DEPARTMENT OF ECONOMICS

Working Paper

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Working Paper No. 2001-7

ISSN 1396-2426

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Rent Control and Tenancy Duration*

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October, 2001

Abstract

This paper investigates how rent control affects mobility on the Danish private rental housing market. Based on a unique and extensive data set a measure of the degree of rent regulation of each housing unit is calculated, and this is coupled with socio-economic characteristics and spells of tenancy duration for each household. To accommodate the special features of such a data set we apply a proportional hazard duration model, that encompasses both the presence of left truncated tenancy durations, right censored observations and allows for a very flexible specification of the time dependency as captured by the baseline hazard function. We find that tenancy mobility is severely reduced by the presence of rent control. Tenancy duration for a typical household in the private rental sector is found to be more than six years longer if the apartment belongs to the 10 per cent most regulated units than if it belongs to the 10 per cent least regulated units.

Keywords: Rent control, mobility, duration model.

*Financial support from the Danish Social Science Research Council is gratefully acknowledged. We thank Rasmus H. Jacobsen, Svend Jespersen, Michael Rosholm and participants at the conference held by The Danish Building and Urban Research Institute at Solhavegaard 2001 for useful comments, and Gerda Christophersen for careful reading of the manuscript. The views expressed are not necessarily reflecting those of the Danish Economic Council.

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1 Introduction

Since 1939 the Danish housing market has, as has been the case for many other countries as well (see e.g. Lind (2001)), been subjected to severe regulations on rent determination. Among economists there seems to be consensus on the misfortunes of rent control when it comes to the effects on quantity and quality of housing (Alston, Kearl & Vaughan (1992)). The opponents of rent control have argued that regulations imply serious inefficiencies on the housing market. These inefficiencies range from lack of maintenance due to low economic profits for landlords (Gyourko & Linneman (1990*b*)) over misallocation of housing (Glaeser & Luttmer (1997)) to reduced mobility on the housing market (Clark & Heskin (1982), Gyourko & Linneman (1989), Ault, Jackson & Saba (1994), and Nagy (1995)). On the other hand, proponents of rent control claim that the regulations could be well suited for distributional reasons. I.e. alleviation of rent control would imply major shifts in welfare from the lower deciles of the income distribution to the higher deciles. More recently it has been argued that the presence of (mild) rent control can be welfare improving since landlords have monopsony power and therefore tend to set rents above marginal cost levels. Hence, a mild rent control can distribute some of the economic rent from landlords to tenants (Arnott & Igarashi (2000)).

As mentioned several authors have studied the implications of rent control for tenancy mobility. Gyourko & Linneman (1989) were the first to econometrically test the impact of rent control on mobility. Based on data from New York City they report a strongly significant positive association between the level of benefits from rent control and tenancy duration. Ault et al. (1994) criticize the study of Gyourko & Linneman (1989) and argue that their approach gives inconsistent estimates as it performs ordinary least squares estimation on grouped data. Instead, they suggest a grouped data regression model. They then estimate their model based on the same data set as Gyourko & Linneman (1989) and find that households living in controlled housing are indeed less mobile, and that 80 per cent of the difference in mobility can be explained by the presence of rent control. Nagy (1995) argues that both of the previous papers ignore a duration censoring problem, because households, which were present to complete the survey that collected the data, obviously had not completed their entire duration. He then suggests using a duration model that nicely incorporates the possibility of right censored observations. In this study it is confirmed that tenants in controlled housing are less mobile than their uncontrolled counterparts, but here it is attributed to differences in observed characteristics of the

tenants rather than to the existence of rent control.

In the present study we follow the approach suggested by Nagy (1995). However, we improve on Nagy's specification in two aspects. First, Nagy only estimates remaining durations. That is, he ignores the part of the tenancy duration that lies before his observation period. This is particularly dangerous in such a set-up since the hypothesis is that households in controlled areas are less mobile. By cutting off part of the tenancy duration he risks reducing the appropriate tenancy duration more in controlled housing. We show how to modify the likelihood function in order to incorporate left truncated observations. Second, Nagy specifies a hazard function with an exponentially distributed baseline hazard. This implies that tenancy duration cannot exhibit any duration dependence. However, as noted by e.g. Arnott (1995) individuals tend to have lower mobility out of their current accommodation the longer they have lived there. In order to accomodate for this expected feature of the data we allow for a more flexible specification.

The paper is organized as follows. In Section 2 we shortly discuss the main features of the Danish private rental housing market. The characteristics of rent control in Denmark fit well with the description rental housing markets of several other countries. The data set is described in Section 3 along with the calculation of apartment specific rent control benefits. Section 4 contains a description of the econometric specification that is applied in order to investigate how mobility is influenced by rent control. In Section 5 we present the results, and in Section 6 we conclude.

