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The Puzzle of Job Search and Housing Tenure. A Reconciliation of Theory and Empirical Evidence

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Abstract

Oswald's thesis posits that workers who own their own home should have longer unemployment spells due to restricted mobility, but repeatedly the reverse is found. We contribute to shed light on this puzzle in two key ways. First, we show that the thesis holds when stated in terms of search intensity instead of unemployment. In a job search model with moving costs we show that unemployed homeowners search less than renters. We confirm this result empirically using UK LFS data. Second, we provide evidence that homeowners select search methods associated with shorter unemployment spells, suggesting that they search more efficiently.

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1 Introduction

Although in the last decades the orientation of several governments, particularly in Europe, has been to promote homeownership (Di Pasquale & Glaeser, 1999; Rohe et al., 2002; Dietz & Haurin, 2003; Engelhardt et al., 2010), economists have raised several concerns about the consequences of large homeownership rates on the functioning of the labour market. The analysis of the relation between the housing tenure and the labour market dates back to mid nineties, when Andrew Oswald pinned on high homeownership rates the blame for the high unemployment rates in Europe (Oswald, 1996, 1997, 1999). The receipt he proposed to reduce unemployment was strikingly at odds with the prevailing political wisdom: "We can put Europe back to work ...by reducing homeownership"(Oswald, 1999). Several studies using regional or cross-country data have later provided support to the claim that high homeownership rates lead to high levels of unemployment rates (Blanchflower & Oswald, 2013; Coulson & Fisher, 2009; Munch et al., 2006; Di Tella & MacCulloch, 2005; Green & Hendershott, 2001a; Nickell & Layard, 1999; Nickell, 1998).

The most influential microeconomic interpretation of this finding has focused on the supposedly lower job finding rates of unemployed people who own their own home. In fact, since homeownership hampers the propensity to move for job reasons, homeowners should experience longer unemployment spells than otherwise comparable renters. While there is abundant evidence supporting the first element of this rationale (Van den Berg & Van Vuuren, 1998; Henley, 1998; Munch et al., 2006; Van Vuuren, 2009; Battu et al., 2008), several empirical studies have found no support for the second, and in most cases even the opposite (Goss & Phillips, 1997; Coulson & Fisher, 2002; Flatau et al., 2003; Munch et al., 2006; Van Vuuren, 2009; Battu et al., 2008).[1]

Recently, Blanchflower & Oswald (2013) and Laamanen (2013) have reinforced the argument against high homeownership rates assessing the role of possible negative externalities. Their argument is not that homeowners themselves are disproportionately unemployed (actually they find further evidence against that), rather that the positive relation between homeownership and unemployment rates can be explained by negative externalities that the housing market can produce upon the labour market.[2]

The existing literature has investigated some possible explanations for the repeated failure of Oswald's hypothesis in micro data. One explanation looks at the dichotomy between the local and non-local labour markets in studying the effect of moving costs. Munch et al. (2006) point out that the lower mobility of owner-occupiers does not necessarily imply that they have lower exit rates from unemployment. In fact, homeowners should have higher reservation wages for jobs which require a residential move, but also lower reservation wages for jobs which do not. Therefore, whether or not homeowners find jobs overall less quickly should be an empirical matter. However, this theoretical argument does not suggest reasons why the counter-Oswald result could emerge in practice. Moreover, Van Vuuren (2009) has shown that whenever the homeownership choice is explicitly modeled in the model of Munch et al. (2006), the hazard rate out of unemployment is always lower for homeowners.[3]

[1] See Havet & Penot (2010) for a comprehensive survey of the literature analyzing the impact of housing tenure on labour market outcomes, both at micro and macro level.

[2] They find evidence of externalities related to lower levels of labour mobility, greater commuting times, lower rates of business formation (Blanchflower & Oswald, 2013), consumption reductions and increased local job competition caused by home purchases, especially if financed by debt (Laamanen, 2013).

[3] In the model of Van Vuuren (2009), the effect of homeownership is still ambiguous in the special case that homeowners can receive unemployment benefits only for a fixed period while renters never run out of it.

Another explanation has focused on the importance of making distinctions among categories of homeowners and among categories of renters. Among owners, one should take into account that a commitment to mortgage payments can counteract the effect of the restricted mobility of owning a home. In general, committed housing expenditures such as the rent and, especially, the mortgage should boost exit rates off unemployment through higher pressure to return to work (Rouwendal & Nijkamp, 2010; Arulampalam et al., 2000). This argument is used in the literature to explain why mortgage-holders have typically the best outcomes (Brunet et al., 2007; Goss & Phillips, 1997; Flatau et al., 2003; Kantor et al., 2013). Also, social and private renters may not behave the same way, since social renters face lock-in effects similarly to homeowners, due to below-market rent, long waiting lists, security of tenure, and restricted transferability within social housing (Hughes & McCormick, 1981, 1987, 2000; McCormick, 1983; Battu et al., 2008; Flatau et al., 2003).[4] The straight comparison between owners and non-owners could be misleading as mortgagers share some similarities with private renters, and outright owners share some with social renters. For the main mechanism underlying Oswald's hypothesis to emerge, the relevant comparison should be made between outright owners and private renters. In fact, outright owners do not have housing costs to cope with, so the mobility mechanism is free from contrasting effects, and private renters do not have same mobility constraints as social renters. However, pieces of evidence on the comparison between outright owners and private renters are in general ambiguous (Flatau et al., 2003; Brunet et al., 2007; Battu et al., 2008), providing again scant support to Oswald's thesis. Moreover the use of a multinomial specification makes it more complicated to control for the likely endogeneity of housing tenure. Though the relevance of the endogeneity issue (Green & Hendershott, 2001b; Brunet & Lesueur, 2009; Flatau et al., 2003; Van Leuvensteijn & Koning, 2004; Munch et al., 2006; Brunet et al., 2007; Van Vuuren, 2009; Battu et al., 2008; Coulson & Fisher, 2009) and of a more refined definition of housing tenure is often stressed in the literature, only seldom are these issues tackled jointly.[5]

Despite this large body of research, the mechanisms yielding more rapid exits from unemployment to less mobile homeowners are not fully understood yet. In this paper, taking into account current explanations, we investigate a novel approach to solve Oswald's puzzle. The solution we propose has two key ingredients. The first ingredient consists in showing that Oswald's hypothesis holds when stated in term of search intensity instead of unemployment. The second ingredient consists in exploring one possible reason why this hypothesis does not work for unemployment.

The standard test of Oswald's hypothesis consists in estimating the effect of housing tenure on hazards out of unemployment.[6] Our first contribution is based on the consideration that unemployment may be a misleading outcome to test the impact of housing tenure, at least according to the channel discussed in the literature. The microeconomics

[4] In the UK, social housing is a form of housing tenure in which the property is owned by Local Authorities or by Housing Associations, usually with the aim of providing accommodation at below-market rent or even rent-free.

[5] Brunet et al. (2007) is the only study we are aware of that simultaneously controls for endogeneity and for multinomial housing tenure, where adequate distinctions among homeowners and among renters are made. Also Flatau et al. (2003) estimate a duration model with multinomial housing tenure correcting for endogeneity and even for sample selection bias. However they use a two step approach *à la* Rivers–Vuong (Rivers & Vuong, 1988), and use age dummies as instruments, which is a questionable device. Moreover, they report only estimates when housing tenure is not instrumented, since the hypothesis of exogeneity cannot be rejected.

[6] Oswald's hypothesis has also been explored, though to a less extent, by looking at the effect of homeownership on the probability of being unemployed, on the risk of becoming unemployed, and on wages (Havet & Penot, 2010). The Oswald's hypothesis is typically rejected even in these cases.

of Oswald's argument suggests that higher mobility costs reduce the expected profits of a job search, and increase the reservation wage, for jobs which require relocation. While this effect translates in a given difference in reservation wages and in the levels of search intensity between owners and non-owners, differences in unemployment outcomes could be biased by other channels. For example, homeowners may be simply more efficient in the search process. Also, employers may prefer to hire workers who own their own accommodation since their expected job tenure is longer. In these cases, homeowners may be able to exit unemployment more rapidly than renters even with the same or lower level of search intensity.

The demonstration of our first proposition is conducted by performing a theoretical and empirical analysis. Firstly, we develop a model of endogenous job search effort with two labour markets which differ geographically as in Munch et al. (2006). In the baseline model with exogenous search effort, the assumption of higher mobility costs entails the main result that homeowners have lower job finding rates far from home but higher job finding rates locally. However, the impact on the job finding rate as a whole remains undetermined. By treating search effort as endogenous, we will show that lower mobility costs imply renters to have unambiguously higher overall search intensity and job finding rate. Secondly, making use of a data set drawn from the UK Labour Force Survey, we test empirically the main theoretical proposition by estimating the effect of housing tenure in a search intensity equation. In line with a wealth of empirical studies, the job search effort is proxied with the number of search methods used (Holzer, 1988; Blau & Robins, 1990; Wadsworth, 1991; Schmitt & Wadsworth, 1993; Gregg & Wadsworth, 1996; Boeheim & Taylor, 2001; Addison & Portugal, 2002; Weber & Mahringer, 2008; Manning, 2009; Bachmann & Baumgarten, 2012). The use of job search methods is a well researched issue in many countries. No one, however, has yet tested Oswald's hypothesis by this means. Also, our study departs from most of those which attempt to control for the endogeneity of housing tenure by adopting a multinomial specification. We employ a multinomial treatment effects estimation which accounts for endogeneity of multiple treatments (Deb & Trivedi, 2006b,a). Identification is achieved by using a set of instrumental variables in a housing tenure selection model that are excluded from the main search equation. The results show that outright owners search less than private renters by around 11%, which is exactly what one would expect according to Oswald's argument. Moreover, we find that mortgage-holders have the highest search intensity, and that social renters search significantly less than private renters.

The finding that (outright) homeowners search less intensively than (private) renters, taken together with the repeated result that the former have shorter unemployment spells, leads us to our second contribution. We explore whether homeowners' shorter unemployment duration can be explained by higher efficiency in the search process. The investigation of this insight is conducted empirically by estimating two models. On the one side, a multinomial logit model is estimated to identify the effect of housing tenure on the selection of the main search method. On the other side, we estimate a competing-risks unemployment duration model, with employment and inactivity as competing risks, to identify search methods with shorter hazards to job. We distinguish six main methods of job search: public employment centres (PEC), private employment agency, newspaper advertisements, employer contact, asking friends and relatives, and other. PEC are typically observed to be ineffective for unemployed and their use has often been criticized (Holzer, 1988; Blau & Robins, 1990; Addison & Portugal, 2002; Longhi & Taylor, 2011). We find that private renters are significantly more likely to rely on PEC as main search channel relative to outright owners, while outright owners are relatively more likely to use newspa-

pers advertisements. Estimates of the competing risks model suggest that PEC relatively lengthens the time needed to reenter employment. Also, counter-Oswald evidence emerges again in these estimates since outright owners are found to become employed more quickly than private renters. Taken jointly, these findings provide some support to the idea that outright owners select search methods which are more effective for finding a job, which in turn can explain why they return to job faster despite lower search intensity.

This paper has the following structure. In the next section, we present the theoretical model of search. In Sections 3 we describe the data used in the empirical analysis. In Section 4, we describe the econometric methodology employed to conduct the analysis of search intensity (Sections 4.1) and the analysis of search methods (Sections 4.2). Section 5.1 and Section 5.2 provide the results for the two empirical analyses. The final section concludes.

2 The Theoretical Model

In this section, we present a simplified model of job search with endogenous search effort and exogenous wage offer distribution.[7] The effect of homeownership is captured by allowing for two distinct labour markets which differ geographically as in Munch et al. (2006). The local labour market is defined as the region in which a worker can take a job without moving. Symmetrically, jobs in the non-local labour market require a move.[8] This framework captures the idea that there exist two distinct reservation wages, one for the local labour market and one for jobs outside, which will diverge when moving entails a cost. The effect of owning owns home is captured by assuming larger relocation costs. In case of exogenous search effort, the main result of the model is that homeowners have lower job finding rates far from home but higher job finding rates in the local labour market (Munch et al., 2006). However, the effect on the job finding rate as a whole is ambiguous. Treating search effort as endogenous will allow us to state propositions in terms of search and to overcome this ambiguity.

