction costs corrected by indexation.

A more detailed description of the subsectors together with price and non-price allocation mechanisms involved is given elsewhere (c.f. Bengs and Loikkanen 1991). For our purposes it suffices to point out that there are so many non-neutral elements involved that it is of interest to study mobility from each sector to another i.a. to detect eventual lock-in effects. Furthermore, we are interested in the housing conditions (realized demand) in the different sectors.

There are several previous studies on housing demand and tenure choice. Here, we only pay attention to empirical studies which utilize mirco level data. The earlier literature analyzed housing demand separately with differing specifications for renters and owners (e.g. de Leeuw (1971), Straszheim (1973) and Polinsky (1977)). Tenure choice was studied separately with a discrete choice econometric model as in Li (1977).

The next step was to recognize that the discrete tenure choice and the continuous

housing demand choice are interdependent. This was taken into account in Lee and Trost (1978), Rosen (1979) and Gillingham and Hagemann (1983) by specifying discrete tenure choice and continuous housing demand models where the error terms are correlated to recognize that the same elements of behaviour are present in both models. A further step was taken by King (1980) and later by Hendersson and Ioannides (1986). They recognized that tenure choice and housing demand are a joint decision based on maximization of the same utility function. This leads to joint estimation with cross-equation constraints on parameters and the functional form of equations determining tenure choice and the demand for housing services.

Brownstone, Englund and Persson (1988,1989), in their latter study identify owner-occupied apartments (coop shares) as a third mode of tenure and also use information on the households' own assessment of their probability of moving during the next year.

Some of the latest studies have included length still additional elements to the setting. In Hendersson and Ioannides (1989) panel data is used to estimate a model of the joint tenure, lenght of stay and housing consumption level choices of families. Panel data is also used in Haurin and Lee (1989) where a structural model of the demand for owner-occupied housing is estimated. The buyer selects the value of the house, the size of the mortgage, and the lenght of stay in the house.

A rather popular approach has also been the adoption of hierarchial models. E.g. Onaka and Clark (1983, 1985) view the decision to move and the choice of a new housing unit as a joint decision and propose a hierarchial decision process that can be estimated using the nested logit specification. Also Börsh-Supan (1985) studies the joint choice of tenure, structure type and dwelling size by constructing hierarchial discrete alternatives and applying nested multinomial logit approach.

Our study is a first effort to describe and model tentatively housing choice and mobility in Helsinki using some of the simplest model alternatives described above. We have constructed a data set using different data bases so that we have household and housing information on a sample of Helsinki residents at two points of time.

This paper proceeds as follows. In section 2 we first describe the Helsinki metropolitan area and our data. Then we consider average housing conditions in terms of average dwelling size and living space per person in Helsinki. Finally, we present simple demand for dwelling size models estimated first from the whole data set and then from some subsets of it. Finally, we use a model where the probability of owning vs. renting, and the demand for dwelling size for owners and renters are jointly estimated by the maximum likelihood method.

In section 3 we turn our attention to mobility. After providing information on average mobility rates, we present results of transition rates from each subsector of the housing market to another. Finally, we present results of a logit model of residential mobility (move or stay model). Section 4 offers some conclusions.

2. DEMAND FOR HOUSING IN HELSINKI

2.1. The metropolitan area of Helsinki

The metropolitan area of Helsinki is the central part of the greater Helsinki, and consists of four municipalities, Helsinki, Espoo, Vantaa and Kauniainen. The population of the greater Helsinki is 1.05 millions, of whom 830 000 live in the metropolitan area.

There are approximately 400 000 dwellings in the metropolitan area. Helsinki grew quite rapidily during the sixties, seventies and eighties, and 70 per cent of dwellings have been built since 1960. Only 18 per cent of the dwellings are in single family houses or terraced houses, and as much as 82 per cent are in multi-storey buildings.

The share of owner-occupied dwellings is high in Helsinki at the moment, approximately 60 per cent. There has been a dramatic change in the tenure structure during the last 30 years. In 1960 renting was the major form of tenure, the share of owner-occupied dwellings was about 40 per cent that time. There has also been a structural change within both the rented and owner-occupied sector due to the increased involvement of the public sector. In 1960 almost all rented dwellings were owned by profit-making institutions and private households. Now almost half of the rented dwellings are owned by municipalities and other non-profit institutions. The share and even absolute number of privately owned rented dwellings has fallen dramatically.

The public sector has influenced the owner-occupied sector as well, in the form of government loans and restrictions. The government started to give loans for housing construction in 1950s.

The owner-occupied housing can be classified roughly into three sectors:

(1) Privately financed "free market" sector in which dwellings can be bought and sold at market prices without any restrictions. This sector covers about 80 per cent of owner-occupied housing.

(2) Publicly financed "regulated" sector in which selling prices are controlled, and there are maximum income, and maximum and minimum dwelling size limits for applicants. Restrictions are applied as long as the state loan has not been totally repaid. The share of this sector is about 17 per cent of owner-occupied housing.

(3) "HITAS" sector (only in the City of Helsinki) in which the city controls the quality of new dwellings and their prices both at the stage of construction and in connection of subsequent sales. The share of the HITAS sector is only 3 per cent of the owner-occupied sector, but the share is increasing.

The rented sector (40 per cent of the housing stock) can also be divided into 3 sectors:

(1) Private ("free market") rented sector in which rents have, however, been controlled untill March 1992. The share of this sector is about half of the rented housing stock.

(2) Public rented sector in which dwellings are owned by the city of Helsinki. This is the social housing sector in Helsinki in which means testing based on income and family structure affect entry through a municipal queue system. The size of this sector is a quarter of the rented sector.

