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The impact of homeownership on unemployment in the Netherlands

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Abstract in English

We analyze the impact of homeownership on unemployment duration using a theoretical model of job search. Earlier studies suggest that this relationship should be positive because workers are less mobile when they own a home. Nevertheless, most of the empirical studies in Europe find an opposite relationship. In this paper, we investigate whether this is due to an omission in the original analysis or whether it is due to an endogeneity problem, i.e. those who can leave unemployment easily are more likely to be a homeowner. In our empirical analysis, we use additional information about the differences in unemployment benefits between homeowners and renters. We find that homeowners have higher hazard rates out of unemployment to a job in the local labour market. The impact is significant but not very large. Homeownership has a negative but insignificant impact on the hazard to leave unemployment to the non-local labour market. Finally, we find that homeowners would reduce their probability to receive a job offer from the local labour market when they become renters. The probability to receive a job offer from the non-local labour market would increase for short spells of unemployment when home owners become renters. However, this probability would be reduced for long spells of unemployment.

Abstract in Dutch

We analyseren het effect van eigenwoningbezit op de werkloosheidsduur. Hierbij maken we gebruik van een theoretisch model. Eerdere studies laten zien dat eigenwoningbezit de duur van werkloosheid zal verlengen. Desondanks vinden de meeste studies dat eigenwoningbezit de kans op werk voor een werkloze vergroot. In onze studie vinden wij dit laatste resultaat ook, alhoewel eigenwoningbezit de kans op werk buiten de eigen regio vermindert. Dit effect is echter niet significant. Verder vinden we dat eigenwoningbezitters minder aanbiedingen uit de lokale arbeidsmarkt zouden krijgen, maar juist meer baanaanbiedingen buiten de eigen regio zouden ontvangen wanneer zij een woning huren in plaats van kopen. Dit laatste effect neemt af naarmate de eigenwoningbezitter langduriger werkloos is.

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Summary

This paper analyzes the interrelationship between the outcome at the labour and housing market. We show that the estimation of reduced form models results in an endogeneity problem. With the absence of valid instruments it is unlikely that reduced form models based on cross-sections result in the right predictions. We show that the use of multiple durations is necessary but we also show that reduced form models can only produce sensible results when important restrictions are met. In particular in order to identify the endogeity bias we need individual changes in tenure status and these changes should not be due to changes in unobserved labour market potential. We use data from the Netherlands in the period 1989 to 2001.

We find that homeowners have higher hazard rates out of unemployment to a job in the local labour market. The impact is significant but not very large. Homeownership has a negative but insignificant impact on the hazard to leave unemployment to the non-local labour market. Our results suggest that unemployed homeowners start looking for a job primarily on the local labour market for the in the first months of unemployment. Thereafter the focus on the non-local labour market is increased gradually. Individuals who are homeowners usually receive lower benefits from social assistance and hence become less selective over time with respect to the offered jobs. Furthermore, the results show some differences between regions. The impact of homeownership on the hazard rate to leave unemployment to the local labour market is positive for almost all of the regions. It is significant for 6 out of the 12 regions. We find very mixed results for the non-local labour market. There are many regions in which there is a surprisingly positive impact, but this impact is never significant. The impact is negative for 5 regions and it is significant for the largest region of Zuid-Holland.

Finally, we find that homeowners would reduce their probability to receive an acceptable job offer from the local labour market when they become renters. The probability to receive a job offer from the non-local labour market would increase for short spells of unemployment when homeowners become renters. However, this probability would be reduced for long spells of unemployment.

1 Introduction

The lack of labour mobility is probably one of the main reasons for Europe's long-term unemployment and persistent differences of unemployment figures between different regions (Blanchard and Katz, 1992). Oswald (1999) argues that homeownership is one of the key determinants of this lack of mobility. Moreover he points at five main mechanisms that drive the positive impact on unemployment. The first reason is a direct relationship between mobility and homeownership in the sense that families who own a home face difficulties (and monetary outlays) selling their home. This implies that even though labour demand is more favorable in other areas of the country, workers prefer to stay unemployed. The other four reasons can be described as externalities of homeownership. For example, in the case of an absent renting market, youngsters face difficulties finding the right residence close to the place where jobs are situated.

The concern of economists about the relationship described above is in sharp contrast with the implementation of policies stimulating homeownership. Many European countries including the Netherlands have used subsidies for low income families to reduce the costs of homeownership. In addition, interest payments are tax deductible in many European countries, while there are quite substantial tax payments for buying a home (Belot and Ederveen, 2005). The simultaneous implementation of policies to subsidize homeownership and increasing the costs of buying a home has unambiguous negative effects on mobility and hence is likely to have a positive effect on unemployment figures.

In a number of studies researchers have focused on the Oswald hypothesis. First, Oswald (1999) investigates the total impact by comparing different countries with different rates in homeownership as well as unemployment rates. He finds a positive impact between homeownership and the level of unemployment between regions and this is still one of the strongest evidence in favor of the Oswald hypothesis. However, it does not yield any information about the relative impact of the different sources. Many researchers tried to disentangle the total effect of the Oswald hypothesis as outlined in his seminal paper. In this research, the focus is mainly on the direct effect of homeownership on unemployment status, as reported in Oswald (1999) as the first reason to expect a positive impact between homeownership and regional unemployment rates. At the moment, there are two approaches in which researchers tried to investigate this part of the Oswald hypothesis. First, the approach taken by Van den Berg and Van Vuuren (1998) is indirect in the sense that they investigate the subjective moving costs of the unemployed. The model they use is a model originally developed in Van den Berg and Gorter (1997) in which there are two types of jobs. The first type of job is close to the present residence and hence an individual does not have to move for that job. The second type of job is too far from the present residence and hence it is necessary to move. The method adopted by Van den Berg and Van Vuuren is to use subjective answers about the reservation wages of the respondents. When a homeowner faces substantial moving costs, the difference between reservation wages should be larger. They find that homeowners have substantially higher moving costs than non-homeowners and hence this implies that homeowners are on average longer unemployed. A drawback of their analysis is that they cannot estimate the level of the impact of homeownership on the unemployment rate and can only show that it should be positive. In the present paper we also show that their approach may yield estimates that are biased downwards, but that the sign of the estimates cannot be affected.

Another approach is to look at individual unemployment duration data. A drawback of such an approach is however that the decision to invest in housing is not exogenous and hence the estimates of homeownership on the unemployment duration are biased. Green and Hendershott (2001a) try to solve this endogeneity problem by using a two stage estimation method. They find evidence for the positive relationship between unemployment and homeownership supporting the results of Van den Berg and Van Vuuren (1998). Koning and Van Leuvenstein (2004) use a similar method as Green and Hendershot, but instead of a two stage estimation process, they use a full information maximum likelihood approach. Munch et al (2006) apply this method in the model as developed in Van den Berg and Gorter (1997) and Van den Berg and Van Vuuren (1998). Koning and Van Leuvensteijn (2004) and Munch et al (2006) find a negative relationship between the unemployment duration and homeownership. An important question is whether this indicates that the endogeneity problem is not properly dealt with or whether it is due to an omission of the present literature on the Oswald hypothesis.

An interesting remark on the existing literature is that there is hardly any economic theory used in the investigation of the relationship between unemployment duration and homeownership. Although Munch et al (2006) use the theoretical framework of job search as developed by Gorter and Van den Berg (1997), the choice of homeownership is not modeled and this implies that the model is partial. The choice between buying and renting is made with the knowledge of an individual about his expected labour market status in the future. Hence, individuals that expect (long) spells of unemployment in the future are unlikely to become homeowners. An aspect that makes this issue even more important is that mortgage banks also look at the labour market prospects of individuals. It is unlikely that econometric researchers can obtain as much information as possible to mimic the decision of the individuals and the banks regarding mortgages. A similar problem arises with job mobility in general.

This paper analyzes the interrelationship between the outcome at the labour and housing market. We show that the estimation of reduced form models results in an endogeneity problem. With the absence of valid instruments it is unlikely that reduced form models based on cross-sections result in the right predictions. We show that the use of multiple durations is necessary but we also show that reduced form models can only produce sensible results when important restrictions are met. In particular in order to identify the endogeity bias we need individual changes in tenure status and these changes should not be due to changes in unobserved labour market potential. Finally, we show that structural empirical analysis can be helpful to identify the endogeneity bias.We use data from the Netherlands in the period 1989 to 2001.

One aspect that is untouched in the present literature is the difference in unemployment benefit systems between homeowners and renters. In the Netherlands, homeowners cannot receive social assistance since their total wealth is above the maximum in order to be eligible.[1] Notice that this system only moderately affects the investment decision in housing by itself. For example, if we expect workers to be able to invest in either stocks or in housing, then the choice between these two assets would not be affected since the tax system looks at the total wealth instead of its components.[2] However, although it has no impact on the total investments on housing, it has an impact on the behavior of workers once they are already unemployed. All else equal, unemployed homeowners are less selective in their job search behavior. This results in different paths of the duration dependence between the individuals.

We use a register based data set of the Netherlands for the period 1989 to 2001. It contains a random draw from the population of tax payers in the Netherlands (*i.e.* everyone who is over 15 and receives income from any possible source). Koning and Van Leuvesteijn (2004) also use this data set (see also Frijters, Lindeboom and Van den Berg, 2000).

Another explanation that has a potential impact on the selection issue concerning homeownership is the risk of mandatory sales of homeowners when they run out of assets due to long spells of unemployment. We do not look at this issue in this paper but conjecture that many of our results do not change by including this aspect. In both situations homeowners receive extra costs of being long-term unemployed in top of the costs that are also made by the renters.

The paper is organized as follows. The next section discusses the Dutch housing and labour market for the period of analysis. Section 4 investigates the theoretical model. Section 5 describes the data we use for our analysis. In section 6 we set up the empirical analysis and the results are in section 7. We conclude in section 8

[1] This assumes that the mortgages of homeowners are lower than the value of the house. As discussed in the next section, there is a continuous increase in the housing price in our period of analysis. Hence, this does not seem to be a very strong assumption.

[2] This statement is true for the period of analysis.

2 The housing and labour market of the Netherlands in the period 1989 to 2000

Our period of analysis concerns a period in the Netherlands that involved many developments over time as well as changes in the system in the housing and labour market. We review these developments in this section.

The Dutch labour market can be described as a market with a high level of unemployment insurance benefits. The system was changed in two stages in the period of analysis. The original system was subdivided into three systems depending on the duration of unemployment and former work experience (OECD, 1997). These systems are called (1) unemployment insurance, (2) unemployment assistance and (3) social assistance. Individuals who worked at least 26 out of the last 52 weeks were eligible for unemployment insurance for at least 6 months. After this period individuals were eligible for an extended period of unemployment insurance if they worked at least four out of the last five years prior to the start of the unemployment spell. The duration of the extended period of unemployment insurance depends on the number of years in paid employment. Individuals who have only 5 to 10 years of paid employment experience receive an extended period of 3 months and individuals with over 10 but less than 15 years receive an extended period of 6 months. For every additional five years of paid employment the duration is extended by 6 months with a maximum of 4 years. This implies a total maximum duration of 4.5 years for individuals with over 40 years of work experience. The level of unemployment insurance is 70 percent of gross income before the start of the unemployment spell. After the period of unemployment insurance individuals may be eligible for unemployment assistance. The eligibility conditions are the same as for the extended period of unemployment insurance. However, unlike the extended period of unemployment insurance the duration is always equal to 1 year, with the exception that older workers (*i.e.* older than 57 years of age at the moment of the start of the unemployment spell) cannot run out of these benefits at all. The level of the unemployment assistance benefit is equal to 70 percent of the gross minimum wage (for example 688 euros in 1995). After the period of unemployment assistance individuals receive social assistance. The amount is approximately the same as the amount of unemployment assistance but the eligibility rules are different. For example, individuals who own wealth over a certain amount (4090 euros in 1993) are not eligible for social assistance. In addition, the own dwelling is disregarded only up to a certain maximum. If the value of the house minus the mortgage exceeds this maximum, the recipient of social assistance should use this money to support his or her own subsistence.

