To be presented at the 2005 ENHR International Housing Conference 29

June to 2 July in Reykjavík, Iceland

Economics of Housing Tenure Choice

by

Jørgen Drud Hansen[a]

and

Morten Skak[b]

[a] EuroFaculty Vilnius Centre, University of Vilnius, Lithuania

[b] Corresponding author Morten Skak. Department of Economics. University of Southern Denmark.

Campusvej 55. DK-5230 Odense M. Denmark. Morten Skak gratefully acknowledges financial support

from the Realdania Foundation.

Phone: +45 6550 2116 Fax.: +45 6615 8790 E-mail: mos@sam.sdu.dk

Economics of Housing Tenure Choice

Abstract

The paper presents a model where ownership becomes important for the utility a household gets from housing consumption. The reason is that each household has an ideal variant of housing that is obtainable by supplementary investments to the housing capital. Because contracting is costly, only consumers with strong preferences for ideal variants choose homeownership instead of renting. The paper derives equilibrium on the residential market under various assumptions about the utility function and modes of adaptation. The model explains why homeowners typically live in bigger dwelling units than tenants, and why congested cities have smaller rates of homeownership.

1. Introduction

Housing is a dual good. On the one hand, the flow of services from housing capital generates utility and is consumed by households. On the other hand, residential capital represents an asset which household may include in their portfolio of wealth. Institutionally, the two goods are traded on separate markets. The flow of services from housing capital is traded on a rental market where tenants contract for use of residential capital during a period and pay rents to owners. Similarly, the stock of housing capital is traded on a market for residential capital.

In a free market economy with perfect foresight and absence of contracting costs, the consumer is in principle indifferent whether to own or rent housing capital. However, as these assumptions are not fulfilled in today's world, consumers' interest for home ownership may be influenced by at least four aspects.

Firstly, consumers may include housing assets in their portfolio of wealth because of uncertainty. Housing capital may be considered a risky asset with yields that, by its covariance with yields from other financial assets and human capital, offers a possibility for consumers to improve the risk-return profile of their total portfolio and consumption flow. The seminal paper by Henderson and Ionnides (1983) on this aspect has been followed by a number of contributions; see e.g. the reference list of the recent paper by Ortalo-Magné and Rady (2002). Although this aspect is important for the housing market, it is equally important to emphasise that it does not explain

why house owners live in their own house as homeowners[1]. Without contracting and transaction costs involved homeownership should only happen by coincidence. Hence, the explanation for homeownership is contracting and transaction costs and not portfolio considerations. Too little attention has been paid to this in the literature on tenure choice. In the model to be presented in section 2, contracting and transaction costs play an important role.

Secondly, home ownership typically has relevance because of institutional factors. In most countries income taxes distorts consumers towards ownership of housing capital used for their consumption. The reason is that implicit income (imputed rent) from owner occupied residential capital is not taxed or taxed at a lower rate than other sources of income. If incomes are taxed under a progressive tax schedule, high income-earners are inclined to own housing capital for own consumption. This tax argument is used in several analyses as a rationale for ownership; see e.g. Swan (1981). Imperfections on the capital market or rent control may also give specific incentives either to rent or buy residential capital for housing consumption; see the survey article about housing by Smith, Rosen and Fallis (1988) for these arguments.

Thirdly, Linneman (1986) invokes differences in production efficiency between landlords and owner-occupiers as an important factor behind ownership rates. In example, landlords internalise externalities, e.g. from external repair, that cause problems among neighbours in multi family structures and may be able to use their

---

[1] Following the U.S. Census Bureau, the difference between homeowner units and owner occupied units consists of vacant for-sale-only homeowner units (less than 2 per cent of homeowner units). The difference between homeownership and owner occupancy is neglected in the paper.

buying power to reduce maintenance costs. Linneman concludes that high production efficiency by landlords in high density residences is the reason why ownership rates tend to fall when one travel from the countryside and into city centres.

Fourthly, ownership matters in a world of contracting costs. For costs reasons a rental contract of an asset only specifies a limited number of future eventualities. A rental contract is in general incomplete leaving the right to decide for the residual range of future outcomes to the owner. For the user of a complex asset it may therefore make sense to buy the asset. This basic point has been developed by Hart (1995) in his analysis of contracts and firms.

