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Home ownership, job duration, and wages

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Abstract

We investigate the impact of home ownership on individual job mobility and wages in Denmark. We find that home ownership has a negative impact on job-to-job mobility both in terms of transition into new local jobs and new jobs outside the local labor market. In addition, there is a clear negative effect of home ownership on the unemployment risk and a positive impact on wages. These results are robust to different strategies for correcting for the possible endogeneity of the home owner variable.
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1. Introduction

In a recent survey of the micro-level consequences of home ownership, Dietz and Haurin [6] found overwhelming evidence of positive externalities of home ownership. These positive effects range from home owners being more environmentally conscious over housing markets for owners appearing to suffer less discrimination than renting markets to home ownership being linked with better physical and mental health. Such externalities seem to support the favorable tax treatment of the capital invested in homes received by home owners (see Hendershott and White [9]). On the other hand, Oswald [14] presents evidence that the unemployment rate and the share

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of home owners are positively correlated for a number of countries and regions. The proposed mechanism is that home owners are much less mobile than renters due to costs associated with buying and selling their home, and so they are relatively inflexible in the labor market. Thus, if the home owner share is high, the work force is immobile, which tends to give higher structural unemployment due to insufficient supply of labor. In his original work, Oswald [14] presented evidence showing that countries or regions with a 10 percentage points higher share of home owners have a two percentage points higher unemployment rate. This relationship has been confirmed by Nickell and Layard [12] and Green and Hendershott [8] also using macro data. These findings have inspired a number of papers investigating the impact of home ownership on labor market outcomes like unemployment duration, job duration and wages. In the present paper, we focus on the latter two outcomes.

In relation to Oswald's hypothesis, a central question is whether home owners are more likely to be unemployed? Munch et al. [11] show that home owners overall have shorter unemployment spells than renters, even after correcting for the possible endogeneity of home owner status. However, they also find that home owners are less mobile in the sense that unemployed owners have a lower transition rate into jobs outside the local labor market, thus offering some support for the proposed mechanism behind Oswald's hypothesis. This effect is, however, dominated by a stronger positive effect on the transition rate into jobs in the local labor market.

Having established that the duration of unemployment spells is shorter for home owners than for renters, it is still possible that employed home owners more often experience unemployment. That is, the duration of *employment* spells could be lower for home owners than for renters? A study on Dutch data by Van Leuvensteijn and Koning [20] suggests that this is not the case—in fact home owners have a lower unemployment risk. They also show that there is no impact of home ownership on the transition rate into a new job.[1]

Another important and related issue is whether home ownership affects wages. According to the survey by Dietz and Haurin [6] not much research exists on this relationship, but Coulson and Fisher [3] is an exception. Based on data from US Current Population Survey and PSID, they find that home owners have higher wages, shorter unemployment spells, and a lower probability of experiencing unemployment.

The purpose of the present paper is twofold. First, we offer some theoretical considerations concerning the impact of home ownership on job duration and wages. From a search theoretic perspective we argue that home owners stay longer in their jobs than renters because of reduced geographical mobility (due to mobility costs), and this in turn makes them more attractive for employers implying that owners are offered higher wages. Second, we empirically examine *all* these predictions using a rich Danish micro data set based on administrative registers. We estimate a competing risks duration model for job spells with a distinction between transitions into new jobs in the local labor market, new jobs outside the local labor market (where the distinction is made by realized housing mobility out of the local commuting area), and unemployment. In addition, we simultaneously estimate a standard human capital wage equation, thus allowing for an impact of home ownership on wages.

In empirical investigations of the effects of home ownership it is important to take into account the endogeneity of home ownership; if the selection process is not explicitly accounted for, the estimated parameters to the home ownership variable in the different equations cannot be interpreted causally. For example, in Coulson and Fisher [3] it is not clear whether the positive

[1] They do not distinguish between local jobs and jobs outside the local labor market.

labor market outcomes found for home owners are causal or spurious, since the authors do not attempt to address the potential endogeneity of the home owner variable. According to Dietz and Haurin [6], this is a criticism that can be aimed at the majority of existing research on the micro-level consequences of home ownership, and they make a call for researchers in future work to put much more effort into identifying the causal linkage between home ownership and the outcomes of interest. In our empirical analysis we explicitly model the selection process into home ownership, and we use two different identification strategies to check the robustness of our results. First, we follow the identification strategy of Munch et al. [11], where multiple observations for some individuals in the sample can be exploited, that is, we exploit the panel structure of our data to identify the causal linkage between home ownership and the outcomes of interest. Second, we also follow a more standard instrumental variables approach along the lines of Van Leuvensteijn and Koning [20]. Our empirical results are completely consistent with the theoretical predictions, and they are very robust to the different identification strategies employed.

The paper is organized as follows. The next section outlines some simple theoretical considerations about the link between home ownership and labor market outcomes. Section 3 describes the data set. Section 4 presents the empirical model and discusses identification issues. Section 5 presents the estimation results, and finally section 6 offers a brief conclusion.

2. Home ownership and labor market outcomes

To set the stage for the empirical analysis, this section presents a few theoretical considerations based on a search theoretical foundation. Munch et al. [11] construct a search model for unemployed workers. Because home owners have higher costs of geographical mobility than renters, they set higher reservation wages for accepting job offers outside commuting distance (requiring a residential move) than renters. The resulting exit rates to employment outside the local labor market are therefore lower for home owners. On the other hand, the risk of eventually having to move lowers the reservation wages for home owners in the local labor market, thus giving them higher hazard rates for local jobs. Empirically, Munch et al. [11] found evidence for both effects, but the latter effect strongly dominates the first one. That is, in general owners have shorter unemployment spells, but they are also less likely to leave unemployment for a job outside the local labor market.