(3) Non-profit rented sector where dwellings are owned by non-profit institutions and financed by state loans. There is also means testing affecting entry through separate (owner specific) queues to this sector which covers one quarter of the rented housing stock.

2.2. The data

The data of the empirical parts of this study is based on a sample of 4640 households who lived in the metropolitan area during the period Jan. 1, 1987 - Jan. 1, 1989. The sample is a panel data which contains variables on each sample household and respective dwelling and location at cross sections on Jan 1 of 1987, 1988 and 1989. The data also contains information about the moves of each household's reference person and other members during the study period.

The sample has been constructed by merging various files of the Urban Data Base of the metropolitan area of Helsinki which contains the population, dwelling, building and real estate data of the whole metroplitan area. Income and wealth data is based on the files of tax authorities, and education data on the exam data base of Statistics Finland. Unfortunately, the data does not contain information on actual housing costs of sample households. Otherwise, the overall quality of the data is very high.

The household head has been defined as the oldest member of the household in 1987. The files of this study contain the following variables from each year:

<u>Household:</u>
- number of household members
- number of chidren (0-6 years and 7-15 years)
- age of the household head
- education code of the household head
- income and wealth of the household (Fmk in 1987)
- moves of the household head and other members within the metropolitan area during 1987-88

<u>Dwelling:</u>
- tenure (rented/owner-occupied)
- finance (private/public)
- owner category

- size (square meters and number of rooms)
- amenities (bathroom, balcony, etc.), yes/no
- age of the building
- neighbourhood (distance to the city centre, social structure, environment, etc.)

2.3. Households' living space in the metropolitan area of Helsinki

The distribution of sample observations and average dwelling size according to the housing type category are presented in table 2.1. The average dwelling size in the metropolitan area of Helsinki is 68.7 square meters which is a rather small size compared with the standard in other Nordic and Central European cities (see Hårsman and Quigley, 1991). Rented dwellings are, on average, remarkable smaller than owner-occupied dwellings. Largest dwellings are in owner-occupied single family houses in which the average size is 106.4 square meters.

Table 2.1. The average dwelling size in 1989 in the metropolitan area of Helsinki, and the number of observations in the household sample

Housing category	Average size, m^2	Obs. in sample freq	%
Rented			
Public (City of Helsinki)	55.0	347	8.4
Non-profit	56.7	343	8.3
Private ("free market")	54.0	676	16.3
Owner-occupied			
Public finance	65.9	546	13.2
HITAS	77.6	74	1.8
Private finance, multi-storey	63.8	1292	31.2
Private finance, single family	106.4	676	16.3
Type unknown	72.2	182	4.4
Total	68.7	4136	100.0

A simple indicator of housing consumption is the living space per person (dwelling size in square meters per person). Table 2.2 contains the average living space per person in 1989 according to housing type category, age, income, and household size.

The average living space per person of the sample households in the metropolitan area of Helsinki was 34.1 square meters in 1989. It is lowest in public and non-profit rented dwellings, and highest in private finance owner-occupied sector, especially in single family houses. The living space increases with respect to the age of the household head. There is an especially large difference between the age groups 35-44 years and 45-64 years which can partially be explained by the fact that grown-up

children usually move away from home when parents are middle-aged. The living space decreases monotonically when the size of the household increases. It also goes up monotonically when the income per person of the household goes up, as expected.

Table 2.2. The average living space (m^2 per person) of sample households according to housing type, age, household size and income in the metropolitan area of Helsinki in 1989 (unweighted averages)

Housing type *							
RPUB	RNP	RPRI	OPUBF	OHIT	OPRIMS	OPRISF	TOT
28.3	28.0	30.2	32.9	30.0	36.4	40.6	34.1

Age of the household head					
-24	25-34	35-44	45-64	65+	TOT
29.5	27.7	28.6	37.1	42.0	34.2

Household size (number of persons)				
1	2	3	4+	TOT
46.6	34.2	25.8	21.9	34.1

Income, 1000 Fmk 1987 (total household income per person)					
-60	60-80	80-100	100-120	120+	TOT
28.3	31.9	34.7	41.6	53.5	34.1

* RPUB = rented, public (City of Helsinki)
RNP = rented, non-profit
RPRI = rented, private (free market)
OPUBF = owner-occupied, public finance
OHIT = owner-occupied, HITAS
OPRIMS = owner-occupied, private finance, in multi-storey buildings
OPRISF = owner-occupied, private finance, single-family houses
TOT = all dwellings

2.4. A model of demand for housing consumption

Modelling strategy

In this section we shall consider models of households' demand for housing where housing consumption is measured in terms of dwelling size (square meters). We shall proceed as follows. First, we estimate a model with all data with and without dwelling type dummy variables. Thereafter, we estimate different models for households in various subsectors. The purpose here is to find out by simple procedures whether the demands differ in different sectors of the market.

Optimal and actual housing demands may differ because of various transaction costs related to adjusting housing consumption which typically takes place by moving. In

order to be able to estimate desired demands more precisely, a typical procedure is to use recent mover data. In our study, we shall present results both for the whole sample and for recent movers, i.e. households which had moved during Jan. 1, 1987 and Jan. 1, 1989.

As a last step in this section we present results of joint estimation of tenure choice (own vs. rent) and the demand for dwelling size.

