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HOUSING DEMAND AND TENURE CHOICE: EVIDENCE FROM FINLAND*

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ABSTRACT:

Data from the Household Expenditure Survey for Finland (year 1985) are being used for estimating tenure choice models either owning or renting - and models for the tenure specific demand for dwelling size (sq.m.), using a two stage estimation procedure. Tenure choice and demand for dwelling size are affected by micro level income, household structure and life cycle variables. The regional ratio of price of owner-occupied housing to rent of renter-occupied dwellings affects the probability of owning negatively in a probit tenure choice model. Regional levels of dwelling prices and rents are used in the models for dwelling size demand. The state of the rented housing market - an element mostly neglected in previous studies despite rent control etc. in many countries - is taken into account by means of a variable describing the queue for rented dwellings. The more people there are in the queue (per units delivered) for publicly allocated rented dwellings, the greater the probability of owning. The size demand for rented dwellings is, however, not affected by the rental queue.

KEY WORDS: Housing demand, tenure choice, rent control

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TIIVISTELMÄ:

Työssä käytetään vuoden 1985 kotitaloustiedustelun aineistoa asunnon hallintamuotovalinnan - omistaa vaiko vuokrata - ja hallintamuodoittaisten pinta-alakysyntöjen tutkimiseksi käyttäen kaksivaiheista estimointimenetelmää. Hallintamuodon valintaan ja pinta-alakysyntöihin vaikuttavat kotitaloustason tulo-, perherakenne- ja elinkaaritekijät. Alueellinen omistusasuntojen ja vuokrien suhde vaikuttaa negatiivisesti omistusasunnon valinnan todennäköisyyteen probit- tyyppisessä hallintamuodon valintamallissa. Vuokra- ja omistusasunnon ohella vuokramarkkinoiden tila (epätasapaino) - aiemmissa tutkimuksissa huomiotta jätetty tekijä huolimatta eri maissa esiintyvästä vuokrasäännöstelystä - otetaan huomioon jonomuuttujalla, joka mittaa vuokra-asuntoa kunnallisesta asunnonjaosta hakevien lukumäärää suhteessa jaettujen asuntojen määrään eri alueilla. Jonomuuttujan kasvaessa omistusasunnon valintatodennäköisyys kasvaa. Jonomuuttuja ei kuitenkaan vaikuta merkitsevästi vuokra-asuntojen pinta-alakysyntään.

AVAINSANAT: Asuntopalvelusten kysyntä, hallintamuodon valinta, vuokrasäännöstely

CONTENTS

1. INTRODUCTION

The purpose of this paper is to report results of a study on tenure choice and housing demand in Finland. There are several good reasons for focusing on this topic. The share of owner-occupied housing was 55.9 per cent in 1950 and 69.4 per cent in 1985. In public discussion tax advantages to owner-occupiers have been referred to as the main reason for this development. However, the last major change favouring owners took place in the beginning of 1970s whereas there has been a marked increase in owner-occupation also more recently despite the fact that tax advantages to owner-occupiers have not increased. Only the increase in marginal tax rates has favoured owners. Another quoted factor, low or negative (especially in 1970s) real rates of interest under interest rate regulated capital markets, favoured not only owners but also landlords and in principle should have affected rents, too.

One purpose of this study is to point out that at least in addition to tax advantages and the like, a more neglected element, the state of rental market ought to be taken into account. In Finland like in many other countries, there has been rent control or rent regulation, and accordingly varying amount of excess demand in the rental markets. On the supply side conversion of rental units to owner-occupied ones takes place. Our hypothesis is that rental housing shortage creates availability problems to newcomers and movers within rental sector and "pushes" households to owner-occupied sector.

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.

Boersh-Supan (1985) studies the joint choice of tenure, structure type and dwelling size by constructing hierarchial discrete alternatives and applying nested multinomial logit approach. 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.

The above and later studies have also other elements that have brought new insight to our understanding of the topic. King directly incorporates into his econometric model the impact of rationing in the private and local authority rental markets in the U.K. Concentrating on income and price variables alone, the probabilities of being rationed do not vary across households, i.e rationing is purely random. Hendersson and Ioannides (1986) differs from King i.a. by using only recent mover data in order to confine their analysis to households in equilibrium. Furthermore, they also study the effects of rationing in the mortgage market by specifying a separate probability of being rationed in their econometric analysis.

Kosonen (1987) recognizes that acquisition of owner-occupied housing and getting housing finance is often preceded by related "saving program". Using cross-section data (1979) from Finland, she estimates sequential binary choice models related to being a "pure renter", "renter-saver", "owner-occupier-saver" and "pure owner-occupier" in which categories saving is targeted to acquisition of housing. 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.

In our study, we shall use Household Expenditure Survey as of 1985. This data source and the form in which it was made available to us restricts our possibilities to operationalize theoretical concepts. As a result of this, especially our quantity of housing as well as housing price and rent variables differ from those used mostly in other studies. We measure housing in terms of dwelling size, i.e. square meters. As for prices, we utilize regional housing price and rent variability. The state of rental markets is also taken into account by using regional averages of queues (applicants per dwelling delivered) of public housing offices. In addition, we use household level information to study the effects of household income, family composition and life-cycle variables. Without direct measure of user cost of owner-occupied housing, household income, being related to marginal tax rate, also indirectly measures the advantageousness of owning. Our household characteristics can also be viewed to take indirectly into account rationing in the rental housing market and/or in the capital market both of which were still regulated (rent and interest rate controls) in 1985 creating excess demand situations. Alternatively, they reflect differences in preferences.