The purpose of this paper is to present a model where ownership of housing capital matters for the consumer of housing service because of incomplete and costly contracts. The model incorporates contracting costs and combines it with a Lancaster (1979) type of consumer individual 'ideal' variants of housing services. Furthermore, the model assumes that the utility of the ideal variant varies among consumers. To give an example, a consumer may find the color on a wall very important: A light red may be the ideal variant and other colors like white or yellow etc. may reduce the utility from living in the room markedly. For other consumers that have the same preferences, or have another color as their ideal variant, the issue is less important, which just shows that the utility they get from the ideal variant is smaller. Yet, other consumers may be close to completely indifference as long as the color is different from black, which indicates that the utility they get from the ideal variant compared to nearly any other variant is minuscule. Other examples might involve the design of the kitchen, bathrooms, choice of furniture, the cultivation of the garden etc. It is not new

in economic literature to assume individual differences in the utility or disutility from a good or service; e.g. Sinn (2000) assumes that workers can be ranked according to the disutility they incur when migrating from their home country to work in another country.

Out of this comes a model where ownership of housing capital matters for the consumption of housing services. Ownership becomes more attractive for consumers with strong preference for adaptation of the housing capital because contracting is incomplete and costly and transaction costs are involved.

The presented model illustrates the consumer's optimization when he or she faces the twin choices of tenure ship and supplementary investment. The choice depends on preferences, investment costs, and contract and transaction costs for alternative tenure ship. Consumers will be divided into two groups, homeowners and tenants, where homeowners have a consumer surplus that exceeds that of renting by an amount no less than the amortized contracting and transaction costs. Hence, homeowners live in bigger dwelling units because they get higher utility from their ideal housing variant than tenants. This is new in the literature. The model also explains why it is important for total welfare in societies to open for private ownership of homes, and why socialist experiments that prohibit private ownership should be avoided. Another important result is that low homeownership rates in congested cities are now easily explained. It is simply because high rents in congested cities imply that fewer households have a consumer surplus that covers the amortized contracting and transaction costs.

The paper is organised as follows. Section 2 presents the basic models of residential demand in the simple case of exogenous investment and contract costs. Section 3 analyses market equilibrium based on the demand function derived in section 2. Section 4 generalises the model by introducing flexible and endogenous supplementary investments. Finally, section 5 concludes.

2. A Model for Residential Demand

The consumer chooses between two composite goods: housing services from a residential unit and a composite good for all other goods. Housing services are assumed measurable in units of *square meters per year*, i.e. a variable, which counts the volume of the flow good residential living. The services from housing might be enriched by adapting the housing capital to the consumer's ideal variant by making a supplementary investment. The consumer holds the residential unit either as tenant or as owner. It is assumed that the consumer demands and gets only one *dwelling unit* consisting of the demanded number of square meters per year on the market, and that discontinuities, e.g. because of minimum renting times, house and apartment sizes etc. does not disturb the functions. To vary the language in the following, home will be used synonymously with dwelling unit.

There are a fixed number of consumers *N*. The preferences of each of the consumers belong to the same class of preference functions. The *i*'th consumer's utility is given by the linear-quadratic utility function

$$U_i = y_i x - \frac{x^2}{2} + z \quad ; \quad 0 < \alpha \le y_i \le \delta, \tag{1}$$

where x is housing consumption in terms of square meters per year, and z is consumption of all other goods per year in units with a price equal to one, and α and δ are fixed parameters. y_i is person specific in the case where the consumer adapt the home to his specific taste[2].The consumer holds the dwelling unit, which contains the demanded number of square meters, either as tenant or as owner. When the consumer rent the unit no adaptation takes place and y_i takes the low value α. Preferences for renting a dwelling unit is thus identical for all consumers and the marginal utility of renting for consumer i $(i = 1,2,\ldots, N)$ is a linearly decreasing function of the number of square meters per year x,

$$\frac{\partial U_i}{\partial x} = \alpha - x_i. \tag{2}$$

Instead of renting, each consumer has the possibility to buy his home and adapt the housing capital to his specific taste. In this case the marginal utility of owner i is given by:

---

[2] In an analysis of housing by Black et al. (2002) a Stone-Geary utility function is introduced with a parameter for heterogeneity of the individual consumer's preferences. The analysis of Black et al. is related to the location of the population between two cities whereas this paper focuses the allocation between owners and tenants.

$$\frac{\partial U_i}{\partial x} = y_i - x_i. \tag{3}$$

y_i will be used in the following as a parameter to characterise the (maximum marginal owner augmented) utility of a consumer[3].