The lifetime utility of the employed is kept as simple as possible, with zero separation rate and no on-the-job search:

$$V^E(w) = \frac{w}{\rho}, \tag{1}$$

where w is the wage and ρ is the discount rate.

The unemployed can increase the job offer arrival rate through search effort at the cost of a utility loss C^s. With two labour markets, the model has two distinct cost functions and job offer arrival rates, which differ uniquely for the search effort exerted in each of them, namely s_l and s_n. We assume that the total cost of search is an additive function in the two separate cost functions, *i.e.*, $C^s = c(s_l) + c(s_n)$, where $c' > 0$ and $c'' > 0$.[9] The arrival rate of job offers in the local and non-local labour markets are, respectively, $\alpha(s_l)$ and $\alpha(s_n)$, where $\alpha' > 0$ and $\alpha'' < 0$. Wage offers are sampled from the *c.d.f.* $F(w)$ which we assume is the same for both markets.

When choosing how to allocate search effort between the two labour markets, the unemployed must take into account the cost of moving, that is, the cost incurred if finding

[7] See Mortensen (1986) for the background of search modeling and Manning (2009) for a similar version.

[8] Commuting is not allowed for, so workers accepting a job offer in the non-local market necessarily have to move and to pay the cost. See Kantor et al. (2013) for a model with commuting.

[9] The assumptions on c yield a standard convex total cost of search function. The model may be enriched by allowing higher costs of search in the non-local labour market, but this is not relevant for the comparison between the search behaviour of homeowners and renters.

and accepting a job in the other region. The difference in this cost for homeowners and renters is precisely what captures Oswald's effect in the model. For simplicity, we set this cost to zero for renters since it just needs to be higher for homeowners (Munch et al., 2006). The value equation for the unemployed renter is

$$\rho V^U = b - c(s_l) - c(s_n) + (\alpha(s_l) + \alpha(s_n)) \int_{w_r^*} (V^E(w) - V^U)\, dF(w), \tag{2}$$

where w_r^* is the reservation wage for the renter and b is the unemployment benefit.

The unemployed sets simultaneously the reservation wage and the search effort levels in order to maximise lifetime utility. As the renter is indifferent between accepting a local or a non-local job because moving is costless, so the reservation wage is the same for both. Given risk neutrality, the reservation wage will satisfy $w_r^* = \rho V^U$. Replacing this and Equation (1) in Equation (2), and rearranging, we have

$$w_r^* = b - c(s_l) - c(s_n) + \frac{(\alpha(s_l) + \alpha(s_n))}{\rho} \int_{w_r^*} (w - w_r^*)\, dF(w). \tag{3}$$

Differentiating Equation (3) with respect to s_l and s_n we get the first order conditions for the maximum,

$$c'(s_l^*) = \alpha'(s_l^*)A, \tag{4}$$

$$c'(s_n^*) = \alpha'(s_n^*)A, \tag{5}$$

where we put $A = \rho^{-1} \int_{w_r^*} (w - w_r^*)\, dF(w)$. It is easy to show that the unemployed renter will exert the same search effort in both markets. In fact, from Equations (4) and (5), we get $c'(s_l^*)/\alpha'(s_l^*) = c'(s_n^*)/\alpha'(s_n^*)$, which is true only when $s_l^* = s_n^*$. In this simple setup, with no additional costs of search far from home and no costs of moving, the renter is indifferent between searching locally and in a distant area.

If the unemployed is a homeowner, the cost m which incurred if accepting a job in the non-local labour market has to be considered.[10] The discounted lifetime utility for the unemployed homeowner is

$$\rho \tilde{V}^U = b - c(s_l) - c(s_n) + \alpha(s_l) \int_{w_l^*} \left(\frac{w}{\rho} - \tilde{V}^U \right) dF(w) + \alpha(s_n) \int_{w_n^*} \left(\frac{w}{\rho} - \tilde{V}^U - m \right) dF(w), \tag{6}$$

where we have already replaced $V^E(w) = w/\rho$. Now, we have two distinct levels of the reservation wage, one for each of the two markets. The reservation wage for the local labour market is $w_l^* = \rho \tilde{V}^U$, while the reservation wage for job offers outside the local labour market is $w_n^* = \rho \tilde{V}^U + \rho m$: to accept a job offer which requires a move, the unemployed homeowner needs compensation for the cost of moving. Equation (6) can be rewritten as

$$w_l^* = b - c(s_l) - c(s_n) + \frac{\alpha(s_l)}{\rho} \int_{w_l^*} (w - w_l^*)\, dF(w) + \frac{\alpha(s_n)}{\rho} \int_{w_n^*} (w - w_l^* - \rho m)\, dF(w). \tag{7}$$

The optimal search levels in the two markets are determined by the first order conditions

$$c'(s_l^*) = \alpha'(s_l^*)B, \tag{8}$$

[10] The cost of moving will be the same whether the homeowner moves to another owner-occupied housing or to a rental accommodation, hence, this model captures only the lower mobility due to the cost of selling a home. We may enrich the model by differentiating between moves to a rental and to an owner-occupied accommodation (with higher costs for the latter), but this higher complexity will not yield higher benefits for our purposes.

$$c'(s_n^*) = \alpha'(s_n^*)C, \tag{9}$$

where we set $B = \rho^{-1}\int_{w_l^*}(w - w_l^*)\,dF(w)$ and $C = \rho^{-1}\int_{w_n^*}(w - w_n^*)\,dF(w)$. Since $w_l^* < w_n^*$, $B > C$ holds for any w. From Equations (8) and (9), $B > C$ implies $c'(s_l^*)/\alpha'(s_l^*) > c'(s_n^*)/\alpha'(s_n^*)$. Given that c is convex and α is concave, the latter inequality implies $s_l^* > s_n^*$. Unlike the renter, for the homeowner it is optimal to search harder in the local labour market than outside.

Up to this point we have shown that the renter chooses the same level of search in both markets, which we notate as s_r^*, while the homeowner sets $s_l^* > s_n^*$. To identify the effect of housing tenure we now compare the search effort of the renter and of the homeowner in both markets. A first result is stated in the following proposition (see Appendix C for the proof).

Proposition 1 $s_l^* > s_r^* > s_n^*$.

The rationale of this proposition is straightforward. When an unemployed person has to face a cost of moving to accept a job offer far from home, there is less searching outside, and the search effort is centred on the local area in order to reduce the probability of incurring this cost.[11] Whether or not the homeowner searches in general less than the renter depends on the balance of these two opposite effects, whose net result can be identified within this framework. Before tackling this point, we will find the relations between the reservation wages of homeowners and renters in both markets, which is the counterpart of Proposition 1. This is stated in the following proposition (see Appendix C for the proof).

Proposition 2 $w_l^* < w_r^* < w_n^*$.

In order to compare the total search level of the homeowner and the renter, that is, the impact of housing tenure on search, we just have to compare the sum of the search levels in the two markets. The search level of the homeowner will be greater than, equal to, or lower than that of the renter depending on whether $s_l^* + s_n^* \gtreqless 2s_r^*$. The only thing which differentiates the homeowner from the renter is the moving cost, so we may expect that an increase of the moving cost from zero to a positive number, which represents just a shift from renting to owner tenure, comes with a reduction of the total search effort. The rationale is that, although this cost is incurred only if the homeowner actually moves, it increases the *expected* cost of the search, which in turn makes unemployment more valuable. Thus, despite the incentive to search harder locally, this expected cost has to be covered by an extra reduction in the non-local search (from s_r^* to s_n^*) compared to what would be needed to compensate for the increase in the local search (from s_r^* to s_l^*). The following proposition confirms this insight (see Appendix C for the proof).

Proposition 3 $2s_r^* > s_l^* + s_n^*$.

Unlike the model of Munch et al. (2006), but like that of Van Vuuren (2009), we can make clear predictions also on the whole job finding rates of the homeowner and the renter. Van Vuuren (2009) generalizes the model of Munch et al. (2006) by introducing the choice of homeownership. In his model, the employed can become homeowners, sustaining a fixed

[11] Commuting would be another mechanism which implies that homeowners may search locally more than renters. Given the higher costs of moving, homeowners would be willing to commute longer so that their local labour market would be larger (Munch et al., 2006). The theoretical results would be simply exacerbated if we allowed for commuting in this set-up, but the main message would not be qualitatively affected.

cost for buying a home. It turns out that for a positive value of this cost, the hazard out of unemployment is unambiguously lower for homeowners.

The renter's job finding rate is two times $h_r = \alpha(s_r^*)\,[1 - F(w_r^*)]$, which is the common job finding rate for both markets, while the owner's job finding rate is the sum of $h_l = \alpha(s_l^*)\,[1 - F(w_l^*)]$ and $h_n = \alpha(s_n^*)\,[1 - F(w_n^*)]$, which refer respectively to the local and to the non-local market. In order to compare job finding rates, we first point out that, by Propositions 1 and 2, $h_l > h_r > h_n$. Thus, the unemployed living in owner-occupied accommodations are expected to have a higher exit rate from unemployment towards jobs which require a move, but a lower exit rate towards employment in the local labour market. The main mechanism of Oswald's hypothesis works in this setup, since homeownership, by hampering residential mobility, reduces the chances of finding an acceptable job far from home. Can we also state that renters have higher exit rates than homeowners *in general*? This is the case if $2h_r > h_l + h_n$, which again can be shown to be true within this framework. The logic of the proof is similar to that of Proposition 3 and relies on its results (see Appendix C for the proof).

Proposition 4 $2\alpha(s_r^*)\,[1 - F(w_r^*)] > \alpha(s_l^*)\,[1 - F(w_l^*)] + \alpha(s_n^*)\,[1 - F(w_n^*)]$.

To conclude, this theoretical section delivers a clear message: due to larger mobility costs, homeowners have lower levels of search effort and lower exit rates from unemployment than renters. This means that the local versus non-local search explanation cannot falsify the argument underlying Oswald's hypothesis. In the empirical section we will provide evidence for the comparison of the search intensity between unemployed homeowners and renters. Since the main argument of Oswald's hypothesis concerns the effect of mobility costs, the relevant comparison will be between outright owners and private renters.

3 The Data

We use a data set drawn from the UK Labour Force Survey (LFS), a quarterly nationwide survey which collects address-based interviews of about 60,000 households for each quarter. Each individual is interviewed in five consecutive quarters on a rotating panel basis. The sample we use spans the period 1999–2009, so that we have 44 calendar quarters of observations.

The LFS provides a rich set of information on job search methods. In particular, unemployed people who state that they have been looking for work in the last four weeks are asked to reply which specific search methods they used, out of a total of 14. The count of methods used is our measure of search intensity. Individuals are also asked to report the main method of search used. The list of search methods is given in Appendix B.

For consistency with our research design, we restrict to a sub-sample of ILO unemployed male heads of households (aged 16–64) and we make some further sample adjustments.[12] We drop observations for people who have never had a paid job, receive a retirement or old age pension, are searching for work only as self-employed[13], or are waiting to take up a job already obtained. Proxy responses are also dropped. See Table 1 for sample statistics on variables used in estimation.

[12] ILO unemployed are people without a job who have been looking for work in the last four weeks and are available to start a new job within the following two weeks.

[13] We drop a small number of workers who search for work only as self-employed, since in this case, the maximum number of methods is lower than for those who search only as employee. The search intensity would be approximated with a different scale of magnitude.

We focus only on heads of households because we analyse the effect on individual labour outcomes of an individual tenure choice. For this purpose, we need individuals for whom the residential status is actually the outcome of an individual choice, which is typically the case for people responsible for the accommodation.[14] For some non-heads of households, it may be misleading to seek for a causal link from housing tenure to labour market behaviour given that the former may not reflect the outcome of an individual choice.[15] For example, a young person still living in the family home and dependent on their parents in an owner-occupied accommodation can hardly have a labour market behaviour assimilable to the typical homeowner.