In estimation, we shall use the two state estimation prucedure suggested by Lee and Trost (1978) and also used i.e. by Rosen (1979) and Gillingham and Hagemann (1983). The first stage is probit estimation of the probability of owning

vs. renting, and the second stage is ordinary least square estimation of the demand for dwelling size (sq.m.) including the inverse Mills' ratios from the first stage in the latter tenure specific equations (c.f. also Heckman (1976,1979)).

2. TOWARDS ECONOMETRIC SPECIFICATION

Consider households in a two commodity framework, housing and non-housing. Assume that the price of non-housing is the same througout the country and normalized to unity. Housing is either rented or owner-occupied. Furthermore, assume that the rental market and the market for housing finance are in equilibrium, i.e. there is no rent control or credit rationing. Under these circumstances prices fully reflect scarcities and each household chooses the form of tenure in which housing is cheaper. Thus tenure choice is a matter of comparing rents to user costs of owner-occupied housing.

Besides eventual regional variation in relative advantageousness of the two tenures, taxation affects the outcome. Given progressive taxation, deductibility of interest costs of housing loans and almost no tax levied on imputed income of owner-occupied housing or on capital gains, owning becomes relatively more attractive to rich and renting to poor households. Thus there is also relative price variability at micro level within each region. Without information which would enable us to calculate user costs of owner-occupied housing or even marginal tax rates, the above considerations suggest the inclusion of household specific income to discrete tenure choice (probit) model in addition to housing price and rent variables.

Due to rent control in the private rental sector, eligibility constraints in the public rental markets and credit rationing in the capital markets, the above "visible" prices do not fully reflect scarcity. In principle, we must add to them margins which reflect non-price rationing to get correct "shadow" prices of housing.

As for owner-occupied housing, prices in this sector have all the time been market determined and they also vary regionally. Housing finance, however, was still rationed in 1985 (interest rate regulation continued until 1987). There is no evidence suggesting that there are regional differences in credit rationing, but rationing varies with income (or wealth). The richest are not rationed at all with given interest rates, whereas other households are typically rationed in varying degree. In order to get housing loans, the latter have had to save in advance from one third to half of the value of the dwelling. The downpayment periods of such loans were typically around ten years in mid-1980s. Without any direct measure of rationing, household income also serves as as a proxy for rationing. Thus the shadow price (or user cost) of owner-occupied housing decreases with income both because of taxation and rationing.

Rents have been regulated by the government so that after a rent control period (1968-72) regionally varying maximum acceptable increases have been determined annually. Real rents have decreased since the beginning of 1970s and this has had a negative impact on supply of private rental dwellings which has only partly been compensated by respective public supply. The relative size of disequilibrium in the regional rental markets varies. Shortage in the rental sector adds a scarcity margin to the regulated rents. Without any direct indicator of disequilibrium, we have constructed regional variables which measure the number of queueing people per delivered dwelling in public rental offices. Here, we assume that this measure increases with the relative size of disequilibrium in the rental market.[1] Thus rental housing shortage is expected to "push" households to the owner-occupied sector.

Besides tenure choice, also housing demand is affected by rental housing shortage. Both within the rental and owner-occupied sectors crowding is increased as the possibilities of e.g. elder children to enter the rental market are limited. Thus we expect housing demand to be a decreasing function of queues. The demand for owner-occupied housing may

also be affected in regions with rental housing shortage if quite a few typical renter households enter this tenure and buy small units.[2]

In addition to the above variables we shall use a number of household characteristics as explanatory variables both in the probit tenure choice and continuous housing demand equations. These can be partly viewed as proxy variables for being rationed both in the rental and in the capital markets, partly they may represent differences in preferences.

3. MODEL SPECIFICATION

Owning and renting housing are assumed to be mutually exclusive alternatives for each household. We assume that prices of non-housing commodities are the same in all regions of the country and do not vary within regions across households either. Asset prices of owner-occupied housing, reflecting partially user costs, vary by region and are denoted by P_{oi} where i refers to region. Average regional rents are denoted by P_{ri}, respectively. In addition to regulated rent level, excess demand in the regional rental markets is measured by average lenght of queue per unit delivered, Q_i, in municipal housing offices. Tax advantages to owner-occupiers are indirectly taken into account by household income (Y) and demographic (D) variables. They also serve as proxies for eventual rationing and furthermore, demographic variables may reflect variations in preferences.

For a particular household living in region i we specify the tenure choice and housing demand model as follows:

$$(1) \qquad I = g(P_{oi}/P_{ri}, Q_{ri}, Y, D) + e,$$

$$(2) \qquad q_o = h_o(P_{oi}, Q_{ri}, Y, D) + e_o,$$

$$(3) \qquad q_r = h_r(P_{ri}, Q_{ri}, Y, D) + e_r,$$

where I(.) is an unobservable summary index reflecting the advantageousness of owning relative to renting. Variables q_o and q_r are the quantities (square meters) of housing if the household is an owner or a renter, respectively. Our queue variable Q_i is also included in the demand for owner-occupied housing.

Refering to (1)-(3), unless error terms e_o and e_r 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 two stage estimation procedure suggested by Lee and Trost (1978).