The investment costs consist of variable and fixed costs in relation to the size of the dwelling. Some costs e.g. painting, wall paper and carpets are by and large proportionate to the size of the dwelling. The flow costs of these, κ per square meter, are initially assumed to be exogenously given. Other costs are close to independent of the size of the home, e.g. comparatively expensive renovations of the kitchen and bathroom. Those costs make up a fixed level per dwelling unit and can be added to the fixed transaction cost that the owner incurs when he buys the dwelling unit. The flow equivalent of the total fixed costs σ is also assumed to be exogenously given.

With the i'th consumer characterised by the utility parameter y_i, all consumers are assumed to be equally (rectangular) distributed in the interval $[\alpha, \delta]$ with respect to y_i and hence, the density of consumers in this interval is given by $N/(\delta - \alpha)$. However, some consumers abstain from being owners and do not adapt the housing capital. In the following it is assumed that the residential market is dual with tenants who rent their home and owners who live in their home after having adapted it to their taste. Finally, identical stationary expectations are assumed for all consumers such that prices and the real interest rate are expected to keep their present levels.

---

[3] The preference function implies zero income elasticity. This may seem strange, but the function is convenient to illustrate effects solely from differences in individual utility from housing services.

Figure 1 illustrates the individual marginal utility curve for tenants I, and the net marginal utility curves II and III for owners with preference parameter y' and δ respectively.

Figure 1: Marginal utility and individual demand curves
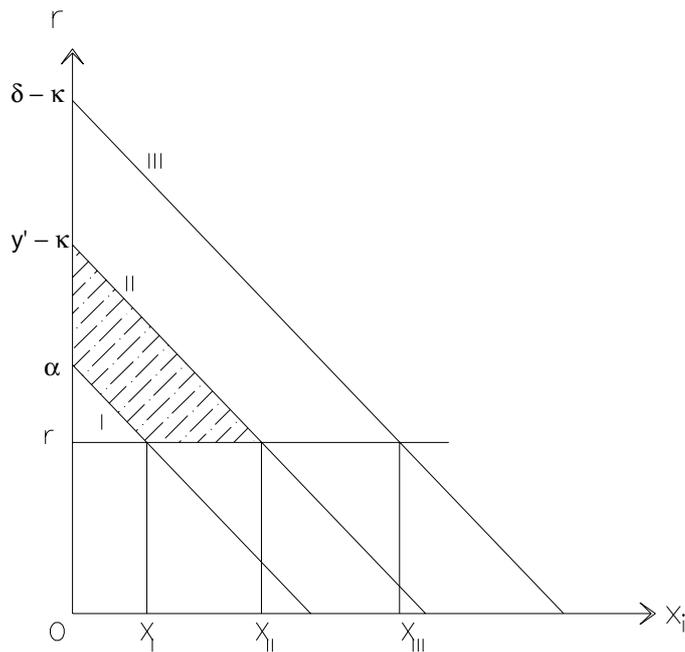
Demand

The individual consumer on the leasing market optimises his consumption by renting a number x of square meters on a perfect competitive market where the marginal utility of the last square meter equalises the rent r for a standard[4] square meter. Thus, using (2), the individual demand function for tenants is given by:

$$x_i = \alpha - r. \tag{4}$$

---

[4] Standard, because it does not contain adaptation investments.

In Figure 1 the individual demand of a tenant follows the curve I. At the rent r_0 demand is X_I.

The demand of an owner i is:

$$x_i = y_i - r - \kappa. \tag{5}$$

Assuming that r is the market equilibrium rent, the tenant's utility or consumer surplus is the area of the triangle between the demand curve and the supply curve at r,

$$CS^t = (\alpha - r)^2 / 2. \tag{6}$$

The owner's net consumer surplus is

$$CS_i^o = (y_i - r - \kappa)^2 / 2. \tag{7}$$

The first step on the way to derive residential demand is to identify the marginal owner defined as the consumer who is indifferent between the option to rent or to own and adapt his home to his preferences. For the marginal owner the consumer surplus for renting equals the net consumer surplus for ownership minus the fixed adaptation and transaction costs, i.e.

$$CS^o - CS^t = \left[(y_i - r - \kappa)^2 - (\alpha - r)^2 \right] / 2 = \sigma. \tag{8}$$

Solving (8) with respect to y gives

$$y' = \left[2\sigma + (\alpha - r)^2\right]^{\frac{1}{2}} + r + \kappa, \tag{9}$$

where $y_r' > 0$, $y_\sigma' > 0$, $y_\kappa' > 0$, and $y_\alpha' > 0$. For the marginal owner, the hatched area in Figure 1 is equal to σ.