2 The Danish private rental housing market

There are around 2.5 mio. housing units on the Danish housing market, and it comprises four main sectors, each characterized by a different set of legal regulations. The four sectors are *owner occupied housing* (51%), *cooperative housing* (6%), where the occupants own a part of the co-operative and have the right to use a specific apartment, *public rental housing* (19%), which is rented housing provided by housing associations, and *private rental housing* (18%).

Rent controls have been a permanent feature of the private rental market for more than 60 years. Rents in most private rental dwellings in larger urban areas are cost-based, regulated rents. Landlords are allowed to pass on all costs, property taxes included, actually incurred in the day-to-day operation of the property and a prescribed charge to cover maintenance cost. The cost-based rent also allows for a capital charge, which can vary between 7 and 14 per cent depending on the age of the dwelling. However, the capital charge is calculated on the basis of the value of the house in 1973 and no

allowance for inflation on this part of the rent is permitted. Also, landlords cannot raise rents due to increased demand for housing. Thus the capital payoff is eroded by inflation and depreciation. Rents in all dwellings constructed after 1991 are exempted from rent control, but only a small number of private rental dwellings (about 6 %) has been built since 1991.

In minor rural districts the local authorities are not imposing rent control in the traditional sense. Instead rents are determined by legislation at the "value of the rental unit", which should not be mistaken for a market rent. The "value of the rental unit" is determined by comparing with similar housing units in the area, and it is then a rather vague concept. However, also housing units in urban areas can be rented at "value of the rental unit" if they are thoroughly improved when they become vacant. In this way substantial rent increases are allowed for, and landlords sometimes use this rule to escape rent control.

Another feature of the private rental sector is that whenever a private rental property is for sale, legislation gives current residents the right to take over the property at the offered price and convert it to a co-operative. The offered price typically reflects controlled rents, so most properties are taken over by residents under favorable conditions. As a result the total number of private rental dwellings has been in decline.

Recently, Lind (2001) has presented a survey of existing rent regulating systems throughout the western world. The main message is that rent regulation exists in a substantial number of countries (e.g. Germany, Sweden, certain states in the US, and provinces in Canada, France and many others), and that the sharing feature of the different systems is to keep rents below market rent. So even though the present analysis is based on data from the Danish housing market, its implications are valid in a much wider context.

3 Data and the rent control benefit

The data used in this study are drawn from administrative registers made available by Statistics Denmark. The complete data set consists of a 10% random sample of the Danish adult population, and it comprises information on a large number of demographic and socio-economic variables as well as information about physical characteristics of all housing units occupied by the sample population in the years 1992-1999.

The sample has been restricted to include only those persons who lived in private rental housing on December 31, 1992. The date at which each person moved into their home is known, and if they moved out of their home during the period December 31, 1992

- December 31, 1999 then this date is known too. That is, spells for tenancy duration are straightforwardly calculated.

In what follows the unit of analysis is the household, so among all persons in a given housing unit a household head is chosen.[1] That is, tenancy duration and some personal characteristics of the household head is used along with socio-economic indicators related to the entire household. To avoid endogeneity all variables for socio-economic status refer to the year before the household moves, or 1999 for those households who did not move in the period 1992-1999. We restrict attention to moves where the household consists of the same individuals before and after the move. I.e. we disregard moves that are due to e.g. divorce or deaths. Table 1 presents means of the different measures of socio-economic status that are used in the analysis.

Table 1 around here

There are indicator variables for which age group the head belongs to (the age group 25-34 years is the reference group), a dummy for the presence of children below 18 years of age in the household, **children**, and indicators for households consisting of single males, **single male**, or single females, **single female** (two or more adults are used as reference group). There is also a variable for citizenship, **non-oecd**, which takes the value 1 if the head is from a non-OECD country and 0 otherwise. The variables **unemployment ratio** and **early retirement ratio** give the share of long term unemployed persons and persons on early retirement in each household.

Disposable household income, **income**, and household wealth, **wealth**, is measured in Danish Kroner (1999 level). There are six different categories for the educational attainment of the household head. The first indicates whether the head is a student, **student**, and the remaining five categories are defined in terms of the level of the most advanced completed education. The lowest level of education consists of persons with just primary schooling, **unskilled**. The next education category are those with vocational training and high school graduates. Graduates have been grouped into the last three categories (**short** (shortest), **medium** and **long** (longest)) based on the length of time needed to obtain a degree. Persons with vocational training are used as reference group.

There are four geographical categories; the capital Copenhagen (**copenhagen**), the five largest cities after Copenhagen (**large city**), medium-sized municipalities (reference)

[1] The household head is chosen as oldest person in the household. In families with two or more adults the oldest male is chosen as household head. In households with more than one family the household head is then chosen as the oldest family head.

and minor rural municipalities (**rural**). Finally the variable **housing consumption** measures the size of the housing unit in square meters per adult occupant.