Choice and construction of variables

Dwellings are heterogenous. To overcome this problem one approach to measurement is to use the market values or rents of dwellings as indicators of housing volumes involved. Often, as in our case, this information is not available or not useful e.g. due to rent control. Here, we shall measure our dependent variable, i.e. housing volume in terms of dwelling size on the first of January, 1989. More precisely, space of dwelling in square meters will be used. To correct for the neglect of location, neighbourhood and internal quality variation, the demand equations will include a price per square meter variable which is the forecast for each observation of a model reported in table 2.3. (A more detailed description of hedonic price models applied in the housing markets of Helsinki is in Laakso (1992)). Although the price equation has been estimated from a data set consisting of privately financed owner-occupied dwellings in multy-storey buildings, we shall use its predictions for all dwelling categories, rented or owned.

Table 2.3. Estimation results of the hedonic price model. Estimated coefficients (and t-statistics).

Data: A sample of dwelling transactions in Helsinki 1989

Dependent variable: Log(total transaction price)

Independent variables

Constant	10.505	(166.43)
Log(floor area,m2)	.839	(78.06)
Terraced house [1=yes,0=no]	.095	(4.42)
Coast <1 km [1=yes, 0=no]	.045	(3.46)
Log(transport distance to city centre, min.)	-.226	(-14.19)
Log(green areas in neighbourhood, %)	.056	(5.28)
Log(highest income quartile in n-hood, %)	.112	(7.03)
Log(city tenants in n-hood, %)	-.019	(-6.74)
R2	.797	
N	1996	

Table 2.4. Estimation results of the permanent income model. Estimated coefficients (and t-statistics).

Data: Sample households in the metropolitan area of Helsinki Jan. 1, 1987

Dependent variable: Total income of the household in 1987

Independent variables

Constant	-28995	(-8.9)
Total wealth of the household in 1987 (Fmk)	.079	(22.1)
Number of adult members of the household	66332	(50.1)
Education of the household head:		
Middle level (1/0)	20125	(7.9)
Higher level (1/0)	75962	(25.1)
Less than middle level (ref. group)	-	
Age of the household head:		
under 25 y. (1/0)	-3611	(-.7)
25-34 y. (1/0)	26331	(7.5)
35-44 y. (1/0)	49139	(14.4)
45-64 y. (1/0)	34776	(11.0)
over 64 y. (ref. group)	-	
R2	.556	
N	4640	

In a neutral housing market the user cost of housing would be the same in similar units irrespective of tenure form etc. As discussed above, this is not the case. Effective prices (user costs) of housing differ from subsector to another and also from one household to another because of tax related deductions etc. In addition to price variability there are also availability problems which vary across subsectors and would require the use of shadow prices. Given that we do not have user cost estimates, we shall use variables which can be viewed as proxies for user cost variables. Dummy variables related to subsectors of the housing market are such proxies.

Income affects both the demand for housing and indirectly the price (user cost) of housing. In case of owner-occupied housing the tax advantages increase with marginal tax rate and thus with income. In case of rental housing, housing allowances and means tested public rental housing are affected by income. Thus, our income variable has several roles, in addition to accounting for basic income. In order to approximate permanent income, our income variable is the prediction of an income equation (c.f. table 2.4 in which the gross incomes of households were explained by household wealth, number of adults, education level and age of head of household in 1989. Our predicted permanent income variable will be used in demand equations without taking into account eventual correlation between the error terms of these equations and the income equation.

Demographic variables in our model will include household size, education level and age of head of household (both in terms of dummy variables), They are assumed to take into account systematic differences in preferences. On the other hand they are related to means test criteria of housing offices and may also be proxies for other kinds of rationing phenomena e.g. in the private rental housing market.

In the estimated models we have taken logarithms of continuous variables so that the respective coefficients are elasticities.

Estimation results

In table 2.5 we have the results of a basic model for all households and recent movers without and with dwelling type dummies. In the latter model obsevations (182) with unknown dwelling type are excluded. Statistically the models are not bad with R-sqaures in the range 0.516 to 0.576. As espected, movers' models are systematically better than those for all households. Typical demand variables also get expected signs.

Permanent income elasticities are statistically significant (5 per cent level) and range from 0.46 to 0.26 being lower for movers. Household size elasticities are also significant but in their case mover households have higher elasticities. The (hedonic) price per square meter of the dwelling gets a negative and very significant coefficient in all cases. Recall that its role is to correct for location, neighbouhood and internal quality differences among dwellings when using the size as the volume measure. High education level of household head increases housing demand. Housing demand also increases monotonically with age of household head.

Models 2 and 4 in table 2.5 include dwelling type dummies so that public rented dwellings of the City of Helsinki form the reference group (0-case). The coefficients express by how many per cent these dwellings are larger in size than public rented dwellings of the City of Helsinki. First, we note that R-squares of the models increase with these dummies relative to models 1 and 3, respectively. Second, we note that there are no differences among rented dwellings, whereas all owner-occupied dwelling types get positive and significant coefficients. Publicly financed owner-occupied dwellings are 7.0 per cent larger than public rented dwellings of the City of Helsinki. The respective figures for HITAS dwellings, free market condominiums and free market houses are 23.9 per cent, 11.7 per cent and 36.3 per cent, respectively, according to model 2. These figures are somewhat larger in the movers' model.

Table 2.5. Estimation results of models of households' demand for housing. Estimated coefficients (and t-statistics).