The new system was introduced in 1996. This implies that individuals who started their unemployment spell after 1996 were treated with the new rules. The main difference between the new and the old system is that the unemployment assistance system in the Netherlands no longer exists. This implies that young individuals (*i.e.* individuals with less than 5 to 10 years of paid employment) do not have a long trajectory of non-means tested unemployment benefits. In addition, unlike the old system, workers older than 57 years of age at the start of the unemployment spell can run out of non-means tested benefits. In order to compensate for this, the workers with more than 40 years of work experience at the start of the unemployment spell receive 5 years instead of 4.5 years of unemployment benefits in the new system.

Dutch unemployment figures varied a lot in the period of analysis. The unemployment rate was 7.6 percent in 1989 and then decreased to 6.5 percent in 1991. Thereafter it increased to 8.5 percent in 1994. Since that period there was a sharp decrease in all years of our analysis and it went down as low as 3.4 percent at the end of 2000.

The period of analysis is a period in which house prices increased without any interruption. Figure A.1 shows the development of house prices over this period. At the end of the eighties the average price of a house was around 70 thousand euros while it was 190 thousand euros in the year 2000. Measured in 1990 euros, we find that houseprices roughly doubled over the period of analysis. At the same time, homeownership increased from around 44 percent in the starting nineties to 54 percent in 2002 (Belot and Ederveen, 2005). Individuals who buy a house face a number of taxes and fees that need to be paid. The largest part of this is due to the property transfer tax which equals six percent over our sample period.[3] In addition to this there are notary and mortgage fees. Note that some of these fees are tax deductible and hence the real costs can differ from the monetary outlays. Belot and Ederveen (2005) calculate the total costs to be equal to 9 percent of the purchase of the house, which is average for the OECD countries they consider.

[3] The property transfer tax is officially 5 percent in the Netherlands, but a temporary supplement was charged from 1979 onwards. This temporary supplement was originally charged to help the government solving the budgetary problems just after the oil crises, but at present the supplement can be interpreted as permanent. We assume in our empirical analysis that individuals never anticipated an end of this temporary increase in the property transfer tax. This seems a valid assumption from the point that the temporary period was already active for 10 years at the start of our sample period.

3 The Oswald hypothesis

In his seminal work, Oswald (1999) states that homeowners should on average face longer unemployment durations than those who rent their home. We denote T_u as unemployment duration and x and v are respectively a set of observed and unobserved characteristics. In addition we denote H as the tenure status. It equals one if tenure status is homeowner and zero otherwise. Hence, the Oswald hypothesis can be stated as follows

$$\mathrm{E}(T_u|x,v,H=1) > \mathrm{E}(T_u|x,v,H=0)$$

a sufficient but not necessary condition for this statement is

$$\Delta_t \equiv \mathrm{P}(T_u \leq t|x,v,H=1) - \mathrm{P}(T \leq t|x,v,H=0) < 0$$

for all $t > 0$. A necessary but not sufficient condition is that $\Delta_t < 0$ for some $t > 0$. Empirical analysts would typically like to know whether Δ_t is significantly smaller than zero for at least some $t > 0$. This is a standard evaluation problem as presented in for example Heckman et al. (1999): it is not possible to receive information of both terms of Δ_t. At most, we receive only one outcome for a particular unemployment spell. A possible solution is to compare the unemployment durations of homeowners with those of the renters. However, such a comparison is only possible when all relevant characteristics that determine the unemployment durations are the same. In the next section we argue that this is unlikely to be the case.

4 The model

4.1 The housing market

In order to invest in housing an individual needs to know the costs as well as the benefits of housing. We assume that the total outlays for buying a house are equal to K. The direct utility derived from owning a home is assumed to equal U for homeowners and zero otherwise. We can interpret U as the direct utility derived from owning a property. It is unlikely that this value is very high. Instead, U can be also interpreted as the difference between the monthly outlays when someone is living in a rental house compared to those of the same house when it is bought by the individual. The difference is usually positive.

4.2 The labour market

The labour market as presented in this paper is a discrete time non-stationary job search model in the spirit of Van den Berg (1990) and Van den Berg and Gorter (1997). Individuals are in one of two states: employment and unemployment. We make the assumption that buying a home is only possible in the state of employment.[4] Employed individuals become unemployed with a layoff probability equal to δ. There are two types of jobs for every individual. These are the jobs in the local labour market, denoted by L and jobs in the non-local labour market (denoted by N). As in Van den Berg and Gorter (1997) and Munch et al (2006), we assume that individuals need to move in order to accept a job in the non-local labour market. Hence, homeowners lose their homeownership at the moment they accept a job in the non-local labour market. Of course, it is possible to retain homeownership with a cost equal to K. In case of unemployment individuals search for a new job. We do not allow for on-the-job search. Individuals receive unemployment benefits, B at the start of an unemployment spell for a period of T months. After this period, renters receive unemployment benefits for the remaining spell of unemployment while homeowners do not receive any unemployment benefits. Individuals discount the future with a discount rate we denote by ρ.

Unemployed individuals receive job offers with a probability equal to λ in each period. Conditional on a job offer the probability that the offer comes from the local labour market equals p. Every job offer is also a wage offer with wages sampled from the wage offer distribution F.[5] When a job offer is received, the individual has to decide whether he accepts the

[4] As turns out in the analysis, this assumption is not restrictive. It can be shown that renters never buy a home at the moment they become unemployed, while homeowners never buy a new home. The only possible restriction is with respect to entrants to the labour market.

[5] Contrary to Van den Berg and Gorter (1997), the wage offer distribution is not dependent on the location of the job. Their analysis is more general and in many situations our framework may even not be valid.

job or rejects it and searches for better alternatives. It is not possible to recall a job offer that is already rejected. In the present case with non-stationarity of the unemployment benefits, this assumption is essential for the analysis. It makes individuals who did not yet run out of unemployment benefits also less selective because of the anticipation of the date of unemployment benefits exhaustion.

We denote the value of unemployment for an individual who is unemployed for t months by $V_t^U(H)$. Using the standard Bellman techniques the value for an individual who is employed with a wage equal to w, $V^E(w,H)$, is equal to

$$V^E(w,H) = \frac{w + UH + \delta V_0^U(H)}{\rho + \delta} \tag{4.1}$$

Given the fact that individuals are not able to search on the job and given the fact that the employment state is a stationary state, individuals prefer buying a home when

$$V^E(w,1) - K > V^E(w,0)$$

or

$$U > \delta \left(V_0^U(0) - V_0^U(1)\right) + (\rho + \delta)K \tag{4.2}$$

An important aspect concerning (4.2) is that both the left- and the right-hand side are independent of the employment states of the individual (*i.e.* it does not contain the wage of the individual). It implies that the preference of housing tenure is constant over time. Hence, an individual who presently owns a home will always choose to buy a new home once he or she accepted a job in the non-local labour market. The value of an unemployed worker who has been unemployed for t months is equal to

$$\begin{aligned}(1+\rho)V_t^U(H) =& V_{t+1}^U(H) + B\mathbf{1}(t \leq T) + B(1-H)\mathbf{1}(t > T) + UH + \\ & \lambda p \int_{x\in\mathbb{R}} \max\left\{V^E(x) - V_{t+1}^U(H), 0\right\} dF(x) \\ & + \lambda(1-p) \int_{x\in\mathbb{R}} \max\left\{V^E(x) - V_{t+1}^U(H) - HK, 0\right\} dF(x)\end{aligned} \tag{4.3}$$

We define the reservation wage at the local labour market, $\varphi_t^L(H)$ of an individual in months t with housing status H as

$$V_{t+1}^U(H) = V^E(\varphi_t^L(H), H)$$

Similarly we define the reservation wage at the non-local labour market as

$$V_{t+1}^U(H) = V^E(\varphi_t^N(H), H) - HK$$

From this, we obtain

$$\varphi_t^N(H) = \varphi_t^L(H) + (\rho + \delta)HK \tag{4.4}$$

For renters we obtain the following reservation wage:

$$\varphi(0) \equiv \varphi_t^L(0) = \varphi_t^N(0) = B + \frac{\lambda}{\rho+\delta} \int_{\varphi_t^L(0)}^{\infty} \overline{F}(x)dx$$

where $\overline{F} = 1 - F$. This formula is also obtained by Munch et al (2006). Next, for homeowners who receive unemployment benefits ($i.e.$ $t < T$) we have

$$\begin{aligned}(1+\rho)\varphi_t^L(1) = \varphi_{t+1}^L(1) - \delta\varphi_0^L(1) + B(\rho+\delta) + \lambda p \int_{\varphi_{t+1}^L(1)}^{\infty} \overline{F}(x)dx \\ + \lambda(1-p) \int_{\varphi_{t+1}^L(1)+(\rho+\delta)K}^{\infty} \overline{F}(x)dx\end{aligned} \tag{4.5}$$

while if $t \geq T$, we have

$$\rho\varphi_T^L(1) = -\delta\varphi_0^L(1) + \lambda p \int_{\varphi_T^L(1)}^{\infty} \overline{F}(x)dx + \lambda(1-p) \int_{\varphi_T^L(1)+(\rho+\delta)K}^{\infty} \overline{F}(x)dx$$

The following general proposition can be derived.

Proposition 1. *For all $t > 0$ we have $\varphi_{t+1}^L(1) \leq \varphi_t^L(1)$ where the inequality is strict for $t \leq T$ and the inequality becomes an equality otherwise.*

Proof: See appendix A.1.■

Proposition 1 implies that the reservation wage path is strictly decreasing for individuals who own a home up till the moment that they run out of unemployment benefits. After this period the reservation wage remains constant.

Proposition 2. *For $K > 0$, $\rho > 0$, and $t \in \mathbb{N}$ it holds (i) $\varphi_t^L(1) < \varphi(0)$, (ii) $\partial\varphi_t^L(1)/\partial K < 0$, (iii) $\partial\varphi_t^L(1)/\partial K < \partial\varphi_{t+1}^L(1)/\partial K$, when $t \leq T$ and $\partial\varphi_t^L(1)/\partial K = \partial\varphi_{t+1}^L(1)/\partial K$ otherwise.*

Proof: See appendix A.2.■

The first part of Proposition 2 states that homeowners are always less selective in the local labour market than renters. The second part states that the reservation wage of homeowners in the local labour market decreases with the moving costs. Finally, the third part states that this is more important the shorter the unemployment duration.