The fraction of consumers that will be owners, v is

$$v = \frac{\delta - y'}{\delta - \alpha}, \tag{10}$$

where $v_\delta > 0$, $v_{y'} < 0$, and $v_\alpha > 0$. The number of owners in the market is thus vN. Because y' is an increasing function of r, v is a decreasing function of r.

Individual preferences for tenants too

Equation (2) assumes that the marginal utility from housing services is identical and equal to α for all individuals when they are tenants, but at the same time (3) shows that the marginal utility y_i varies among individuals when they become owners. This may sound awkward; and a natural change would be to let y_i vary for all individuals irrespective of their tenure position. Moreover, it might be more realistic to allow tenants to make minor adaptation investments, e.g. change of the wall paper and paintings, but exclude bigger investments like renovation of the kitchen and bathroom. However, the investment costs would be larger for tenants as they are unable to recoup some of the investment when they quit. Because of this, the variable

12

flow adaptation costs of tenants become $\beta\kappa$ with $\beta > 1$. Finally, tenants do not incur

the big transactions costs from the buying of a dwelling unit that goes into σ. The

consumer surplus for a tenant is now

$$CS_i^t = (y_i - r - \beta\kappa)^2 / 2. \tag{11}$$

Figure 2 shows the relation between the consumer surplus of tenants with a common

low level of utility α according to (6), tenants with individual levels of utility y_i

according to (11) and owners net consumer surplus equal to $CS_i^o - \sigma$.

Figure 2: Consumer surplus of tenants and owners
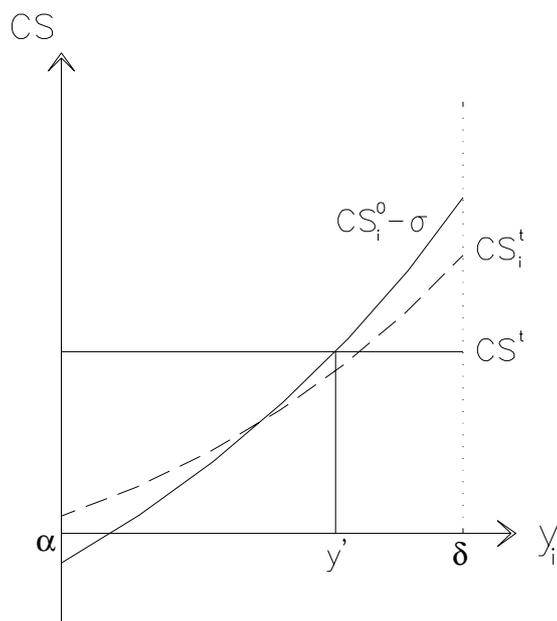
The *y'* shown in Figure 2 follows from equation (9), and gives the "position" of the

marginal owner who is indifferent between owning and renting. The dashed line

shows the consumer surplus of a tenant according to the more sophisticated equation

(11). A change of the parameter values β and σ will change the position of the curves,

and the dashed line may well cross at a higher point. However, with both tenants and

owners in the market, owners will be individuals with relatively high preference for

individual adaptation of dwellings. This leads to the first proposition:

Proposition 1: Homeowners occupy bigger dwelling units than tenants.

With owners being the only to have the fixed cost σ, the marginal owner will have

higher preference for individual adaptation than all tenants and demand more square

meters per dwelling unit, see Figure 1.

Aggregate demand

Because the simple specification (6) is much easier to work with than (11) it will be

used in the following. The aggregate demand for x from owners with preferences in

an interval *[y , y + dy]*, remembering that the density of owners is *N/($\delta - \alpha$)*, is

$$(y - r - \kappa)\frac{N}{\delta - \alpha}dy,$$

and, hence, aggregate demand for x from all actual owners X_o^d is determined by

$$X_o^d = \frac{N}{\delta - \alpha}\int_{y'}^{\delta}(y - r - \kappa)dy. \tag{12}$$

By solving (12) the aggregate demand function for owners appears to be

$$X_o^d = (\gamma - r - \kappa)vN, \tag{13}$$

where $\gamma = (\delta + y')/2$ is the preference of the average owner. It follows that $\gamma_\delta > 0$ and $\gamma_{y'} > 0$.