3.1 The rent control benefit

To determine the impact of rent control on tenancy duration a measure of the benefit associated with receiving a rent controlled apartment is required. We follow the approach taken by Gyourko & Linneman (1989) by measuring a household's annual benefit from rent control as the difference between the uncontrolled rent predicted for that household's controlled housing unit and the actual rent paid on that unit.[2] However, due to the lack of a sufficiently sized random sample of uncontrolled housing units[3], we do not predict the uncontrolled rent for a controlled unit by estimating a hedonic rent function for the uncontrolled sector. Instead we employ the Danish Tax Authorities (henceforth DTA) model for owner occupied housing to estimate the value of the controlled unit as if it had been sold on the free market for owner occupied dwellings. From the estimated market value a predicted rent is deducted through an estimate of user costs in Denmark.[4] That is, the rent control benefit for housing unit i is

$$b_i = c_i p(Z_i, \hat{\alpha}) - r_i, \tag{1}$$

where c_i is user costs, Z_i is housing traits[5] and r_i is the actual rent paid on housing unit i. $\hat{\alpha}$ is the estimated coefficient vector of the DTA model and so $p(Z_i, \hat{\alpha})$ gives the estimated price of housing unit i.

The DTA model for 1999 is basically a hedonic price function which is estimated using data on actual sales of owner occupied dwellings in the years 1996-1999 and a comprehensive list of housing traits. The DTA price estimates for all housing units in the owner occupied sector is used as a property tax base, and so the quality of the model is highly regarded. In particular, the model has been constructed to accommodate a very high degree of geographical precision as each housing unit has been placed into one

[2] For a discussion on the properties of this measure, see e.g. Gyourko & Linneman (1989) or Gyourko & Linneman (1990*a*).

[3] Only the small number of dwellings constructed after 1991 are completely exempted from rent control.

[4] The estimated user cost is made up of land taxes, the real interest rate, risk premium and depreciation minus expected capital gain. The land tax rate varies over municipalities, but on average the user cost is 8.9%.

[5] The variables include for example square meters, number of rooms, construction year, year for major improvements, floor, number of apartments in property, the presence of kitchen, shower and toilet and type of heating installations.

of more than 50,000 different areas with their own geographical coefficient (included in $\hat{\alpha}$). When applying the price structure of owner occupied dwellings to that of private rental dwellings through the DTA model it should be kept in mind that rent control in the private rental sector spills over to the owner occupied sector. Theoretically, it is well established, that rent control affects prices of owner occupied housing (see e.g. Häckner & Nyberg (2000)), and for the Danish housing market it is estimated that this spillover from rent control amounts to 12 to 15 per cent of rents in owner occupied housing, cf. Rasmussen (1999). Therefore our estimated market rents could all be biased upwards, but as discussed below we seek a relative measure of the degree of rent control for each unit that avoids such problems.

In order to employ the DTA model for the private rental sector housing traits for all private rental housing units have been used. A problem with the data set, however, is that the yearly rent, r_i, is known for only about half of the private rental units in 1999. Therefore missing rent observations are estimated by the Heckman two-step procedure to control for sample selection bias. That is, the estimated rent for housing unit i is

$$\hat{r}_i = X_i\hat{\beta} + \hat{\psi}\frac{\varphi(W_i\hat{\gamma})}{\Phi(W_i\hat{\gamma})}, \tag{2}$$

where X_i and W_i are different housing trait vectors. W_i is used in the step 1 probit model and X_i is used in the step 2 OLS regression. Variables for number of apartments in building and indicator variables for type of heating installations are included in W_i but not in X_i, as these significantly affect the probability of observing a rent but are not important for the level of rents. The second part of the right hand side is the inverse Mills ratio, where $\hat{\gamma}$ is the estimated coefficient vector from step 1 and $\hat{\beta}$ and $\hat{\psi}$ are estimated coefficients from step 2.[6]

We acknowledge, as noted by Ault et al. (1994), that measuring the benefits of rent control as the difference between the observed rent and the market rent, where the market rent is the outcome of a hedonic rent function estimated for the owner occupied sector applied to the controlled sector's attributes, is likely to produce measurement errors, since the hedonic rent function (in our case the DTA model) is unlikely to fully explain rents. However, given the structure of the Danish housing market for private rental housing we are not able to compare households in controlled versus uncontrolled sectors since there is (in practice) no uncontrolled sector in the private rental housing market. In order to reduce the impact from the potential measurement error we construct a relative measure

[6] Additional details can be found in Jespersen & Munch (2001).

of the degree of benefit obtained due to rent control. More specifically, we divide all units into deciles according to their rent control degree, where the rent control degree is given as the rent control benefit, b_i, divided by the uncontrolled rent, $c_i p(Z_i, \hat{\alpha})$. Thus if the decile of unit i, d_i, is 9, then that unit is among the 10% of the units with highest rent control degrees, whereas if $d_i = 0$ then that unit is among the 10% of the units with lowest rent control degrees.