For the analysis of job search methods we focus on the main method of search reported by the unemployed. We group main methods in six categories (see Appendix B). In order to perform an unemployment duration analysis by means of the LFS, we use a survey variable reporting the minimum of the length of time since the start of job search and the last job.[16] Durations are grouped in 8 time intervals: 0-3 months, 3-6 months, 6-12 months, 1-2 years, 2-3 years, 3-4 years, 4-5 years, 5 years or more. We use as measure of the spell length the value reported in the last interview associated with the unemployed status before a switch. The status in which the spell ends up may be either employment or inactivity, or may be unemployment when the interview is the last, that is the spell is right censored. Regressors are assumed spell constant and their values refer to the last interview before the exit (or the last interview for censored spells). We focus on a sub-sample with stable housing tenure data over the spell. In particular, we drop spells for individuals who switch housing tenure in the quarter either immediately preceding or following that in which the spells ends. We come up with 11,374 spells of which 3,579 end in employment, 1,769 end in inactivity and 6,026 are right censored.

4 Methodology

4.1 Job search intensity

As a test of the theory outlined in Section 2, we aim at estimating the effect of housing tenure on search intensity. The theoretical model predicts, in agreement with Oswald's hypothesis, that the higher mobility costs implied by homeownership reduce the optimal search intensity. For that mechanism to emerge, one should compare outright owners with private renters in the empirical analysis, as discussed in Section 1. An equation of search intensity is estimated, plugging in on the right hand side a set of dummies for residential status, namely *own_out*, *own_mort*, and *rent_soc*, where *rent_pri* is the baseline category. The dependent variable *nummet* is the count of search methods used, from a minimum of 1 to a maximum of 14. Other measures of search effort have been used in the literature, such as the time spent for search in a given time interval, the number of employer contacts, or a combination of different measures (Green et al., 2011). The number of search methods may be an imperfect measure of search intensity as it cannot quantify the effort the individual dedicates to each method. Despite this criticism, evidence suggests that this variable can capture relevant dimensions of search intensity. In fact,

[14] The LFS uses this definition of head of household: "Head of household (HOH) is defined as either the man or the husband/male partner of the woman in whose name the accommodation was owned or rented. Where two people have equal claim, either the oldest male is selected or, in all female households, the oldest female".

[15] Neither might the residential status of some heads of households be an individual choice, but this issue can be handled using controls at the household level in the empirical analysis.

[16] This is the LFS `durun` variable.

it is typically found to be strongly associated to the probability of gaining job (Holzer, 1988; Gregg & Wadsworth, 1996; Boeheim & Taylor, 2001), notably in UK data (Gregg & Wadsworth, 1996; Boeheim & Taylor, 2001), and to be related to other variables coherently with theory (Holzer, 1988; Blau & Robins, 1990; Schmitt & Wadsworth, 1993; Gregg & Wadsworth, 1996; Addison & Portugal, 2002; Weber & Mahringer, 2008; Bachmann & Baumgarten, 2012).

When trying to identify the effect of housing tenure on search intensity, one should take into account that selection into housing tenure can be affected by unobserved factors that are likely to be related to labour market outcomes. For example, less mobile people as well as people with a greater desire to retain proximity to family members or friends may self-select into homeownership, and restricted mobility is expected to be associated with low search intensity. We hence adopt a structural estimation method which takes into account that housing tenure and search intensity are jointly determined. Specifically, we employ the endogenous multinomial treatment effect method developed by Deb and Trivedi (Deb & Trivedi, 2006b,a).[17] This turns out to be the most suitable method we are aware of for our case, given the multinomial specification of the endogenous variable.[18]

The model specification comprises a set of equations that model the generating process of the treatment variables, *i.e.* residential states, and an outcome equation with a structural-causal interpretation. Each individual i chooses a residential status j from a set of four choices ($j = 0, 1, 2, 3$), where $j = 0$ is the control group (private renters). Let d_j be binary selection variables representing the observed tenure choice and $\mathbf{d}_i = (d_{i1}, d_{i2}, d_{i3})$. Also let $\mathbf{l}_i = (l_{i1}, l_{i2}, l_{i3})$, where l_{ij} are latent factors which incorporate unobserved characteristics common to individual i's status choice and outcome. Then the probability function for the tenure choice is modeled by a mixed multinomial logit (MMNL) structure:

$$P(\mathbf{d}_i|\mathbf{z}_i, \mathbf{l}_i) = \frac{\exp(\mathbf{z}_i'\alpha_j + \delta_j l_{ij})}{1 + \sum_{k=1}^{J} \exp(\mathbf{z}_i'\alpha_k + \delta_k l_{ik})}, \tag{10}$$

where $\mathbf{z}_i$ denotes a set of exogenous regressors and $J = 3$. The equation for the expected count outcome is

$$E(y_i|\mathbf{d}_i, \mathbf{x}_i, \mathbf{l}_i) = \exp(\mathbf{x}_i'\boldsymbol{\beta} + \sum_{j=1}^{J} \gamma_j d_{ij} + \sum_{j=1}^{J} \lambda_j l_{ij}), \tag{11}$$

where $\mathbf{x}_i$ is a set of exogenous variables within $\mathbf{z}_i$ and the γ_j-s are the treatment coefficients relative to private renters. The distribution of y_i is assumed to follow a negative binomial process that can accommodate overdispersion of the count variable unlike the standard Poisson. The data are overdispersed if the conditional variance exceeds the conditional mean, which is the case in several applications. An indication of the magnitude of the overdispersion can be obtained by simply comparing the sample mean and the variance. In our estimation sample, the mean and variance of *nummet* are, respectively, 4.6 and 6.4 (see Table 1), which suggests the presence of overdispersion.

The estimation method relies on the specification of a joint distribution for the outcome and the endogenous treatment choice (see Appendix C for a formal and detailed representation). Since the latent factors enter into the likelihood function but are unknown, the maximization of the likelihood function is performed through simulation, by drawing

[17] The method is implemented using the Stata routine `mtreatreg` provided by the reference.

[18] See Trivedi & Munkin (2010) for a survey of recent developments in count models, in particular with reference to endogenous categorical regressors.

several random numbers from a standard normal distribution.[19]

In principle, the parameters of the structural model are identified through nonlinear functional forms even if all variables in the outcome equation are included in the residential status equations, *i.e.* $\mathbf{x}_i = \mathbf{z}_i$. However, for more robust identification we use traditional exclusion restrictions by specifying instrumental variables in the residential status choice that are excluded from the search intensity equation (Deb & Trivedi, 2006b,a). Several variables have been proposed in the literature to instrument housing tenure, or more specifically homeownership. One prominent instrument, often used in the literature, is the regional homeownership rate (Van Leuvensteijn & Koning, 2004; Munch et al., 2006; Brunet & Lesueur, 2009). However this instrument has also been criticized for being likely related to labour market aggregate outcomes, hence likely to impact on individual performance (Coulson & Fisher, 2009; De Graaf & Van Leuvensteijn, 2007; De Graaf et al., 2009).[20] Other instruments used in the literature are the user cost of owning compared to renting in the area (Flatau et al., 2002; Brunet & Lesueur, 2004, 2009; Barrios García & Rodríguez Hernández, 2004), the father's job (Battu et al., 2008; Brunet et al., 2007), the age at entry into the housing (Brunet et al., 2007), the average distance to jobs (Brunet & Lesueur, 2004, 2009), the past residential status of parents (Van Leuvensteijn & Koning, 2004), the homeowner rate in the city where the individual was born (Van Leuvensteijn & Koning, 2004), age dummies (Flatau et al., 2003) and US states dummies (Green & Hendershott, 2001b). Unfortunately these variables are often either based on barely convincing arguments for exogeneity or rare in data. Coulson & Fisher (2009) employ a careful application of IV techniques using a set of plausible instruments: the percentage of households in the area living in multifamily housing, an indicator capturing whether the two first-born children in the household have the same sex, and the state marginal tax rate as applied to the mortgage interest deduction. In our analysis, we use a set of three instruments, borrowing from Coulson & Fisher (2009) the first and second instrument, and using the relative cost of owning with mortgage versus renting as third instrument. Specifically we use these variables: $log(multifamrate)$, $samesex$ and $log(C_{mort}/C_{rent})$. These variables should be relevant to explaining the housing tenure choice and should have no effect on the search intensity once the effect of the included regressors is partialled out.

The variable $multifamrate$ indicates the percentage of households living in multifamily housing for each region and quarter. House sharing among families is more common in rented than in owner-occupied dwellings as a rent can be more easily shared than an ownership or a mortgage. Hence multifamily households are more likely to live in rentals while single-family households are more likely to live in owner-occupied dwellings. It follows that the propensity for homeownership should be correlated to the share of multifamily dwellings in the area (Coulson & Fisher, 2009).[21]

The instrument $samesex$ has been originally designed by Angrist & Evans (1998) to identify the causal effect of fertility on labour supply. Since fertility decisions can be endogenously determined with labour force participation, Angrist & Evans (1998) exploit the preference of parents for siblings of different sexes to instrument the number of children.

[19] Provided that the number of draws is sufficiently large, maximization of the simulated log likelihood is equivalent to maximizing the log likelihood (Gourieroux et al., 1984). See Deb & Trivedi (2006b) and Deb & Trivedi (2006a) for a discussion of the choice of the number of draws. We set the number of draws to 2,000. Estimation with fewer draws gave very similar results.

[20] Di Pasquale & Glaeser (1999) proposed a modification of this, stratifying the local homeownership rate by race and income quantile.

[21] Coulson & Fisher (2009) point out that multifamily housing could be endogenous at the individual level.

They find that the number of children does not have any effect on male labour outcomes. Considering that the presence of children is correlated with the propensity to become owners, Coulson & Fisher (2009) use the sex of children in the household as an instrument for homeownership in a male unemployment binary equation. We replicate this instrument using the dummy *samesex*, which indicates whether the two first-born children in the household are the same sex. In our estimation sample, households for whom the two first-born children are the same sex are 3.7% more likely to have more kids.[22] Moreover, households with two children are 16.2% more likely to be homeowners than households with more than two children.

The third instrument is the ratio between mortgage costs and rental costs and varies over years and quarters. These data are drawn from the UK Family Resource Survey (FRS) since information on housing costs is not present in the LFS (see Appendix B for details). The higher the cost of holding a mortgage on owns home relative to the market rent in the area, the lower should be the propensity of occupying home with a mortgage rather than rent. While we expect this variable is capturing the impact on tenure choice for owning with mortgage over renting, this could have in principle also a negative impact on owning outright as this state can be achieved once the loan is paid off.

4.2 Job search methods

The choice of the amount of effort to spend on search affects the job finding rate by enhancing the probability of receiving a job offer. However this probability can be influenced by the way this effort is allocated as well. For example, homeowners may select search channels that ease the matching to employers, for a given total effort used. We investigate this issue by estimating two models. First, we estimate a multinomial logit that models the selection process of the main search method. We use six categories as possible choices: public employment centres (PEC), private employment agency, newspaper advertisements, employer contact, asking friends and relatives, and other. For each individual we consider the main method of search reported, and we include *nummet* as control variable. The housing tenure dummies are included as regressors to identify the probability of selecting a specific method for each status.

Second we perform an unemployment duration analysis to identify search methods that are associated with faster job finding, controlling for the total number of methods. We estimate a competing risks model with two possible risks, namely exits into employment and exits into inactivity. The duration variable is drawn from a specific question which groups answers in discrete intervals. The likelihood of exiting to a specific state is modeled by a multinomial logit, using data expanded into person-period form and trimesters as time unit (Allison, 1982). This allows for unobserved factors affecting each destination-specific hazard.