Demand from tenants X_t^d will be

$$X_t^d = (\alpha - r)(1 - v)N. \tag{14}$$

By addition, total demand X^d becomes

$$X^d = \left[(\gamma - \kappa - \alpha)v + \alpha - r\right]N. \tag{15}$$

Differentiating X^d with respect to r, remembering $y_r{}' > 0$, gives

$$\frac{\partial X^d}{\partial r} = -\left(\frac{y' - \kappa - \alpha}{\delta - \alpha}\frac{\partial y'}{\partial r} + 1\right)N < 0. \tag{16}$$

Total demand is, as expected, a decreasing function of the rent r. The reduction of demand that follows from a rise of r can be cut into two parts. Firstly, both tenants' and owners' demand will fall. This is captured by the part $- r N$ of (15). Secondly, some owners will go out of ownership and become tenants because a rise of r will raise y' and reduce the share v of owners among consumers. This movement contributes to a further fall of the demand.

15

The position of the total demand curve with respect to r depends on the size of the parameters δ, α and κ. Differentiation, see appendix, reveals that total demand X^d is increasing in δ, the parameter for the maximum owner specific utility from housing services. An increase of the bottom utility (for tenants) α will also increase X^d, but increasing investment and transaction costs, i. e. an increase of κ or σ, reduces total demand X^d.

3. Market Equilibrium on the residential market

Market equilibrium prevails when residential supply equals demand. Three cases are treated below.

Perfect elastic supply

The simplest case appears when no scarcity of land or other resources for residential output exists, and hence, the supply of residential units X^s is perfect elastic at the production price of new residential square meters. The flow price or rent r per square meter is thus exogenously given, i.e. $r = r_0$. The equilibrium condition is thus

$$X = \left[(\gamma - \kappa - \alpha)v + \alpha - r_0\right]N. \tag{17}$$

With the supply of homes being perfect elastic with respect to the rent r at the level r_0, a change of the number of consumers N generates a proportionate change of the amount of residential square meters and also the number of homes if new consumers are proportional identical to old consumers, Hence, the preference of the marginal owner, y', is unchanged as well as the share, v, of residential owners of the total population. A change in the rent appears if the real interest rate in the economy

16

changes or if the stock price of homes changes relative to other goods, i.e. because of a difference in the of growth of productivity between the construction sector and the rest of the economy. It follows from (9), (10) and (16) that a rise of r_0 will lower demand and increase the relative number of tenants as it increases y' and reduces v.

An increase of maximum utility effect of adaptation, illustrated by an increase of the parameter δ, lifts the preference of the average owner, γ, by half of the increase in δ, and hence the average owner's demand, and raises the share of owners (the fraction v). Total demand will increase, and the owners' share of the market goes up. Finally, the effect of an increase of the required investments for an owner, i.e. κ or σ, will raise y', reduce the number of owners and so owners demand. Total demand will fall and so will owners' share. It will, however, raise the average owner's demand γ.

Fixed supply

Limited supply of residential square meters x may be the case in big cities. Congestion and environmental problems may force authorities to stop the building of new units. The case of limited supply is therefore most interesting for big cities, and generally wherever scarcity of land and building restrictions limit the supply.

Total supply of residential square meters is now assumed to be completely inelastic with respect to the price, i.e.

$$X^s = S, \tag{18}$$

where *S* denotes the given endowment of square meters. To have tenants in the market, it is assumed that the rent $r < \alpha$ in equilibrium. The equilibrium is now given by the condition

$$S = \left[(\gamma - \kappa - \alpha)v + \alpha - r\right]N. \tag{19}$$

Equation (19) is very similar to (17) but now *S* and *N* are exogenous and *r* endogenous. Because of this, the implications of changes of the exogenous can be traced using the above-deducted relations. (19) shows that a reduction of the supply *S* has the same implications as an inflow of new inhabitants, i.e. an increase of *N*, where supply is limited. Thus, an increase of *N* raises the rent *r*, and, to repeat, it follows from (9), (10) and (16) that higher *r* reduces the quantity demanded and increases the relative number of tenants as it increases *y'* and reduces *v*.