The available DTA model is for 1999 and in addition rents are only observed for 1999, but we need a relative measure of the degree to which each housing unit is regulated within each of the years 1992-1999. The relative rent control degree, d_i, for a housing unit can change over time either because the number of private rental dwellings has decreased over the years (see Section 2) or because some of the physical characteristics have changed (which is known in the data set). Thus for a year prior to 1999, say 1992, the uncontrolled 1999-rent is calculated by use of the DTA model from the 1992 housing trait vectors. A housing unit is then allocated the observed 1999-rent only if it has not undergone a major improvement from 1992 to 1999, and the remaining units have their rents estimated (based on the housing traits for 1992) as outlined above. In this way the relative rent control degree, d_i, for each of the years 1992-1999 has been constructed based on the 1999 DTA model and 1999 rents.

3.2 Rent control, equity and efficiency

In order to get a first-hand impression of how rent control affects the Danish housing market this section presents some descriptive statistics on the relationship between the rent control benefit, household income and tenancy duration.

Generally it is found that the rent control benefit is very poorly targeted among tenants in private rental housing, as can be seen in table 2. The average rent control benefit in 1999 is 10,200 DKK per tenant (more than 9 per cent of the average income). Income is correlated with the rent control benefit, such that low income groups receive more than this average, but the highest benefits go to high income groups, while the lowest benefits accrue to middle income groups.

Table 2 around here

Furthermore, a regression of the rent control benefit on several socio-economic characteristics (along the lines of Gyourko & Linneman (1989)) reveals that in particular a high level of education are associated with higher benefits, but that also household wealth and

household income is positively correlated with the rent control benefit.[7] Thus the rent control is not targeted towards those that would be the natural receiver, that is, the low income groups. This point is made even more drastically with the observation that a very large fraction of households in the lowest decile consists of students. That is, individuals who are currently investing in human capital that most likely will result in a significant move up the income ladder after graduation.

Rent control also seems to affect housing market efficiency as mobility is distorted. Table 3 shows that the average household had lived in their present accommodation for 6.8 years in 1999. However, those households with the lowest relative rent control degrees (decile 1) only had an average tenancy duration of 5.5 years, while those with the highest relative rent control degrees had lived in their present accommodation for 8.7 years. In the following we want to go into more detail with this relationship between rent control and tenancy duration. Specifically, we try to determine whether a housholds housing units rank in the distribution of rent control degrees, d_i, significantly affects tenure duration.

Table 3 around here

4 Methodology

In this section we describe the econometric model used to investigate how rent control affects mobility. The data allow us to observe household transitions on the housing market from 1992 to 1999. We have information on the date at which all households living in private rental housing ultimo 1992 moved into their accommodation. We therefore have what is known as left truncated observations. Since some households still live in their 1992 accommodation by the end of 1999 we also have, what Nagy (1995) addressed as the duration censoring problem or alternatively labelled right censored observations. In order to handle the features of the data we will apply a hazard model.

Let the continuous stochastic variable T, $T \in (0, \infty)$, denote tenancy duration. The hazard rate, which denotes the probability for households with characteristics x of moving in the interval $t + dt$ given that the accommodation is still occupied at time t, is then given by

$$h(t|x) = \lim_{dt \to 0} \frac{\mathbf{P}(t < T \leq t + dt | T > t, x)}{dt}. \tag{3}$$

The hazard function is specified as a proportional hazard model. That is, the hazard is the product of the baseline hazard, which captures the time dependence and a function

[7] Further details can be found in Jespersen & Munch (2001).

of observed characteristics, x,

$$h\left(t|x\right)=\lambda\left(t\right)\cdot\varphi(x), \tag{4}$$

where $\lambda\left(t\right)$ is the baseline hazard and $\varphi\left(x\right)$ is the scaling function specified as $\exp(x\beta)$.

If the data are flow sampled, the contribution to the likelihood function for a given household is simply the density[8], $f(t)$. However, here we sample from the stock of households living in private rental housing in ultimo 1992. In this case we have to adjust for the fact that we know when households moved into the housing unit they resided in 1992. Let e denote the elapsed tenancy duration of household j in 1992. The contribution for this household to the likelihood function is then

$$\begin{aligned} f(t_j|t_j>e) &= \frac{f(t_j)}{P(t_j>e)} \\ &= \frac{h(t_j)S(t_j)}{S(e)} \\ &= \frac{h(t_j)\exp\left(-\int_0^{t_j}h(s)ds\right)}{\exp\left(-\int_0^{e}h(s)ds\right)} \\ &= h(t_j)\exp\left(-\int_0^{t_j}h(s)ds+\int_0^{e}h(s)ds\right) \\ &= h(t_j)\exp\left(-\int_e^{t_j}h(s)ds\right), \end{aligned}$$

where $S(e)=\exp\left(-\int_0^{e}h(s)ds\right)$ is the survivor function. This adjustment is neglected by Nagy (1995). By ignoring the presence of left truncated observations (even though they are present in the data set from New York City) length biased sampling is created as elapsed durations are ignored.