Data: Sample households in Jan. 1, 1989
Dependent variable: Log(size of the dwelling, m^2)

	----------All dwelling types----------			
	All households----------		Recent mover households-----	
Independent variables	(1)	(2)	(3)	(4)
Constant	6.057 (13.3)	6.138 (13.0)	7.935 (8.1)	8.933 (8.5)
Log(permanent income)	.460 (16.6)	.355 (12.9)	.365 (5.9)	.260 (4.1)
Log(number of h-hold members)	.234 (14.7)	.232 (14.7)	.304 (10.3)	.280 (9.2)
Log(hedonic price of dwelling)	-.836(-21.9)	-.722(-17.8)	-.940(-11.9)	-.924(-10.5)
Education of the household head:				
Middle level (1/0)	.016 (1.2)	.005 (.4)	-.009 (-.4)	-.012 (-.5)
Higher level (1/0)	.090 (4.4)	.067 (3.4)	.106 (2.5)	.088 (2.0)
Less than middle level (ref.gr.)	-	-	-	-
Age of the household head:				
under 25 y. (1/0)	-.596(-18.3)	-.463(-14.1)	-.448 (-6.2)	-.374 (-5.1)
25-34 y. (1/0)	-.414(-21.9)	-.329(-17.3)	-.254 (-4.2)	-.225 (-3.7)
35-44 y. (1/0)	-.322(-16.2)	-.254(-13.0)	-.167 (-2.7)	-.184 (-2.9)
45-64 y. (1/0)	-.239(-11.7)	-.179 (-8.9)	-.140 (-2.1)	-.148 (-2.2)
over 64 y. (ref.gr.)	-	-	-	-
Dwelling type:				
Rented, City of Hel. (ref.gr.)		-		-
Rented, other non-profit (1/0)		.040 (1.7)		.035 (.7)
Rented, free market (1/0)		.008 (.4)		.018 (.4)
Owner occ., gov. finance (1/0)		.070 (3.2)		.071 (1.5)
Oo, HITAS (1/0)		.239 (5.9)		.323 (4.7)
Oo, free market, m-storey (1/0)		.117 (5.9)		.138 (3.2)
Oo, free market, s-family (1/0)		.363 (16.5)		.397 (7.6)
R2	.516	.566	.530	.576
N	4318	4130	979	877

In models 5-8 in table 2.6 we have estimation results for owner-occupiers and in models 9-12 for renters separately. First, we note that in terms of R-squares the models for owner occupiers are systematically better than those of renters. Movers' models are better in case of owners, but the opposite is true in renters' models. These results support the view that the rental markets operate badly due to rent regulation and related availability problems, and also due to the distribution mechanisms operating through public queues. Mobility is simply not a quarantee to improve the match between actual and desired housing.

There are also interesting differences related to explanatory variables. Permanent income elasticities are significant and range from 0.489 to 0.403 for owners. Renters' elasticities are much smaller (0.121 to 0.116) when significant and in movers' model they are simply insignificant. Household size is significant in all models and gets greater values in case of renters. This may reflect the mixed price and non-price allocation principles in private rent regulated sector and, on the other hand, public housing with its queueing and means testing mechanisms.

Table 2.6. Estimation results of models of households' demand for housing by tenure type. Estimated coefficients (and t-statistics).

	----------Owner-occupied dwellings----------			
	All households----------		Recent mover households-----	
Independent variables	(5)	(6)	(7)	(8)
Constant	5.702 (9.5)	4.949 (8.3)	7.853 (5.7)	8.036 (5.8)
Log(permanent income)	.489 (13.8)	.451 (13.3)	.432 (5.1)	.403 (5.0)
Log(number of h-hold members)	.198 (9.5)	.157 (7.9)	.246 (6.2)	.201 (5.2)
Log(hedonic price of dwelling)	-.826(-16.1)	-.697(-13.2)	-1.004 (-9.1)	-.992 (-8.6)
Education of the household head:				
Middle level (1/0)	.011 (.6)	.006 (.4)	-.048 (-1.3)	-.040 (-1.1)
Higher level (1/0)	.057 (2.3)	.043 (1.8)	.053 (1.0)	.042 (.8)
Less than middle level (ref.gr.)	-	-	-	-
Age of the household head:				
under 25 y. (1/0)	-.597(-11.3)	-.545(-10.9)	-.499 (-4.9)	-.497 (-5.2)
25-34 y. (1/0)	-.443(-18.1)	-.403(-17.3)	-.311 (-3.9)	-.317 (-4.2)
35-44 y. (1/0)	-.330(-13.9)	-.309(-13.6)	-.208 (-2.6)	-.263 (-3.4)
45-64 y. (1/0)	-.248(-10.1)	-.231(-10.0)	-.197 (-2.3)	-.215 (-2.6)
over 64 y. (ref.gr.)	-	-	-	-
Dwelling type:				
Owner-occ., gov. finance (1/0)		-		-
Oo, HITAS (1/0)		.188 (4.8)		.267 (4.2)
Oo, free market, m-storey (1/0)		.034 (2.0)		.067 (1.7)
Oo, free market, s-family (1/0)		.295 (15.6)		.327 (7.1)
R2	.491	.545	.547	.599
N	2644	2644	485	485