In the present context, the focus is on employed workers rather than unemployed workers. They may also look for jobs locally or outside the local labor market (requiring a residential move), and they may quit or lose the job and search as unemployed. In the following we consider in turn the predicted impact of home ownership on the transition from employment into unemployment, into new jobs (local or non-local) and the impact on wages.

A straightforward implication of the theoretical and empirical analysis of unemployed workers in Munch et al. [11] is that home owners are less likely to quit the job and become unemployed, because as unemployed they are worse off relative to renters due to their inclination not to move for jobs. As a consequence owners may accept lower paying jobs as reflected in their lower local labor market reservation wages. Thus, *ceteris paribus* home owners are less likely to become unemployed than renters.

When it comes to on-the-job search behavior (i.e. job-to-job transitions), the issues are slightly more complicated. Assume, without loss of generality, that renters have no costs of mobility. Hence, for renters the reservation wage for any job is the current wage. Home owners must be compensated for the costs of moving, so their reservation wages for non-local jobs will exceed the current wage by the annuitized value of the mobility cost. However, the worker can always

keep her old job, so the reservation wage for another local job must be equal to the current wage. Hence, in a partial equilibrium analysis, we would straightforwardly conclude that employed home owners would be less likely to switch to jobs outside the local labor market than renters.

However, when investigating employment spells, equilibrium considerations become more important; suppose employers take these facts into account in the wage setting process. Home owners are likely to stay longer in a given job than renters, because they are less likely to accept a non-local job. Therefore, the expected present discounted value to the employer of a job which is occupied by a home owner is higher than if it were occupied by a renter. Thus, employers may prefer to hire home owners *ceteris paribus* and they may even set their wages somewhat higher than for renters, in order to attract them. Another argument for paying higher wages to home owners is that the incentives to invest in these workers in terms of enhancing their human capital by providing firm-specific training are higher than for renters, since home owners have a longer expected duration in the firm. Consequently, the firm can (expect to) recoup more of its initial investment (see e.g. Rosholm and Svarer [17]) when training home owners than they can when training renters. This implies that employed home owners have higher productivity than employed renters, thus justifying higher wages for home owners. Moreover, higher wages leads them to accept other local jobs less often than renters.

In sum, based on these simple considerations we would expect employed home owners to

- become unemployed less often than renters (they have lower reservation wages in unemployment, cf. Munch et al. [11]),
- accept job offers outside the local labor market less often than renters (due to mobility costs),
- accept local job offers less often than renters (they have more firm specific productivity), and
- earn higher wages than renters (same reason as above).

3. Data and the Danish labor and housing markets

The Danish labor market shares some characteristics with Anglo-Saxon labor markets which are important in the context of this paper. The Danish labor market is very flexible due to weak employment protection, and as a consequence turnover rates are higher than in other continental European countries. At the same time, the labor market is highly unionized and the wage structure is very compressed. The geographical mobility of both employed and unemployed workers is modest, and regional migration rates are at the low end compared to other continental European countries, cf. OECD [13] and Danish Economic Council [5].

The Danish housing market is comprised of four different main segments, but in the analysis we will only distinguish between owners and non-owners. The largest part is owner-occupied housing, including more than 50% of all housing units. Private rental housing and social housing each constitute almost 20%, and cooperative housing accounts for 6% of the housing market.

It should be noted that the markets for private rental housing, social housing and cooperative housing are regulated by rent controls. Rents in most private rented dwellings in larger urban areas are cost-based rents implying that landlords may pass on all costs in the operation of the property. Included in these costs is a capital charge, which is calculated on the basis of the value of the property in 1973 and allowance for inflation on this part of the rent is not possible. As a consequence the capital payoff on the property is eroded by inflation. This means in particular that rents in older dwellings, which typically are located in city centers, are lower than market rents. In minor rural districts, local authorities use a different set of rules to regulate rents. Rents are set at the "value of the rental unit," which is determined by comparing with similar housing

units in the area, and so it is a rather vague concept. In effect the "value of the rental unit" is typically closer to the market rent than rents in units with cost-based rents. Also housing units in urban areas can be rented at the "value of the rental unit" if they are thoroughly improved when they become vacant. In this way substantial rent increases are allowed for, and so a large part of the private rented housing units are not seriously regulated by rent control. Thus there is considerable variation in the degree to which each unit is regulated, and not surprisingly this has an impact on tenancy duration. Munch and Svarer [10] show that rent control distorts mobility, as tenancy duration is longer the more regulated the rent of the dwelling is.

Cooperative housing is a relatively new segment of the housing market which previously belonged to the privately rented segment. Whenever a private rented property is for sale, legislation gives current residents the right to take over the property at the offered price and convert it to a cooperative. The offered price typically reflects controlled rents, so most properties are taken over by residents under favorable conditions. Whenever residents move out of their home they sell their share in the cooperative at a fixed price such that the variation in the degree of initial rent control to a large extent is kept.

Social housing consists of housing associations that are run as non-profit societies with rents basically being determined from their costs, of which interest payments and amortization of the initial capital outlay are the major components. The housing associations are directly supported by the government through reduced expenditure related to interest payments and amortization of the loans, and because they are exempted from paying property tax. Again the degree to which each unit is regulated varies, and it is correlated with the age of the dwelling.

To sum up the alternative to being a home owner is being a renter under rent control, where the degree of control varies substantially. Large parts of these alternative rental markets are almost unregulated, while some housing units have rents that are much lower than market rents. Thus there are costs in terms of lost rent control benefits associated with moving out of such regulated units, but overall average tenancy durations in these three non-owner segments of the housing market are still much lower than in owner-occupied housing units. According to Danish Economic Council [4] in 1999 the mobility rate among occupants in private rental housing were on average 5 times the mobility rate in owner occupied housing, while in cooperative housing and social housing it was 2 and 2.5 times higher respectively.[2] These pronounced differences justify our focus on owners vs. non-owners.