4.1 The likelihood function

Nagy (1995) also uses a hazard model to investigate tenancy durations, and he assumes that the baseline hazard is exponentially distributed. This means that the model cannot exhibit any duration dependence. We do not impose the same restriction since we believe tenancy duration depicts duration dependence. Along the lines of Jovanovic (1979), who consider matches on the labor market, we conjecture that the match quality of households and their accommodation reveals itself over time, and consequently that the hazard rate out of a housing unit diminishes with tenure. In order to allow for negative duration dependence or any other kind of duration dependence, we allow for a completely flexible

[8]Suppressing dependency on covariates.

baseline hazard specification. Specifically, we specify a piecewise constant baseline hazard with splitting times $\tau_0 = 0, \tau_1, ..., \tau_K = +\infty$. Notice, that the baseline can attain arbitrary flexibility by increasing the number of intervals. The value of the baseline hazard in the k'th interval is given by λ^k. Let $k(t) : \Re_+ \curvearrowright \{1, 2, ..., K-1, K\}$ be a function that maps the duration, t, into interval k, and let c be an indicator variable that takes the value 1 if the household moves before the end of 1999. The contribution for a household with observed characteristics, x, is then

$$\begin{aligned} \mathcal{L}(\theta) &= h(t|x)^c \exp\left[-\int_r^t h(s|x)\,ds\right] \\ &= \left(\lambda^{k(t)} \cdot \exp(x\beta)\right)^c \\ &\quad \times \exp\left[-\exp[x\beta] \cdot \left(\sum_{h=r+1}^{k(t)-1} \lambda^h (\tau_h - \tau_{h-1}) + \lambda^{k(t)}\left(t - \tau_{k(t)-1}\right)\right)\right]. \end{aligned} \tag{5}$$

Note that uncompleted (i.e. right censored) observations only contribute with the conditional survivor function as $c = 0$.

4.2 Expected tenancy duration

Interpretation of estimation results in hazard models is more complicated than in other statistical models, since the size of the estimated coefficient for the explanatory variables is not straightforward to evaluate. In order to accommodate this feature of hazard models we quantify the effect of the household characteristics on the tenancy durations by calculating the expected duration of remaining tenancy. That is, for given household characteristics it is possible to calculate how the expected remaining tenancy changes when the size of a covariate changes. Below we illustrate how the calculations are done.

Suppressing the dependency of the hazard function on x, the integrated hazard is

$$\begin{aligned} H(t) &= \int_0^t h^{k(s)} ds \\ &= H^{k(t)-1} + h^{k(t)}(t - \tau_{k(t)-1}), \end{aligned}$$

where $H^{k(t)-1}$ is the integrated hazard up to the beginning of the k'th interval.

The expected duration for a household that moves into the housing unit ultimo 1992

(i.e. where $e = 0$) is then

$$\begin{aligned}
E[T] &= \int_0^\infty S(t)dt \\
&= \int_0^\infty \exp\left(-H(t)\right) dt \\
&= \sum_{k=1}^{K} \int_{\tau_{k-1}}^{\tau_k} \exp\left(-H^{k-1} - h^k(t-\tau_{k-1})\right) dt \\
&= \sum_{k=1}^{K} \left(-\frac{1}{h^k} \exp\left(-H^{k-1} - h^k(\tau_k - \tau_{k-1})\right) + \frac{1}{h^k} \exp\left(-H^{k-1} - h^k(\tau_{k-1} - \tau_{k-1})\right) \right) \\
&= \sum_{k=1}^{K} \frac{1}{h^k} \left(\exp\left(-H^{k-1}\right) - \exp\left(-H^k\right) \right).
\end{aligned}$$

This can also be expressed as

$$E[T] = \sum_{k=1}^{K} \frac{1}{h^k} P(\tau_{k-1} < T \leq \tau_k). \tag{6}$$

That is, the expected tenancy duration is simply the sum of the inverse interval-specific hazard functions weighted with the interval-specific occurrence probability.

5 Results

First, we present the shape of the hazard rate out of private rental housing. Figure 1 shows that there is indeed negative duration dependence as suggested above. That is, our flexible baseline specification allows tenants with higher tenure to have a lower escape rate from their accommodation.