Assuming error term e to have a standard normal distribution, the first step is to estimate a probit tenure choice model by maximum likelihood method. In the second stage, we shall employ the simplest possible functional form for (2)-(3), i. e. assume that they are linear. The variable (inverse Mill's ratio) $k_o=-f(I^{est})/F(I^{est})$ is added to the list of regressors in owners' (and $k_r=f(I^{est})/F(-I^{est})$ to renters') demand function, where $F(I^{est})$ is the estimated probability for the considered household to own as F(.) is the cumulative normal distribution and f(.) is the ordinate of the standard normal distribution. When the augmented regressions are estimated by ordinary least squares, the estimates are consistent. Furthermore, the coefficient of k_o in the owners' demand equation is an estimate of the covariance between the error term e in tenure choice equation and e_o. Coefficient of k_r has a similar interpretaion for renters. Whether or not there is statistically significant correlation between the error terms can be tested by t-test on k_o for owners and k_r for renters. However, in judging whether or not the coefficients are significant, standard errors from the second stage (OLS) of the two stage procedure are incorrect (under-estimates) because explanatory variables include estimated elements (c. f. Maddala 1983, p. 242). Our t-statistics will be based on corrected standard errors.

In addition to the above formulation, we shall shortly report results from equations in which regional dummy variables have been substituted for regional housing price and queue variables.

4. DATA DESCRIPTION

In this study the data come from the Household Expenditure Survey (HES) as of 1985. It is a stratified sample survey of 8200 households and affords detailed information on incomes and expenditures at micro (household) level. As a data source HES has a number of deficiences, some of which are related to the form of variables that were made available for us from the original full data set. Quantity of housing is a key variable in housing demand studies. In the Finnish case using values assessed by official assessors for tax purposes as e. g. in King (1980) is not a relevant one for several reasons. Furthermore, HES does not contain information on assessed values, nor owners' own estimates of market values used e.g. by Brownstone et. al. (1989). Thus we shall confine ourselves to measuring housing consumption in terms of dwelling size. Our variable SQM is the square meters of the permanent dwelling of the household. The average size of dwellings in 1985 was 73 square meters.

The dominant tenure type in Finland is owner-occupation. In 1985 its share was 69.4 per cent of the permanently inhabited housing stock covering both houses and owner-occupied apartments in housing companies. This tenure form can in principle be further divided into privately and (partly) publicly financed units. Unlike e.g. in Sweden the cooperative tenure form is practically non-existent in Finland. The rental sector (30.6 per cent) consists of three main categories, namely private rental dwellings, publicly (mainly municipally) owned partly state financed rental dwellings and employee related rental dwellings. The last group also contains dwellings that are partly state financed

with subsidized loans. A more detailed description of the Finnish housing market is in Bengs and Loikkanen (1991).

HES does not contain the information whether a dwelling is partly state financed or not. Here we shall simply use the dichotomy such that OWNED is a dummy variable with value one in case of owner-occupied dwellings. In the demand for rental space equations we shall use dummy variables related to dormitories (DORMITORY) and rental dwellings provided on non-market basis (NONMARDWE).

Alongside the problem of measuring housing quantity, there are problems with price variables in HES. For owner-occupied housing there is nothing that could be easily utilized as user cost or (asset) price per unit of housing. That is why we have augmented the original data with average regional prices per square meter of owner-occupied dwellings in 1985 (REGPRICE). Average regional gross rents per square meter (REGRENT) have been calculated from HES itself. These variables will be used in demand for dwelling size models. In the tenure choice model (c.f. equation (1)) the regional ratio of price of owner-occupied square meter to the respective (PRICE/RENT) is used.

As for the regionalization, instead being able to identify e. g. the municipality involved, for privacy protection reasons we can locate the households only to six mutually exclusive regions. Their abbreviations and definitions are the following

HKI	= Helsinki
HKISUR	= the rest of the Helsinki Metropolitan Area (i.e. the surrounding municipalities of Espoo, Kauniainen and Vantaa)
HKIREG	= the rest of the Helsinki Region
CITY4	= the four biggest cities (Kuopio, Oulu, Tampere and Turku) outside Helsinki Region
TOWN16	= sixteen next biggest cities
RESTFIN	= rest of the country, i.e. small cities and the country-side

Our income variable (INCO) is disposable household income, i. e. it contains income from all sources (including imputed income from owner-occupied housing but excluding capital gains) minus taxes plus transfers. It is an annual income concept which does not correspond to permanent income or even normal income as all sources of annual variation are present. This is why we can expect to get lower income elasticities in the demand for space equations than in studies with income concepts closer to permanent income. A second reason to expect low income elasticities is our quantity variable. Demand for quality components of housing are typically more income elastic than demand for space.

In addition to income and price variables we include the following variables into our equations. We have dummy variables corresponding to part-time work (PARTJOB) and full-time work (FULLJOB) of the second income earner in the household. Here, one earner household is the 0-case. Education level of the head of household is classified into four groups. 0-case EDUCA12 represents least education. The level of education increases in classes EDUCA34, EDUCA56 and EDUCA78. Female heads of household are caught by dummy variable FEMALE.

As for household structure, we use an interactive dummy variable structure where households are located into classes according to the number of adults and children and the age of head of household. These variables are denoted such that e.g. R23I4564 denotes a household with two adults and three children (R23 stands for this part) and the age of head of household is 45-64 (I4564 stands for this). The basic or 0-case to which all the other dummy variable classes are compared is R21I3044, i.e. a household with two adults and one child, the head of household being in age class 30-44. The purpose of this procedure is to find out eventual life cycle and family structure patterns in housing consumption without an a priori restrictive functional form.