	----------Rented dwellings----------			
	All households----------		Recent mover households----	
Independent variables	(9)	(10)	(11)	(12)
Constant	8.635 (12.3)	8.798 (11.5)	10.450 (7.2)	10.554 (6.5)
Log(permanent income)	.121 (2.5)	.116 (2.4)	.046 (.5)	.043 (.4)
Log(number of h-hold members)	.376 (14.6)	.379 (14.6)	.386 (8.0)	.389 (7.9)
Log(hedonic price of dwelling)	-.718(-12.8)	-.733(-11.8)	-.834 (-7.0)	-.843 (-6.2)
Education of the household head:				
Middle level (1/0)	.014 (.7)	.013 (.6)	.029 (.7)	.027 (.7)
Higher level (1/0)	.143 (3.6)	.141 (3.5)	.163 (2.1)	.162 (2.0)
Less than middle level (ref.gr.)	-	-	-	-
Age of the household head:				
under 25 y. (1/0)	-.219 (-4.3)	-.223 (-4.3)	-.160 (-1.3)	-.163 (-1.4)
25-34 y. (1/0)	-.146 (-4.3)	-.150 (-4.4)	-.064 (-.6)	-.065 (-.6)
35-44 y. (1/0)	-.063 (-1.7)	-.067 (-1.7)	-.014 (-.1)	-.016 (-.1)
45-64 y. (1/0)	-.007 (-.2)	-.007 (-.2)	-.021 (-.2)	-.018 (-.2)
over 64 y. (ref.gr.)	-	-	-	-
Dwelling type:				
Rented, City of Hel. (ref.gr.)		-		-
Rented, other non-profit (1/0)		.029 (1.3)		.029 (.6)
Rented, free market (1/0)		.027 (1.2)		.023 (.5)
R2	.483	.483	.432	.433
N	1485	1485	391	391

Hedonic housing price gets expected negative and very significant coefficients in all eight models without an easily detectable size pattern. High education level of head of household gets a positive and significant coefficient in all models for renters, but only in model 5 for owners. Life-cycle variables, i.e. age of household head dummies have a very clear and significant pattern in case of owners. Dwelling sizes increase with age. In renters' models life cycle variables work differently. None of the age dummies is significant in movers' models. In models for all households the two youngest age groups get significant negative coefficients, i.e. dwelling sizes of young people are smaller than those of the oldest age group. Thus from age 35 on there is no change in dwelling size (ceteris paribus).

Finally, we shall comment the role of tenure specific dwelling type dummies. In owners' models the 0-case is publicly financed dwellings, typically condominiums in multi-storey buildings. Similar privately financed free market condominiums are slightly (3.4 per cent in model 6) greater in size compared to respective public condominiums. HITAS dwellings are much larger (18.8 per cent for all, 26.7 per cent for movers) and free market houses the largest ones (29.5 per cent for all, 32.7 per cent for movers) than the reference group of public condominiums. As for rental sector, dwelling type dummies are statistically insignificant.

2.5. A model for tenure choice and housing demand

Above housing demand was studied as if it were independent of tenure choice. The next step is to recognize that the discrete tenure choice and the continuous housing demand choice are interdependent by specifying discrete tenure choice and continuous housing demand models where the error terms are correlated to recognize that the same elements of behaviour are present in both models (c.f. Lee and Trost (1978), Rosen (1979) and Gillingham and Hagemann (1983)).

Owning and renting housing are assumed to be mutually exclusive alternatives for each household. For a particular household we specify the tenure choice and housing demand model as follows:

$$(1) \qquad I = g(Y,D) + e \,,$$
$$(2) \qquad q_o = h_o(P,Y,D) + e_o \,,$$
$$(3) \qquad q_1 = h_1(P,Y,D) + e_1 \,,$$

where I(.) is an unobservable summary index reflecting the advantageousness of owning relative to renting indirectly through income (Y) and demographic (D) variables. Variables q_o and q_1 are the quantities (square meters) of housing if the household is an owner or a renter, respectively. Here, in addition to Y and D we have the hedonic price (P) as explanatory variable. Below we shall employ the simplest possible functional form for (2)-(3), i.e. assume that they are linear.

Refering to (1)-(3), unless error terms e_o and e_1 are independent of e separate estimation of tenure specific demand equations yields biased and inconsistent estimates. To allow for and test for eventual correlation among the error terms we

employ the maximum likelihood estimation procedure. Assuming error terms e, e_o and e_1 to have normal distribution, the loglikelihood of an individual observation can be written as

$$(4)\quad l = I_o[-\log s_o + \log f(e_o/s_o) + \log F((1+r_o)^{1/2}\,(g+r_o/s_o e_o)] + I_1[-\log s_1 + \log f(e_1/s_1) + \log F(-(1+r_1)^{1/2}\,(g+r_1/s_1 e_o)],$$

where I_o, is the indicator for an owner and I_1 for a renter, the residuals of quantities of housing are $e_k = q_k - h_k$, $k = 0,1$. The parameters s_k, $k = 0,1$, correspond to the standard deviations of the variables e_k, and r_k is the correlation coefficient between e_k and e, $k = 0,1$. Finally, F(.) is the cumulative normal distribution and f(.) is the ordinate of the standard normal distribution.

The estimated mean quantities of housing can be calculated for owners,

$$(5)\quad E(q_o \mid I_o=1) = h_o + r_o s_o f(g)/F(g),$$

and for renters,

$$(6)\quad E(q_1 \mid I_1=1) = h_1 - r_1 s_1 f(g)/F(-g).$$

In principle the parameters of the model could be estimated by utilizing the regression equations (5) and (6) for owners and renters, as suggested by Lee and Trost (1978). In doing this the first step is to estimate a probit tenure choice model by maximum likelihood method. In the second stage, the variable lambda= $f(g_{est})/F(g_{est})$ (inverse Mill's ratio) is added to the list of regressors in owners' (and $-f(g_{est})/F(-g_{est})$ to renters') demand function, where $F(g_{est})$ is the estimated probability for the considered household to own. In trying out the two-stage estimation method we ran into some difficulties of estimation and we resorted to the more efficient method of maximum likelihood.

Results of maximum likelihood estimation are given in table 2.7. First, we note that tenure choice and housing demands for owners and renters are interdependent. The corresponding CHI-square test statistic 20.4 with 2 degrees of freedom is highly significant.