Figure 1 around here

Table 4 presents the effects of the covariates on the hazard rate out of private rental housing.

Table 4 around here

Before discussing the effect of rent control on household mobility patterns we shortly go through some of the most interesting control variables. The age of the household head is seen to be monotonic negatively correlated with the movement out of the housing unit.

This is also what is found in the literature. There are, however, some attempts to describe the age effect by a second order polynomial. Nagy (1995) follows this approach and finds - somewhat surprisingly - that age is positively correlated with tenancy duration until the household head reaches the age of 58, whereafter age is negatively correlated with tenancy duration. We suggest that this effect is spurious and emerges as a consequence of the polynomial structure imposed on the age variable.

Ault et al. (1994) suggest two potential effects of family income on mobility. First, high income tenants, if currently residing in an up-scale unit, may view their options for alternative rental housing as quite limited, thereby reducing their mobility. Alternatively, the cost of any potential move should comprise a smaller percentage of their budget than for their lower income counterparts, so that mobility is increased. In the empirical part of their paper they find that tenancy duration is positively associated with income. Similar results emerge in table 4 and are also found by Nagy (1995). In contrast to the US based investigations we also include information about family wealth. Wealth appears to be positively correlated with mobility. The positive association between wealth and mobility could be attributed to a savings motive. That is, households who wish to move to owner occupied housing need a substantial amount of liquidity for down payments, refurbishment etc. and therefore save some of the income they receive before buying property. Also, households in the owner occupied sector receive an implicit subsidy through the tax system, because imputed rents from equity invested in the house are taxed at lower effective rates than private market rents are taxed, and so relatively wealthy households should be inclined to move to owner occupied housing.

We also find that households consisting of single individuals - both women and men - are more prone to move. This result is consistently found in related studies. Likewise we find that students move more frequently than others. This effect is found even though students tend to live in larger cities where rent control is known to be more binding. The effect, like the effect from singles, is probably associated with a more turbulent way of life. Since, as suggested, rent control is more binding in larger cities we also correct for this, and find that the coefficient to larger cities, i.e. Copenhagen and other large cities, is indeed negative. For large cities it is, however, marginally insignificant. We also control for additional characteristics of the household as seen in table 4.

Even after controlling for a wide range of household characteristics as well as duration dependence we find a very significant negative association between the level of obtained benefits from the presence of rent control and mobility. In order to obtain a clear impression of the magnitude of this effect we have calculated expected tenancy durations for different tenancy groups on the Danish housing market.

Table 5 around here

Table 5 contains the expected remaining tenancy durations for a household that moved into their housing unit ultimo 1992. For all groups we see a substantial difference in expected tenancy duration between households occupying housing that have benefits in the lower decile compared to households residing in housing units in the highest decile. Tenancy duration for a typical household in the private rental sector is found to be more than six years longer if its apartment belongs to the 10 per cent most regulated units than if it belongs to the 10 per cent least regulated units.

5.1 Discussion

Arnott (1995) argues that the empirical evidence on the effects of rent control on various outcomes is disappointingly uninformative. With respect to the effects on mobility he stresses that "...there is weak evidence that average mobility is somewhat lower in controlled housing...". However, that rent control encourages staying in a private rental housing unit longer can according to Arnott be attributed to three other effects. First, there is a tenancy composition effect. The mobility rate is lower, the longer the period of tenancy, and tenants in controlled housing have on average been in their units longer. Second, there is a landlord selection effect; landlords in the controlled sector have an incentive to choose low-mobility tenants because low mobility is correlated with stability and responsibility. Third, there is a tenant selection effect; low-mobility tenants have a stronger incentive to search for controlled housing, since their search costs are amortized over a longer period. The observed association between rent control benefits and mobility could be due to the three effects Arnott lines up, but as will be argued below it is possible to purge the investigation for these effects by applying the appropriate econometric tools to the data, and so our results strongly suggest that mobility is indeed hampered by rent control.

First, by allowing for a flexible baseline hazard in the hazard model we control - in contrast to Nagy (1995) - for the fact that hazard rate out of apartment is declining with tenancy duration. Second, the landlord selection effect is hard to justify on the Danish housing market. Of course, landlords prefer responsible tenants, but long tenancy duration also complicates the possibility for improvements of the housing units. Improvements which, as mentioned in Section 2, can lead to significant increases in the rent. We therefore suggest that there is a trade-off for landlords with respect to preferring high mobility or low mobility tenants.