Two locations: fixed and flexible supply

The model can be generalized to two locations, e.g. two cities where one city offers a flexible supply of houses and the other a fixed supply. Introducing the so-called "open city" assumption, i.e. assuming perfect mobility of consumers between the cities, no consumer can in equilibrium improve his utility by moving from one city to the other. Because of scarcity, rents and stock prices of homes in the congested city exceed prices in the city with a flexible supply. However, the congested city typically offers better city amenities, e.g. better cultural institutions, traffic connections and a larger labour market, and the additional utility from such amenities counterbalances the negative effect on utility of higher rents. This is a fairly standard result in urban economics. To keep the analyses simple, and similar to Black et al. (2002) and

18

Bruckner et al. (1999), amenities are assumed to be independent of housing consumption. The utility function (1) can be reformulated for the congested city by adding an amenity utility term a, i.e.

$$U_i = a + y_i x - \frac{x^2}{2} + z \quad ; \quad 0 < a, \ 0 < \alpha \leq y_i \leq \delta. \tag{1a}$$

The consumer surplus of the tenant in the congested city will then change into the following

$$CS^t = a + (\alpha - r_c)^2 / 2, \tag{6a}$$

where r_c is the rent in the congested city. If the utility effect of the amenities is relatively weak, so that the rent in the congested city r_c is less than α, tenants will settle in both cities. This allows for the determination of rent in the congested city as the consumer surplus for tenants in the city with flexible supply $CS^{t,f}$ must exceed the consumer surplus for tenants in the congested city $CS^{t,c}$ with exactly the utility value a of amenities. Setting (6a) equal to (6) and using r_f for the rent in the city with flexible supply gives the equilibrium condition

$$r_c = \alpha - \left[(\alpha - r_f)^2 - 2a \right]^{1/2}. \tag{20}$$

In this case, there will be no owners in the congested city, because the high rent in the congested city will cut more of the owners' consumer surplus than the value of the

amenity. To see this, note that the owner will settle in the flexible supply city if the consumer surplus in this city $CS^{o,f}$ exceeds the consumer surplus in the congested city $CS^{o,c}$ more than the utility value of the amenities a. Calculating $CS^{o,f}$ and $CS^{o,c}$ from (7) using r_f and r_c respectively, we have

$$CS^{o,f} - CS^{o,c} = (r_c - r_f)(y_i - \kappa - \frac{r_c + r_f}{2})$$

$$> CS^{t,f} - CS^{t,c} = (r_c - r_f)(\alpha - \kappa - \frac{r_c + r_f}{2}) = a. \tag{21}$$

On the other hand, for strong amenities, the rent in the congested city r_c might exceed α, precluding settlements of tenants. In the appendix it is shown that in this case, the market will screen the group of owners so that owners with weak preferences for adapting housing capital will settle in the congested city, while owners with strong preferences will settle in the city with flexible supply. The reason is that owners with strong preferences demand big dwelling units and hence feel attracted by the lower rent in the city with flexible housing supply.

However, the above extreme results depend crucially on the assumption that the utility effect of amenities is uniform for all consumers. Some consumers typically get higher utility from amenities than others. This can be the case, e.g. for high educated people with a thin job market concentrated in the congested city. Such people that get high utility both from adaptive housing investments and amenities may live as owners in congested cities. Keeping this in mind, the assumption of both tenants and owners in the market can be maintained, so that proposition 2 reads

Proposition 2: Congested cities have higher rent, smaller dwelling units and lower rates of homeownership.

That higher rents lead to smaller dwelling units is evident form Figure 1. Moreover, it follows from (9) and (10) that a higher rent will reduce the relative number of homeowners as it increases *y'* and reduces *v*. It is worthwhile noting that if a low or zero taxation of implicit income from owner occupied residential capital plays a crucial role among institutional factors, see section 1 on this, this would tend to lift homeownership rates in congested cities[5].

4 Tenure choices with endogenous investments

As an extension of the utility function (1) consumers may get individual utility from the investments needed to adapt the home to their taste. In the following it is assumed that y_i is influenced by adaptation investments per square meter, bearing the flow of costs κ, so that y_i in (1) is

$$y_i = \alpha + \varphi_i \kappa_i^\varepsilon; \quad 0 < \alpha, \ 0 < \varepsilon < 1, \ 0 < \varphi_i < \delta, \tag{22}$$

where the individual consumer *i* is characterised by the size of the parameter φ. ε, a parameter common for all consumers, indicates the sensitivity of marginal utility with respect to housing investments κ per square meter. To simplify the notation the consumer identification *i* is omitted in the following.

---

[5] However, the table on the web page http://www.census.gov/hhes/www/housing/hvs/q104tab6.html demonstrates that the homeownership rate by area follows proposition 2 on the US Housing market.