As discussed above, in case of housing households are not only facing a problem of choosing quantities (and qualities)

given prices. They also face rationing. Access to and demand for housing in the owner-occupied sector is affected by eventual credit rationing. In our analysis this is taken only indirectly into account through income and demographic variables. Richer households are expected to face less rationing in the capital market. On the other hand, they do have more limited access to means tested public rental housing.

As for market level variables, in addition to regulated rents the state of the rental market is taken into account by augmenting HES with regional information on queues. QUEUE is defined as the number of applicants per delivered rented dwelling in queues for public housing.

Our data source makes it possible to identify households which moved during the year 1985, covered by the survey. This would make it possible to estimate separate models using recent mover data as in several other studies. Here, we postpone such procedures and instead only use in our demand for dwelling size equations a dummy variable (MOVER) with value one to "recent movers". A priori it is hard to say which way this should affect.

5. ESTIMATION RESULTS

The estimation results of probit tenure choice model and tenure specific linear demand for square meters models are in table 1. We shall comment the results paying mainly attention to coefficients that are significant at the 95 per cent level in a two-tailed test.

Table 1

First, we note that the coefficient of the inverse Mill's ratio is positive and statistically significant in owners' dwelling size model. The respective coefficient is negative

Table 1 Probit tenure choice model (probability of owning) and demand for dwelling size (square meters) models for owners and renters

	PROBIT MODEL		DEMAND FOR SQUARE METERS MODELS			
			OWNERS' MODEL		RENTERS' MODEL	
VARIABLE	COEFF.	T-STAT.	COEFF.	T-STAT.	COEFF.	T-STAT.
CONSTANT	0.636	4.76	74.14	12.24	39.48	2.39
MILLS			26.15	2.52	-11.18	-1.49
INCO	0.008	12.9	0.346	11.80	0.146	2.96
EDUCA34	0.076	1.91	5.061	4.47	-0.335	-0.27
EDUCA56	0.020	0.28	14.28	7.20	4.252	1.99
EDUCA78	-0.174	-2.05	17.04	7.14	20.03	7.72
NONMARDWE					7.673	5.56
DORMITORY					-13.05	-0.89
PARTJOB	-0.013	-0.23	-2.964	-1.75	-3.463	-1.95
FULLJOB	0.149	2.63	3.946	2.35	-6.180	-3.26
FEMALE	-0.153	-3.39	-7.414	-4.89	1.039	0.74
MOVER			-4.280	-2.33	1.465	1.15
PRICE/RENT	-1.383	-8.20				
REGPRICE			-8.740	-7.72		
REGRENT					0.041	0.05
QUEUE	0.056	2.58	-1.941	-3.50	-0.015	-0.03
R10I1729	-0.971	-7.23	-38.79	-3.57	-19.11	-4.31
R10I3044	0.042	0.33	-17.51	-3.68	-20.54	-6.19
R10I4564	0.617	5.29	-0.988	-0.24	-21.56	-4.69
R10I6599	0.581	5.18	-0.521	-0.13	-23.02	-5.29
R1PI1729	-1.235	-4.29	-40.76	-2.09	3.798	0.62
R1PI3099	0.047	0.38	-1.841	-0.42	2.130	0.65
R20I1729	-0.732	-7.56	-27.78	-4.43	-6.244	-1.47
R20I3044	0.115	1.09	-10.92	-3.34	-8.532	-2.77
R20I4564	0.714	8.12	11.11	3.07	-3.921	-0.83
R20I6599	0.885	8.71	10.98	2.55	-11.97	-2.04
R21I1729	-0.592	-5.62	-18.66	-3.56	1.499	0.37
R21I4564	0.654	4.75	15.76	3.82	6.931	1.17
R21I6599	0.741	1.18	33.80	2.01	-6.881	-0.33
R22I1729	-0.455	-3.94	2.306	0.47	11.91	3.10
R22I3044	0.267	3.64	14.31	5.93	3.091	1.15
R22I4564	0.597	3.35	26.32	5.60	6.891	0.95
R2PI1729	-0.233	-1.14	12.46	1.77	8.954	1.58
R2PI3044	0.127	1.52	25.54	10.16	17.07	6.52
R2PI4564	0.391	2.04	24.78	4.96	12.26	1.81
R30I1744	0.335	2.39	5.306	1.30	-7.484	-1.54
R30I4599	0.586	5.99	14.09	4.19	0.701	0.15
R31I1744	0.361	2.53	16.43	4.26	-2.562	-0.48
R31I4599	0.705	4.60	24.98	6.12	2.709	0.37
R32I1744	0.252	1.47	22.82	4.95	13.54	2.30
R32I4599	0.428	1.69	23.60	3.89	0.870	0.09
R3PI1744	0.313	1.30	38.27	6.81	8.697	1.01
R3PI4599	0.200	0.71	41.14	5.65	31.56	3.39
R40I1744	0.350	1.76	3.518	0.71	-9.638	-1.31
R40I4599	0.574	3.86	20.31	5.27	-5.084	-0.78
R41I1744	0.028	0.11	23.53	3.48	-11.35	-1.22
R41I4599	0.649	2.99	21.58	4.63	-11.45	-1.26
R4PI1744	0.238	0.89	25.18	4.27	25.98	2.79
R4PI4599	0.475	1.86	24.62	4.46	14.80	1.55
RPPI1744	0.478	1.44	11.97	2.02	-9.121	-0.62
RPPI4599	0.569	2.71	15.08	3.47	-11.71	-1.26
number of obs.	8175		6260		1915	
log likelihood	-3631.9					
correct predictions (%)	80.5					
adj. R-square			0.32		0.46	

and insignificant in renters' model. These results indicate that there is a selectivity effect involved such that owners tend to have larger dwelling sizes than renters.