5 Empirical Results

5.1 Job search intensity

Table 2 shows estimates of different models for *nummet*. We first report OLS results to provide a baseline estimate. Using $log(nummet)$ as dependent variable, OLS estimates suggest that, relative to private renters, outright owners search less by 5.7%, social renters

[22] As compared to 7% in Angrist & Evans (1998) and 6% in Coulson & Fisher (2009), who make different sample restrictions.

search less by 6.6%, and mortgagers search more by 7.5%. However, these results do not take into consideration the count dimension of the dependent variable, either overdispersion or endogeneity of housing tenure. The exogenous NB model deals with the first two issues. In the second column, the overdispersion test of δ confirms the presence of a significant amount of overdispersion, supporting the use of a NB specification instead of a Poisson. Estimates under the exogeneity assumption incorporate both the causal effect and the selection effect. In the third column, we report NB estimates that take into account endogeneity of housing tenure. The housing tenure coefficients are strongly significant. Owning owns home outright implies $(\exp(-0.1163) - 1) \cdot 100 = -11.0\%$ lower search intensity than private renting. This large "exogenous" difference in search intensity between outright owners and private renters is precisely what Oswald's thesis calls for. Moreover, mortgagers have $(\exp(0.1232) - 1) \cdot 100 = 13.1\%$ higher search intensity than private renters, while social renters search less by (approximately) 4.7%.[23]

The coefficients of the latent factors λ_j capture the effect on the search intensity of the unobserved characteristics related to housing tenure. In particular, a positive (negative) λ_j means that the latent factors which increase the relative probability of selecting the j-th residential status have a positive (negative) impact on the search intensity. Estimates point to positive selection in unobservables for outright ownership and social renting, and point to negative selection for ownership with mortgage. Consistently, β-s in the endogenous NB are smaller for the former states and larger for the latter. A simple likelihood ratio (LR) test for exogeneity of housing tenure can be constructed under the null hypothesis that the λ-s are jointly equal to zero, *i.e.*, $\lambda_{own\_out} = \lambda_{own\_mort} = \lambda_{rent\_soc} = 0$.[24] The LR statistic suggests that exogeneity can be safely rejected.

The estimated effects of the other regressors are generally consistent with standard economic interpretation and with earlier empirical evidence using the count of methods as proxy for search intensity (Holzer, 1988; Blau & Robins, 1990; Schmitt & Wadsworth, 1993; Gregg & Wadsworth, 1996; Addison & Portugal, 2002; Weber & Mahringer, 2008; Bachmann & Baumgarten, 2012). Search intensity increases with education levels and decreases with duration of unemployment since the last job. The age effect is concave and peaks at 35–44, with the oldest workers (55–64) searching significantly less than the youngest (16–34). Married male heads of household search more than unmarried. Receipt of disability benefits disincentives search. However, search intensity is positively related to the receipt of unemployment benefit, indicating a spurious effect. In fact, receipt of unemployment benefits in the UK is conditioned on compliance with relatively strict search-related criteria, so that only job-seekers who exert a substantial amount of search effort are eligible (Manning, 2009; Petrongolo, 2009).[25]

The estimates of the MMNL for housing tenure, as showed in Table 3, are also consistent with our expectations and earlier evidence (Battu et al., 2008; Van Leuvensteijn & Koning, 2004; Flatau et al., 2003, 2002; Brunet & Lesueur, 2009). In particular, the instruments are significant and have the expected signs. The LR test for joint significance of instruments is fairly large confirming their relevance. In regions with larger share of multifamily dwellings, individuals are more likely to select ownership status. Families with two first-born children of the same sex are more likely to occupy with rentals than owning outright. This difference is particularly strong for social tenancy, with a significantly larger likelihood than private tenancy. Ownership with mortgage stands out as a peculiar case, with a positive and

[23]These coefficients are estimates of γ_j in Equation (11). Since the conditional mean of *nummet* is exponential, exponentiated coefficients measure the factor increase in *nummet* for a switch in the status.

[24]The LR statistic is equal to q times the difference between the log-likelihoods of the endogenous and exogenous models, and follows a $\chi^2(q)$ distribution, where $q = 3$ is the number of λ parameters.

[25]Estimates hold very similar omitting the *claimant* regressor.

significant coefficient. Considering that *samesex* is capturing the effect of the number of children, this result points out that families with more kids tend to prefer ownership with loan than outright, reaffirming the importance of distinguishing between ownership states. The third instrument $log(C_{mort}/C_{rent})$ impacts positively the likelihood of owning with mortgage relative to tenancy. Supporting the relevance of these instruments is also the fact that their coefficients are jointly significant in each treatment equation. Unfortunately, there is no formal test for the validity of exclusion restrictions in a nonlinear setting such this (Deb & Trivedi, 2006b). However, as an informal check of exogeneity we estimated the same model but including instrumental variables also in the outcome equation. Their coefficients turn out to be individually and jointly not significant, which is quite a strong result given the size of our sample and the significance of the other coefficients.[26]

5.2 Job search methods

In Figure 2 we report the distribution of the main method of search by housing tenure. PEC and newspapers advertisements account for a large portion of the distribution and there is a clear difference in their use between homeowners and renters. Homeowners relatively prefer newspapers advertisements while renters relatively prefer PEC. In Table 4 we report estimates of the multinomial logit for the six main methods of search. Reported coefficients are Relative Risk Ratios (RRR).[27] The RRR for outright owners and newspapers advertisements is 1.380 suggesting that the ratio between the probability of selecting newspapers advertisements and the probability of selecting PEC is 38% higher for outright owners than private renters. Out of these estimates we compute the conditional probabilities of selecting each method by housing tenure, that are reported in Figure 3. Statistically significant differences between outright owners and private renters are found only for newspapers advertisements and for PEC, with outright owners preferring the former and private renters preferring the latter.[28]

Concerning the effectiveness of search methods, related studies have documented that PEC are typically poorly effective for unemployed and their use has often been criticized (Holzer, 1988; Blau & Robins, 1990; Bishop & Abraham, 1993; Ports, 1993; Addison & Portugal, 2002; Longhi & Taylor, 2011). Unemployed who do not rely mainly on PEC are likely to be more proactive in their job search, therefore having enhanced chances to find a job (Longhi & Taylor, 2011). However, the PEC may be often approached when alternative search channels are not available (Bachmann & Baumgarten, 2012), hence it may be also possible that PEC is less effective because used at the last resort (Green, 2011). The coefficient of $log(nummet)$ in Table 4 suggests actually that unemployed who use more methods prefer any method to PEC as main one.

In Table 5 we report estimates of the competing risks model for the unemployed. First, consistently with standard evidence, we notice that the probability of finding a job decreases as the time spent unemployed increases, and increases with the number of methods. We find also the typical result that homeowners have higher chance to escape unemployment for a job than renters. In particular, mortgagers have the best performance and outright owners have 55.1% higher risk of finding job than private renters. In agreement with previous evidence, we find that, relatively to the use of PEC, four methods are associated with higher relative risk to find a job, namely private employment agency, direct

[26] These results are made available by the author.

[27] The RRR for a pair outcome states (i_1, i_2) and a pair of residential states (j_1, j_2), is defined as $RRR_{i_1,i_2,j_1,j_2} = (p_{i_1,j_1}/p_{i_2,j_1})/(p_{i_1,j_2}/p_{i_2,j_2})$, where $p_{i,j} = P(main = i|HT = j, X = \bar{X})$.

[28] Given the estimated probabilities, we obtain $RRR_{news,pec,out,pri} = (p_{news,out}/p_{pec,out})/(p_{news,pri}/p_{pec,pri}) = (52.33/25.54)/(45.87/30.90) = 1.380$.

contact to employers, newspapers advertisements and other. The fact that using newspapers advertisements shortens significantly the unemployment duration relative to PEC is somewhat interesting given that outright owners select significantly more the former and private renters select significantly more the latter.

Taken jointly, these results suggest that outright owners, and homeowners in general, tend to select search methods associated with shorter unemployment spells. The interpretation of this finding can be related to a better position to identify more effective channels that homeowners can have locally. Certainly, homeowners can access more easily relevant information and opportunities in the area they reside in, because they are more well-established and can rely on a denser social network in local communities. This explains why homeowners are less likely to use PEC (Osberg, 1993). On the contrary, individuals with flimsy ties with the local community should be less aware of or have limited access to search channels other than the PEC (Bachmann & Baumgarten, 2012). In the end, it may be possible that the spatial bias in search activities induced by mobility constraints, with homeowners searching relatively more locally and renters relatively more non-locally, is more beneficial to owners.

6 Conclusions

This paper has investigated the well-known argument that homeownership reduces exit rates from unemployment by hampering residential mobility, known under the name of Oswald's effect. The empirical literature on this point has confirmed that unemployed homeowners are less prone than renters to move for job reasons, but has also found that homeowners have typically shorter unemployment spells, as opposite to Oswald's hypothesis. By taking into account the role of mobility constrains in the regional allocation of job search, and a refined definition of housing tenure, we have explored a novel solution to this puzzle. First, by using the job search effort of the unemployed as outcome of interest instead of the unemployment duration, we have provided both theory and evidence in line with Oswald's thesis. That is, outright owners have lower search intensity than private renters. Second, by analyzing empirically the selection of search methods, we have investigated whether homeowners' lower search intensity and shorter unemployment spells can be reconciled in terms of higher efficiency in the search process.

Regarding the first contribution, we have shown that in a simple model of endogenous search with moving costs, while homeowners search more intensively than renters for jobs in the local area, they search less intensively in distant areas, so that their total search level is unambiguously lower. Accordingly, our econometric analysis of the number of search methods used has shown that outright owners search less intensively than private renters, even after controlling for endogeneity of housing tenure. Moreover, estimates corroborate the importance of using a multinomial definition of housing tenure. We find that mortgagers have the highest search, and that social renters search significantly less than private renters. This is in line with the intuition that mortgage-holders have larger pressure to reenter employment than outright owners, and that social renters face lock-in effects hindering incentives to search relative to private renters. The take-home message is that Oswald's thesis, in terms of search intensity, is strongly supported.

But still, why do owners search less intensively and have at the same time better chances of escaping unemployment? We have pointed out that while mobility costs affect the choice of the level of search intensity in the first place, as explained by Oswald's argument, the length of the unemployment spell can depend on factors which are not related to that argument but still are related to housing tenure. We have put forward

one possible solution focusing on the efficiency of job search. The evidence we have come up with shows that private renters rely more on public employment offices and outright owners rely more on newspapers advertisements, whereas the latter channel is associated with relatively shorter unemployment spells. This leads us to conclude that outright owners select more effective search methods despite a lower overall amount of search.

Our argument is based on the insight that mobility constraints, by limiting the spatial extension of the search process, may bring about a redistribution of search activities more beneficial to homeowners. Indeed, a stronger connection with the local social network can put them in a better position to access relevant information and opportunities in the area. Hence, comparative advantages in the local search may compensate for disproportionately lower non-local search, resulting ultimately in shorter unemployment duration. This line of reasoning can provide a solution to the puzzle of unemployment and housing tenure, and can open the way for further investigation based on the search behaviour. Moreover, while our focus has been on the unemployed's behaviour, other explanations could focus on the employer's side. For example, employers' hiring strategies may be biased toward homeowners, since residential stability can act as a signal of a higher propensity for long-lasting labour relations. Investigation of this insight is left for future research.