A typical reservation wage path of individuals is illustrated in Figure A.2. As can be seen from the figure, unlike the results of Munch et al (2006), it is no longer the case that homeowners always have a higher reservation wage in the non-local labour market. When the level of the unemployment benefits is high and/or T is small it might even be possible that the reservation wage path in the non-local labour market of homeowners starts already at a lower level. However, unlike the path in Figure A.2, it is also possible that the complete path of homeowners in the non-local labour market is above the reservation wage of renters.

Next, we look at the decision to buy a home. Let U^* be the minimum level for U that a worker needs in order to buy a home. From equation (4.2) this value satisfies

$$U^* = \delta \left(V_0^U(0) - V_0^U(1)\right) + (\rho + \delta)K$$

Substitution of the definition of the reservation wage and repeated substitution of equation (4.1) results in

$$U^* = \frac{\delta}{\rho + \delta} \left(\varphi_0^L(0) - \varphi_0^L(1)\right) + \rho K$$

Using proposition (2), we conclude that both parts are larger than zero.
We are able to derive the following proposition.

Proposition 3. *Individuals are more likely to become homeowners when*

1. *U is larger.*
2. *K is smaller.*
3. *δ is smaller.*
4. *p is larger.*
5. *ρ is smaller.*

For (3) we need that $\overline{F}(x)$ is log-concave, when $T \to \infty$.

Proof: See appendix A.3. ■
Proposition 3-1 indicates that individuals who have a higher preference for homeownership are more likely to buy a house. Proposition 3-2 shows that when the costs are higher, homeownership is less likely. Propositions 3-3 shows that the higher the likelihood to become unemployed, the lower the likelihood to own a home. This is the endogeneity problem as indicated in the introduction. Proposition 3-4 states that individuals are more likely to become homeowners when there are more opportunities in the local labour market, compared to the non-local labour market. Finally, as stated by 3-5, the discount rate has a negative impact on the likelihood that individuals own a home. This is intuitive since the costs of becoming homeowner proceed the benefits.

Unfortunately, we are not able to prove that the overall labour market opportunities have a monotonic impact on the likelihood that individuals own a home. When $T \to \infty$ and with log-concavity of F, then it is possible to show that U^* increases with λ. Hence the overall labour market opportunities make individuals less likely to become homeowner. However, for the more plausible case that T is small and for large enough levels of B, we are able to show the opposite.

When individuals are compared with respect to unemployment duration and tenure situation, then it is likely that homeowners with good economic prospects are compared with renters who do not have as favorable economic prospects. Hence, unless someone is able to find an instrument that solves this problem, it is unlikely that a reduced form approach estimates the right relationship between unemployment duration and homeownership.

We perform a simulation exercise in order to gain insight into this mechanism. For this exercise we assume that wage offers follow a log-normal distribution, with parameters μ and σ. We assume μ to be equal to 7.2 and σ is assumed to be 0.3. The values of p and δ are equal to 0.5 and 0.02 in the baseline simulation. The number of months for unemployment insurance is taken as 24 months. The discount rate is equal to 0.01 and unemployment benefits equal 1200. The costs of buying a house are assumed to equal 10,000. For our analysis we vary λ from 0.01 to 0.2. Figure A.3 shows the results of this exercise. As we see, for these parameter values, the relationship between U^* and λ is negative and large. Note that it is also realistic to assume that there is a negative relationship between λ and δ, and this assumption makes the endogeneity problem even more stringent.

4.3 The duration in unemployment

We denote $T_L(H)$ as the duration to find a job in the local labour market and $T_N(H)$ as the duration to find a job in the non-local labour market. In order to determine the distributions of T_L and T_N, we first determine the probability to leave unemployment in period t. We denote this by $\theta_{L,t}(H)$ for the local labour market and $\theta_{N,t}(H)$ for the non-local labour market.[6] These probabilities equal

$$\theta_L(0) = \lambda p\overline{F}(\varphi(0))$$

and

$$\theta_N(0) = \lambda(1-p)\overline{F}(\varphi(0))$$

for renters, while it equals

$$\theta_{L,t}(1) = \lambda p\overline{F}(\varphi_t^L(1))$$

and

$$\theta_{N,t}(1) = \lambda(1-p)\overline{F}(\varphi_t^N(1))$$

for homeowners.

Hence, when individuals are homogeneous, the duration distributions can be easily derived. From the previous subsection, it is not difficult to see that the distribution $T_{L,t}(1)$ is first-order stochastically dominated by $T_L(0)$, while it is not possible to make an a-priori statement about the relationship between $T_{N,t}(1)$ and $T_N(0)$. However, when $T \to \infty$ we are able to show that

[6] In line with continuous duration analysis, we denote these probabilities by hazard rates for the remainder of the paper.

$T_{N,t}(1)$ first-order stochastically dominates $T_N(0)$. The (first part of the) Oswald hypothesis states that homeowners leave unemployment slower than renters. In order to investigate whether this also holds in the present theoretical framework we introduce the probabilities to leave unemployment to either the local or the non-local labour market. We denote these as $\theta(0)$ for renters and $\theta_t(1)$ for homeowners. These probabilities are the sum of the probabilities introduced above. In line with the discussion above, it should not come as a surprise that it is not possible to make general statements about comparisons between the two hazard rates. However, this changes when we make the assumption as in Munch et al (2006) that homeowners do not run out of unemployment insurance.

Proposition 4. *Suppose that $\overline{F}(x)$ is log-concave for $x > 0$. When $T \to \infty$, we have that* $\theta_t(1) < \theta(0)$, $t > 0$.

Proof: See appendix A.4. ■

Many of the well-known distributions in labour economics have the property that $\overline{F}(x)$ is log concave (Mortensen, 1986 and Bagnoli and Bergstrom, 1989). Among these are the normal, log-normal and the Pareto distribution.[7]

The proposition states that in the case of no unemployment insurance exhaustion, workers find it more difficult to leave unemployment when they are homeowner. Hence, in order to find perverse effects, we need the additional framework of unemployment benefits exhaustion. Note that this implies that the framework of Munch et al (2006) cannot explain these perverse effects.

These conclusions are based on the assumption that individuals are homogeneous. In a panel data setup, it is possible to defend such an assumption by using more than 1 observation for the same individual. However, such an assumption is hard to defend in cross-sections. In the remainder of this section we focus on differences in the population in the univariate case, *i.e.* only one variable is allowed to differ over the population. We focus on the impact of the probability to lose a job, but the impact of the other parameters can be calculated in a similar fashion. For renters, the probability that an individual finds a job in the local labour market can be calculated as follows

$$\mathrm{P}\left(T_L(0) = t | H = 0\right) = \frac{\int_0^\infty \mathbf{1}(U < U^*)\lambda p\overline{F}(\varphi^L(0))(1-\lambda p\overline{F}(\varphi^L(0)))^{t-1} dG_\delta(y)}{\int_0^\infty \mathbf{1}(U < U^*) dG_\delta(y)}$$

The interpretation of this equation is that the probability to find a job in the local labour market is weighted by the density of δ conditional on the event that the individual is a renter. Using Proposition 3, we know that renters have higher levels of δ. This implies that $\mathbf{1}(U < U^*)$ equals

[7] However, as this condition is too restrictive for some distribution (Van den Berg, 1994). From the outset of the proof it can be shown that the condition of log-concavity is much too strong. It is not in the scope of this paper to prove more general results.

zero for low levels and 1 for higher levels. In addition, the reservation wage decreases in δ and hence for small levels of t we find higher values of $\mathrm{P}(T_L(0)=t|H=0)$ than in the homogeneous case. This is the same as saying that the unobserved heterogeneity case is stochastically dominated by the homogeneous case. This implies that the hazard rate for renters is overestimated when we would not correct for the unobserved heterogeneity in the empirical estimation. In addition, it can be shown that the hazard rate for homeowners is underestimated. This result is not dependent on the focus on the local labour market. The same results apply for the non-local labour market.

Table 4.1 shows the impact of unobserved heterogeneity on the hazard rate for the other parameters when $T \to \infty$. The hazard rate is not affected by unobserved heterogeneity in U. When we assume that $T \to \infty$, we know from the discussion above that the individuals with lower levels of λ become homeowners while those with high levels of λ become renters. Hence, $\lambda \overline{F}(\varphi^L(0))$ is larger for renters than for homeowners would they be renters.[8] This implies that the hazard rate for renters is overestimated by this impact. For unobserved heterogeneity in p we know that renters have lower levels of p than homeowners. However, this does not have any impact on their total hazard rate since any underestimation in the hazard rate of the local labour market cancels with the overestimation in the non-local labour market. This does not happen for the homeowners since they have different levels of the reservation wage for the local and non-local labour market.

Table 4.1 The impact of unobserved heterogeneity when $T \to \infty$ on the hazard rate to leave unemployment.

	U	K	λ	δ	p
Hazard rate of renters	0	0	+	+	0
Hazard rate of homeowners (local)	0	-	-	-	+
Hazard rate of homeowners (non-local)	0	+	-	-	-

What happens when we assume that unemployment benefits exhaust after $T < \infty$ periods? This may have an impact on the relationship between the level of λ and the tenure status. Now, it is possible that we obtain the opposite signs, *i.e.* the hazard rate of renters is underestimated, while the hazard rate of homeowners is overestimated.

When more than one parameter is not observed, the same techniques can be used as above using multidimensional integrals. This makes the analysis quite difficult and virtually every relationship can be explained by the correlation between the different components. For example, when we assume a negative correlation between λ and δ, then even in the case that $T \to \infty$, the exit rate of homeowners may be overestimated. This can be seen intuitively by the fact that the low level of δ of homeowners makes them more likely to have high levels of λ. This counteracts

[8] This is again based on the assumption that $\overline{F}$ is log concave.

the overestimation we obtained from the direct impact of λ on the likelihood of owning a home. Hence, the correlation between the unobserved components of these two parameters is important and therefore we pay a lot of attention to this type of correlation in the empirical analysis.

5 The Data

We use a Dutch data set known as the Income Panel Register Database. This database is gathered from the registers of the tax office and stored at Statistics Netherlands for statistical research. Virtually any question asked to individuals who are in the payroll tax system is included in the data set. In addition, some information not filled in by the respondents but known by the tax officer is also in the data set. The period that is available ranges from January, 1^{st} 1989 to December, 31^{st} 2000.

For our analysis we use only a part of the total data set. It is set up as follows: from the total data set Statistics Netherlands draws a sample of register numbers. The size of the sample is around 75,000 and this is approximately equal to 1 percent of the Dutch labour force. Together with the individuals drawn directly from this data set, Statistics Netherlands adds those individuals who are in the same household. Hence, individuals in large households are oversampled. The total size of the dataset is approximately 270,000 individuals for each year.

Individuals have to fill in their income and the source of income they earned as well as the start and end of the period in which they earned this type of income. In this setup, individuals who earned a particular type of income the whole year have a start date equal to January, 1^{st} and an end date equal to December, 31^{st}. We match the different years in order to derive the employment and unemployment spells. It is important to realize that unemployment is not a source of income but a state in the labour market, being unimportant for the tax office. Hence, there is more than one income source that matches with the state of unemployment. This implies that individuals report transitions even though for our analysis nothing happens. In those cases, we take this as an ongoing spell. Related to this, many individuals report very small breaks in their unemployment benefits collection, after which they continue receiving these benefits. This is particularly the case at the start and end of every calendar year. We take these spells as ongoing whenever the period in which no unemployment benefits were collected is no longer than 3 weeks. A final problem with the construction of the unemployment spells is that relatively many individuals report January, 1^{st} as the start of their collection period and December, 31^{st} as their last day of collection of benefits after which they report no further collection of benefits in the next year. Most likely, these individuals found their job already before the end of the year but since they were not able to reconstruct the exact date at which they started their new job, they just report the end of the year as end date of the collection of benefits.