The probability of owning (hereafter PO) and the demand for dwelling size (hereafter DDS) increase with income. To get a quantitative idea of the impact of annual disposable household income on the probability of owning, consider a reference family case (average income, lowest education, one earner, two adults, one child, household head 30-44 years) assuming that the family lives in Helsinki. The average annual disposable income for all households in 1985 was 84.6 thousand Finnish marks. The household's probability of owning is 0.435. Conditional of being an owner (a renter) the household's dwelling size would be 63.6 (60.6) square meters. With a ten procent higher (lower) income the probability of owning would be 0.462 (0.408) and the conditional dwelling sizes would be 65.3 square meters (61.9 sq.m.) for an owner and 62.3 square meters (58.9 sq.m.) for a renter. Income elasticities of the demand for dwelling size conditional on tenure form become very similar in size, 0.27-0.28, for both owners and renters.

While income seems to have a clear impact on tenure, it is worth repeating that this variable is here a proxy for the tax advantages of owner-occupation which increases with higher marginal tax rates and hence with income. Additionally, our income variable catches eventual effects related to rationing both in the capital and the rental markets.

Education level of household head does not have a clear effect on PO but dwelling size increases with education level in both tenures. Nonmarket rental dwellings are larger than other ones whereas dormitory dummy is statistically insignificant. Full-time work by second adult in the family increases PO and owners' DDS which can also be interpreted to mean that labour supply responds to home acquisition. For renters the effect on DDS is the opposite. Female heads of household have lower PO than families with male heads, and

also their DDS is smaller than that of males in owned dwellings. Mover dummy gets a negative and significant coefficient in case of owners.

Household structure and life cycle dummies have a rather interesting and expected pattern. The 0-case is R21I3044, i.e. a household with two adults and one child, and household head being of age 30-44. Quite a few coefficients of other classes differ significantly from zero, i.e. the 0-case. They typically increase both with an increase in the age of household head and the number of children in all three models. To illustrate the role of these variables, we have calculated percentage shares of owner-occupants for most common family structures from the probit model in table 1. The results for our reference household are in table 2. The predicted selectivity corrected dwelling sizes for owners are in table 3, and for renters in table 4. In both cases we used the coefficient of the Mill's ratio coefficient despite the fact that it was statistically insignificant.

Tables 2-4

According to the results of tables 2-4 one can distinguish a life cycle pattern. The probability of owning as well as dwelling size of owners increases with family size and the age of household head. The results of tables 3 and 4 indicate that quantitatively, renters' dwelling sizes change less with demographic variables than those of owners'. This may be due to both limited opportunities of adjusting housing demand in the regulated private rental housing market and/or it may reflect selection criteria of municipal housing offices. Accordingly, renters' DDS model may well reflect supply restrictions insted of being a pure demand equation.

Finally, we turn our attention to price and queue variables. PO decreases when the ratio of housing prices to rents increases. To get a quantitative idea of the impact of this ratio on the probability of owning, consider a reference family case (average income, lowest education, one earner, two adults, one child, household head 30-44 years) and assume

Table 2 Predicted percentage shares of owner-occupiers by household type for a reference case (with average income, lowest education, wife not working and living in Helsinki)

Household structure		Age of household head			
Adults	Children	-29	30-44	45-64	65-
1	0	12.8**	45.1	67.5**	66.2**
2	0	18.5**	48.0	70.9**	76.5**
2	1	22.8**	43.51	68.8**	71.8**
2	2	26.8**	54.1**	66.8**	no obs.
2	3+	34.6	48.5	59.0*	no obs.

[1] 0-case in tenure choice model
* respective coefficient differs from 0-case at 5 % level
** respective coefficient differs from 0-case at 1 % level

Table 3 Owners' selectivity corrected dwelling size by household type (using results of table 1); square meters

Household structure		Age of household head			
Adults	Children	-29	30-44	45-64	65-
1	0	44.3	45.7	53.3	54.2
2	0	50.3	56.5	64.0	61.7
2	1	56.3	63.9[1]	69.3	86.4
2	2	74.7	73.8	80.9	no obs.
2	3+	80.5	87.2	82.2	no obs.

[1] 0-case in owners' demand for dwelling size model

Table 4 Renters' selectivity corrected dwelling size by household type (using results of table 1); square meters

Household structure		Age of household head			
Adults	Children	-29	30-44	45-64	65-
1	0	36.2	40.2	43.5	63.7
2	0	50.1	52.7	61.9	55.4
2	1	58.4	60.4[1]	72.2	59.2
2	2	69.6	65.3	71.7	no obs.
2	3+	67.8	78.3	75.5	no obs.

1y 0-case in renters' demand for dwelling size model

the price/rent variable to have its national average value 1.0 and similarly the queue variable its average value 3.2. PO becomes 0.55. When price/rent variable is set to values 1.25 and 0.75 (in which range they vary) PO gets values 0.41 and 0.68, respectively, indicating rather substantial effects.

PO increases with the length of queue per delivered rental dwelling. This supports our hypothesis that shortage of rental housing "pushes" households to the owner-occupied sector and tenure choice analysis must also take into account the state of the rental market. Again, to get a quantitative idea, consider our reference family for which PO became 0.55 with national average values. If, instead of 3.2, the queue variable has values 6.56 and 2.7 (max and min values), POs become 0.62 and 0.54, respectively. Finally, assume that the rental market is in balance such that there is one delivered dwelling per applicant. In this case QUEUE=1 and PO is 0.50. These results indicate that the queue variable is also quantitatively important thinking of tenure choice decisions.