To investigate the causes behind mobility of employed workers in Denmark, a very rich data set, which is drawn from administrative registers, is employed. The data set covers 1% of the Danish population for the years 1993–2001. In each year, detailed information about the labor market states of all individuals along with information on socioeconomic characteristics is available. These socioeconomic variables are extracted from the integrated database for labor market research (IDA) and the income registers in Statistics Denmark. Of particular importance is the fact that a workplace identity is associated with each worker at the end of each year. A firm can have more than one workplace so if a worker changes between two workplaces within the same firm, then this is counted as a job change in the present analysis. Job spells are then straightforwardly constructed from successive years at the same workplace.

Here we are interested in the duration of job spells and transitions into new jobs and unemployment, and for the present purposes job spells are flow sampled such that only spells starting

[2] The mobility rate is here defined as the number of households moving out divided by the total number of housing units.

in 1993 and later are included in the analysis. The destination state for all spells that end before 2001 is known, and if job spells end with transitions into other states than a new job or unemployment (e.g. out of the labor force), or if spells are not completed by the end of 2001, they are treated as independently right censored observations. In addition, if job spells end because of a firm closure, they are also treated as independently right censored observations.[3] All students with (student) jobs have been excluded from the sample. We operate with three different destination states from a job; unemployment, a new job in the local labor market, and a new job outside the local labor market.

The local labor markets are so-called commuting areas, which are defined such that the internal migration rate is 50% higher than the external migration rate, cf. Andersen [2]. The commuting areas are based on geographically connected municipalities, and the 275 municipalities in Denmark are merged into 51 such commuting areas. An employed worker is defined to find a new job outside the local labor market if he or she changes job and moves to another commuting area in the same year as the beginning of the new job spell.[4]

In the resulting data set there are 29,878 job spells for 17,297 individuals. Table 1 displays summary statistics for all explanatory variables. Self explanatory dummies for age, gender, the presence of children, the presence of two adults in the household, and education are included. Also, three geographic dummies are included to distinguish between the capital Copenhagen, 5 large cities, and all other localities (small city). Information on the hourly wage rate and years of working experience are also included. In the model for the hourly wage rate, we also include the elapsed duration of the job, denoted job tenure. In addition, Table 1 describes three variables that will act as exclusion restrictions, that is, they will enter the equation for the selection into home ownership but not the other equations in the analyses performed below. These are the proportion of home owners in the municipality of residence,[5] the proportion of home owners in the municipality of birth, and finally a dummy variable for the home owner status of the individual's parents in 1980.

There are 58% home owners in the sample, which is slightly above the proportion of home owners in the country. Presumably the over-representation is due to the selection of employed workers only, who are more likely to be home owners than those who are unemployed or outside the labor market. A comparison of home owners to renters reveals that home owners tend to be older, are more likely to have children, are less likely to live in Copenhagen, and likely to have more education, more working experience and more tenure, and to earn higher wages. This pattern is consistent with Coulson and Fisher [3], who finds that home owners have more favorable labor market outcomes than renters.

4. Econometric model

To investigate the impact of home ownership on job duration and wages, we formulate an empirical model for job duration, wages, and selection into home owner status simultaneously. The first step is to specify a competing risks duration model. We are specifically interested in addressing exits from employment to unemployment, to new jobs in the local labor market, and

[3] The reason for this treatment of individuals losing their job from plant closures is that we want to investigate only job-worker separations that are, at least partly, determined by either the worker or the firm, not by exogenous forces.

[4] Exact moving dates are known for all individuals.

[5] This variable is also used by Van Leuvensteijn and Koning [20] as an exclusion restriction.

Table 1
Summary statistics

Variables	All		Owners		Renters	
	Mean	Stdv.	Mean	Stdv.	Mean	Stdv.
Home owner	0.58	0.49				
Age 18–24	0.14	0.35	0.04	0.19	0.30	0.45
Age 25–29	0.15	0.36	0.11	0.31	0.21	0.41
Age 30–39	0.31	0.46	0.34	0.47	0.27	0.44
Age 40–49	0.22	0.41	0.29	0.45	0.13	0.33
Age 50–59	0.15	0.35	0.20	0.40	0.07	0.26
Female	0.42	0.49	0.44	0.49	0.40	0.49
Children 0–17 years	0.23	0.42	0.29	0.45	0.15	0.35
Two adults	0.67	0.46	0.86	0.34	0.40	0.49
Copenhagen	0.23	0.42	0.17	0.37	0.31	0.46
Large city	0.14	0.35	0.13	0.33	0.16	0.36
Small city	0.62	0.48	0.69	0.46	0.52	0.49
Basic education	0.33	0.47	0.26	0.43	0.43	0.49
Vocational education	0.40	0.49	0.44	0.49	0.35	0.47
Further education	0.26	0.43	0.29	0.45	0.21	0.41
Experience (years)	13.3	9.1	16.2	8.3	9.5	7.6
Tenure (years)	1.3	1.6	1.8	1.7	1.1	1.4
Log wage (/10)	5.08	0.41	5.18	0.36	4.94	0.43
Owner share, region of residence	0.58	0.13	0.60	0.13	0.54	0.12
Owner share, region of birth	0.49	0.22	0.51	0.21	0.46	0.23
Parents' home owner status 1980	0.57	0.49	0.58	0.49	0.57	0.49
Number of individuals						17,297
Number of spells						29,878
Mean duration of spell (years)						2.78
Proportion of spells:						
right-censored spells						0.33
end with job change locally						0.40
end with job change non-locally						0.14
end with unemployment						0.08
Persons with change of home owner status (%)						0.188
Persons with change of home owner status and more than 1 spell (%)						0.068

to new jobs outside the local labor market, where the distinction between local and non-local labor markets is made as described in the previous section.