We use the first 10 unemployment and employment spells of individuals over the period 1989 to 2000. We exclude the spells of individuals who were reported to be a child of or raised by the head of the household at the start of the unemployment duration. These individuals are usually in a different situation than the population of individuals that we tend to describe by the model. The number of unemployment spells are reported in Table A.1. In total we have around 20,000 individuals with at least one unemployment spell and as can be seen from the table there is a substantial amount of recidivists in our data set. The average age of our sample is around 38 years and it increases when we look at individuals who have multiple spells. The percentage of females is somewhat over 40 percent for the first unemployment duration and drops for the later unemployment durations. Almost half of the observations in the first unemployment spell are from individuals who are head of the household. It increases for the later unemployment spells. There is no clear pattern for the other two types of positions within the household. The variables for employment type (*i.e.* civil servant, employed in the business sector and self employed) indicate whether individuals were ever employed in this sector. This definition is convenient since it abstracts from the problem that individuals in the registers do not have any employment type whenever they are unemployed. We distinguish between the 12 different regions in the Netherlands. Table A.2 reports the same descriptive statistics for the employment spells. There are almost 200,000 individuals with at least one unemployment spell. In general, individuals in employment spells are younger, more likely to be single and more likely to be observed self employed over the sample period.

We define a transition to the local labour market when it is within the COROP area in the Netherlands. These are areas that divide the Netherlands into 40 different regions that are economically related.

Table A.3 lists the unemployment durations as well as the number of individuals with at least one unemployment spell. In general the unemployment spell decreases with the number of unemployment spells that someone already experienced. Although there are some exceptions, the unemployment spells are shorter for the individuals that are homeowners.

6 Empirical implementation

6.1 Single spell reduced form duration model

This section discusses a single spell reduced form model in the spirit of Munch, *et al.* (2003). The analysis is based on the joint distribution of homeownership versus renting and the distribution of unemployment spells. As in the previous sections, we denote H for the status at the housing market. In addition we use $T = \min(T_L, T_N, T_O)$ for the unemployment duration, where T_L is the unemployment duration that terminates due to a transition to the local labour market and T_N is an unemployment duration that terminates due to a transition to the non-local labour market. T_O is the time till exit to non-participation. The vector x is used for the set of characteristics that have an impact on the decision to become homeowner whereas x_1 is used for the set of characteristics that have an impact on the unemployment duration (excluding homeownership). The set of variables included in x_1 is a subset of the variables included in x. The variable V contains the unobserved time-independent characteristics related with the outcome vector (H,T). The dimension of this variable is equal to 4 and we denote $V_i; i = 0,1,2,3$ for the scalars of unobserved heterogeneity related to (1) the housing decision, (2) the duration of an unemployment spell that terminates to a transition to the local labour market, (3) the duration of an unemployment spell that terminates to a transition to the non-local labour market, (4) the duration of an unemployment spell that terminates into non-participation. The distribution of V is denoted by G.

We model the housing decision as a probit model. This implies that the time dependent individual characteristics that influence the housing decision are assumed to be drawn from a standard normal distribution that is independent from V. We denote H^* for the nuisance parameter with $H = 1$ if $H > 0$ and zero otherwise. We specify this parameter as $H^* = x\beta_0 + v_0 + u$ with $u \sim N(0,1)$. The unemployment duration T is modeled as a competing risks model (Lancaster, 1990). We denote the hazard rates out of unemployment to employment in the local and non-local labour market by θ_L and θ_N. We use the following mixed proportional hazards specification for the local labour market

$$\theta_L(H,x_1,t,v_1) = \exp(\xi(H,x_1,\gamma_1) + x_1\beta_1)\psi_L(t,H)v_1$$

where β_1 is a vector of coefficients that corresponds to the set of characteristics x_1. The vector γ_1 measures the impact of homeownership on the outflow out of unemployment to the local labour market. The function ξ represents the interdependence between x_1 and H. In particular we allow the relationship between unemployment duration and homeownership to be dependent on regional characteristics. The function ψ_L is the baseline hazard. We allow homeowners to have different baseline hazards. The main reason for this more flexible specification is related with the difference in unemployment benefits collection of the homeowners as discussed in the previous sections. Note that this additional interdependence has as a drawback that the model is no longer non-parametrically identified (Van den Berg, 2002). Essentially, this implies that our identification comes from the parametric assumptions concerning the baseline hazard and the unobserved heterogeneity distribution. In our opinion this drawback is not outweighted by the fact that we know from economic theory that this type of interdependence should exist. We use a piecewise constant baseline hazard function for our analysis. A similar representation for the non-local labour market is assumed

$$\theta_N(x_1,t,v_2) = \exp(\xi(H,x_1,\gamma_2) + x_1\beta_2)\psi_N(t,H)v_2$$

where β_2 is a vector of coefficients and the function ψ_N is the baseline hazard for this market. Finally, the hazard rate for the transition from unemployment to non-participation is specified as follows

$$\theta_O(x_1,t,v_3) = \exp(\xi(H,x_1,\gamma_3) + x_1\beta_3)\psi_O(t)v_3$$

For individuals that had no terminating unemployment spells at the end of December, the conditional likelihood contributions equal

$$\begin{aligned}
L_i(x_i,x_{1,i},v) =& \Phi(x_i\beta_0+v_0)^{H_i}(1-\Phi(x_i\beta_0+v_0))^{(1-H_i)} \\
& \times \{\theta_L(x_{1,i},s,v_1)\}^{d_{2,i}(1-d_{3,i})(1-d_{4,i})} \exp\left(-\int_0^{t_i}\theta_L(x_{1,i},s,v_1)ds\right) \\
& \times \{\theta_N(x_{1,i},s,v_2)\}^{(1-d_{2,i})(1-d_{3,i})(1-d_{4,i})} \exp\left(-\int_0^{t_i}\theta_N(x_{1,i},s,v_2)ds\right) \\
& \times \{\theta_O(x_{1,i},s,v_3)\}^{(1-d_{2,i})(1-d_{3,i})d_{4,i}} \exp\left(-\int_0^{t_i}\theta_O(x_{1,i},s,v_3)ds\right)
\end{aligned}$$

where d_2 is equal to one if the individual transits to a job in the local labour market and zero if the transit is to the non-local labour market. The variable d_3 indicates right censoring. The variable d_4 denotes a transit into non-participation.

As we stated in the data section there are relatively many individuals with unemployment spells that terminate at the end of the year. It is unlikely that these individuals really find a job in that period. Instead of taking the reported unemployment spell and use the conditional likelihood contributions as we described above, we assume that these individuals ended their spells at some stage over the year. We correct the likelihood contributions for these individuals accordingly.

For the parameterization of the model, we use a two point distribution for the unobserved heterogeneity terms (as in Munch et al, 2003). Hence, the joint distribution of V has 16 mass points. For the identification of the model we do not include a constant into x and x_1 and we restrict the baseline hazards to equal one in the first period. These restrictions are sufficient for identification and hence the estimates for the unobserved heterogeneity distribution. This implies that the mean of the unobserved heterogeneity distribution can be interpreted in the same way as the constant term in regression analysis.

In order to omit problems with left censoring, we ignore unemployment spells that are ongoing at the moment individuals first enter the panel. Although these spells have a likelihood contribution that can be calculated from the analysis in Ridder (1984), the assumptions underlying these calculations are restrictive.

Since we are not interested in the transition process from unemployment to non-participation, this process only enters the estimation method through the dependence of v_3 with $v_i; i = 0, 1, 2$. When we make the assumption that v_3 is independent with the other unobserved components, then a transition to non-participation can be interpreted as right-censoring (Lancaster, 1990). As discussed in Frijters and Van der Klaauw (2005), the assumption that v_3 is unrelated with the other unobserved components is not always valid.

6.2 Multiple spell duration models

Including multiple spells has the advantage that some of the identifying assumptions related to the single spell duration models no longer hold. Especially, the restriction that x and t need to be proportional, is no longer necessary (see Honore, 1993 and Van den Berg, 2001). Unfortunately it also complicates the analysis. We denote the duration in a job as T_E. The transition from a job into unemployment is modelled using a mixed proportional hazard model, where we specify the hazard rate as

$$\theta_E(x_1, t, v_4) = \exp(\xi(H, x_1, \gamma_4) + x_1\beta_4)\psi_E(t)v_4$$

where v_4 is the unobserved heterogeneity x_1 is the same as in the previous subsection and the vectors β_4 and γ_4 are vectors of coefficients.

Define $L^U_{ij_u}$ as the likelihood contribution of individual i for unemployment spell j_u. This contribution is the same as L_i as defined in the previous subsection. In addition, $L^E_{ij_u}$ is defined as the likelihood contribution of individual i for employment spell j_e. The total likelihood contribution of individual i equals:

$$L_i = \int \prod_{j_u=1}^{M_u} L^U_{ij_u}(v_0, v_1, v_2, v_3) \prod_{j_e=1}^{M_e} L^E_{ij_e}(v_4) dG(v_0, v_1, v_2, v_3, v_4)$$

with M_u and M_e the number of unemployment and employment spells. The method discussed above is rather difficult. The solution adopted in previous studies to reduce its complexity is to assume that v_4 is independent of the other unobserved components. In that case we can just omit the employment durations from the estimation procedure. The assumption of independence implies that individuals who have difficulties finding a job (low levels of v_1 and v_2) face the same probabilities of keeping their job as individuals with high probabilities of finding a job. This may not be a valid assumption, since many individuals with low abilities face both high probabilities of becoming unemployed as well as low probabilities of leaving unemployment. In addition, as we concluded from our theoretical analysis, the selection issue is highly dependent on the question whether v_4 is negatively correlated with v_1 and v_2. Therefore, in contrast to previous studies we do not make the assumption that v_4 is independent of the other unobserved components.

We are able to solve the problem of endogeneity when there is variation in the tenure status and when the assumption that v_0, v_1, v_2 and v_4 are constant is valid. However, the question arises why individuals change their tenure status when their unobserved labour market potential and their unobserved taste for being a homeowner do not change. A potential explanation for this variation is the change in the age of the individual affecting both the taste for homeownership as well as labour market potential. In this way, we are able to estimate Δ_t as discussed in Section 3.

7 Results

We estimated our reduced form model for the first 10 unemployment and employment spells as described in the previous section. We do not estimate the hazard of leaving unemployment to non-participation. Table A.4 lists the results of this exercise. The figures are measured in terms of the monthly hazard rates. We find a strong and significant impact of the fraction of homeownership on the likelihood that someone is a homeowner. The presence of children has a small negative impact on the likelihood to own a home, while being female increases this likelihood. Individuals who received a scholarship for higher education in the period of analysis have a higher likelihood to own a home. In addition, we find that age does not have an important impact on the decision whether an individual owns a home. The single exception is the youngest age group having a much smaller probability to own a house. Single individuals as well as heads of households are less likely to own a home. In addition, individuals who were ever working in the private sector or working as a self employed have a high likelihood to own a house. Note that the baseline here contains individuals who were managers or individuals who never stated to be self employed or working in either the private or public sector. There are some differences between regions, but it is not related to urbanization in these different regions.