Regional housing price level affects owners' DDS negatively. To see how much, consider our reference household and assume that the price of owner occupied housing is increased by 10 % from its initial national average level. Conditional of being an owner, dwelling size decreases from 77.7 square meters to 76.1 square meters, i.e. by two per cent. Regional rent level in renters' equation gets a positive and totally insignificant coefficient. This could also be expected due to rent regulation.

The rental queue variable was also included in both demand equations although this procedure is ad hoc in case of owners. According to our results the DDS of owned dwellings is negatively affected by rental queue. A possible explanation for this is the following: quite a few typical renter households are pushed to the owner-occupied sector and there they buy smaller units than typical owner-occupants.

DDS in rented dwellings is unaffected by our queue variable. The sign is as expected but the coefficient is totally insignificant. This is contrary to our expectations, because (assuming our queue variable measures shortage properly, c.f. footnote 1), we would expect renter households in regions with housing shortage to underconsume housing the more relative to "equilibrium demands", the greater the shortage.

In addition to the problem of understanding the role of queue variable in renters' equation, the whole equation is ambiguous. Part of rental dwellings are public units to which mainly municipal authorities allocate tenants according to norms of the National Housing Board. Thus our equation is not a proper demand equation, at least partly we are modeling the allocation criteria of housing authorities. This may also explain why especially economic variables (especially rent level) have so small effect on DDS. From this view-point it is unfortunate that we cannot distinguish private and public rental dwellings in our data.

6. COMPARISON TO A MODEL WITH REGIONAL DUMMY VARIABLES

Our results above supported the view that price and queue variables affect tenure choice and and housing demand, although the role of our queue variable is problematic in demand equations and the renters' demand equation is open to alternative interpretations. Here, our purpose is to present results of same equations as before except that regional dummy variables have been substituted for respective price and queue variables.

The estimation results of models with regional dummy variables are in table 5. Comparing the values of log likelihood functions and adjusted R-squares, these models are only marginally better than those with regional price and queue variables. Coefficients of Mill's ratios are here insignificant in both DDS equations. The signs and t-values

of other variables that are the same in both cases remain very much the same. Thus, we only comment the role of regional dummy variables as compared to respective price and queue variables. Our intention here is to see how big regional differences there are by looking at the effects of regional dummy variables. Secondly, to what extent they can explained by regional price and queue differences.

Table 5

In the estimated tenure choice model and owners' DDS model all region dummies are statistically significant, i.e. the regions differ from the 0-case consists of countryside and smaller towns. On the other hand, in renters' DDS model none of region dummies is significant. To get an idea of the size of regional differences we have calculated POs and tenure conditional DDSs from our basic models (BM) and the models with dummy variables (RDM) for a reference household assuming that it lives in different regions.

Table 6

The results in table 6 indicate that the predictions of PO from the basic model and the region dummy model are pretty close to each other. As for the DDS predictions, we have used the model with Mill's ratios in calculating the tenure conditional demands despite the fact that the respective coefficients are not significant in the regional dummy models. The DDS predictions for owners from the two models differ especially in case of Helsinki surroundings (HKISUR) and four big cities outside Helsinki (CITY4).

As regional dummy variables take into account all regional differences unexplained by other variables, according to our results, in most cases prices and queues contribute to some extent in explaining such differences.

According to the results of regional dummy models in table 6, there are clear regional differences in POs and the sizes of

Table 5 Probit tenure choice model and demand for dwelling size models for owners and renters with region dummy variables