Inserting (22) in (11) gives the consumer surplus

$$CS = (\alpha + \varphi\kappa^\varepsilon - r - \beta\kappa)^2 / 2, \tag{23}$$

where $\beta = 1$ for owners. Maximising the consumer surplus with respect to κ gives the following optimal value for κ

$$\kappa^* = \left(\frac{\varphi\varepsilon}{\beta}\right)^{\frac{1}{1-\varepsilon}}. \tag{24}$$

Proposition 3: If tenants are allowed to make adaptation investments they invest less than owners because of contracting costs.

Equation (24) shows, with $1 < \beta$ for tenants, that ownership induces consumers to invest more because of the difference in cost efficiency. Higher utility from adaptation φ naturally also gives higher investments.

Using (24) in (23) gives the maximum consumer surplus with endogenous investments CS*. As before, the marginal owner is found by setting the net consumer surplus of renting equal to the net consumer surplus for ownership minus the fixed adaptation and transaction costs, i.e.

$$CS^{*o} - CS^{*t} = \sigma, \tag{25}$$

22

which determines φ' and y'. For consumers with $\varphi_i > \varphi'$, the difference exceeds σ and they become owners. In the appendix it is shown that the difference increases in φ so that owners are to be found among consumers with high utility from adaptation investments. Figure 3 shows the relationship between the adaptation investments and consumers derived utility. The dashed curve from α to b shows the optimal investment κ for gradual increasing φ (and y), and the dashed curve from c to d shows the same for owners. As can be seen on the figure and from equation (24), a jump in investments will take place for the marginal owner when he buys his home and leave the tenant position. Being at the margin, he is indifferent between renting the home with a modest adaptation investment and owning it with a bigger investment.

Figure 3: Endogenous adaptation investments and consumer utility
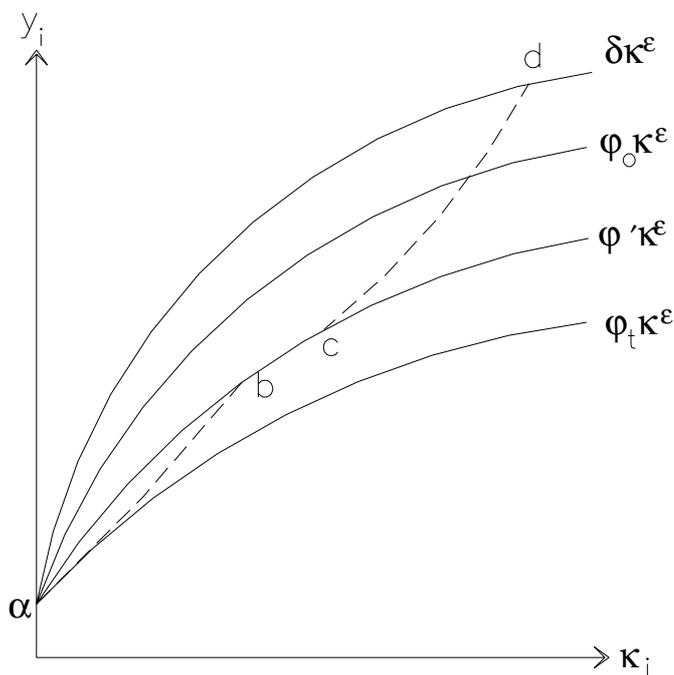
5 Concluding remarks

In the seminal paper by Lancaster (1979) on monopolistic competition the menu of product variants is exogenously given at the consumer level and hence the market will only offer the consumer his ideal variant by chance. This perception of an ideal variant also applies for housing. However, as housing services represents a unique bundle of characteristics, it is assumed in this paper that the residential capital has to be adapted through an investment if the consumer wants to realize the ideal variant. This gives the consumer a rationale for ownership as it minimizes the cost of adapting the housing capital. This rationale for ownership might also apply for several other durable consumption goods such as cars or leisure boats.

The possibility to adapt the housing capital (or other durable consumer goods) through an investment increases the utility of the good for consumers with a strong preference for realising their ideal variant of the good. Ownership makes it cheaper for the consumer to adapt the housing capital to the ideal variant and hence allowing for ownership is welfare improving. Furthermore, the model shows that homeowners occupy bigger dwelling units than tenants and that congested cities have higher rent, smaller dwelling units and a lower rate of homeowners, and, finally, where tenants are allowed to make adaptation investments they invest less than owners because of contracting costs.