We find that homeowners have higher hazard rates out of unemployment to a job in the local labour market. The impact is significant but not very large. The presence of children in the household has a positive impact while being female has a negative impact on the hazard rate for a job in the local labour market. Whether an individual received a scholarship from higher education has virtually no impact on the hazard rate in the local labour market. This hazard rate decreases with the age of an individual. Singles and heads of households have a lower hazard to leave unemployment for the local labour market, while individuals who ever worked in the private sector have a higher hazard rate. Again, there are some differences between the regions.

Homeownership has a negative but insignificant impact on the hazard to leave unemployment to the non-local labour market. Note that although the point estimate is about the same in absolute values compared to the point estimate we found for the local labour market, the comparison between these two estimates is somewhat difficult. This is related to the fact that the levels of unobserved heterogeneity components also differ (as can be seen from the last row of Table A.4). Both the presence of children as well as being female has a positive impact on the hazard to leave unemployment to the non-local labour market. Both results are somewhat surprising and not in line with the results of Van den Berg and Van Vuuren (1998) who find that females face higher non-monetary costs of moving to a new residence. Older individuals have lower hazard rates for leaving unemployment to the non-local labour market. In addition, spouses of heads of households have a lower hazard rate to leave unemployment to the non-local labour market. This is in line with the results of Van den Berg and Van Vuuren (1998). Individuals who stated that they worked in the private sector have a low hazard to leave unemployment to the non-local labour market. To a smaller extend this is also true for civil servants and self employed.

The baseline hazards out of unemployment to the local and non-local labour market have the same shape. They both increase in the first year and then decrease in the later quarters. Remember that this is the period at which for most of the individuals the unemployment insurance benefits are terminated. After this period, individuals receive social assistance. The increase is higher for the non-local labour market which suggests that unemployed workers start looking for a job primarily on the local labour market for the first months of the unemployment spells. Thereafter the focus on the non-local labour market is increased gradually. The baseline hazard fluctuates much more over time for homeowners than for renters. This is exactly the mechanism as described during the previous sections. Individuals who are homeowners usually receive lower benefits from social assistance and hence become less selective with respect to the offered jobs.

The impact of homeownership on the hazard to leave employment is negative and very significant. This is in line with previous results found in Van Leuvensteijn and Koning (2004). Both the presence of children as well as being female has a positive impact on the hazard to leave employment. Individuals in between 30 and 40 have the lowest hazard to leave employment while the highest hazard is found for the oldest age group. Heads of households have a very small hazard to leave employment, while the largest hazard is found for partners. Surprisingly we do not find any impact of the employment types on the hazard to leave employment.

The correlation coefficients for the components of the unobserved heterogeneity distribution are summarized in Table A.5. We find virtually no correlation in the unobserved components of homeownership and the hazard to leave unemployment through the local labour market (*i.e.* Δ_t as in Section 3). On the contrary there is a positive but insignificant relationship between the unobservable components that result in a high likelihood to become homeowner and the hazard to leave unemployment through the non-local labour market. The unobservables between the likelihood to become homeowner and the hazard rate to leave employment are negatively correlated. Again the correlation does not differ significantly from zero. Not surprisingly, there is a large positive correlation between the unobservables of the hazard rate to leave unemployment to the local and the non-local labour market. The correlations between the unobservables to leave unemployment to either the local or the non-local labour market with the unobservables to leave employment are both negative. Although not that surprising, as stated in the theory section, this has an important implication on the interpretation of the results.

We estimated a second model specification in order to check the robustness of our results. In the second specification, we estimate the impact of homeownership on the hazard rate of leaving unemployment taking account of the different regions in the Netherlands. The results of this specification are not radically different from the previous exercise. However, we find some differences between the different regions. The impact of homeownership on the hazard rate to leave unemployment to the local labour market is positive for almost all of the regions. It is significant for 6 out of the 12 regions. We find very mixed results for the non-local labour market. There are many regions in which there is a surprisingly positive impact, but this impact is never significant. The impact is negative for 5 regions and it is significant for the largest region of Zuid-Holland.

In order to increase the insight in our results we calculate the counterfactual probabilities of leaving unemployment for the two states. Denote $\widetilde{h}$ as the (counterfactual) tenure state of an individual. This variable is equal to one if we consider the individual to be homeowner and zero otherwise. The probability that an individual observed and considered to be home owner has to wait for an acceptable job offer from the local labour market equals

$$\begin{aligned} \mathrm{P}(T_L \leq t|x;H=1;\widetilde{h}=1) = \sum_{v_0,v_1,v_2,v_4} & \mathrm{P}(T_L \leq t|x;\widetilde{h}=1;V_0=v_0;V_1=v_1;V_2=v_2;V_4=v_4) \\ & \times \frac{\mathrm{P}(H=1|V_0=v_0)\mathrm{P}(V_0=v_0;V_1=v_1;V_2=v_2;V_4=v_4)}{\mathrm{P}(H=1)} \end{aligned}$$

The counterfactual distribution of receiving an acceptable job offer from the local labour market of someone being observed homeowner when he would no longer own a house equals

$$\begin{aligned} \mathrm{P}(T_L \leq t|x;H=1;\widetilde{h}=0) = \sum_{v_0,v_1,v_2,v_4} & \mathrm{P}(T_L \leq t|x;\widetilde{h}=0;V_0=v_0;V_1=v_1;V_2=v_2V_4=v_4) \\ & \times \frac{\mathrm{P}(H=1|V_0=v_0)\mathrm{P}(V_0=v_0;V_1=v_1;V_2=v_2;V_4=v_4))}{\mathrm{P}(H=1)} \end{aligned}$$

Hence, the difference between the two equations is the net effect of owning a house on the arrival rate of acceptable job offers from the local labour market ($i.e.$ Δ_t as in Section 3) . Using these techniques it is also possible to find the same difference for the non-local labour market. The actual and counterfactual distributions can also be calculated using exactly the same method, but changing $H=1$ into $H=0$ in the equations above. Finally, the probability to receive an acceptable offer can be calculated using:

$$\begin{aligned} \mathrm{P}(T \leq t|x;,H=1;\widetilde{h}=1) = & 1-\Big(1-\mathrm{P}(T_L \leq t|x;,H=1;\widetilde{h}=1)\Big) \\ & \times \Big(1-\mathrm{P}(T_N \leq t|x;,H=1;\widetilde{h}=1)\Big) \end{aligned}$$

The results of these simulations are in figures A.4 to A.7. We find that homeowners reduce their probability to receive a job offer from the local labour market for any month of unemployment duration when they would become renters. On the contrary, the probability to receive a job offer from the non-local labour market increases for low levels of the unemployment duration. This probability reduces for higher levels of unemployment duration. The pictures for the renters are not much different from the mirror image of those of the homeowners.

8 Conclusions

In this paper we analyzed the impact of homeownership on unemployment duration using a theoretical model of job search. Previous analysis suggests that this relationship should be positive because workers are less mobile when they own a home. Nevertheless, in much of the empirical work in Europe an opposite relationship is found. In this paper, we argued that this negative relationship is a classical endogeneity problem which is originated from the expectations of individual workers about their future labour market status. We concluded that the use of multiple spells can be an essential element to solve the endogeneity problem but the necessary assumptions are still restrictive and not very likely to hold in practice. One way to solve this is the estimation of a structural model. In particular, the estimation of such a model can help the identification using the different predictions with respect to the outflow rate of individuals.

We found that homeowners have higher hazard rates out of unemployment to a job in the local labour market. The impact is significant but not very large. Homeownership has a negative but insignificant impact on the hazard to leave unemployment to the non-local labour market. Our results suggest that unemployed workers start looking for a job primarily on the local labour market in the first months of unemployment. Thereafter the focus on the non-local labour market is increased gradually. Individuals who are homeowners usually receive lower benefits from social assistance and hence become less selective over time with respect to the offered jobs.

Furthermore, the results show some differences between regions. The impact of homeownership on the hazard rate to leave unemployment to the local labour market is positive for almost all of the regions. It is significant for 6 out of the 12 regions. We find very mixed results for the non-local labour market. There are many regions in which there is a surprisingly positive impact, but this impact is never significant. The impact is negative for 5 regions and it is significant for the largest region of Zuid-Holland.

Finally, we find that homeowners would reduce their probability to receive a job offer from the local labour market when they become renters. The probability to receive a job offer from the non-local labour market would increase for short spells of unemployment when home owners become renters. However, this probability would be reduced for long spells of unemployment.

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Appendix A Derivations and proofs

A.1 Proof of proposition 1

The equality is trivial. The inequality is proved by induction. Let $t = T$. Hence

$$\rho \varphi_{T+1}^{L}(1) = -\delta \varphi_{0}^{L}(1) + \lambda p \int_{\varphi_{T+1}^{L}(1)}^{\infty} \overline{F}(x)dx + \lambda (1-p) \int_{\varphi_{T+1}^{L}(1)+K}^{\infty} \overline{F}(x)dx$$

$$\begin{aligned}(1+\rho)\varphi_{T}^{L}(1) = \varphi_{T+1}^{L}(1) - \delta \varphi_{0}^{L}(1) + B(\rho+\delta) + \lambda p \int_{\varphi_{T+1}^{L}(1)}^{\infty} \overline{F}(x)dx \\ + \lambda (1-p) \int_{\varphi_{T+1}^{L}(1)+K}^{\infty} \overline{F}(x)dx\end{aligned}$$

Deducting the first from the second equation we obtain

$$\varphi_{T}^{L}(1) - \varphi_{T+1}^{L}(1) = \frac{B(\rho+\delta)}{1+\rho}$$

Hence the base follows directly. Now assume that $\varphi_{t+1}^{L}(1) > \varphi_{t}^{L}(1)$. Hence

$$(1+\rho)\varphi_{t-1}^{L}(1) = \varphi_{t}^{L}(1) - \delta \varphi_{0}^{L}(1) + B(\rho+\delta) + \lambda p \int_{\varphi_{t}^{L}(1)}^{\infty} \overline{F}(x) + \lambda (1-p) \int_{\varphi_{t}^{L}(1)+K}^{\infty} \overline{F}(x)$$

Taking differences with equation (4.5) results in

$$\begin{aligned}(1+\rho)\left[\varphi_{t-1}^{L}(1) - (1+\rho)\varphi_{t}^{L}(1)\right] =& \varphi_{t}^{L}(1) - \varphi_{t+1}^{L}(1) - \lambda p \int_{\varphi_{t}^{L}(1)}^{\varphi_{t+1}^{L}(1)} \overline{F}(x)dx \\ &- \lambda (1-p) \int_{\varphi_{t}^{L}(1)+K}^{\varphi_{t+1}^{L}(1)+K} \overline{F}(x)dx \\ &\geq (1-\lambda)\left(\varphi_{t}^{L}(1) - \varphi_{t+1}^{L}(1)\right) \\ &> 0\end{aligned}$$