According to the probit tenure choice equation the increase in permanent income increases the probability of owning (hereafter PO) while household size has the opposite effect. PO increases with the education level and the age of household head.

In table 2.7 we also have the results of continuous demand for dwelling size model for owners and renters. For owners, permanent income, household size, medium and high education level as well as the age of household head affect dwelling size positively.

For renters, household size has a significant positive effect on dwelling size. High education also increases housing consumption. The coefficient for permanent income is surprisingly negative. The connection between the age of the household head and dwelling size differs in renters' equation from that in owners' equation. The dwelling

size is higher for age groups 35-44 and 45-64 years than for older and younger households.

As noted in section 2.4 it is questionable whether the renters' model reflects demand behaviour because of allocation procedures of public housing authorities, and restrictions in a regulated private rental market. Furthermore, the model does not contain housing cost or price variables which may affect the estimation results.

Table 2.7. Estimation results of the joint model of tenure choice and dwelling size demand. Estimated coefficients (and t-statistics).

Data: Sample households in Jan. 1, 1989

Dependent variable:
Tenure choice (probit): renting=0 / owning=1
Dwelling size demand: log(size of the dwelling (m2))

	Tenure choice (probit)		Dwelling size demand
	Owners	Renters*	
Independent variables	(1)	(2)	(3)
Constant	-3.378 (-9.3)	2.421 (15.8)	3.961 (24.4)
log(Permanent income (1000 Fmk))	.928 (10.2)	.314 (9.0)	-.153 (-3.1)
log(Number of h-hold members)	-.099 (-3.5)	.313 (11.8)	.591 (17.5)
Education of the household head:			
Middle level (1/0)	.236 (4.4)	.083 (4.0)	.030 (1.2)
Higher level (1/0)	.395 (5.0)	.197 (7.1)	.104 (2.5)
Less than middle level (ref.gr.)	-	-	-
Age of the household head:			
under 25 y. (1/0)	-1.347(-12.0)	-.554 (-9.0)	.037 (.6)
25-34 y. (1/0)	-1.180(-15.6)	-.536(-16.4)	.054 (1.0)
35-44 y. (1/0)	-.860(-10.8)	-.322(-11.1)	.112 (2.3)
45-64 y. (1/0)	-.678 (-8.9)	-.182 (-6.8)	.194 (4.5)
over 64 y. (ref.gr.)	-	-	-
N	4076	2478	1598
CHI-squared (2 df.)	20.41		

3. MOBILITY WITHIN THE METROPOLITAN AREA OF HELSINKI

3.1. Mobility as part of the housing markets

The move from the old dwelling to the new one almost always requires time. It is a dynamic reaction to a change in circumstances of the household. Within an urban area the reason to move is usually a change in the demand for housing service. Marriages, divorces, babies, grown-up children who move away from home, as well as changes in income are reasons that may cause a change in housing service demand. Because

the location of a dwelling is fixed and its size and quality are not very adjustable especially in multi-storey apartment buildings (but more in case of single family houses), households are often forced to move to be able to adapt to a change in demand.

The benefits from a move must exeed the costs of moving, otherwise the move does not make sense. The moving costs include both the monetary and time costs of the search, transaction and move as well as the psychological costs of the change of the neighbourhood. A theoretical search and mobility model which includes these elements is in Loikkanen (1982).

The mobility rates usually vary between different household groups. One reason for this is that some household types face changes in their housing demand more often (typically young) than others. Another reason may be that there are differences in moving costs, especially in psychological costs. There may also be differences in mobility rates between different housing sectors due to differences in mechanisms in price determination and resident selection. Income limits and minimum and maximum dwelling size restrictions are typically applied in publicly financed dwellings both in rented and owner-occupied sectors. Notices are typical only in private rented sector. Rent control (until March 1992) has caused a permanent disequilibrium (undersupply) in the rented sector which also may have affected the mobility rates to and out of this sector.

In this chapter we first present some descriptive figures about the mobility rates in the metropolitan area of Helsinki during 1987-88 according to demografic variables as well as housing sectors. We then proceed to a logit model which aims to explain households' mobility by demografic and housing market variables as well as by variables of change in housing demand.

3.2. Mobility rates in the metropolitan area of Helsinki

In this study the household has been defined as having moved if the household head has moved during the years 1987-1988. The average annual probability to move within the metropolitan area of Helsinki was 0.114 during the two-years study period. In addition the average annual probability to move away from the metropolitan area was 0.019. Hence the average length of stay in the same dwelling was about 7.5 years (1/(0.114+0.019)).

The probability to move depends strongly on the age of the household head. According to table 3.1 the annual mobility rate is highest (0.267) among the youngest and lowest (0.035) among the oldest households.

According to the size of the household the probability is highest among the one member households, but in general an one dimensional table does not reveal clear dependence between the family size and mobility rate, partly because of the fact that the age and the size of the household are strongly negatively correlated.

Lack of space (low dwelling size per person) increases remarkably the probability to move. If the dwelling size per person is less than 15 squared meters the annual probability to move is as high as 0.221.

The connection between income and mobility rate is not perfectly clear either, on the basis of an one dimensional table. The mobility rate is highest in the middle income group and significantly lower in lowest and highest income groups, when income is measured as the total household income per person.

The probability to move is in general higher in rented dwellings than in owner-occupied dwellings. The higest mobility rate (0.170) is in free market rented dwellings. The lowest mobility rates is in owner-occupied, private finance, single family houses (0.061) in which the dwelling sizes are largest (absolutely and per person).