We specify a duration model with a flexible non-parametric specification of the baseline hazard. To distinguish between different destinations we use a competing risks duration model. Even if there is access to a comprehensive data set there might still be some unobserved heterogeneity left, as no measures for e.g. ability or motivation are available. Therefore we attempt to capture unobserved worker characteristics by specifying a mixed proportional hazard model for the labor market transitions:

$$\theta_i(t \mid x_t, \upsilon_i) = \lambda_i(t) \exp(\beta_i' x_t + \gamma_i z_t + \upsilon_i), \tag{1}$$

where $i = el, en, u$ indicates the different destination states for the transition (i.e., employment locally, employment outside the local labor market, and unemployment), $\lambda_i(t)$ is the baseline hazard capturing the time dependence for transitions into destination i, and $\exp(\beta_i' x_t + \gamma_i z_t + \upsilon_i)$ gives the proportional effects of the time-varying home-ownership dummy, z_t, other observed

and time-varying characteristics, x_t, and unobserved characteristics, υ_i. All job spells that end with a transition to another state than one of the three described above (e.g. out of the labor force) are treated as independently right censored observations.

The annual observations in the data imply that the duration variable T is grouped into $K+1$ intervals $\{[0,t_1),[t_1,t_2),\ldots,[t_k,\infty)\}$, which must be accounted for in the econometric specification. The interval specific survival rate is defined as

$$\begin{aligned}\alpha_k &= P(T \geqslant t_k \mid T \geqslant t_{k-1}, x_t, z_t, \upsilon)\\ &= \exp\left[-\sum_{i=el,en,u}\int_{t_{k-1}}^{t_k}\theta_i(t \mid x_k, z_k, \upsilon_i)\,\mathrm{d}t\right]\\ &= \exp\left[-\sum_{i=el,en,u}\exp(\beta_i' x_k + \gamma_i z_k + \upsilon_i)\Lambda_{i,k}\right]\\ &= \prod_{i=el,en,u}\alpha_{i,k}, \end{aligned} \tag{2}$$

where $\Lambda_{i,k} = \int_{t_{k-1}}^{t_k}\lambda_i(t)\,\mathrm{d}t$ and $\alpha_{i,k} = \exp[-\exp(\beta_i' x_k + \gamma_i z_k + \upsilon_i)\Lambda_{i,k}]$.

To find the contribution to the likelihood function from a job spell it is noted that the probability that a spell ends in interval k is given by the conditional probability of failure in that interval times the probability that the spell survives until interval k, or $(1-\alpha_k)\prod_{j=1}^{k-1}\alpha_j$. Right censored spells contribute to the likelihood with the survivor function, $\prod_{j=1}^{k}\alpha_j$, and so the contribution to the likelihood function from a job spell can be written

$$\mathcal{L}_e(t \mid x_t, z_t, \upsilon_{el}, \upsilon_{en}, \upsilon_u) = (1-\alpha_{el,k})^{d_{el}}(1-\alpha_{el,k})^{d_{en}}(1-\alpha_{u,k})^{d_u}\alpha_k^{1-d_{el}-d_{en}-d_u}\prod_{j=1}^{k-1}\alpha_j, \tag{3}$$

where d_{el}, d_{en} and d_u are destination state indicators. If the job spell is right censored then $d_{el} = d_{en} = d_u = 0$. Instead of imposing a functional form on the baseline hazard, we allow for a flexible specification by simply estimating the interval specific baseline parameters $\Lambda_{i,k}$.

The wage of an individual at tenure t is specified as

$$\ln w_t = \zeta_0 + \zeta_1 t + \zeta_2 x_t + \varepsilon_t$$

where, for a given individual, the error term is composed of two components, an independently normally distributed idiosyncratic component and a random individual-specific effect,

$$\varepsilon_t = u_t + \upsilon_w.$$

The likelihood contribution from a sequence of wage observations over a job spell is thus

$$\mathcal{L}_w(w_1,\ldots,w_t \mid x_1,\ldots,x_t,\upsilon_w) = \prod_{m=1}^{t}\varphi\left(\frac{\ln w_m - \zeta_0 - \zeta_1 m - \zeta_2 x_m - \upsilon_w}{\sigma_u}\right)$$

with σ_u being the standard deviation of the idiosyncratic component, and $\varphi(.)$ the standard normal probability density function. Note that in this model, we would have had a simultaneity problem if we had allowed the wage to affect job durations as well. In the equation above, tenure affects the wage, but one might just as well have argued that the dependence should go the other

way, or rather, both ways. However, the latter is not possible to identify in the present setup, and hence, a decision had to be made.[6]

To account for possible endogeneity of the home ownership variable, z_t, we simultaneously model the probability of being a home owner, the transition rates out of the job spell, and the wage. The probability of being home owner in year t depends on explanatory variables, x_t and y_t, and an unobserved component, υ_h, and is specified as a logit model

$$P(x_t, y_{t,}\upsilon_h) = P(z_t = 1 \mid x_t, y_t, \upsilon_h) = \frac{\exp(\beta_h' x_t + \alpha_h' y_t + \upsilon_h)}{1 + \exp(\beta_h' x_t + \alpha_h' y_t + \upsilon_h)}, \tag{4}$$

where x_t are the same explanatory variables that are included in the duration model, and y_t are variables that are included in the logit model, but not in the duration model. The corresponding contribution to the likelihood function from a job spell is

$$\mathcal{L}_h(t \mid x_t, y_t, \upsilon_h) = \prod_{j=1}^{k} P(x_j, y_t, \upsilon_h)^{z_j} \big(1 - P(x_j, y_t, \upsilon_h)\big)^{1-z_j}. \tag{5}$$

We assume that all sources of correlation between the three processes can be represented by the individual-specific heterogeneity terms. These terms are assumed to be time-invariant and hence constant across repeated spells for the same individual.