Where we use $\overline{F}(x) \leq 1$. This proves the proposition. ■

A.2 Proof of proposition 2

Using equation (4.5), we immediately obtain

$$
\begin{aligned}
\varphi_0^L(1) =& \frac{\varphi_1^L(1)-\varphi_0^L(1)}{\rho+\delta} + B + \frac{\lambda p}{\rho+\delta}\int_{\varphi_1^L(1)}^{\infty}\overline{F}(x)dx + \frac{\lambda(1-p)}{\rho+\delta}\int_{\varphi_1^L(1)+(\rho+\delta)K}^{\infty}\overline{F}(x)dx \\
<& \frac{\varphi_1^L(1)-\varphi_0^L(1)}{\rho+\delta} + B + \frac{\lambda p}{\rho+\delta}\int_{\varphi_0^L(1)}^{\infty}\overline{F}(x)dx + \frac{\lambda(1-p)}{\rho+\delta}\int_{\varphi_0^L(1)+(\rho+\delta)K}^{\infty}\overline{F}(x)dx \\
<& B + \frac{\lambda p}{\rho+\delta}\int_{\varphi_0^L(1)}^{\infty}\overline{F}(x)dx + \frac{\lambda(1-p)}{\rho+\delta}\int_{\varphi_0^L(1)+(\rho+\delta)K}^{\infty}\overline{F}(x)dx \\
\leq& B + \frac{\lambda}{\rho+\delta}\int_{\varphi_0^L(1)}^{\infty}\overline{F}(x)dx
\end{aligned} \tag{A.1}
$$

Now assume that $\varphi_0^L(1) \geq \varphi_0^L(0)$, we obtain

$$
\begin{aligned}
\varphi_0^L(1) <& B + \frac{\lambda}{\rho+\delta}\int_{\varphi_0^L(1)}^{\infty}\overline{F}(x)dx \\
\leq& B + \frac{\lambda}{\rho+\delta}\int_{\varphi_0^L(0)}^{\infty}\overline{F}(x)dx \\
=& \varphi_0^L(0)
\end{aligned}
$$

which is contrary to our assumption. Together with proposition (1) this proves the first part of the proposition. For part (ii) we use induction. For $t = T$ we have

$$
\rho\frac{\partial\varphi_T^L}{\partial K} = -\delta\frac{\partial\varphi_0^L(1)}{\partial K} + \lambda p\overline{F}\left(\varphi_T^L\right)\frac{\partial\varphi_T^L}{\partial K} + \lambda(1-p)\overline{F}\left(\varphi_T^L+(\rho+\delta)K\right)\left(\varphi_T^L+(\rho+\delta)\right)
$$

For $t = T-1$, it can be derived that $\frac{\partial\varphi_{T-1}}{\partial K} = \frac{\partial\varphi_T}{\partial K}$. Next, for $t < T-1$

$$
\begin{aligned}
(1+\rho)\frac{\partial\varphi_t^L(1)}{\partial K} =& \left[1-\lambda p\overline{F}\left(\varphi_{t+1}^L(1)\right)-\lambda(1-p)\overline{F}\left(\varphi_{t+1}^L(1)+(\rho+\delta)K\right)\right]\frac{\partial\varphi_{t+1}^L}{\partial K} \\
&-\delta\varphi_0^L(1)-\lambda(1-p)\overline{F}\left(\varphi_{t+1}^L(1)+(\rho+\delta)K\right)(\rho+\delta) \\
&> \left[1-\lambda p\overline{F}\left(\varphi_{t+2}^L(1)\right)-\lambda(1-p)\overline{F}\left(\varphi_{t+2}^L(1)+(\rho+\delta)K\right)\right]\frac{\partial\varphi_{t+2}^L}{\partial K} \\
&-\delta\varphi_0^L(1)-\lambda(1-p)\overline{F}\left(\varphi_{t+2}^L(1)+(\rho+\delta)K\right)(\rho+\delta) \\
=&(1+\rho)\frac{\partial\varphi_{t+1}^L}{\partial K}
\end{aligned}
$$

Hence $\partial\varphi_t^L/\partial K > \partial\varphi_{t+1}^L/\partial K$ and hence this proves (ii). For part (iii) we use the first line of (A.1) to obtain

$$
\begin{aligned}
\frac{\partial\varphi_0^L(1)}{\partial K} =& \frac{\frac{\partial\varphi_1^L(1)}{\partial K}-\frac{\partial\varphi_0^L(0)}{\partial K}}{\rho+\delta} - \frac{\lambda p}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)\right)\frac{\partial\varphi_1^L(1)}{\partial K} \\
&-\frac{\lambda(1-p)}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)+(\rho+\delta)K\right)\left(\frac{\partial\varphi_1^L(1)}{\partial K}+\rho+\delta\right) \\
<& -\frac{\lambda p}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)\right)\frac{\partial\varphi_1^L(1)}{\partial K} - \frac{\lambda(1-p)}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)+(\rho+\delta)K\right)\left(\frac{\partial\varphi_1^L(1)}{\partial K}+\rho+\delta\right) \\
<& -\frac{\lambda p}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)\right)\frac{\partial\varphi_0^L(1)}{\partial K} - \frac{\lambda(1-p)}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)+(\rho+\delta)K\right)\left(\frac{\partial\varphi_0^L(1)}{\partial K}+\rho+\delta\right)
\end{aligned}
$$

where we use (ii) twice. Hence

$$\frac{\partial \varphi_0^L(1)}{\partial K}\left[1+\frac{\lambda p}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)\right)+\frac{\lambda(1-p)}{\rho+\delta}\overline{F}\left(\varphi_1^L(1)+(\rho+\delta)K\right)\right]$$
$$< -\lambda(1-p)\overline{F}\left(\varphi_1^L(1)+(\rho+\delta)K\right)<0$$

Together with (ii), this proves the last part of the proposition.

■

A.3 Proof of proposition 3

First, we proof the following lemma.

Lemma 1. *When $p<1, K>0$, we have*

$$\lambda\overline{F}(\varphi(0))>p\lambda\overline{F}(\varphi(1))+(1-p)\lambda\overline{F}(\varphi(1)+(\rho+\delta)K)$$

Proof: The second order derivative of $\varphi(1)$ with respect to K is equal to

$$\frac{\partial^2\varphi(1)}{\partial K^2}=\frac{(\rho+\delta)^2\lambda(1-p)f\left(\right)\left(\frac{\partial\varphi(1)}{\partial K}+\rho+\delta\right)}{\left(\rho+\delta+\lambda p\overline{F}(\varphi(1))+\lambda(1-p)\overline{F}(\varphi(1)+(\rho+\delta)K)\right)^2}$$

From the first order derivative we can derive that $\partial\varphi(1)/\partial K>-(\rho+\delta)$ and hence $\partial^2\varphi(1)/\partial K^2>0$. Hence using Taylor's theorem

$$\begin{aligned}
\varphi(1) >&\varphi(0)+\left.\frac{\partial\varphi(1)}{\partial K}\right\rfloor_{K=0}K\\
=&\varphi(0)-\frac{\lambda(1-p)(\rho+\delta)\overline{F}(\varphi(1))}{\rho+\delta+\lambda\overline{F}(\varphi(1))}K\\
>&\varphi(0)-\lambda(1-p)\overline{F}(\varphi(1))K\\
>&\varphi(0)-\lambda(1-p)\overline{F}(\varphi(1)+(\rho+\delta)K)K
\end{aligned}$$

■

A.4 Proof of proposition 4

First note that the reservation wage equation when $T\to\infty$ changes into

$$\varphi^L(1)=B+\frac{\lambda p}{\rho+\delta}\int_{\varphi^L(1)}^{\infty}\overline{F}(x)dx+\frac{\lambda(1-p)}{\rho+\delta}\int_{\varphi^L(1)+(\rho+\delta)K}^{\infty}\overline{F}(x)dx$$

where we drop the subscript t because of the non-existence of time dependence. The first order derivative of this reservation wage with respect to K equals

$$\frac{\partial\varphi(1)}{\partial K} = -\frac{\lambda(1-p)(\rho+\delta)\overline{F}(\varphi(1)+(\rho+\delta)K)}{\rho+\delta+\lambda p\overline{F}(\varphi(1))+\lambda(1-p)\overline{F}(\varphi(1)+(\rho+\delta)K)}$$

Denote

$$\theta(0) = \lambda\overline{F}(\varphi(0))$$

and

$$\theta(1) = p\lambda\overline{F}(\varphi(1))+(1-p)\lambda\overline{F}(\varphi(1)+(\rho+\delta)K)$$

Note that $\theta(0) = \theta(1)$ when $K = 0$. Taking derivatives with respect to K results in:

$$\begin{aligned}\frac{\partial\theta(1)}{\partial K} =& -p f(\varphi(1))\frac{\partial\varphi(1)}{\partial K} - (1-p)\lambda f(\varphi(1))\left[\frac{\partial\varphi(1)}{\partial K}+\rho+\delta\right]\\ =& -\lambda f(\varphi(1))\frac{\partial\varphi(1)}{\partial K} - \lambda f(\varphi(1))(1-p)(\rho+\delta)\\ =&(\rho+\delta)\lambda(1-p)f(\varphi(1))\left[\frac{\lambda\overline{F}(\varphi(1)+(\rho+\delta)K)}{\rho+\delta+\lambda p\overline{F}(\varphi(1))+\lambda(1-p)\overline{F}(\varphi(1)+(\rho+\delta)K)}-1\right]\\ =& -\frac{(\rho+\delta)\lambda(1-p)f(\varphi(1))}{\rho+\delta+\lambda p\overline{F}(\varphi(1))+\lambda(1-p)\overline{F}(\varphi(1)+(\rho+\delta)K)}\times\\ &\left[\rho+\delta+\lambda p\left(\overline{F}(\varphi(1))-\overline{F}(\varphi(1)+(\rho+\delta)K)\right)\right]\\ <&0\end{aligned}$$

while $\frac{\partial\theta(0)}{\partial K} = 0$. This proofs the proposition. ■

Proof of Propostion 3

Parts 1 and 2 are trivial. For the third we need to proof that $\partial U^*/\partial\delta > 0$. We have

$$\frac{\partial U^*}{\partial\delta} = \frac{\rho}{(\rho+\delta)^2}\left[\varphi_0^L(0)-\varphi_0^L(1)\right]+\frac{\delta}{\rho+\delta}\left[\frac{\partial\varphi_0^L(0)}{\partial\delta}-\frac{\partial\varphi_0^L(1)}{\partial\delta}\right]$$

The first part at the right hand side of this equation is positive using Proposition XX. The second part is positive whenever we are able to proof that

$$\frac{\partial\varphi_0^L(1)}{\partial\delta} < \frac{\partial\varphi^L(0)}{\partial\delta}$$

Notice that $\partial\varphi_0(1)/partial\delta$ increases with T. This implies that we restrict ourselves to the situation in which $T\to\infty$. We have

We have

$$
\begin{aligned}
\frac{\partial \varphi(1)}{\partial \delta} =& \frac{B - \varphi(1) - \lambda(1-p)K\overline{F}(\varphi(1) + (\rho+\delta)K)}{\rho + \delta + \lambda p \overline{F}(\varphi(1)) + \lambda(1-p)\overline{F}(\varphi(1) + (\rho+\delta)K)} \\
=& \frac{B - \varphi(0)}{\rho + \delta + \lambda p \overline{F}(\varphi(1)) + \lambda(1-p)\overline{F}(\varphi(1) + (\rho+\delta)K)} \\
&+ \frac{\varphi(0) - \varphi(1) - \lambda(1-p)K\overline{F}(\varphi(1) + (\rho+\delta)K)}{\rho + \delta + \lambda p \overline{F}(\varphi(1)) + \lambda(1-p)\overline{F}(\varphi(1) + (\rho+\delta)K)} \\
<& \frac{B - \varphi(0)}{\rho + \delta + \lambda p \overline{F}(\varphi(1)) + \lambda(1-p)\overline{F}(\varphi(1) + (\rho+\delta)K)} < \frac{\partial \varphi(0)}{\partial \delta}
\end{aligned}
$$

which proofs the third part of the theorem. For the fourth part we have

$$
\frac{\partial U^*}{\partial p} = -\frac{\delta}{\rho + \delta} \frac{\partial \varphi_0^L(1)}{\partial p}
$$

which is negative since $\partial \varphi_0^L(1) > 0$

Table A.1 Descriptive statistics for the unemployment spells.