	PROBIT MODEL		DEMAND FOR SQUARE METERS MODELS			
			OWNERS' MODEL		RENTERS' MODEL	
VARIABLE	COEFF.	T-STAT.	COEFF.	T-STAT.	COEFF.	T-STAT.
CONSTANT	-0.245	-2.52	49.74	6.43	41.77	5.68
MILLS			15.62	1.50	-9.200	-0.78
INCO	0.008	12.90	0.324	11.23	0.158	2.11
EDUCA34	0.085	2.15	5.333	4.86	-0.234	-0.17
EDUCA56	0.029	0.40	14.90	7.84	4.343	2.04
EDUCA78	-0.162	-1.91	18.56	8.15	19.66	7.18
NONMARDWE					7.414	5.36
DORMITORY					-13.57	-0.94
PARTJOB	-0.013	-0.23	-2.799	-1.72	-3.564	-2.03
FULLJOB	0.146	2.57	3.309	2.06	-6.167	-2.92
FEMALE	-0.150	-3.31	-6.691	-4.58	0.782	0.48
MOVER			-3.823	-2.07	1.451	1.15
HKI	-0.659	-10.09	-30.06	-8.48	-1.487	-0.27
HKISUR	-0.180	-2.18	-22.67	-9.87	2.079	0.75
HKIREG	-0.061	-0.59	-5.52	-2.12	-2.658	-0.85
CITY4	-0.206	-3.51	-16.73	-9.16	-0.877	-0.38
TOWN16	-0.153	-3.25	-10.44	-7.36	-1.445	-0.80
R10I1729	-0.968	-7.21	-29.14	-2.64	-20.07	-3.43
R10I3044	0.056	0.44	-15.87	-3.42	-20.14	-6.02
R10I4564	0.625	5.36	-2.068	-0.52	-20.73	-3.32
R10I6599	0.581	5.18	-1.570	-0.42	-22.40	-3.83
R1PI1729	-1.20	-4.20	-27.69	-1.37	2.997	0.39
R1PI3099	0.060	0.49	-0.379	-0.09	2.240	0.68
R20I1729	-0.727	-7.51	-22.41	-3.60	-7.029	-1.20
R20I3044	0.116	1.11	-11.49	-3.65	-8.188	-2.60
R20I4564	0.715	8.12	8.378	2.36	-2.708	-0.40
R20I6599	0.884	8.70	7.870	1.87	-10.79	-1.28
R21I1729	-0.592	-5.62	-15.30	-2.95	0.806	0.15
R21I4564	0.646	4.69	12.89	3.25	7.953	1.07
R21I6599	0.764	1.23	32.55	2.03	-6.614	-0.31
R22I1729	-0.465	-4.03	4.538	0.94	11.32	2.38
R22I3044	0.261	3.56	12.70	5.45	3.604	1.13
R22I4564	0.591	3.32	23.76	5.27	7.816	0.93
R2PI1729	-0.245	-1.20	12.65	1.85	8.835	1.51
R2PI3044	0.116	1.38	23.98	9.93	17.50	6.51
R2PI4564	0.387	2.02	22.45	4.71	13.35	1.86
R30I1744	0.319	2.28	2.870	0.73	-6.852	-1.30
R30I4599	0.582	5.93	11.40	3.49	1.880	0.30
R31I1744	0.351	2.45	14.02	3.80	-1.736	-0.30
R31I4599	0.698	4.55	22.29	5.66	3.922	0.44
R32I1744	0.226	1.32	20.53	4.67	13.60	2.25
R32I4599	0.402	1.59	20.89	3.63	1.954	0.19
R3PI1744	0.274	1.14	35.18	6.60	9.246	1.05
R3PI4599	0.177	0.63	39.25	5.66	31.55	3.38
R40I1744	0.336	1.69	1.174	0.25	-8.597	-1.12
R40I4599	0.558	3.75	17.55	4.77	-4.169	-0.54
R41I1744	0.001	0.01	21.43	3.34	-11.27	-1.22
R41I4599	0.635	2.92	18.34	4.12	-9.667	-0.95
R4PI1744	0.215	0.80	22.70	4.05	26.72	2.85
R4PI4599	0.451	1.77	21.62	4.12	16.09	1.61
RPPI1744	0.438	1.33	8.614	1.54	-8.369	-0.55
RPPI4599	0.541	2.58	11.92	2.89	-10.96	-1.09
number of obs.	8175		6260		1915	
log likelihood	-3622.5					
correct predictions (%)	80.3					
adj. R-square			0.33		0.46	

Table 6 Regional differences in probability of owning and (tenure choice conditional) dwelling sizes for a reference household[1] as predicted by our basic models with regional prices and queues (table 1) and the models with regional dummy variables (table 5).

	Probability of owning		Dwelling size (square meters)			
			Owners'		Renters'	
	BM[2]	RDM[3]	BM[2]	RDM[3]	BM[2]	RDM[3]
HKI	0.44	0.42	63.7	61.6	62.7	59.8
HKISUR	0.57	0.61	63.6	64.3	60.2	66.2
HKIREG	0.60	0.65	73.0	80.4	59.6	62.3
CITY4	0.60	0.60	81.7	70.5	59.6	63.1
TOWN16	0.70	0.62	76.9	76.3	58.0	62.9
RESTFIN	0.66	0.68	84.5	85.5	58.6	65.3

[1] Reference case here has average income, lowest education, male head of household, wife not working and and lives in a normal rental dwelling if renter.
[2] BM = basic models (table 1)
[3] RDM = models with regional dummies (table 5)

owner-occupied dwellings whereas the same is not true for rental dwellings. For instance, the reference household has 24 square meters less in Helsinki than in the smallest towns and the country-side (RESTFIN) if it owns, whereas in rental dwellings the difference is almost non-existent reflecting also the fact that region dummies are not statistically significant. This suggests that the mechanisms behind the provision of public housing may partly explain the almost total lack of regional differences in rental dwelling sizes for similar households. On the other hand, there is less regional variation in rents due to rent regulation than in prices of owner-occupied housing (c.f. table 3 in Appendix 1).

7. CONCLUDING REMARKS

This study has been our first effort to use Household Expenditure Survey (year 1985) data from Finland to estimate tenure choice and tenure specific demand for dwelling size (square meters) models using a two stage estimation procedure.

The results of our study can be summarized as follows. Micro level income (also proxy for tax effects), household structure and life cycle variables affect both demand decisions. Regional ratio of (asset) price of owner-occupied housing to respective rent affects the probability of owning negatively. Regional housing price (for owners) has a negative and significant effect on the demand for square meters, whereas regional rent level is insignificant in renters demand for dwelling size model. The latter result is not unexpected as rents have been controlled or regulated since 1968.

The state of rental housing market, a mostly neglected element in previous studies despite rent controls etc. in many countries, is taken into account by a regional queue variable. The more people there are in the queue per publicly allocated rental dwelling, the greater the probability of owning. Thus there is an expected push effect to owning. Also the demand for owner-occupied dwelling size is negatively affected by the rental queue. An ad hoc explanation for this is the following. With great excess demand for rental housing (under rent regulation) also typical renter households are "pushed" to buy small owner-occupied dwellings.

Demand for rented dwelling size is unaffected by our queue variable. This is contrary to our expectations, since we would have expected regional housing shortage to manifest itself as regional underconsumption of housing relative to "equilibrium demands".