The unobserved heterogeneity is specified by the stochastic variables $\upsilon_{en}, \upsilon_{el}, \upsilon_u, \upsilon_w, \upsilon_h$, so the complete contribution to the likelihood function for each individual is

$$\begin{aligned}\mathcal{L} = \int_{\upsilon_{el}}\int_{\upsilon_{en}}\int_{\upsilon_u}\int_{\upsilon_w}\int_{\upsilon_h} & \mathcal{L}_e(t \mid x_t, z_t, \upsilon_{el}, \upsilon_{en}, \upsilon_u) \cdot \mathcal{L}_w(w_1, \ldots, w_t \mid x_1, \ldots, x_t, \upsilon_w) \\ & \cdot \mathcal{L}_h(t \mid x_t, y_t, \upsilon_h)\, \mathrm{d}F(\upsilon_{el}, \upsilon_{en}, \upsilon_u, \upsilon_w, \upsilon_h),\end{aligned} \tag{6}$$

where F is the joint CDF for the unobserved heterogeneity, which remains to be specified. We use a flexible and widely applied specification of the distribution of the unobservables; it is assumed that $\upsilon_{el}, \upsilon_{en}, \upsilon_u, \upsilon_w$ and υ_h each can take two values, where one of the support points in each destination specific hazard is normalized to zero (i.e., $\upsilon_{el} = 0$, $\upsilon_u = 0$ and $\upsilon_{en} = 0$), because the baseline hazard acts as a constant term in the hazard rates. Thus, there are 32 possible combinations of this unobserved heterogeneity distribution, each with an associated probability. For more details on this class of mixture distributions in duration models, see e.g. van den Berg [19].

4.1. Identification

In order to identify the causal relation between home ownership and the outcomes of interest, two identification strategies may be pursued. The first identification strategy relies on multiple occurrences of job spells and ownership status for the individuals. This implies that we observe some individuals in several job spells, and in some they are home owners while in others they are not. Moreover, during a given job spell, some persons may change ownership status, in which case the argumentation from the 'timing-of-events' literature (Abbring and Van den Berg [1]) further adds to the identification of the model parameters. This identification approach has been

[6] We have also estimated a model with reverse causality between job duration and wages, but the results regarding home ownership still hold in that model, the results of which are available on request.

used in a series of papers by Panis and coauthors (see e.g. Panis and Lillard [15], Upchurch et al. [18], and Panis [16]) and Munch et al. [11].

Identification here requires that we—for at least a subset of individuals—observe job spells both when the individual is a home owner and when the individual is a renter. The intuition for identification is spelled out in Panis [16]. In terms of our application, his argument goes as follows: suppose one observes only one respondent over a long period of time during which he switches home owner status. With a sample of one, there is no heterogeneity and no correlation across equations, so that equations are independent. The effect of home owner status on exit rates from employment is identified because of repeated observations on job spells and variations in home owner status. More generally, conditional on heterogeneity, the equations are independent, and identification rests on repeated outcomes with interpersonal variation in home owner status. In terms of interpersonal variation in home owner status, 6.8% (see Table 1) of the individuals we observe are observed both as renters and as home owners in different job spells. In addition, 18.8% change ownership status during a job spell, thus allowing separate identification of time-invariant unobserved heterogeneity and time-varying ownership effects, see Abbring and Van den Berg [1].

The second identification strategy uses exclusion restrictions, that is, the existence of a set of variables that affect home ownership but have no direct impact on labor market outcomes is postulated. While we use the first identification strategy as our baseline scenario, we check robustness of the results by estimating the model using both identification strategies. In the literature on home ownership and labor markets, this strategy has been exploited by Van Leuvensteijn and Koning [20]. Like Van Leuvensteijn and Koning [20] we use regional home ownership rate as an instrumental variable, which only affects home ownership status. In addition, we also include home owner status of the parents (in 1980) and the regional home owner rate in the municipality in which the individual was born. The regional home ownership rate will naturally affect the probability of being a home owner through a supply effect, but there is no reason to presume that this will have an impact on the individual's labor market outcomes, *ceteris paribus*. The same should hold for the regional home ownership rate in the region of birth. Finally, after conditioning on education and labor market experience, we find no reason why the parents' home ownership status should assert a current influence on labor market outcomes, given the past educational and labor market outcomes of the individual.

5. Results

In this section, we present the main results.[7] We first show the results from a model where we endogenize home ownership status and identify the home owner equation by exploiting the multiple spell features of our data and time variation in ownership status, that is, the first identification strategy outlined above. These results are reported in Table 2. Focusing first on explanatory variables other than home ownership, the effects are roughly in line with our expectations and the established wisdom. First, by comparing the two job-to-job transition rates, it is clear that younger workers are relatively more mobile, and that this age effect is more pronounced for the job change hazard for non-local jobs. Workers living outside Copenhagen (large city or small city) have a lower job change hazard rate for local jobs, but a higher job change hazard rate for

[7] We do not present results for a model where we do not attempt to correct for the endogeneity of home owner status. These results show that home owners have 7% higher wages than renters, and that home owners are less likely to leave a current job spell for all three destinations. The results are of course available upon request.

non-local jobs. With respect to the unemployment risk, older workers have a higher hazard rate. Note, however, that this impact is conditional on years of working experience, and more working experience exerts a strong negative influence on the unemployment risk. Workers with further education have a markedly lower unemployment risk than workers with basic or vocational education. We do not present the estimated baseline hazards here. For all three transitions, we find negative duration dependence.[8] This is in accordance with e.g. Farber [7], who finds a similar pattern for job mobility in the US.