	1	2	3	4	5	6	7	8	9	10
Age	38.33	39.93	42.15	44.47	46.49	47.29	46.44	45.77	45.18	46.73
Female	0.42	0.43	0.43	0.42	0.38	0.34	0.32	0.31	0.28	0.32
Children	0.36	0.45	0.45	0.43	0.40	0.40	0.46	0.48	0.51	0.43
Position in the household										
Single	0.08	0.07	0.07	0.06	0.07	0.07	0.05	0.03	0.04	0.04
Head of household	0.48	0.51	0.52	0.55	0.59	0.63	0.65	0.69	0.70	0.68
Partner	0.28	0.31	0.33	0.33	0.30	0.26	0.27	0.25	0.22	0.26
Type of employment										
Civil servant	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.17	0.17	0.16
Employed in business sector	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.23	0.24	0.24
Self-employed	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.06	0.08	0.08
Regions										
Groningen	0.04	0.04	0.04	0.05	0.04	0.05	0.05	0.06	0.08	0.07
Friesland	0.04	0.05	0.05	0.06	0.06	0.07	0.09	0.11	0.14	0.16
Drenthe	0.01	0.03	0.03	0.03	0.03	0.04	0.04	0.06	0.07	0.04
Overijssel	0.07	0.07	0.08	0.08	0.08	0.08	0.10	0.11	0.10	0.13
Flevoland	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.00
Gelderland	0.12	0.13	0.12	0.12	0.12	0.12	0.12	0.09	0.08	0.09
Utrecht	0.06	0.06	0.05	0.05	0.04	0.03	0.02	0.03	0.01	0.02
Noord-Holland	0.16	0.14	0.14	0.13	0.12	0.12	0.10	0.10	0.08	0.10
Zuid-Holland	0.21	0.19	0.17	0.17	0.16	0.15	0.13	0.11	0.12	0.10
Zeeland	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.02	0.03	0.05
Noord-Brabant	0.17	0.17	0.19	0.19	0.20	0.21	0.21	0.19	0.18	0.14
Limburg	0.08	0.08	0.08	0.08	0.09	0.09	0.09	0.09	0.10	0.10
Number of observations	19869	10972	6817	4290	2672	1572	825	448	250	135

Table A.2 Descriptive statistics for the employment spells.										
	1	2	3	4	5	6	7	8	9	10
Age	36.29	36.86	36.10	35.80	35.86	36.24	36.80	37.50	38.23	39.37
Female	0.44	0.52	0.57	0.58	0.57	0.56	0.55	0.56	0.55	0.54
Children	0.25	0.45	0.49	0.50	0.49	0.48	0.48	0.48	0.48	0.50
Position in the household										
Single	0.11	0.15	0.17	0.19	0.20	0.20	0.18	0.17	0.16	0.00
Head of household	0.42	0.38	0.37	0.38	0.39	0.41	0.41	0.41	0.42	0.00
Partner	0.35	0.38	0.37	0.36	0.35	0.34	0.35	0.37	0.38	0.00
Type of employment										
Civil servant	0.10	0.11	0.11	0.11	0.12	0.12	0.13	0.13	0.14	0.14
Employed in business sector	0.10	0.12	0.12	0.12	0.12	0.13	0.13	0.14	0.15	0.15
Self-employed	0.10	0.11	0.11	0.11	0.11	0.11	0.12	0.13	0.13	0.13
Regions										
Groningen	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Friesland	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.05	0.04
Drenthe	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.03	0.03
Overijssel	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.06	0.05
Flevoland	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02
Gelderland	0.12	0.12	0.12	0.11	0.12	0.11	0.11	0.10	0.12	0.10
Utrecht	0.07	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.08	0.07
Noord-Holland	0.17	0.17	0.18	0.18	0.18	0.19	0.18	0.19	0.23	0.18
Zuid-Holland	0.23	0.22	0.22	0.22	0.21	0.20	0.22	0.23	0.26	0.23
Zeeland	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.02
Noord-Brabant	0.15	0.15	0.15	0.14	0.15	0.15	0.15	0.15	0.02	0.14
Limburg	0.07	0.06	0.06	0.07	0.06	0.07	0.07	0.06	0.08	0.07
Number of observations	140082	47008	21298	11480	6730	4272	2819	1955	1172	914

Table A.3 Numbers and average unemployment durations for the total data set, homeowners and non-homeowners

	Total		Homeowner		Non-homeowner	
	number	duration	number	duration	number	duration
1	48831	26.06	18200	14.63	36631	32.86
2	22897	20.71	9328	15.64	13569	24.19
3	12911	19.01	5551	17.22	7360	20.37
4	7731	19.25	3487	17.65	4244	20.57
5	4610	18.60	2103	16.96	2507	20.18
6	2760	17.29	1276	15.86	1484	18.52
7	1497	16.25	743	14.80	754	14.08
8	852	15.45	434	13.80	418	17.17
9	486	14.80	269	15.01	217	14.54

Table A.4 Results of the reduced form duration model

	Homeowner	θ_L	θ_N	θ_E
Fraction of homeowners	3.991			
	(0.068)			
Homeownership		0.113	− 0.105	− 0.223
		(0.022)	(0.084)	(0.009)
Personal characteristics				
Presence of children	− 0.057	0.055	0.124	0.371
	(0.020)	(0.012)	(0.039)	(0.010)
Female	0.105	− 0.347	0.309	0.232
	(0.027)	(0.017)	(0.056)	(0.010)
Higher eduction	0.127	0.023	− 0.977	− 0.020
	(0.021)	(0.014)	(0.066)	(0.011)
Age groups (base: below 30)				
Between 30 and 40	0.732	− 0.210	− 0.355	− 0.666
	(0.025)	(0.016)	(0.049)	(0.011)
Between 40 and 55	0.710	− 0.456	− 1.279	− 0.383
	(0.031)	(01019)	(0.076)	(0.018)
55 and over	0.650	− 1.224	− 2.351	0.0207
	(0.034)	(0.023)	(0.104)	(0.035)
Position in household (base: spouse of head)				
Single	− 1.489	− 0.193	0.578)	− 0.178
	(0.035)	(0.026)	(0.083)	(0.017)
Head of household	− 0.289	− 0.145	0.545	− 0.730
	(0.024)	(0.016)	(0.051)	(0.012)
Occupation (base: manager and other)				
Private sector	0.115	0.077	− 0.796	0.000
	(0.029)	(0.018)	(0.085)	(0.034)
Civil servant	0.047	0.031	− 0.706	− 0.005
	(0.023)	(0.015)	(0.074)	(0.027)
Self employed	0.126	− 0.030	− 0.627	0.009
	(0.039)	(0.027)	(0.108)	(0.038)

Table A.4 Results of the reduced form duration model (Table continued)

	Homeowner	θ_L	θ_N	θ_E
Regions (base: Groningen)				
Friesland	0.131	0.1541	− 0.070	0.063
	(0.050)	(0.040)	(0.145)	(.033)
Drenthe	0.236	− 0.033	0.232	− 0.058
	(0.056)	(0.045)	(0.146)	(0.037)
Overijssel	0.105	0.104	0.143	− 0.042
	(0.049)	(0.037)	(0.126)	(0.030)
Flevoland	0.041	0.019	0.533	0.109
	(0.090)	(0.057)	(0.162)	(0.041)
Gelderland	0.107	0.095	0.073	− 0.090
	(0.044)	(0.035)	(0.119)	(0.028)
Utrecht	− 0.032	0.053	0.025	− 0.044
	(0.059)	(0.040)	(0.137)	(0.031)
Noord-Holland	0.135	0.018	0.181	0.075
	(0.045)	(0.034)	(0.115)	(0.027)
Zuid-Holland	0.183	0.018	0.027	− 0.017
	(0.043)	(0.033)	(0.113)	(0.027)
Zeeland	0.194	0.078	0.003	− 0.005
	(0.078)	(0.047)	(0.168)	(0.039)
Noord-Brabant	0.190	0.113	0.052	0.001
	(0.043)	(0.034)	(0.115)	(0.028)
Limburg	0.111	0.043	− 0.134	0.058
	(0.049)	(0.037)	(0.129)	(0.030)
Baseline Hazard				
Homeowners				
3–6 months		2.059	2.412	2.042
		(0.033)	(0.211)	(0.029)
6–9 months		1.987	3.546	2.098
		(0.049)	(0.416)	(0.031)
9–12 months		4.464	14.448	1.773
		(0.125)	(1.626)	0.029)
12–15 months		2.741	6.330	4.635
		(0.123)	(1.677)	(0.064)
15–18 months		0.355	2.597	1.220
		(0.019)	(0.491)	(0.018)
Renters				
3–6 months		1.810	2.093	
		(0.031)	(0.158)	
6–9 months		2.131	4.329	
		(0.049)	(0.376)	
9–12 monthsh		4.185	11.743	
		(0.113)	(1.176)	
12–15 months		(2.051)	5.287	
		(0.098)	(1.202)	
15-18 months		0.391	1.584	
		(0.018)	(0.257)	

Table A.4 Results of the reduced form duration model (Table continued)