Third, the tenant selection effect is surely present. In order to correct as much as possible for this effect we include a vector of tenant characteristics along with the rent control benefits in the econometric analysis. This amounts to controlling for the selection based on observables. E.g. older individuals who have on average longer mobility acknowledge this and put more effort into the search for high benefit accommodation. This selection effect can be accounted for by including age in the regression. The same applies to other covariates. If, on the other hand, the selection process is grounded on unobservable characteristics, i.e. there are some characteristics that are unobserved to the researcher, that influence the probability of obtaining a controlled unit of housing, a more advanced approach is called for. In the New York City data set, where there are two types of apartments (controlled and uncontrolled), a possible solution is to estimate the selection process into controlled and uncontrolled housing simultaneously with the tenancy duration model. In this type of modelling the correlation between the unobservable characteristics can be described, and one may then test whether - based on unobservables - low mobility tenants are more inclined to end up in controlled housing (see e.g. Lillard, Brien & Waite (1995) for a suitable econometric model). In the Danish context this is somewhat different since almost all housing units are controlled. However, it would be possible to divide the controlled housing units into categories based on the degree of benefits and then estimate the selection process into these categories simultaneously with the tenancy duration model in order to get an idea of the correlation between the unobservable parts of the two processes. We leave the more elaborated econometric model for future research.

Another interesting extension is to take a closer look at the destination states for households that move out of their private rental housing. Clearly, households have different preferences when it comes to housing. Households, which are looking for owner occupied housing are presumably more inclined to save a larger part of their income due to the financial needs that are required for buying a house. Also, households that are searching for owner occupied accomodation are prone to seeking a more stable way of life, since the cost of changing accomodation rises substantially for houseowners compared to households living in rental accomodation. In sum, we wish to extend the current analysis with a competing risks structure in order to conduct a more profound description of the effects of rent control on the mobility out of or between private rental housing.

6 Conclusion

Based on an extensive data set collected by administrative registers we analyse how the presence of rent control on the Danish private rental housing market affects mobility. We do this by applying a duration model that encompasses both the presence of left truncated tenancy durations, right censored observations and allows for a very flexible specification of the time dependency as captured by the baseline hazard function.

We find that tenancy mobility is clearly reduced by the presence of rent control. For a standard household we find that expected tenancy duration is increased with 6 years for households, which recieve benefits in the highest decile of the benefits distribution compared to households, which obtain benefits in the lowest decile.

We argue that the present analysis can be extended by allowing for a competing risks specification, which would give a more profound picture of the processes that drive mobility on the housing market. This is a topic for future research. However, the present analysis still indicates that rent control has a very unfortunate effect on household mobility and thereby on the efficient allocation of housing. A perhaps even more serious problem could appear on the labour market. Hardman & Ioannides (1999) argue that reduced mobility on the housing market dampens economic growth by virtue of inefficient labour market allocations. If households are less inclined to move due to rent control they are also less inclined to react to changes in labour market conditions. Presently, this hypothesis is only formulated theoretically, but in future research it should be possible to combine the two closely connected markets to investigate whether a positive association between benefits from rent control and mobility on the labour market can be found. If the theoretical hypothesis is confirmed this is yet another argument for loosening the rent regulating systems worldwide.

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A Appendix: Tables and figures

Table 1: Summary Statistics

Variable	Mean	Standard deviation
Children	0.122	0.327
Age 18-24	0.117	0.321
Age 35-44	0.138	0.345
Age 45-54	0.122	0.327
Age 55-64	0.094	0.292
Age 65	0.316	0.465
Unemployment ratio	0.039	0.181
Early retirement ratio	0.095	0.282
Student	0.068	0.252
Unskilled	0.561	0.496
Short	0.032	0.177
Medium	0.041	0.198
Long	0.032	0.175
Income	142,000	117,000
Wealth	-3,000	124,000
Single female	0.375	0.484
Single male	0.327	0.469
Housing consumption (m^2/adult)	80.6	60.5
Non-OECD	0.012	0.109
Copenhagen	0.232	0.422
Large city	0.123	0.328
Rural	0.176	0.381
Duration (elapsed and remaining, in years)	11.68	8.408
# observations	39,934	
# of these completed	23,449	

TABLE 2: THE RENT CONTROL BENEFIT AND INCOME, 1999

Decile	Maximum income	Rent control benefit
	- - - - - - - - - 1,000 DKK - - - - - - - - -	
1	59	15.8
2	75	8.1
3	85	7.0
4	95	7.0
5	104	6.5
6	115	7.3
7	127	9.4
8	143	10.1
9	167	12.4
10	225	18.4
All	111	10.2

Note: Income is diposable household equivalent income. For "decile 10" and "All" average income is reported.
Source: Danish Economic Council (2001)

TABLE 3: RENT CONTROL AND TENURE DURATION, 1999

Rent control degree decile	Duration, years
1	5.5
2	6.0
3	5.9
4	6.0
5	6.3
6	6.6
7	7.4
8	7.7
9	8.3
10	8.7
All	6.8