Appendix

The derivatives of X^d from equation (15) with respect to δ, α, κ and σ are found to be

$$\frac{\partial X^d}{\partial \delta} = \left(\frac{v}{2} + \frac{(\gamma - \kappa - \alpha)(y' - \alpha)}{(\delta - \alpha)^2} \right) N > 0. \tag{26}$$

$$\frac{\partial X^d}{\partial \alpha} = \left[(1 - v) + (\gamma - \kappa - \alpha)v_\alpha + v\gamma_\alpha \right] N > 0. \tag{27}$$

$$\frac{\partial X^d}{\partial \kappa} = -\frac{\delta - \kappa - \alpha}{\delta - \alpha} N < 0. \tag{28}$$

$$\frac{\partial X^d}{\partial \sigma} = -\frac{y' - \kappa - \alpha}{\delta - \alpha} y'_\sigma N < 0. \tag{29}$$

In the two cities case with amenities, the rent r_c might exceed α leaving only owners in the congested city. In this case, the marginal owner who is indifferent between the two cities is identified by the condition $CS^{o,c} + a = CS^{o,f}$. Using (7), this gives the following y value for the marginal owner

$$y'' = \frac{r_c + r_f}{2} + \kappa + \frac{a}{r_c - r_f}. \tag{30}$$

Equation (21), repeated for owners, now becomes

$$CS^{o,f} - CS^{o,c} = (r_c - r_f)(y_i - \kappa - \frac{r_c + r_f}{2}) > (r_c - r_f)(y'' - \kappa - \frac{r_c + r_f}{2}) = a, \tag{31}$$

which shows that owners with $y_i > y''$ will settle in the city with flexible supply.

For endogenous investments, the consumer surplus in equation (26) is

$$CS^* = \frac{1}{2}\left(\alpha - r + \varphi(\frac{\varphi\varepsilon}{\beta})^{\frac{\varepsilon}{1-\varepsilon}} - \beta(\frac{\varphi\varepsilon}{\beta})^{\frac{1}{1-\varepsilon}} \right)^2 ,$$ (32)

with

$$\frac{\partial CS^*}{\partial \varphi} = x(\frac{\varphi\varepsilon}{\beta})^{\frac{\varepsilon}{1-\varepsilon}}.$$ (33)

Thus, $DIF = CS^{*o} - CS^{*t}$ has the derivative

$$\frac{\partial DIF}{\partial \varphi} = x^o (\varphi\varepsilon)^{\frac{\varepsilon}{1-\varepsilon}} - x^t (\frac{\varphi\varepsilon}{\beta})^{\frac{\varepsilon}{1-\varepsilon}} > x^t \left[(\varphi\varepsilon)^{\frac{\varepsilon}{1-\varepsilon}} - (\frac{\varphi\varepsilon}{\beta})^{\frac{\varepsilon}{1-\varepsilon}} \right] > 0.$$ (34)

References

Black, Dan, Gary Gates, Seth Sanders and Lowell Taylor (2002), Why do Gay Men Live in San Francisco. *Journal of Urban Economics,* 51, 54-76.

Brueckner, Jan K., Jacques-François Thisse and Yves Zeou (1999), Why is Central Paris Rich and Downtown Detroit Poor? An Amenity-Based Theory. *European Economic Review,* 43, 91-107.

Hart, Oliver (1995), *'Firms, Contracts, and Financial Structure'* Clarendon Lectures. Oxford: Clarendon Press.

Henderson, J., Vernon and Yannis M., Ionnides (1983), A Model of Housing Tenure Choice. *American Economic Review*, 73, 98-113.

Lancaster, K.J. (1979), *'Variety, Equity and Efficiency'*, NewYork: Columbia University Press.

Linneman P (1986), A New Look at the Homeownership Decision. *Housing Finance Review*, 5, 159 – 87.

Ortalo-Magné, François and Sven Rady (2002) Tenure choice and the riskiness of non-housing consumption. *Journal of Housing Economics*, Vol. 11, 266-279.

Smith, Lawrence B., Kenneth T. Rosen and George Fallis (1988), Recent Developments in Economic Models of Housing Markets. *Journal of Economic Literature*, Vol. 26 Issue 1 Mar. 29-64.

Sinn, Hans-Werner (2000), EU Enlargement, Migration, and Lessons from German Unification. German Economic review Vol. 1 No. 3, 299-314.

Swan, Craig (1983), A Model of Rental and Owner-Occupied Housing, *Journal of Urban Economics*, Vol. 16, 297-316.