Tables and Figures

Table 1

Estimation sample statistics

Variable	Mean	S.D.	Min	Max	Variable	Mean	S.D.	Min	Max
nummet	4.607	2.521	1	14	*Greater Manchester*	0.043	0.204	0	1
own_out	0.135	0.342	0	1	*Merseyside*	0.031	0.174	0	1
own_mort	0.263	0.440	0	1	*Rest of North West*	0.044	0.204	0	1
rent_soc	0.409	0.492	0	1	*South Yorkshire*	0.031	0.172	0	1
rent_pri	0.193	0.395	0	1	*West Yorkshire*	0.043	0.204	0	1
white	0.887	0.316	0	1	*Rest York. & Humb.*	0.032	0.176	0	1
married	0.388	0.487	0	1	*East Midlands*	0.067	0.250	0	1
claimant	0.555	0.497	0	1	*West Midlands Metro*	0.065	0.246	0	1
disabben	0.071	0.256	0	1	*Rest of West Mids.*	0.038	0.190	0	1
incsup	0.099	0.299	0	1	*Eastern*	0.073	0.260	0	1
age_16_34	0.284	0.451	0	1	*Inner London*	0.061	0.240	0	1
age_35_44	0.255	0.436	0	1	*Outer London*	0.063	0.243	0	1
age_45_54	0.253	0.435	0	1	*South East*	0.097	0.296	0	1
age_55_64	0.209	0.406	0	1	*South West*	0.061	0.240	0	1
degree	0.124	0.330	0	1	*Wales*	0.052	0.223	0	1
higher_educ	0.065	0.246	0	1	*Strathclyde*	0.057	0.233	0	1
gce	0.236	0.425	0	1	*Rest of Scotland*	0.054	0.227	0	1
gcse	0.189	0.391	0	1	*Northern Ireland*	0.021	0.144	0	1
other_qual	0.177	0.382	0	1	*qrtr1*	0.261	0.439	0	1
no_qual	0.209	0.407	0	1	*qrtr2*	0.251	0.434	0	1
managers & admins	0.114	0.318	0	1	*qrtr3*	0.246	0.430	0	1
professional	0.060	0.237	0	1	*qrtr4*	0.243	0.429	0	1
associate prof & tech.	0.068	0.252	0	1	*year1999*	0.124	0.329	0	1
clerical & secretarial	0.048	0.215	0	1	*year2000*	0.106	0.308	0	1
craft & related	0.153	0.360	0	1	*year2001*	0.097	0.296	0	1
plant & machine opers.	0.167	0.373	0	1	*year2002*	0.101	0.301	0	1
other occupations	0.285	0.451	0	1	*year2003*	0.092	0.289	0	1
0-3 months (last job)	0.185	0.388	0	1	*year2004*	0.073	0.260	0	1
3-6 months	0.146	0.353	0	1	*year2005*	0.075	0.264	0	1
6-12 months	0.165	0.371	0	1	*year2006*	0.077	0.267	0	1
1-2 years	0.168	0.374	0	1	*year2007*	0.074	0.263	0	1
2-3 years	0.077	0.266	0	1	*year2008*	0.077	0.267	0	1
3-4 years	0.049	0.215	0	1	*year2009*	0.105	0.306	0	1
4-5 years	0.036	0.187	0	1	*multifamrate*	0.059	0.024	0.025	0.167
5-8 years	0.069	0.253	0	1	C_{mort}	96.106	27.789	44.138	207.232
>8 years	0.105	0.307	0	1	C_{rent}	86.207	26.377	50.747	185.016
Tyne & Wear	0.030	0.171	0	1	$log(C_{mort}/C_{rent})$	0.112	0.184	-0.615	0.512
Rest of North East	0.035	0.184	0	1	*samesex*	0.086	0.281	0	1
obs		26,005			obs		26,005		

Notes: The sample is made of respondent male heads of households who are ILO unemployed. See Appendix B for description of variables.

Table 2

The effect of housing tenure on unemployed's search intensity

	log-linear OLS		NB — exogenous		NB — endogenous	
	β	*s.e.*	β	*s.e.*	β	*s.e.*
own_out	-0.0567 **	(0.0147)	-0.0617 **	(0.0121)	-0.1163 **	(0.0144)
own_mort	0.0753 **	(0.0122)	0.0733 **	(0.0099)	0.1232 **	(0.0128)
rent_soc	-0.0664 **	(0.0111)	-0.0285 **	(0.0091)	-0.0467 **	(0.0113)
white	0.0438 **	(0.0142)	0.0218	(0.0118)	0.0201	(0.0119)
married	0.0200 *	(0.0089)	0.0199 **	(0.0073)	0.0121	(0.0075)
claimant	0.2812 **	(0.0085)	0.2316 **	(0.0072)	0.2324 **	(0.0072)
disabben	-0.0817 **	(0.0169)	-0.0741 **	(0.0153)	-0.0742 **	(0.0154)
Age						
age_35_44	0.0336 **	(0.0110)	0.0207 *	(0.0089)	0.0153	(0.0090)
age_45_54	0.0110	(0.0115)	0.0055	(0.0094)	0.0035	(0.0095)
age_55_64	-0.0808 **	(0.0132)	-0.0721 **	(0.0111)	-0.0592 **	(0.0116)
Highest education						
degree	0.2190 **	(0.0163)	0.2078 **	(0.0135)	0.2016 **	(0.0137)
higher_educ	0.2295 **	(0.0186)	0.2201 **	(0.0152)	0.2136 **	(0.0154)
gce	0.1963 **	(0.0125)	0.1884 **	(0.0106)	0.1834 **	(0.0107)
gcse	0.1567 **	(0.0130)	0.1484 **	(0.0109)	0.1455 **	(0.0109)
other_qual	0.1228 **	(0.0131)	0.1182 **	(0.0111)	0.1176 **	(0.0112)
Duration since last job						
$0-3$ *months*	0.2439 **	(0.0180)	0.2061 **	(0.0155)	0.1927 **	(0.0158)
$3-6$ *months*	0.2477 **	(0.0182)	0.2111 **	(0.0157)	0.2027 **	(0.0159)
$6-12$ *months*	0.2150 **	(0.0177)	0.1768 **	(0.0154)	0.1724 **	(0.0156)
$1-2$ *years*	0.1792 **	(0.0175)	0.1495 **	(0.0153)	0.1486 **	(0.0154)
$2-3$ *years*	0.1213 **	(0.0202)	0.0956 **	(0.0176)	0.0960 **	(0.0177)
$3-4$ *years*	0.1143 **	(0.0233)	0.0984 **	(0.0202)	0.0995 **	(0.0203)
$4-5$ *years*	0.0868 **	(0.0255)	0.0606 **	(0.0224)	0.0633 **	(0.0226)
$5-8$ *years*	0.0479 *	(0.0211)	0.0396 *	(0.0188)	0.0422 *	(0.0189)
occupation dummies	✓		✓		✓	
region dummies	✓		✓		✓	
quarter dummies	✓		✓		✓	
year dummies	✓		✓		✓	
δ			0.2209 **	(0.0103)	0.1834 **	(0.0126)
λ_{own_out}					0.0684 **	(0.0090)
λ_{own_mort}					-0.0633 **	(0.0095)
λ_{rent_soc}					0.0244 **	(0.0084)
log-likelihood			-84205.3		-84197.6	
LR exogeneity $\sim \chi^2(2)$					15.4 ($p < 0.01$)	
obs	26,005		26,005		26,005	

Notes: * significant at 5%; ** significant at 1%. The dependent variable y is the count of search methods used. In the OLS case, the logarithm of y is used so β-s are semi-elasticities. For the Negative Binomial (NB) models, β-s are coefficients of the linear index, whereas exponentiated β-s have the standard interpretation in terms of factor change. The variance function used for the NB models is $\omega = \mu(1+\delta)$, leading to the NB1 version. Positive δ implies overdispersion. Robust standard errors are reported. The sample is made of respondent male heads of households who are ILO unemployed. Observations are quarterly for the period 1999–2009. See Appendix B for the base categories of discrete regressors.
Endogeneity of housing tenure is accounted for estimating a multinomial endogenous treatment effects model, where a NB for y is estimated jointly with a mixed multinomial logit for the housing tenure choice (see Table 3). λ-s are loading factors of the latent terms and positive (negative) λ indicates positive (negative) selection on unobservables. The LR test strongly supports rejection of exogeneity.

Table 3
THE HOUSING TENURE CHOICE—MULTINOMIAL MIXED LOGIT

	own_out		*own_mort*		*rent_soc*	
	β	*s.e.*	β	*s.e.*	β	*s.e.*
$log(multifamrate)$	-0.748 *	(0.323)	-0.570 *	(0.265)	-0.314	(0.231)
samesex	-0.381 **	(0.131)	0.203 *	(0.091)	0.582 **	(0.081)
$log(C_{mort}/C_{rent})$	-0.107	(0.278)	-0.469 *	(0.231)	-0.135	(0.205)
white	0.451 **	(0.112)	0.407 **	(0.084)	0.051	(0.069)
married	1.236 **	(0.062)	1.561 **	(0.053)	0.094	(0.051)
claimant	-0.641 **	(0.061)	-0.405 **	(0.050)	0.513 **	(0.045)
disabben	0.101	(0.122)	0.371 **	(0.105)	0.699 **	(0.090)
Age						
age_35_44	1.569 **	(0.114)	1.248 **	(0.063)	0.262 **	(0.053)
age_45_54	3.017 **	(0.109)	1.728 **	(0.067)	0.377 **	(0.059)
age_55_64	4.482 **	(0.114)	1.884 **	(0.082)	0.480 **	(0.074)
Highest education						
degree	0.663 **	(0.113)	0.667 **	(0.096)	-1.365 **	(0.092)
higher_educ	0.601 **	(0.130)	0.789 **	(0.113)	-0.867 **	(0.105)
gce	0.375 **	(0.090)	0.574 **	(0.078)	-0.573 **	(0.066)
gcse	0.180	(0.101)	0.409 **	(0.082)	-0.268 **	(0.065)
other_qual	-0.174	(0.101)	-0.018	(0.085)	-0.203 **	(0.064)
Duration since last job						
$0-3$ *months*	0.381 **	(0.132)	1.233 **	(0.114)	-0.998 **	(0.090)
$3-6$ *months*	0.632 **	(0.135)	1.069 **	(0.118)	-0.759 **	(0.093)
$6-12$ *months*	0.552 **	(0.130)	0.736 **	(0.116)	-0.585 **	(0.089)
$1-2$ *years*	0.375 **	(0.129)	0.323 **	(0.117)	-0.476 **	(0.086)
$2-3$ *years*	0.157	(0.149)	0.083	(0.136)	-0.402 **	(0.100)
$3-4$ *years*	0.223	(0.165)	-0.026	(0.148)	-0.458 **	(0.114)
$4-5$ *years*	0.089	(0.175)	-0.308	(0.168)	-0.416 **	(0.124)
$5-8$ *years*	-0.174	(0.152)	-0.369 **	(0.141)	-0.285 **	(0.104)
occupation dummies	✓		✓		✓	
region dummies	✓		✓		✓	
quarter dummies	✓		✓		✓	
year dummies	✓		✓		✓	
LR test for instruments $\sim \chi^2(9)$			99.2 ($p < 0.01$)			
LR test for instruments $\sim \chi^2(3)$	13.7 ($p < 0.01$)		13.8 ($p < 0.01$)		53.6 ($p < 0.01$)	
obs			26,005			

Notes: * significant at 5%; ** significant at 1%. The table shows estimates of the MMNL model for housing tenure estimated jointly with the NB for search intensity. Results for the latter are shown in Table 2. Notes to that table apply here. β-s are coefficients of the index function. Robust standard errors are reported. The LR statistic tests the joint significance of the instrumental variables $log(multifamrate)$, $log(C_{mort}/C_{rent})$ and *samesex*.