Table 3.1. The average annual moving rates of households within the metropolitan area of Helsinki during 1987-1988

Age of the household head					
-24	25-34	35-44	45-64	65+	TOT
0.267	0.201	0.119	0.070	0.035	0.114

Household size (number of persons)				
1	2	3	4+	TOT
0.119	0.115	0.117	0.103	0.114

Living space (squared meters per person)				
-15	15-30	30-45	45+	TOT
0.211	0.125	0.079	0.086	0.114

Income, 1000 Fmk 1987 (total household income per person)					
-60	60-80	80-100	100-120	120+	TOT
0.109	0.116	0.135	0.119	0.100	0.114

Housing type *							
RPUB	RNP	RPRI	OPUBF	OHIT	OPRIMS	OPRISF	TOT
0.098	0.164	0.170	0.083	0.086	0.099	0.061	0.114

* RPUB = rented, public (City of Helsinki)
RNP = rented, non-profit
RPRI = rented, private (free market)
OPUBF = owner-occupied, public finance
OHIT = owner-occupied, HITAS
OPRIMS = owner-occupied, private finance, in multi-storey buildings
OPRISF = owner-occupied, private finance, single-family houses
TOT = all dwellings

The distributions of transitions from each subsector to another are presented in table 3.2. For those who have moved during 1987-1988 the probability to stay in the same subsector is higest (62.5 per cent) in the rented dwellings owned by the city of Helsinki. It is high also (60.0 per cent) in HITAS-dwellings, in spite of the fact that it is the smallest subsector considered. In other subsectors the probability to change the subsector is higher than the probabilty to remain in the same category. Transitions from owner-occupied sectors to rented sector are very rare. On the other hand, there is a relatively large proportion of transitions from the rented to the owner-occupied sector, especially from free market rented dwellings.

Table 3.2. The distribution (%) of transitions between subsectors during 1987-1988 in the metropolitan area of Helsinki. (Calculated of mover households. Does not contain transitions from and to the subsector "unknown".)

Subsector*	Subsector* on Jan. 1, 1989							
on Jan 1, 1987	RPUB	RNP	RPRI	RPUBF	OHIT	OPRIMS	OPRISF	TOT
RPUB	62.5	1.8	7.1	7.1	8.9	10.7	1.8	100.0
RNP	8.7	35.9	21.7	10.9	5.4	13.0	4.3	100.0
RPRI	7.4	10.3	38.2	9.3	1.0	29.4	4.4	100.0
OPUBF	4.0	0.0	2.0	38.0	6.0	32.0	18.0	100.0
OHIT	10.0	0.0	0.0	10.0	60.0	20.0	0.0	100.0
OPRIMS	2.6	4.7	12.0	8.9	2.6	47.6	21.5	100.0
OPRISF	0.0	4.9	9.8	14.6	2.4	26.8	41.5	100.0
TOT	10.2	10.2	20.2	11.8	4.2	30.7	12.6	100.0

* RPUB = rented, public (City of Helsinki)
RNP = rented, non-profit
RPRI = rented, private (free market)
OPUBF = owner-occupied, public finance
OHIT = owner-occupied, HITAS
OPRIMS = owner-occupied, private finance, in multi-storey buildings
OPRISF = owner-occupied, private finance, single-family houses
TOT = all dwellings

3.3. A logit model of residential mobility

Table 3.1 described differences in mobility rates with respect to one variable at a time. Furthermore, the variables referred to levels of income, family size etc. which is contrary to the view that mobility is a dynamic reaction to changed conditions. In this section we shall use multiple regression models which take into account that the probability to move is a result of several interconnected factors. Second, the explanatory variables to be included into the model are of four basic types. First, there are variables which try to catch crowdedness of initial dwelling and the change in demand. These variables include square meters per person in 1987, and the changes in family size and permanent income during 1987-89. Second, there are variables related to the age of household head, his/her education level and family size. These

can be viewed as proxies for transactions (search and moving) costs. Third, there are (dymmy) variables related to the type of housing sector involved and the location of dwelling in 1987 which aim at summing up related differences which affect the propensity to move. Fourth, we include the age of dwelling in 1987. This is mainly because the HITAS stock is new, and one would expect the propensity to move from a new dwelling to be low as there must have been a recent previous move.

Logit models provide one approach by which the relationship between mobility and various demographic, economic and housing market variables can be analyzed. In our logit model the decision to move within the metropolitan area during 1987-1988 (yes=1 / no=0) is explained by the age and education of the sample person, by the income, size and living space of the household, and by the type and location of the dwelling. (See eg. Maddala (1983) about the theory of logit models.)

Estimation results are presented in table 3.3. According to the results the probability to move depends strongly on the age of household head. The probability to move is highest for young people who typically move a lot because they move away from their parents' home and form new households. Somewhat surprisingly the coefficient (and probability) for age groups "under 24 years" and "between 24 and 34" are of the same size. Thereafter, the probability goes systematicly down when household heads become older.

Education level of household head affects mobility in a monotonic way. Mobility is lowest for the least educated and increases for those with medium or high level of education. There is, however, only a non-significant difference among the latter two groups.

According to our estimation results the type of dwelling affects the probability to move, even when demographic and economic variables are controlled. The mobility rates are highest from the private rented sector. Publicly financed dwellings, owned by non-profit institutions or firms (with employee dwellings) do not differ significantly from private rented dwellings as for mobility. Mobility from the rented dwellings owned by the City of Helsinki is somewhat lower. However, it seems that dwellings in all these rented sectors are temporary places where quite a few people only stop to look for better alternatives from other sectors, especially from the owner-occupied side, if possible.