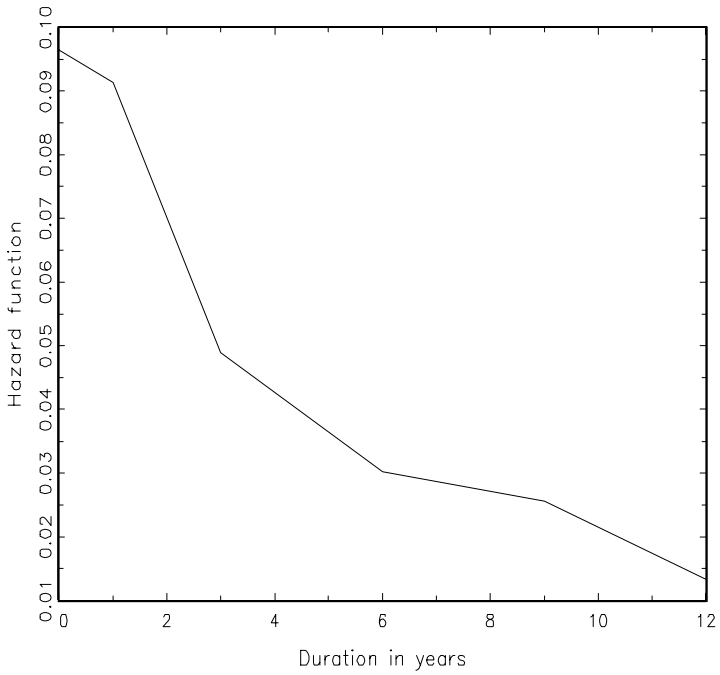

Figure 1: Hazard function out of private rental housing.

Table 4: Results from hazard model.

Variable	Coefficient	Standard error
Benefit from rent control (in deciles)	**-0.7975**	0.0316
Children	-0.0067	0.0273
Age 18-24	**0.3538**	0.0223
Age 35-44	**-0.4715**	0.0263
Age 45-54	**-0.7574**	0.0314
Age 55-64	**-0.8588**	0.0380
Age above 65	**-1.2535**	0.0325
Unemployment ratio	0.0331	0.0383
Early retirement ratio	**-0.0956**	0.0318
Student	**0.1273**	0.0276
Unskilled	*-0.0381*	0.0202
Short	**0.0899**	0.0426
Medium	0.0643	0.0404
Long	**0.1679**	0.0453
Income	**-0.4334**	0.0807
Wealth	**0.2159**	0.0597
Single female	**0.5363**	0.0248
Single male	**0.5931**	0.0247
Housing consumption	**0.0418**	0.0060
Non-OECD	0.0500	0.0591
Copenhagen	**-0.0972**	0.0232
Large city	*-0.0461*	0.0279
Rural	-0.0111	0.0205

Note: Bold (italic) figures indicate that the parameter estimate is different from 0 at the 5% (10%) significance level. In order to aid maximization of the likelihood function we have scaled benefit from rent control with 10, housing consumption/adult with 100, and income and wealth with 1,000,000.

Table 5: Expected tenancy durations (in years)

		Deviation from standard household						
Decile	Standard household	2	3	4	5	6	7	8
1	12.8	11.2	13.7	13.3	14.2	12.0	19.9	1.7
2	13.6	11.9	14.5	14.1	15.0	12.8	20.6	1.9
3	14.4	12.7	15.3	14.9	15.7	13.6	21.1	2.1
4	15.2	13.5	16.0	15.7	16.5	14.4	21.7	2.4
5	16.0	14.3	16.8	16.4	17.2	15.2	22.2	2.7
6	16.7	15.1	17.5	17.2	17.9	15.9	22.7	3.0
7	17.4	15.9	18.2	17.9	18.6	16.7	23.2	3.4
8	18.1	16.6	18.9	18.6	19.3	17.4	23.7	3.8
9	18.8	17.4	19.5	19.2	19.9	18.1	24.1	4.3
10	19.5	18.1	20.2	19.9	20.6	18.8	24.5	4.8
Average	16.3	14.7	17.0	16.7	17.5	15.5	22.4	3.0

Note: The standard household consists of a couple with children. They have a yearly disposable income of DKK 200.000, and wealth equal to DKK 40.000. They live in a large provincial town, and consume 60 m^2/person. The household head is between 35-44 years old and is educated as a skilled worker.

The different deviations from this household are:

Type 2: Standard household with an annual disposable income of DKK 400,000.

Type 3: Standard household with household head having a college degree.

Type 4: Standard household living in Copenhagen.

Type 5: Standard household living in Copenhagen with an annual disposable income of DKK 400,000.

Type 6: Standard household with household head having a college degree and an annual disposable income of DKK 400,000.

Type 7: Standard household without children and head being older than 65 years.

Type 8: Single man studying and living in Copenhagen, has no children, an annual disposable income and wealth of DKK 40,000.

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