Table 4
Selection of the Main Method of Search—Multinomial Logit

	private agency		use ads newspapers		employer contact		friends or relatives		other	
	RRR	*s.e.*	*RRR*	*s.e.*	*RRR*	*s.e.*	*RRR*	*s.e.*	*RRR*	*s.e.*
own_out	1.492 **	(0.186)	1.380 **	(0.088)	0.955	(0.097)	1.200	(0.118)	1.490 *	(0.269)
own_mort	1.839 **	(0.181)	1.547 **	(0.082)	1.152	(0.094)	1.165	(0.096)	1.764 **	(0.256)
rent_soc	0.691 **	(0.073)	0.745 **	(0.032)	0.759 **	(0.051)	0.815 **	(0.057)	1.070	(0.149)
log(nummet)	1.193 **	(0.076)	1.419 **	(0.042)	1.274 **	(0.066)	1.129 **	(0.051)	0.598 **	(0.053)
white	1.394 **	(0.155)	1.640 **	(0.088)	1.285 **	(0.114)	1.345 **	(0.119)	1.773 **	(0.285)
married	0.993	(0.073)	1.252 **	(0.045)	1.209 **	(0.069)	1.044	(0.058)	1.272 *	(0.127)
claimant	0.356 **	(0.026)	0.516 **	(0.020)	0.509 **	(0.029)	0.465 **	(0.027)	0.557 **	(0.057)
disabben	0.718	(0.123)	1.077	(0.070)	0.870	(0.096)	1.046	(0.104)	1.547 **	(0.221)
incsup	0.572 **	(0.099)	0.954	(0.055)	0.717 **	(0.071)	1.045	(0.089)	1.350 *	(0.195)
Age										
age_35_44	0.981	(0.089)	1.126 **	(0.049)	0.943	(0.063)	1.180 *	(0.081)	0.809	(0.100)
age_45_54	0.966	(0.093)	1.122 *	(0.052)	0.874	(0.064)	1.156 *	(0.085)	0.786	(0.104)
age_55_64	0.974	(0.108)	1.159 **	(0.061)	0.822 *	(0.071)	1.151	(0.096)	0.558 **	(0.090)
Highest education										
degree	5.173 **	(0.740)	3.114 **	(0.237)	1.923 **	(0.222)	1.962 **	(0.220)	5.316 **	(0.945)
higher_educ	3.221 **	(0.510)	2.270 **	(0.182)	1.639 **	(0.205)	0.990	(0.133)	3.336 **	(0.668)
gce	2.030 **	(0.257)	1.708 **	(0.083)	1.556 **	(0.121)	1.235 **	(0.091)	1.820 **	(0.284)
gcse	1.385 *	(0.191)	1.442 **	(0.071)	1.197 *	(0.099)	0.941	(0.075)	1.608 **	(0.260)
other_qual	1.425 *	(0.201)	1.264 **	(0.062)	1.347 **	(0.107)	1.059	(0.081)	1.276	(0.214)
Duration since last job										
$0-3$ *months*	5.198 **	(1.322)	0.828 **	(0.057)	1.625 **	(0.187)	1.394 **	(0.150)	0.952	(0.188)
$3-6$ *months*	4.239 **	(1.090)	0.912	(0.063)	1.587 **	(0.186)	1.196	(0.131)	1.035	(0.209)
$6-12$ *months*	3.302 **	(0.848)	0.869 *	(0.058)	1.323 *	(0.152)	1.102	(0.119)	0.795	(0.161)
$1-2$ *years*	2.352 **	(0.604)	0.887	(0.056)	1.223	(0.137)	0.879	(0.094)	0.839	(0.166)
$2-3$ *years*	2.031 *	(0.575)	0.893	(0.067)	1.106	(0.147)	0.990	(0.119)	0.845	(0.191)
$3-4$ *years*	1.409	(0.453)	0.838 *	(0.071)	0.975	(0.150)	1.003	(0.135)	0.931	(0.223)
$4-5$ *years*	2.190 *	(0.710)	0.962	(0.090)	0.993	(0.169)	0.701 *	(0.115)	1.161	(0.299)
$5-8$ *years*	0.729	(0.249)	0.851 *	(0.065)	1.049	(0.142)	0.753 *	(0.096)	0.803	(0.183)
occupation dummies					✓					
region dummies					✓					
quarter dummies					✓					
year dummies					✓					
obs					26,005					

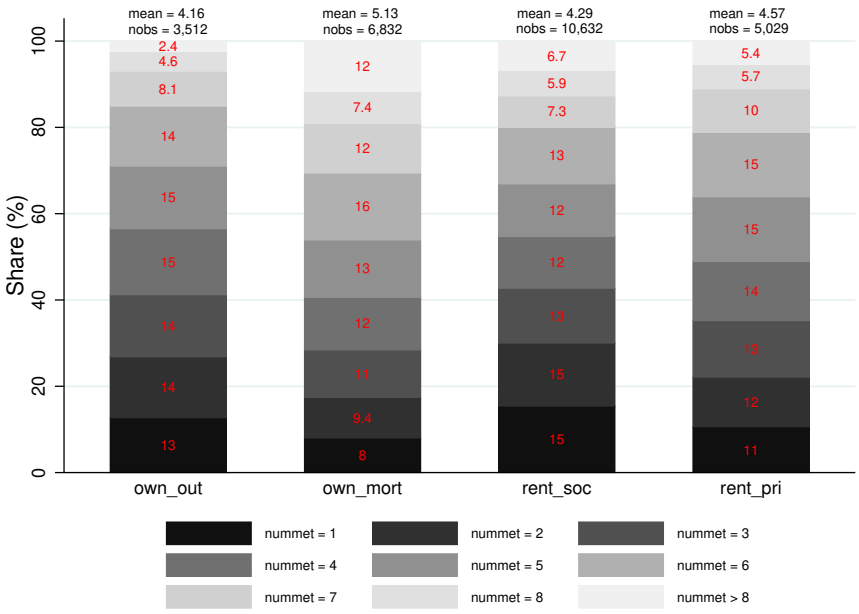
Notes: * significant at 5%; ** significant at 1%. The dependent variable indicates 6 categories of main search methods, where the base category is PEC. See Appendix B for the base categories of discrete regressors. Reported coefficients are Relative Risk Ratios (*RRR*), which can be easily computed as $RRR_{i_1,i_2,j_1,j_2} = \exp(\beta_{i_1,i_2,j_1,j_2})$, where (i_1, i_2) are two generic outcome states and (j_1, j_2) are two generic residential states. Defining $p_{i,j} = P(main = i|HT = j, X = \bar{X})$ we have also $RRR_{i_1,i_2,j_1,j_2} = (p_{i_1,j_1}/p_{i_2,j_1})/(p_{i_1,j_2}/p_{i_2,j_2})$. Robust standard errors are similarly transformed. The sample is made of respondent male heads of households who are unemployed and use at least one method of search. Observations are quarterly for the period 1999–2009.

Table 5
Competing Risks Model for Unemployment Duration

	risk=job			risk=inactivity		
	RRR		*s.e.*	*RRR*		*s.e.*
own_out	1.551	**	(0.075)	1.581	**	(0.072)
own_mort	1.922	**	(0.077)	1.200	**	(0.053)
rent_soc	1.345	**	(0.047)	1.446	**	(0.051)
log(nummet)	1.328	**	(0.033)	0.652	**	(0.013)
white	1.296	**	(0.056)	1.388	**	(0.060)
married	1.393	**	(0.038)	1.202	**	(0.033)
claimant	0.903	**	(0.026)	0.574	**	(0.017)
disabben	0.673	**	(0.035)	1.648	**	(0.058)
incsup	0.547	**	(0.026)	1.263	**	(0.042)
Main search method						
private agency	1.297	**	(0.081)	0.843	*	(0.065)
ads newspapers	1.103	**	(0.033)	1.078	**	(0.031)
employer contact	1.213	**	(0.056)	1.035		(0.053)
friends/relatives	0.937		(0.045)	1.267	**	(0.056)
other	1.439	**	(0.110)	1.113		(0.086)
Spell duration						
$3-6$ *months*	0.780	**	(0.029)	1.042		(0.046)
$6-12$ *months*	0.637	**	(0.022)	1.056		(0.041)
$1-2$ *years*	0.520	**	(0.018)	1.025		(0.038)
$2-3$ *years*	0.430	**	(0.020)	1.009		(0.043)
$3-$ *over*	0.403	**	(0.022)	0.986		(0.046)
Age						
age_35_44	0.995		(0.034)	1.140	**	(0.044)
age_45_54	0.864	**	(0.031)	1.185	**	(0.045)
age_55_64	0.561	**	(0.023)	1.538	**	(0.061)
Highest Education						
degree	1.415	**	(0.071)	1.109	*	(0.056)
higher_educ	1.206	**	(0.070)	0.942		(0.055)
gce	1.371	**	(0.053)	1.108	**	(0.038)
gcse	1.290	**	(0.052)	1.026		(0.040)
other_qual	1.320	**	(0.051)	1.064		(0.038)
occupation dummies			✓			
region dummies			✓			
quarter dummies			✓			
year dummies			✓			
obs			54,995			

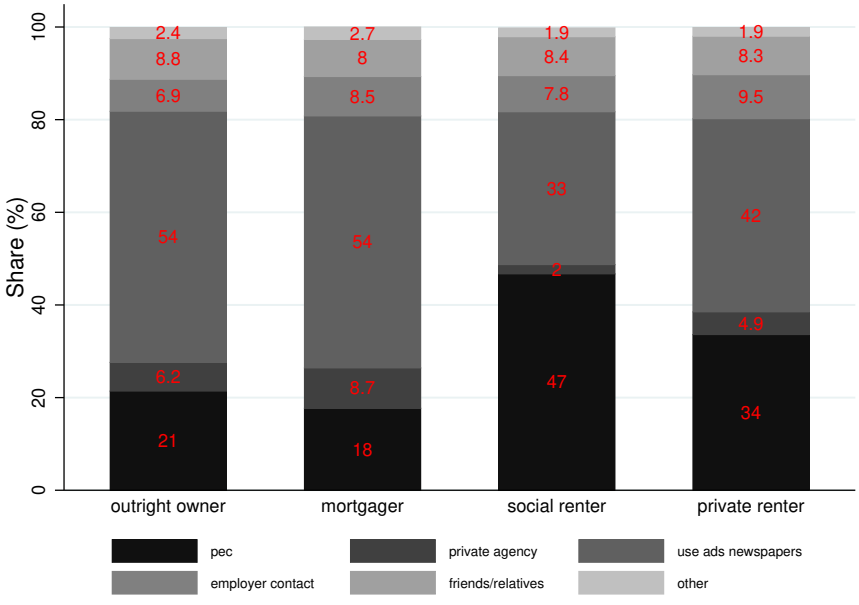
Notes: * significant at 5%; ** significant at 1%. The base category for the main method of search is PEC. See Appendix B for the base categories of the other discrete regressors. Reported coefficients are Relative Risk Ratios (*RRR*). Robust standard errors are reported. The sample is made of unemployment spells of respondent male heads of households who use at least one method of search. The unemployment spell can end with a job, with inactivity or be right censored.

Figure 1
Distribution of Search Methods by Housing Tenure



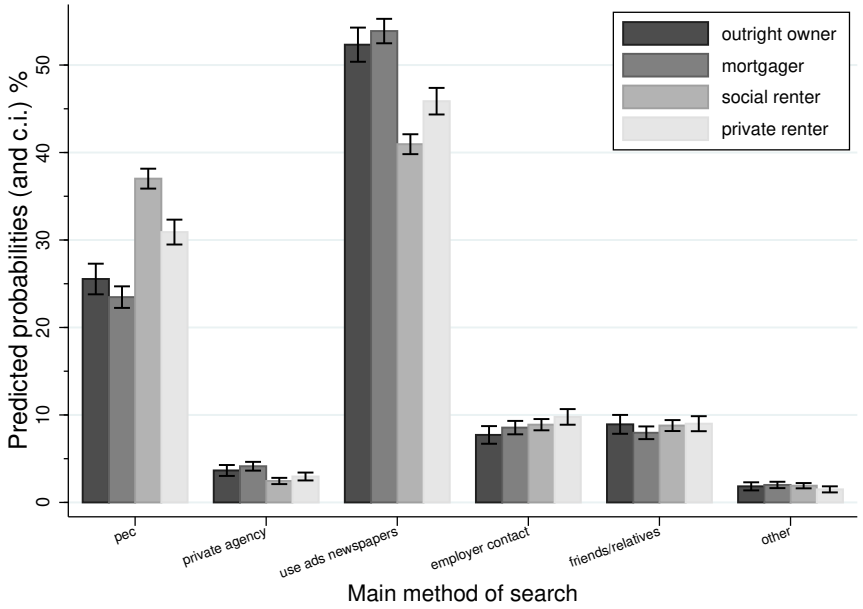
Notes: Statistics are based on the estimation sample, which consists of ILO unemployed males heads of household.

Figure 2
Distribution of Main Method of Search by Housing Tenure



Notes: Statistics are based on the estimation sample, which consists of ILO unemployed males heads of household.

Figure 3
Selection of Main Method of Search by Housing Tenure



Notes: Predicted probabilities are computed from estimates of the multinomial logit reported in Table 4. The quantity reported is the probability $P(main = i|HT = j, X = \bar{X})$ of selecting the main method $main = i$ $(i = 1, \ldots, 6)$, for given housing tenure $HT = j$ $(j = 1, \ldots, 4)$ and with regressors evaluated at sample means.