In owner-occupied dwellings the probability to move is highest from dwellings in privately financed apartments (condominiums) in multi-storey buildings. It is somewhat lower in case of privately financed single family and terraced houses where dwelling sizes are larger, and in publicly financed sector where price and entry (eligibility) are controlled by the government. It is lowest in the HITAS sector where second hand prices are indexed to initial construction costs and transactions are controlled by the City of Helsinki.

The location of the dwelling does not have a significant effect on the probability to move. Only in the case of Vantaa (a suburb municipality North of the City of Helsinki), there is a slight (but still statistically insignificant) indication of lower

mobility rate relative to central parts of Helsinki.

As for the age of dwelling, there is some tendency for mobility rates to increase with "younger dwellings" until in case of the newest ones mobility rate becomes lower again. However, only one of the coefficients is significant at 10 per cent level.

The probability to move increases with crowdedness, i.e. a decrease in space per person. The effect is non-linear as the second order term also becomes significant.

Greater families have lower mobility rates. An increase is family size (during 1987-89) increases the probabilty of moving. This effect is higher for small families on the basis of the interaction term.

Permanent income level in 1987 and its change (caused only by changes in demographic variables) during 1987-89 get positive but insignificant coefficients. Neither does their interaction with negative coefficient become significant.

In conclusion, it seems that there are differences in mobility rates between housing market sectors in the metropolitan area of Helsinki, even if demographic and economic factors are controlled. The mobility rates are in general higher in the rented sector than in the owner-occupied sector. Lowest mobility rates in the rented sector are in dwellings owned by the City of Helsinki where where rents are determined by downpayments of historical construction costs and other running costs, and tenants are very rarely given notice. On the owner-occupied side the lowest mobility rate is in the price controlled HITAS sector. Thus there are indications of lock-in effects in these sectors during the period 1987-89 when unregulated prices of housing boomed in Finland leaving the regulated prices and rents far behind.

Table 3.3. Estimation results of the logit mobility model

Dependent variable: The household has moved within the metropolitan area during 1987-1988 (yes=1 / no=0)

Independent variable	coeff.	t-stat.[1]
Age of the houshold head		
-24 years (1/0)	1.562	7.34 **
25-34 years (1/0)	1.562	9.67 **
35-44 years (1/0)	1.216	7.19 **
45-64 years (1/0)	0.712	4.31 **
65+ years (ref. group)	-	-
Education of the household head		
less than intermediate level (ref.group)	-	-
intermediate level	0.321	3.04 **
university level (1/0)	0.354	2.67 **
Housing sector		
rented, public (C. of Helsinki) (1/0)	-0.327	-1.81
rented, non-profit (1/0)	-0.086	-0.55
rented, private (ref.group)	-	-
owner-occ., public finance (1/0)	-0.521	-3.13 **
owner-occ., HITAS (1/0)	-0.798	-1.99 *
owner-occ., priv. fin., multi-stor. (1/0)	-0.429	-3.70 **
owner-occ., priv. fin., sigle fam. (1/0)	-0.595	-3.11 **
Location		
inner city of city of Helsinki (ref.group)	-	-
suburbs of the city of Helsinki (1/0)	-0.042	-0.36
municipality of Vantaa (1/0)	-0.212	-1.38
munic. of Espoo and Kauniainen (1/0)	-0.020	-0.14
Age of the building		
0-1 years (1/0)	-0.557	-1.44
2-3 years (1/0)	-0.051	-0.22
4-5 years (1/0)	0.371	1.75
6-9 years (1/0)	-0.081	-0.51
10+ years (ref.group)	-	-
Continuous variables		
dwelling size per pers. (m^2) 1987	-0.069	-14.01 **
dwelling size per pers. (m^2) 1987 squared	0.00034	9.46 **
size of the household 1987	-0.292	-7.04 **
change of household size 1987-1989	1.000	6.17 **
(size of hh 1987)x(change 1987-1989)	-0.240	-5.95 **
change of permanent income 1987-1989	0.0025	0.83
(perm. income 1987)x(change 1987-1989)	-0.00001	-0.59
Number of observations	3927	
Log-Likelihood	-1664.1	
Proportion of right choices (percent)	81.5	

[1] ** = significant at 1 percent level
* = " 5 percent level

4. CONCLUSIONS

In this paper we have estimated models of housing demand and residential mobility using household level data from the metropolitan area of Helsinki. Dwellings have been divided to housing sectors according to tenure type and form of finance.

Results from both the housing demand models and mobility models indicate that there are a lot of non-neutralities in the housing markets of Helsinki due to different allocation, price and subsidy mechanisms in subsectors of housing.

Dwelling sizes are significantly smaller and mobility rates higher in rented than in owner-occupied dwellings. In addition, the mobility rates in publicly controlled dwellings are lower than in free market dwellings both in the rented and in the owner-occupied sector. Spacious housing for a family seems to be possible only in owner-occupied dwellings in Helsinki. Especially free market rented dwellings can today be characterized as places of temporary housing. On the other hand, in publicly controlled sectors it may be the case that many families remain locked in their dwellings even when the demand for housing service changes.

An interesting feature in the housing markets of Helsinki is that the demand for dwelling size depends very strongly on the age of the household head, especially in the owner-occupied sectors. The dwellings size increases monotonically with respect to age. In other words, households in Helsinki are forced to increase their dwelling size step by step towards the optimal size. One reason is in short amortizing periods of Finnish housing loans. Another reason is related to supply restrictions in the housing markets of Helsinki which manifest themselves in internationally high housing prices in the owner-occupied sector, and availability problems in the regulated housing sector.

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