Table 2
Estimation results

Variables	Job change hazard local jobs		Job change hazard non-local jobs		Unemployment hazard	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Home ownership	**−0.0587**	0.0245	**−0.1597**	0.0401	**−0.3468**	0.0597
Age 19–24	**0.3472**	0.0395	**0.6666**	0.0630	**−0.6235**	0.0831
Age 25–29	0.0488	0.0317	**0.3315**	0.0510	**−0.3454**	0.0718
Age 40–49	**−0.1978**	0.0317	**−0.1885**	0.0531	**0.2059**	0.0746
Age 50 +	**−0.2838**	0.0430	**−0.5172**	0.0850	**0.7257**	0.0887
Female	−0.0045	0.0200	**−0.4632**	0.0345	**0.1474**	0.0493
Children 0–17 years	0.0388	0.0267	**−0.0953**	0.0447	−0.0140	0.0670
Two adults	**−0.0709**	0.0243	−0.0483	0.0406	**−0.3207**	0.0556
Large city	**−0.3928**	0.0321	**1.3110**	0.0683	**0.2656**	0.0765
Small city	**−0.4417**	0.0226	**1.4523**	0.0597	0.0531	0.0607
Basic education	**−0.0594**	0.0230	**−0.1019**	0.0373	0.0843	0.0528
Further education	**−0.1978**	0.0267	0.0721	0.0440	**−1.0689**	0.0752
Experience/10	0.0553	0.0526	0.1044	0.0893	**−0.9309**	0.1150
Experience squared/100	−0.0286	0.0152	**−0.0642**	0.0269	**0.0935**	0.0352
v_h^1	**−7.3118**	0.0746				
v_h^2	**−2.1912**	0.0591				
v_w^1	**4.8949**	0.0036				
v_w^2	**5.3353**	0.0037				
v_{en}^2	**2.3898**	0.0585				
v_{el}^2	**3.1652**	0.0751				
v_u^2	**1.8440**	0.0431				
$p_1(v_h^1, v_w^1, v_{e.}^1)$	**0.2294**	0.0043				
$p_2(v_h^1, v_w^1, v_{e.}^2)$	**0.0296**	0.0022				
$p_3(v_h^2, v_w^1, v_{e.}^1)$	**0.4146**	0.0050				
$p_4(v_h^2, v_w^1, v_{e.}^2)$	**0.0386**	0.0026				
$p_5(v_h^1, v_w^2, v_{e.}^1)$	**0.0884**	0.0031				
$p_6(v_h^1, v_w^2, v_{e.}^2)$	**0.0086**	0.0014				
$p_7(v_h^2, v_w^2, v_{e.}^1)$	**0.1718**	0.0039				
$p_8(v_h^2, v_w^2, v_{e.}^2)$	**0.0190**	0.0019				
$\text{Corr}(v_h, v_w)$	**0.0261**	0.0115				
$\text{Corr}(v_h, v_{e.})$	**−0.0309**	0.0149				
$\text{Corr}(v_{e.}, v_w)$	−0.0001	0.0135				

[8] Results are available from the authors upon request.

Table 2 (*continued*)

	Wage equation		Selection equation	
	Coeff.	Std. Err.	Coeff.	Std. Err.
Home ownership	**0.0537**	0.0020		
Age 19–24	**−0.2317**	0.0031	**−1.3097**	0.0462
Age 25–29	**−0.0427**	0.0028	**−0.6156**	0.0369
Age 40–49	**−0.0053**	0.0023	**0.0920**	0.0413
Age 50 +	**−0.0133**	0.0030	**0.3203**	0.0556
Female	**−0.1682**	0.0015	**0.3152**	0.0249
Children 0–17 years	**0.0088**	0.0022	**0.5183**	0.0344
Two adults	**0.0326**	0.0020	**2.1304**	0.0283
Large city	**−0.0728**	0.0022	**0.3821**	0.0365
Small city	**−0.0912**	0.0016	**1.0794**	0.0274
Basic education	**−0.1736**	0.0017	**−0.5306**	0.0288
Further education	**0.1787**	0.0018	**0.2262**	0.0322
Experience/10	**0.2198**	0.0037	**3.0468**	0.0660
Experience squared/100	**−0.0411**	0.0010	**−0.6075**	0.0199
Tenure/10	**0.0932**	0.0053		
Var(u)	**−2.7024**	0.0018		

Note: Bold numbers indicate a significant parameter estimate (5% level). Since the hazard models are perfectly correlated they are represented by $v_{e\cdot}$ in the probabilities and correlations. The standard error for the correlation coefficient and mass point probabilities has been calculated based on 1000 drawings from the multivariate normal distribution with mean and covariance matrix set equal to the estimated parameter vector and covariance matrix.

The wage equation has the traditional concave shape in working experience, and wages increase even more with job tenure in the sense that tenure is also a component in working experience. The results of the selection equation are also in line with what one would expect; the probability of being a home owner increases with e.g. age and family size.