Appendix

A Proofs of theoretical propositions

We report below proofs of the propositions stated in Section 2.
Proof of Proposition 1:

(a) $s_l^* > s_r^*$. To prove this we calculate the derivative of s_l^* with respect to m by means of the implicit function theorem. At first, we need to calculate dw_l^*/ds_l and dw_l^*/dm and evaluate these functions at the optimum.

Differentiating Equation (7) with respect to w_l^* and s_l we obtain

$$\frac{dw_l^*}{ds_l} = \frac{\rho^{-1}\alpha'(s_l)\int_{w_l^*}(w - w_l^*)\,F'(w)dw - c'(s_l)}{1 + \rho^{-1}\alpha(s_l)[1 - F(w_l^*)] + \rho^{-1}\alpha(s_n)[1 - F(w_n^*)]}. \tag{12}$$

It can be easily shown that this derivative is zero for $s_l = s_l^*$, since the numerator is zero (as follows directly from the first order condition for s_l^*). Moreover, $dw_l^*/ds_l > (<)0$ if $s_l < (>)s_l^*$. Differentiating Equation (7) with respect to w_l^* and m we obtain

$$\frac{dw_l^*}{dm} = -\frac{\alpha(s_n)[1 - F(w_l^* + \rho m)]}{1 + \rho^{-1}\alpha(s_l)[1 - F(w_l^*)] + \rho^{-1}\alpha(s_n)[1 - F(w_n^*)]} < 0. \tag{13}$$

This derivative is negative for any value of s_l. Intuitively, as the moving cost increases, the reservation wage in the local labour market for the homeowner drops since the acceptance of a job far from home comes with a lower expected surplus. We rewrite now the first order condition for s_l^* as

$$\Phi(s_l^*, m) = c'(s_l^*) - \frac{\alpha'(s_l^*)}{\rho}\int_{w_l^*(s_l^*,m)}[w - w_l^*(s_l^*, m)]F'(w)dw = 0. \tag{14}$$

Applying the implicit function theorem, we have[29]

$$\frac{ds_l^*}{dm} = -\frac{\Phi_m}{\Phi_{s_l^*}} = -\frac{\rho^{-1}\alpha'(s_l^*)\int_{w_l^*}\left(\frac{dw_l^*}{dm}\right)F'(w)dw}{c''(s_l^*) - \rho^{-1}\alpha''(s_l^*)\int_{w_l^*}(w - w_l^*)F'(w)dw} > 0. \tag{15}$$

As expected, the higher the moving cost, the higher the level of search effort of the homeowner in the local labour market. Since the relation between s_l^* and m is positive for any value of m, this will be true in particular when $m = 0$, that is, when the optimal search locally (and non-locally) is $s_r^* = s_l^*$. Thus, when m increases from zero to a positive number, which captures a shift from tenant to owner status, the unemployed will increase their search effort in the local labour market from s_r^* to s_l^*.

[29] When computing $\Phi_{s_l^*}$, we remark that

$$\Phi_{s_l^*} = c''(s_l^*) - \frac{\alpha''(s_l^*)}{\rho}\int_{w_l^*}(w - w_l^*)F'(w)dw + \frac{\alpha'(s_l^*)}{\rho}\int_{w_l^*}\left(\frac{dw_l^*}{ds_l}\right)F'(w)dw =$$
$$= c''(s_l^*) - \frac{\alpha''(s_l^*)}{\rho}\int_{w_l^*}(w - w_l^*)F'(w)dw > 0,$$

where the simplification is allowed given that $dw_l^*/ds_l = 0$ when $s_l = s_l^*$. This derivative is clearly positive since $c'' > 0$, $\alpha'' < 0$, and $F' > 0$. Also, Φ_m is negative since $\alpha' > 0$, $F' > 0$, and $dw_l^*/dm < 0$.

(b) $s_n^* < s_r^*$. As in the previous case, we calculate the derivatives dw_n^*/ds_n and dw_n^*/dm and we study the sign of ds_n^*/dm. Differentiating the Equation $w_n^* = w_l^* + \rho m$ with respect to w_n^* and s_n we obtain

$$\frac{dw_n^*}{ds_n} = \frac{\rho^{-1}\alpha'(s_n)\int_{w_n^*}(w - w_n^*)\,F'(w)dw - c'(s_n)}{1 + \rho^{-1}\alpha(s_l)[1 - F(w_l^*)] + \rho^{-1}\alpha(s_n)[1 - F(w_n^*)]}. \tag{16}$$

Given the first order condition for s_n^*, this derivative is zero when $s_n = s_n^*$. Moreover, $dw_n^*/ds_n > (<)0$ if $s_n < (>)s_n^*$. Differentiating with respect to w_n^* and m we obtain

$$\frac{dw_n^*}{dm} = \frac{\rho + \alpha(s_l)[1 - F(w_l^*)]}{1 + \rho^{-1}\alpha(s_l)[1 - F(w_l^*)] + \rho^{-1}\alpha(s_n)[1 - F(w_n^*)]} > 0. \tag{17}$$

This derivative is positive for any value of s_n. A rise in the moving cost requires a higher wage to induce the homeowner to move for a job. We rewrite the first order condition for s_n^* as

$$\Psi(s_n^*, m) = c'(s_n^*) - \frac{\alpha'(s_n^*)}{\rho}\int_{w_n^*(s_n^*,m)}[w - w_n^*(s_n^*, m)]F'(w)dw = 0. \tag{18}$$

Applying the implicit function theorem, we have[30]

$$\frac{ds_n^*}{dm} = -\frac{\Psi_m}{\Psi_{s_n^*}} = -\frac{\rho^{-1}\alpha'(s_n^*)\int_{w_n^*}\left(\frac{dw_n^*}{dm}\right)F'(w)dw}{c''(s_n^*) - \rho^{-1}\alpha''(s_n^*)\int_{w_n^*}(w - w_n^*)F'(w)dw} < 0. \tag{19}$$

The derivative of s_n^* with respect to m is negative for any value of m, thus, when m increases from zero to a positive number the unemployed will reduce their level of search effort in the non-local labour market from s_r^* to s_n^*.

Proof of Proposition 2:
We only need to look at the first order conditions (4), (5), (8), and (9), and to use the result of Proposition 1 and that $c'(\cdot)/\alpha'(\cdot)$ is an increasing function.

$$w_l^* < w_r^* \longleftrightarrow B > A \longleftrightarrow \frac{c'(s_l^*)}{\alpha'(s_l^*)} > \frac{c'(s_r^*)}{\alpha'(s_r^*)} \longleftrightarrow s_l^* > s_r^*,$$

$$w_n^* > w_r^* \longleftrightarrow C < A \longleftrightarrow \frac{c'(s_n^*)}{\alpha'(s_n^*)} < \frac{c'(s_r^*)}{\alpha'(s_r^*)} \longleftrightarrow s_n^* < s_r^*.$$

Proof of Proposition 3:
Since we cannot derive a closed form for the optimal search levels, the mechanism of the demonstration is to study the derivatives of s_l^* and s_n^* with respect to m evaluated at $m = 0$. In fact, when $m = 0$, the optimal search is identical in both the local and non-local markets, so by deriving the optimal search levels with respect to m we can compare the magnitude of the (opposite) marginal variations, which can be interpreted simply as "marginal" differences in each market's search levels between homeowner and renter. Then we just need to show that the magnitude of the marginal decrease in the non-local search is higher, in absolute terms, than the marginal increase in the local search. Let's look at Equations (15) and (19), which represent the marginal variations of, respectively, the homeowner's local and non-local search. When $m = 0$, we have $s_l^* = s_r^* = s_n^*$, and thus

[30] In the computation of $\Psi_{s_n^*}$ we make use of the fact that $dw_n^*/ds_n = 0$ when $s_n = s_n^*$. The sign of Ψ_m is positive since $dw_n^*/dm > 0$.

the two derivatives are identical expect for the derivatives of the reservation wage in the numerator, which have opposite signs:

$$\frac{ds_l^*}{dm}(m=0) = -\frac{\rho^{-1}\alpha'(s_r^*)\int_{w_r^*}\left(\frac{dw_l^*}{dm}(m=0)\right)F'(w)dw}{c''(s_r^*)-\rho^{-1}\alpha''(s_r^*)\int_{w_r^*}(w-w_r^*)F'(w)dw}, \tag{20}$$

$$\frac{ds_n^*}{dm}(m=0) = -\frac{\rho^{-1}\alpha'(s_r^*)\int_{w_r^*}\left(\frac{dw_n^*}{dm}(m=0)\right)F'(w)dw}{c''(s_r^*)-\rho^{-1}\alpha''(s_r^*)\int_{w_r^*}(w-w_r^*)F'(w)dw}. \tag{21}$$

Making use of Equations (13) and (17), we can evaluate the derivatives of the reservation wages at the optimal values of search when $m=0$:

$$\frac{dw_l^*}{dm}(s_r^*, m=0) = -\frac{\alpha(s_r^*)[1-F(w_r^*]}{1+\rho^{-1}\alpha(s_r^*)[1-F(w_r^*)]+\rho^{-1}\alpha(s_r^*)[1-F(w_r^*)]}, \tag{22}$$

$$\frac{dw_n^*}{dm}(s_r^*, m=0) = \frac{\rho+\alpha(s_r^*)[1-F(w_r^*)]}{1+\rho^{-1}\alpha(s_r^*)[1-F(w_r^*)]+\rho^{-1}\alpha(s_r^*)[1-F(w_r^*)]}. \tag{23}$$

It is easy to show that $\rho>0$ implies $\frac{dw_n^*}{dm}(s_r^*, m=0) > |\frac{dw_l^*}{dm}(s_r^*, m=0)|$, which in turn implies $|\frac{ds_n^*}{dm}(m=0)| > \frac{ds_l^*}{dm}(m=0)$. This means that the difference in the non-local search between homeowner and renter is higher, in absolute value, than the difference in the local search, that is $s_r^* - s_n^* > s_l^* - s_r^*$, which, upone rearranging, is identical to the proposition.

Proof of Proposition 4:

Proof: We just need to prove that the derivative of $(h_l + h_n)$ with respect to m at the optimal values of search when $m=0$ is negative. Putting $\frac{dw_l^*}{dm}(s_r^*, m=0) = L^w$, $\frac{dw_n^*}{dm}(s_r^*, m=0) = N^w$, $\frac{ds_l^*}{dm}(m=0) = L^s$, and $\frac{ds_n^*}{dm}(m=0) = N^s$, we have

$$\begin{aligned}\frac{d(h_l+h_n)}{dm}(s_r^*, m=0) &= \alpha'(s_r^*)\left[1-F(w_r^*)\right]L^s - \alpha(s_r^*)F'(w_r^*)L^w + \\ &+ \alpha'(s_r^*)\left[1-F(w_r^*)\right]N^s - \alpha(s_r^*)F'(w_r^*)N^w = \\ &= \alpha'(s_r^*)\left[1-F(w_r^*)\right](L^s+N^s) - \alpha(s_r^*)F'(w_r^*)(L^w+N^w) < 0,\end{aligned} \tag{24}$$

where the latter inequality holds since $(L^s+N^s)<0$ and $(L^w+N^w)>0$, which are results of Proposition 3.

B Description of Variables

Housing Tenure

Housing tenure related questions refer to the household. Then the outcome of the household is imputed to all individuals belonging to it at the date of the interview.

own_out: accommodation owned outright.

own_mort: accommodation owned with mortgage.

rent_soc: accommodation rented from Local Authorities or Housing Associations.

rent_pri: accommodation rented from private.

nummet

This variable is the count of search methods used by unemployed people. People who state they have been looking for work in the last four weeks are asked to reply whether or not they use a specific search method for each of 14. The variable *nummet* is just the sum of positive answers. The unemployed can look for work as employee, as self-employed, or for both. In our estimation sample, we drop those individuals who search only as self-employed. The search methods are the following: (1) visiting a Jobcentre, (2) visiting a Careers Office, (3) visiting a Jobclub, (4) having owns name on the books of a private employment agency, (5) advertising for jobs in newspapers or journals, (6) answering advertisements in newspapers and journals, (7) study vacant situations in newspapers or journals, (8) apply directly to employers, (9) ask friends, relatives, colleagues, or trade unions about jobs, (10) waiting for the results of job application, (11) looking for premises or equipment, (12) seeking any kind of permit, (13) trying to get a loan or other financial backing for a job or business, (14) doing anything else to find work.