There are several possibilities to improve and extend our analysis. Here, we only want to point out that hopefully our results serve as a recommendation to the Central Statistical Office of Finland to get a more detailed regional classification such that e.g. 30 biggest urban areas could be identified. This would substantially improve our possibilities to get reliable results concerning price and queue effects.

FOOTNOTES

1. This is not necessarily the case. Namely, our measure may in principle be inversely U-related to relative disequilibrium. With a market in equilibrium there is no queue. On the other hand, if disequilibrium is sufficiently great and everybody knows there is nothing to be expected from a queue, there is no queue. Between these extremes the queue has a maximum size and accordingly, depending on the side around maximum, increases in queue may mean either increses or decreases in disequilibrium.

2. In addition to these effects average discrepancies between desired and actual rental housing consumption levels increase with shortage of rental dwellings. As a reason for such discrepancies in general, earlier residential mobility and more recent housing demand literature (c.f. Quigley and Weinberg (1977), Hanuschek and Quigley (1978), and Venti and Wise (1984)) has stressed the role of transactions costs. As a result of them households tolerate discrepancies between their actual and desired housing demands to a certain degree without trying to adjust their consumption. In Loikkanen (1982) an explicit search model of housing demand and mobility is used e.g. to show how an increase in housing shortage, manifesting itself in decreased arrival rates of offers when searching, increases the equilibrium sets of households. This means that they tolerate more disequilibrium in the rental market without searching. On the other hand, if they search their acceptance sets are large under housing shortage, i.e. they accept also offers which deviate much from the best options. This suggest that in regions with great rental housing shortage we expect to get poorly fitting models as demands do not correspond to desired demands to the extent that they do on more balanced markets. Testing this hypothesis by running regional equations with more and less balanced rental markets is postponed to a later stage.

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Appendix 1: Descriptive statistics of variables

Table 1/A1: Sample means standard deviations, minimums and maximums (8175 obs.) (Household size and age of household head dummies are in table 2, price and queue variables in table 3).

VARIABLE	MEAN	STAND. DEV.	MINIMUM	MAXIMUM
INCO	104.6	47.69	0.259	399.1
FEMALE	0.232	0.422	0	1
FULLJOB	0.465	0.498	0	1
PARTJOB	0.262	0.439	0	1
MOVER	0.088	0.284	0	1
EDUCA34	0.391	0.488	0	1
EDUCA56	0.069	0.253	0	1
EDUCA78	0.052	0.223	0	1
OWNED	0.765	0.423	0	1
RENTED	0.202	0.401	0	1
NONMARDWE	0.031	0.174	0	1
DORMITORY	0.000	0.015	0	1
SQM	89.23	42.23	8	600.0
REGPRICE	3.598	0.838	3.203	6.31
REGRENT	16.66	1.015	14.78	19.68
PRICE/RENT	0.841	0.139	0.771	1.258
QUEUE	3.349	1.110	2.70	6.56
HKI	0.064	0.246	0	1
HKISUR	0.045	0.209	0	1
HKIREG	0.029	0.168	0	1
CITY4	0.089	0.285	0	1
TOWN16	0.154	0.361	0	1

Table 2/A1: Sample means of dummy variables related to household structure and age of household head multiplied by 100 (8175 obs.)

VARIABLE[1]	MEAN (%)	VARIABLE	MEAN (%)
R10I1729	2.67	R2PI3044	7.77
R10I3044	1.92	R2PI4564	0.99
R10I4564	3.24	R30I1744	1.89
R10I6599	4.15	R30I4599	6.29
R1PI1729	0.46	R31I1744	2.06
R1PI3099	2.21	R31I4599	2.43
R20I1729	3.60	R32I1744	1.17
R20I3044	3.05	R32I4599	0.61
R20I4564	8.31	R3PI1744	0.70
R20I6599	5.60	R3PI4599	0.40
R21I1729	2.69	R40I1744	1.06
R21I3044	6.77	R40I4599	2.63
R21I4564	2.39	R41I1744	0.46
R21I6599	0.07	R41I4599	1.32
R22I1729	2.09	R4PI1744	0.62
R22I3044	15.35	R4PI4599	0.78
R22I4564	1.33	RXXI1744	0.63
R2PI1729	0.55	RXXI4599	1.57

[1] *E.g. R21I1729 refers to a household with two adults and one child, and the age of household head is 17-29. Symbol P means the next size class of children without upper limit. E.g. R1PI1729 is a case where the number of children is one or more as in the previous class there were no children.*

Table 3/A1: Means of housing price, rent and queue variables by region in 1985.

	PRICE[1]	RENT[2]	QUEUE[3]	PRICE/ RENT INDEX
HKI	6.310	19.68	4.21	1.2522
HKISUR	5.214	18.71	6.29	1.0917
HKIREG	3.978	14.78	6.56	1.0581
CITY4	3.682	15.97	3.18	0.9032
TOWN16	3.434	17.02	4.92	0.7879
RESTFIN	3.203	16.30	2.70	0.7684
COUNTRY AVERAGE	4.374	17.17	3.20	1.0000

[1] Price of owner-occupied dwellings (1000 marks/sqm)
[2] Monthly rent (marks/sqm)
[3] Queueing persons per delivered dwelling in municipal housing offices

Sources: Prices of owner-occupied dwellings are originally from Housing Price Statistics of the Central Statistical Office of Finland. Regional weighting has taken place by using population statistics. Rents have been calculated from HES. Original queue figures were obtained from National Housing Board and they were also weighted using population statistics.