Turning to the effect of home ownership, we find that owners are less likely to leave their job for unemployment—their unemployment risk is 29% lower than that of renters ($1 - \exp[-0.3468] \approx 0.29$). This result confirms the findings of Van Leuvensteijn and Koning [20] on Dutch data. However, Van Leuvensteijn and Koning [20] also found that home ownership does not affect the job change hazard rate. Since they do not distinguish between transitions into local jobs and non-local jobs, this result could hide a negative effect on job changes to non-local jobs. Our results for the Danish labor market show that both job change hazard rates are lower for home owners, with the effect being strongest for transitions into non-local jobs as expected—the parameter estimates imply that home owners have a 14% (5%) lower transition rate into a new job outside (inside) the local labor market. Recall that these results are completely consistent with the theoretical predictions outlined in Section 2. Thus, our results suggest that owners set higher reservation wages for jobs outside the local labor market relative to renters, because they have to be compensated for transaction costs. The same result is found for local jobs, and this may be explained by the fact that employers invest more in firm-specific skills for owners.

In addition, home owners have a wage premium of 5.37% compared to renters even after correcting for endogeneity. Again, this result is in accordance with our theoretical considerations; owners stay longer in their jobs, and therefore they are more attractive to employers. As a consequence, employers may be willing to offer a wage premium in order to attract owners, and they may be more willing to invest in firm specific human capital for home owners.

When we tried to estimate the full model, we experienced problems in terms of obtaining reliable estimates for the mass points and probabilities of the 32 different combinations of the 5 unobserved heterogeneity distributions. This is not unusual in these models. In order to make the model more tractable, we therefore restrict the correlation structure between the three hazard models to be perfect. This may appear to be overly restrictive. However, it still enables us to allow for completely flexible correlation between the wage equation, the home ownership status equation, and the transition rates out of a given job. In Table 2, we present the implied correlations between the three unobserved components. Although some of the correlations are significant,

Table 3
Estimation results: instruments

Variables	Job change hazard local jobs		Job change hazard non-local jobs		Unemployment hazard	
	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Home ownership	**−0.0640**	0.0244	**−0.1776**	0.0399	**−0.3847**	0.0595
Age 19–24	**0.3628**	0.0395	**0.6403**	0.0628	**−0.6259**	0.0829
Age 25–29	**0.0624**	0.0316	**0.3227**	0.0508	**−0.3399**	0.0719
Age 40–49	**−0.1985**	0.0317	**−0.2041**	0.0530	**0.1898**	0.0747
Age 50 +	**−0.2927**	0.0430	**−0.5250**	0.0849	**0.6970**	0.0889
Female	−0.0060	0.0199	**−0.4623**	0.0342	**0.1507**	0.0492
Children 0–17 years	0.0410	0.0267	**−0.0883**	0.0446	−0.0019	0.0670
Two adults	**−0.0733**	0.0243	−0.0540	0.0405	**−0.3141**	0.0557
Large city	**−0.3933**	0.0321	**1.2826**	0.0681	**0.2437**	0.0764
Small city	**−0.4372**	0.0225	**1.4310**	0.0596	0.0524	0.0608
Basic education	**−0.0601**	0.0229	**−0.1202**	0.0371	0.0819	0.0527
Further education	**−0.1883**	0.0266	0.0543	0.0436	**−1.0608**	0.0754
Experience/10	0.0845	0.0525	0.0887	0.0891	**−0.8910**	0.1147
Experience squared/100	**−0.0338**	0.0152	**−0.0577**	0.0269	**0.0897**	0.0351
v_h^1	**−10.1338**	0.1004				
v_h^2	**−5.0737**	0.0846				
v_w^1	**4.8953**	0.0036				
v_w^2	**5.3361**	0.0037				
v_{en}^2	**2.4424**	0.0605				
v_{el}^2	**3.2331**	0.0766				
v_u^2	**1.9074**	0.0452				
$p_1(v_h^1, v_w^1, v_{e.}^1)$	**0.2339**	0.0044				
$p_2(v_h^1, v_w^1, v_{e.}^2)$	**0.0297**	0.0022				
$p_3(v_h^2, v_w^1, v_{e.}^1)$	**0.4111**	0.0051				
$p_4(v_h^2, v_w^1, v_{e.}^2)$	**0.0393**	0.0026				
$p_5(v_h^1, v_w^2, v_{e.}^1)$	**0.0881**	0.0029				
$p_6(v_h^1, v_w^2, v_{e.}^2)$	**0.0086**	0.0014				
$p_7(v_h^2, v_w^2, v_{e.}^1)$	**0.1707**	0.0038				
$p_8(v_h^2, v_w^2, v_{e.}^2)$	**0.0188**	0.0019				
$\mathrm{Corr}(v_h, v_w)$	**0.0313**	0.0118				
$\mathrm{Corr}(v_h, v_{e.})$	−0.0267	0.0142				
$\mathrm{Corr}(v_w, v_{e.})$	−0.0016	0.0132				

Table 3 (*continued*)

	Wage equation		Selection equation	
	Coeff.	Std. Err.	Coeff.	Std. Err.
Home ownership	**0.0531**	0.0020		
Age 19–24	**−0.2372**	0.0031	**−1.4841**	0.0476
Age 25–29	**−0.0426**	0.0028	**−0.6296**	0.0372
Age 40–49	**−0.0054**	0.0023	**0.3261**	0.0460
Age 50 +	**−0.0134**	0.0030	**0.5949**	0.0686
Female	**−0.1681**	0.0015	**0.2654**	0.0248
Children 0–17 years	**0.0087**	0.0022	**0.4552**	0.0344
Two adults	**0.0327**	0.0020	**2.2705**	0.0290
Large city	**−0.0728**	0.0022	**0.5811**	0.0372
Small city	**−0.0912**	0.0016	**0.1395**	0.0330
Basic education	**−0.1736**	0.0017	**−0.6207**	0.0288
Further education	**0.1788**	0.0018	**0.1336**	0.0319
Experience/10	**0.2199**	0.0037	**2.9132**	0.0666
Experience squared/100	**−0.0412**	0.0010	**−0.5740**	0.0199
Tenure/10	**0.0936**	0.0053		
Var(u)	**−2.7023**	0.0018		
Owner share, reg. of residence			**0.0571**	0.0012
Owner share, reg. of birth			**0.0028**	0.0005
Owner share, reg. of birth missing			0.0577	0.7162
Parents' owner status 1980			**0.3826**	0.0279
Parents' owner status missing			**−0.1823**	0.0479

Note: Bold numbers indicate a significant parameter estimate (5% level). Since the hazard models are perfectly correlated they are represented by $v_{e\cdot}$ in the probabilities and correlations. The standard error for the correlation coefficient and mass point probabilities has been calculated based on 1000 drawings from the multivariate normal distribution with mean and covariance matrix set equal to the estimated parameter vector and covariance matrix.

none of them are very large, implying that the selection bias that would have arisen if the selection process had been ignored is actually quite small.