Main method of search

Each individual is asked to report the main method of search used among those described above. We operate the following grouping taking also into account that some categories have very few observations.

pec: (1)+(2)+(3).

private employment agency: (4).

use ads newspapers: (5)+(6)+(7).

direct approach employer: (8)+(10).

ask friends relatives: (9).

other: (11)+(12)+(13)+(14).

white

Race dummy.

married

Whether legally married (not separated), regardless of living in the same household.

claimant

Whether claiming the unemployment benefit, *i.e.* the Jobseeker's Allowance (JSA).

disabben

Whether on sickness or disability benefit.

incsup

Whether claiming income support not related to unemployment.

Age

Omitted category in regressions is *16–34* years.

Highest education

Education dummies refer to the highest education level attained. (1) Degree or equivalent (2) higher education, (3) GCE, A-level or equivalent, (4) GCSE grades A*-C or equivalent, (5) other qualifications, (6) no qualification. The base category in the regressions is no qualification.

Duration since last job

(1) Less than three months, (2) three months but less than six, (3) six months but less than 12, (4) one year but less than two, (5) two years but less than three, (6) three years but less than four, (7) four years but less than five, (8) five years or more, (9) more than eight years ago. The category (9) is omitted in regressions.

Occupation in last job

(1) Managers and administrators, (2) professional occupations, (3) associate professional and technical occupations, (4) clerical or secretarial occupations, (5) craft and related occupations, (6) plant and machine operatives, (7) other occupations.

Region dummies

(1) Tyne and Wear, (2) Rest of North East, (3) Greater Manchester, (4) Merseyside, (5) Rest of North West, (6) South Yorkshire, (7) West Yorkshire, (8) Rest of Yorkshire and the Humberside, (9) East Midlands, (10) West Midlands and Metropolitan County, (11) Rest of West Midlands, (12) Eastern, (13) Inner London, (14) Outer London, (15) South East, (16) South West, (17) Wales, (18) Strathclyde, (19) Rest of Scotland, (20) Northern Ireland.

Quarter dummies

qrtr1 (January-March), *qrtr2* (April-June), *qrtr3* (July-September), *qrtr4* (October-December).

Year dummies

Our sample spans the period 1999–2009 for a total of 11 years and 44 quarters of observations.

$log(multifamrate)$

The variable $multifamrate$ indicates the percentage of households living in multifamily housing for each region and quarter.

$log(C_{mort}/C_{rent})$

The variables C_{mort} and C_{rent} capture average housing costs for mortgagers and renters at regional and quarter level. Data on housing costs are retrieved from the UK Family Resource Survey (FRS). For mortgagers, we consider the total weekly mortgage costs including mortgage payments, endowment policies, structural insurance and service payments. For renters, we consider the total weekly rent payment comprehensive of service charges. These variables are expressed in real weekly pounds of 2010q2 and are weighted with household sampling weights. In the FRS around 25,000 households are surveyed for each year using a stratified random sample. The primary sampling unit (PSU) is the postcode sector. For each year, the PSUs are systematically allocated to quarters to ensure that the sample is balanced on a quarterly basis.

samesex

This is a dummy indicating whether the two first-born children in the household are the same sex.

C The Endogenous Multinomial Treatment Effect

We give a formal description of the methodology used to estimate the effect of housing tenure on search intensity, whose results are reported in Table 2 (Deb & Trivedi, 2006b,a). In this model, the housing tenure is determined jointly with the search methods count equation. The specification is consistent with selection on unobserved heterogeneity.

Each individual i chooses a residential status j from a set of four choices ($j = 0, 1, 2, 3$), where $j = 0$ is the control group (private renters). Let d_j be binary selection variables representing the observed tenure choice and $\mathbf{d}_i = (d_{i1}, d_{i2}, d_{i3})$. Also let $\mathbf{l}_i = (l_{i1}, l_{i2}, l_{i3})$, where l_{ij} are latent factors which incorporate unobserved characteristics common to individual i's status choice and outcome. Then the probability function for the tenure choice is endogenously modeled by a mixed multinomial logit (MMNL) structure:

$$P(\mathbf{d}_i|\mathbf{z}_i, \mathbf{l}_i) = \frac{\exp(\mathbf{z}_i'\alpha_j + \delta_j l_{ij})}{1 + \sum_{k=1}^{J} \exp(\mathbf{z}_i'\alpha_k + \delta_k l_{ik})}, \tag{25}$$

where $\mathbf{z}_i$ denotes a set of exogenous regressors and $J = 3$. The estimates for this model are shown in Table 3.[31]

The equation for the expected count outcome is

$$E(y_i|\mathbf{d}_i, \mathbf{x}_i, \mathbf{l}_i) = \exp(\mathbf{x}_i'\boldsymbol{\beta} + \sum_{j=1}^{J} \gamma_j d_{ij} + \sum_{j=1}^{J} \lambda_j l_{ij}), \tag{26}$$

where $\mathbf{x}_i$ is a set of exogenous variables within $\mathbf{z}_i$ and the γ_j-s are the treatment coefficients relative to private renters. Latent factors enter into the outcome equation as in the treatments equations, so the expected count is a function of unobserved characteristics which affect the selection into housing tenure as well. When the factor loading parameter λ_i in Equation (26) is positive (negative), unobserved factors which increase the probability of selecting the j-th residential status also increase (reduce) the number of search methods, *i.e.*, there is positive (negative) selection. The distribution of y_i is assumed to follow a negative binomial process:

$$f(y_i|\mathbf{d}_i, \mathbf{x}_i, \mathbf{l}_i) = \frac{\Gamma(y_i + \psi)}{\Gamma(\psi)\Gamma(y_i + 1)} \left(\frac{\psi}{\mu_i + \psi}\right)^{\psi} \left(\frac{\mu_i}{\mu_i + \psi}\right)^{y_i}, \tag{27}$$

where $\mu_i = E(y_i|\mathbf{d}_i, \mathbf{x}_i, \mathbf{l}_i) = \exp(\mathbf{x}_i'\boldsymbol{\beta} + \mathbf{d}_i'\boldsymbol{\gamma} + \mathbf{l}_i'\boldsymbol{\lambda})$ and ψ incorporates the overdispersion parameter (and may vary with i). The negative binomial is a generalization of the Poisson distribution, as it takes into account an overdispersion of counts, which occurs when the count variance is larger than the mean. In the general class of negative binomial models, the variance is modeled by a function of the mean μ_i and of the overdispersion parameter α: $V[y_i|x_i] = \mu_i + \alpha\mu_i^p$ (Cameron & Trivedi, 1998). For $p = 1$ and $p = 2$, we have the two most known densities: the negative binomial of the first (NB1) and of the second

[31] As in the standard multinomial logit model, the parameters in the MMNL are identified only up to a scale, hence a scale normalization for the latent factors is required. For that, we can simply set $\delta_j = 1$ for each j.

kind (NB2), for which the variance is either proportional or quadratic in the mean. For $\alpha = 0$, the negative binomial reduces to the Poisson. The null hypothesis of equidispersion, $H_0 : \alpha = 0$, can be tested against the alternative of overdispersion, $\alpha > 0$, by performing a Wald test on the estimated α (Cameron & Trivedi, 1998). Equation (27) is the density of the NB1 for $\psi = \alpha^{-1}$ and of the NB2 for $\psi = \alpha^{-1}\mu_i$.

The joint distribution of the treatment and outcome variables is

$$\begin{aligned} Pr(y_i, \mathbf{d}_i|\mathbf{x}_i, \mathbf{z}_i, \mathbf{l}_i) &= f(y_i|\mathbf{d}_i, \mathbf{x}_i, \mathbf{l}_i) \times Pr(\mathbf{d}_i|\mathbf{z}_i, \mathbf{l}_i) = \\ &= f(\mathbf{x}_i'\boldsymbol{\beta} + \mathbf{d}_i'\boldsymbol{\gamma} + \mathbf{l}_i'\boldsymbol{\lambda}) \times g(\mathbf{z}_i'\boldsymbol{\alpha}_1 + \boldsymbol{\delta}_1 l_{i1}, \ldots, \mathbf{z}_i'\boldsymbol{\alpha}_J + \boldsymbol{\delta}_J l_{iJ}). \end{aligned} \tag{28}$$

Some difficulties in the estimation of the maximum likelihood arise, since the l_{ij} are unknown. The method to be used will consist of assuming that the l_{ij} are $i.i.d$ draws from the standard normal distribution, so that their joint distribution $\mathbf{h}$ can be integrated out of Equation (28). Moreover, as the model does not have a closed form log-likelihood, the estimation will be carried out using numerical integration and simulation-based methods.[32] Equation (28) can be rewritten as

$$\begin{aligned} Pr(y_i, \mathbf{d}_i|\mathbf{x}_i, \mathbf{z}_i) &= \int \left[f(\mathbf{x}_i'\boldsymbol{\beta} + \mathbf{d}_i'\boldsymbol{\gamma} + \mathbf{l}_i'\boldsymbol{\lambda}) \times g(\mathbf{z}_i'\boldsymbol{\alpha}_1 + \boldsymbol{\delta}_1 l_{i1}, \ldots, \mathbf{z}_i'\boldsymbol{\alpha}_J + \boldsymbol{\delta}_J l_{iJ}) \right] \mathbf{h}(\mathbf{l}_i) d\mathbf{l}_i \\ &\approx \frac{1}{S} \sum_{s=1}^{S} \left[f(\mathbf{x}_i'\boldsymbol{\beta} + \mathbf{d}_i'\boldsymbol{\gamma} + \bar{\mathbf{l}}_{is}'\boldsymbol{\lambda}) \times g(\mathbf{z}_i'\boldsymbol{\alpha}_1 + \boldsymbol{\delta}_1 \tilde{l}_{i1s}, \ldots, \mathbf{z}_i'\boldsymbol{\alpha}_J + \boldsymbol{\delta}_J \tilde{l}_{iJs}) \right], \end{aligned} \tag{29}$$

where $\bar{\mathbf{l}}_{is}$ is the s-th random draw from the distribution $\mathbf{h}$ out of a total S. The simulated log-likelihood can be written as

$$\begin{aligned} lnL(y_i, \mathbf{d}_i|\mathbf{x}_i, \mathbf{z}_i) = \sum_{i=1}^{N} ln \Bigg(\frac{1}{S} \sum_{s=1}^{S} \Big[& f(\mathbf{x}_i'\boldsymbol{\beta} + \mathbf{d}_i'\boldsymbol{\gamma} + \bar{\mathbf{l}}_{is}'\boldsymbol{\lambda}) \\ & \times g(\mathbf{z}_i'\boldsymbol{\alpha}_1 + \boldsymbol{\delta}_1 \tilde{l}_{i1s}, \ldots, \mathbf{z}_i'\boldsymbol{\alpha}_J + \boldsymbol{\delta}_J \tilde{l}_{iJs}) \Big] \Bigg). \end{aligned} \tag{30}$$

Maximizing the simulated log-likelihood is equivalent to maximizing the log likelihood provided S is sufficiently large. We set $S = 2,000$. The parameters of this model are identified through nonlinearities even if all regressors in the outcome equations are included in the treatment equations, *i.e.*, $\mathbf{z}_i = \mathbf{x}_i$. However exclusion restrictions are recommended for more robust identification (Deb & Trivedi, 2006b,a)

[32] In order to economize on computing time, the routine uses quasi-random draws based on Halton sequences instead of standard methods based on pseudo-random draws. The former have been proved to be more effective for maximum simulated estimation: they can provide the same accuracy with fewer draws (Bhat, 2001; Train, 2003).

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