In Table 3, we present a version of the model where we identify the home owner equation with instrumental variables as well as multiple spells. The results do not differ much from those presented in Table 2, and we can therefore conclude that the results are robust to the choice of identification strategy. This could of course also be due to the instruments included. We did try different combinations of the instruments included in Table 3 (results are available on request), but they all produced results similar to those reported in Tables 2 and 3.

6. Conclusion

We have examined the causal impact of home ownership on job duration and wages. From a search theoretic perspective, we have argued that because of transaction costs employed home owners should have a lower transition rate into new non-local jobs, and therefore owners overall stay longer in their jobs. This makes owners more attractive for employers, i.e. employers are more likely to invest in firm-specific human capital and so owners are offered higher wages, and consequently they should also be less likely to leave the current job for other local jobs.

We have empirically examined these predictions using a detailed Danish micro data set. We have estimated a competing risks duration model for job spells with a distinction between transitions into new local jobs, new non-local jobs, and unemployment, and in addition we simultaneously estimate a standard human capital wage equation. Special attention has been devoted

to identifying the causal linkage between home ownership and the labor market outcomes of interest.

Our empirical results are completely consistent with the theoretical predictions. Owners have lower transition rates into all three destinations than renters, and they also earn higher wages. The results contribute to the empirical literature on the labor market effects of home ownership in two ways. First, the reduced transition rates into new jobs are at odds with the results of Van Leuvensteijn and Koning [20] for the Dutch labor market, but consistent with search theory. Second, the impact of home ownership on wages has not been the subject of intense scrutiny, and to the best of our knowledge it has never been studied in empirical models where the selection into home ownership has been carefully taken into account.

In terms of the arguments mentioned in the introduction, where positive externalities associated with home ownership has been used to argue for favorable tax treatments of home owners, our results suggest that there are also significant labor market gains associated with home ownership. Since these gains are private, and since they might even impose negative externalities on others (because with a given budget constraint, training home owners implies that renters do not receive training), we do not see the results as strengthening the case for favorable tax treatment of home ownership.

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References

[1] J. Abbring, G. van den Berg, The non-parametric identification of treatment effects in duration models, Econometrica 71 (2003) 1491–1517.
[2] A.K. Andersen, Commuting areas in Denmark, AKF Forlaget, Copenhagen.
[3] N.E. Coulson, L.M. Fisher, Tenure choice and labour market outcomes, Housing Studies 17 (2002) 35–49.
[4] Danish Economic Council, Danish Economy Spring 2001, Copenhagen.
[5] Danish Economic Council, Danish Economy Autumn 2002, Copenhagen.
[6] R.D. Dietz, D.R. Haurin, The social and private micro-level consequences of homeownership, Journal of Urban Economics 54 (2003) 401–450.
[7] H.S. Farber, Mobility and stability: The dynamics of job change in labor markets, in: O. Ashenfelter, D. Card (Eds.), The Handbook of Labor Economics, vol. 3, North-Holland, Amsterdam, 1999.
[8] R. Green, P. Hendershott, Home ownership and unemployment in the US, Urban Studies 38 (2001) 1501–1520.
[9] P. Hendershott, M. White, The rise and fall of housing's favored investment status, Journal of Housing Research 11 (2000) 257–275.
[10] J.R. Munch, M. Svarer, Rent control and tenancy duration, Journal of Urban Economics 52 (2002) 542–560.
[11] J.R. Munch, M. Rosholm, M. Svarer, Are home owners really more unemployed? Economic Journal 116 (2006) 991–1013.
[12] S. Nickell, R. Layard, Labour market institutions and economic performance, in: O. Ashenfelter, D. Card (Eds.), The Handbook of Labor Economics, vol. 3, North-Holland, Amsterdam, 1999.
[13] OECD, Employment Outlook, OECD, Paris, 2000.
[14] A. Oswald, A conjecture of the explanation for high unemployment in the industrialized nations: Part I, Paper No. 475, Warwick University Economic Research, 1996.
[15] C. Panis, L. Lillard, Health inputs and child mortality: Malaysia, Journal of Health Economics 13 (1994) 455–489.
[16] C. Panis, Microsimulations in the presence of unobserved heterogeneity, Draft, RAND Corporation, 2004.

[17] M. Rosholm, M. Svarer, Endogenous wage dispersion and job turnover in a search-matching model, Labour Economics 11 (2004) 623–645.
[18] D.M. Upchurch, L. Lillard, C. Panis, Nonmarital childbearing: Influences of education, marriage, and fertility, Demography 39 (2002) 311–329.
[19] G. van den Berg, Duration models: Specification, identification, and multiple durations, in: J.J. Heckman, E. Leamer (Eds.), Handbook of Econometrics, vol. 5, North-Holland, Amsterdam, 2001.
[20] M. Van Leuvensteijn, P. Koning, The effects of home ownership on labour mobility in the Netherlands, Journal of Urban Economics 55 (2004) 580–596.