	Homeowner	θ_L	θ_N	θ_E
Mass points				
$v_{\cdot,0}$	− 1.159	0.112	0.004	0.018
	(0.052)	(0.004)	(0.001)	(0.001)
$v_{\cdot,1}$	− 4.540	0.338	0.034	0.076
	(0.061)	(0.013)	(0.004)	(0.002)
Probabilities				
$P(V_0 = v_{00}, V_1 = v_{10}, V_2 = v_{20}, V_3 = v_{30})$	0.137			
	(0.009)			
$P(V_0 = v_{01}, V_1 = v_{10}, V_2 = v_{20}, V_3 = v_{30})$	0.108			
	(0.008)			
$P(V_0 = v_{00}, V_1 = v_{11}, V_2 = v_{20}, V_3 = v_{30})$	0.000			
	.			
$P(V_0 = v_{01}, V_1 = v_{11}, V_2 = v_{20}, V_3 = v_{30})$	0.021			
	(0.017)			
$P(V_0 = v_{00}, V_1 = v_{10}, V_2 = v_{21}, V_3 = v_{30})$	0.000			
	.			
$P(V_0 = v_{01}, V_1 = v_{10}, V_2 = v_{21}, V_3 = v_{30})$	0.000			
	.			
$P(V_0 = v_{00}, V_1 = v_{11}, V_2 = v_{21}, V_3 = v_{30})$	0.200			
	(0.010)			
$P(V_0 = v_{01}, V_1 = v_{11}, V_2 = v_{21}, V_3 = v_{30})$	0.154			
	(0.020)			
$P(V_0 = v_{00}, V_1 = v_{10}, V_2 = v_{20}, V_3 = v_{31})$	0.116			
	(0.008)			
$P(V_0 = v_{01}, V_1 = v_{10}, V_2 = v_{20}, V_3 = v_{31})$	0.122			
	(0.008)			
$P(V_0 = v_{00}, V_1 = v_{11}, V_2 = v_{20}, V_3 = v_{31})$	0.000			
	.			
$P(V_0 = v_{01}, V_1 = v_{11}, V_2 = v_{20}, V_3 = v_{31})$	0.000			
	.			
$P(V_0 = v_{00}, V_1 = v_{10}, V_2 = v_{21}, V_3 = v_{31})$	0.000			
	.			
$P(V_0 = v_{01}, V_1 = v_{10}, V_2 = v_{21}, V_3 = v_{31})$	0.000			
	.			
$P(V_0 = v_{00}, V_1 = v_{11}, V_2 = v_{21}, V_3 = v_{31})$	0.074			
	(0.007)			
$P(V_0 = v_{01}, V_1 = v_{11}, V_2 = v_{21}, V_3 = v_{31})$	0.067			
	(0.009)			
Means of unobserved heterogeneity distributions				
$E(v_{\cdot})$	− 2.757	0.040	0.019	0.040
	(− 2.757)	(0.040)	(0.019)	(0.040)

Table A.5 Correlation coefficients for the unobserved heterogeneity components

	v_0	v_1	v_2	v_3
v_0	1			
	.			
v_1	0.0067	1		
	(0.0502)	.		
v_2	0.0525	0.8936	1	
	(0.0432)	(0.0177)	.	
v_3	-0.0399	-0.2117	-0.1933	1
	(0.0428)	(0.0679)	(0.0660)	.

Figure A.1 The development of house prices over the period 1989-2000. The corrected series are measured in 1990 euros.

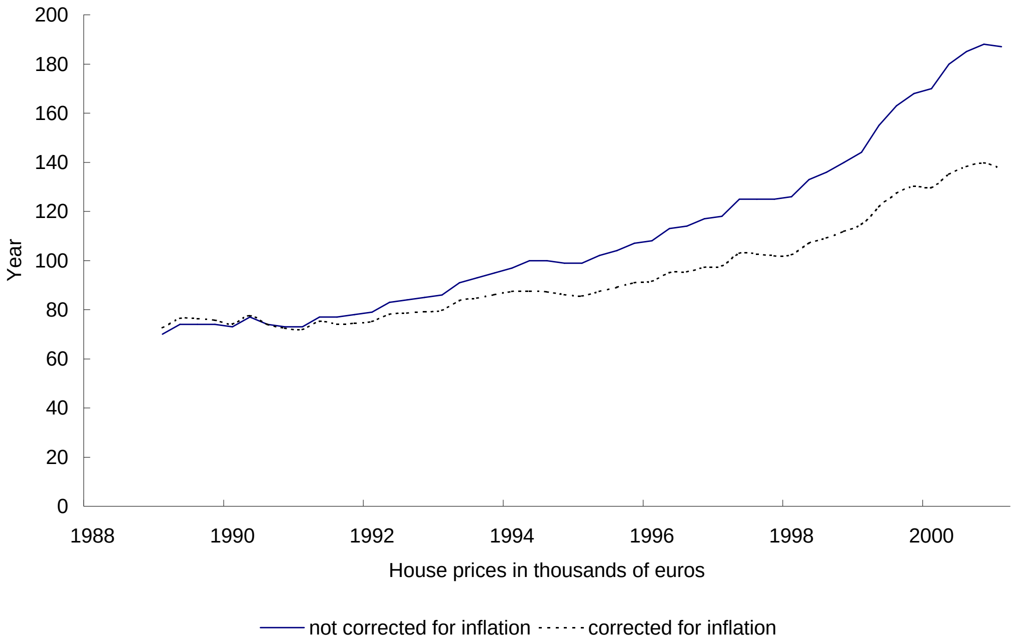

Figure A.2 Reservation wage path for individual workers with parameters: $K = 10000$, $\lambda = 0.1$, $p = 0.5$, $\delta = 0.02$, $\rho = 0.01$, $B = 1200$.

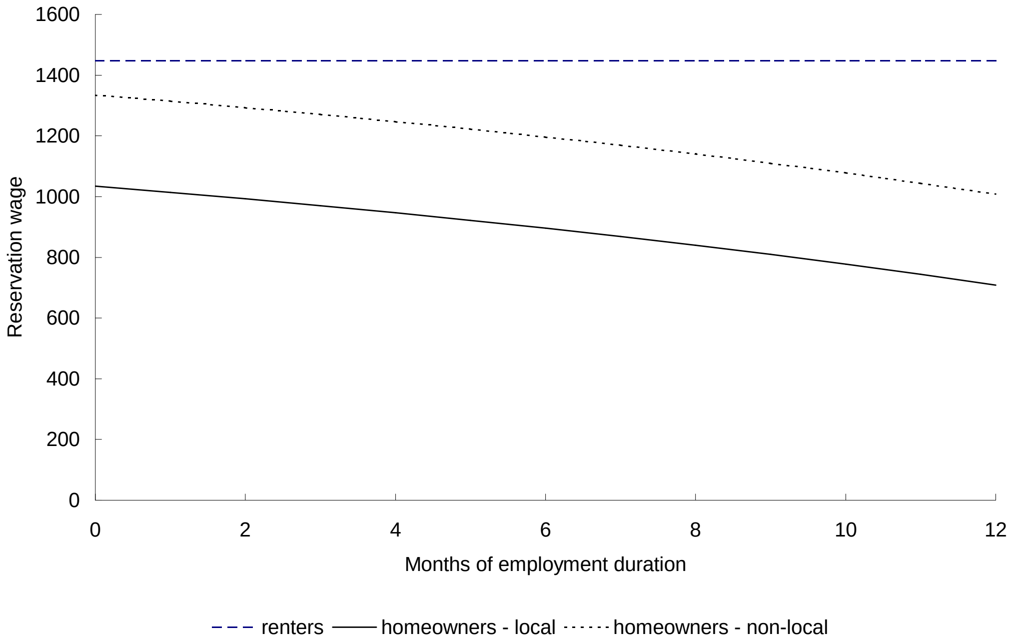

Figure A.3 Levels of U^* evaluated at different values for λ and with the following parameter values: $K = 10000$, $p = 0.5$, $\delta = 0.02$, $\rho = 0.01$, $B = 1200$.

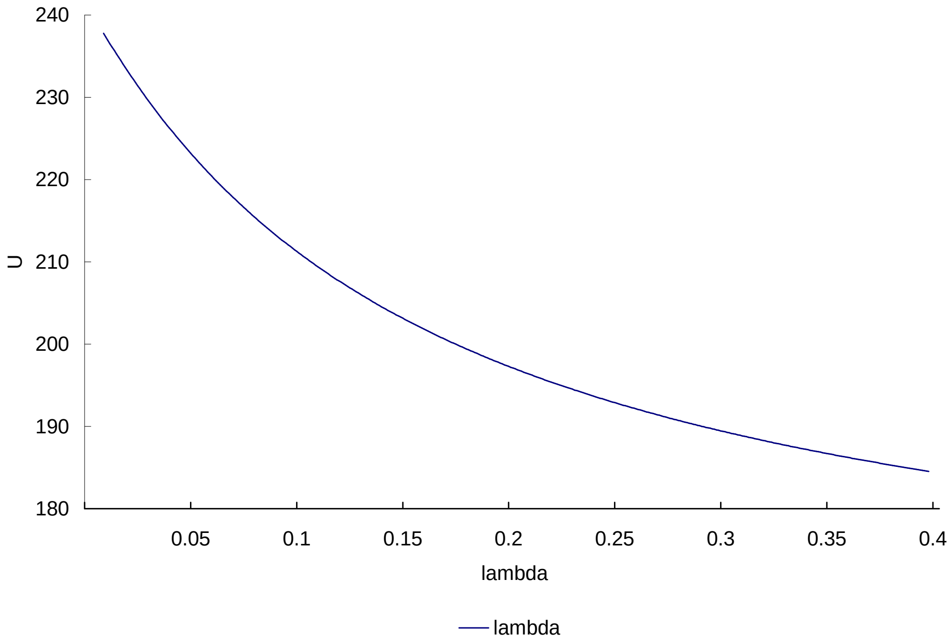

Figure A.4 Actual and counterfactual probability to receive an acceptable job offer from local labour market for homeowners.

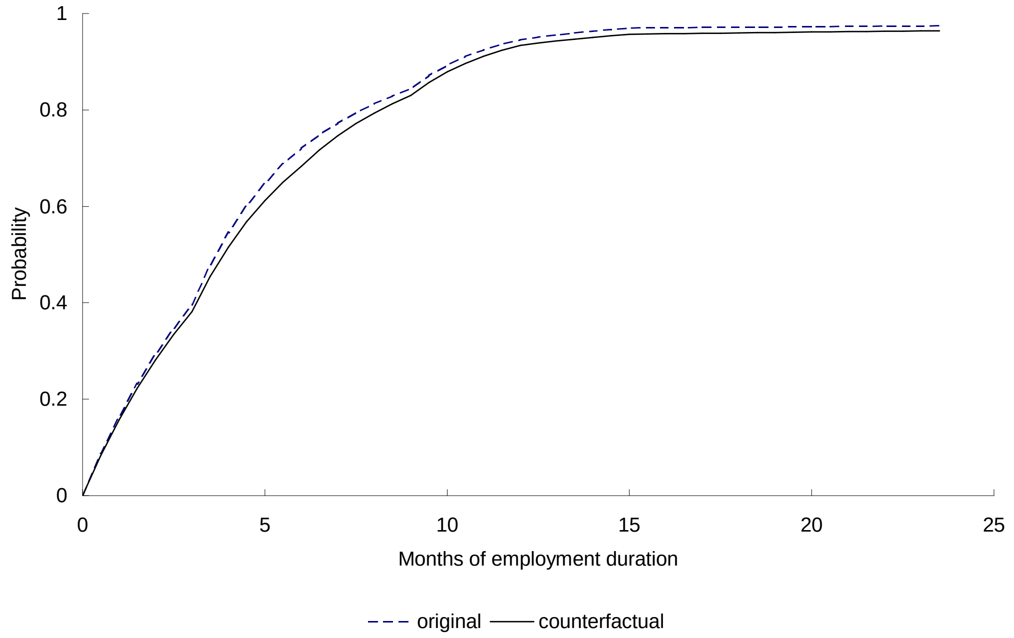

Figure A.5 Actual and counterfactual probability to receive an acceptable job offer from non-local labour market for homeowners.

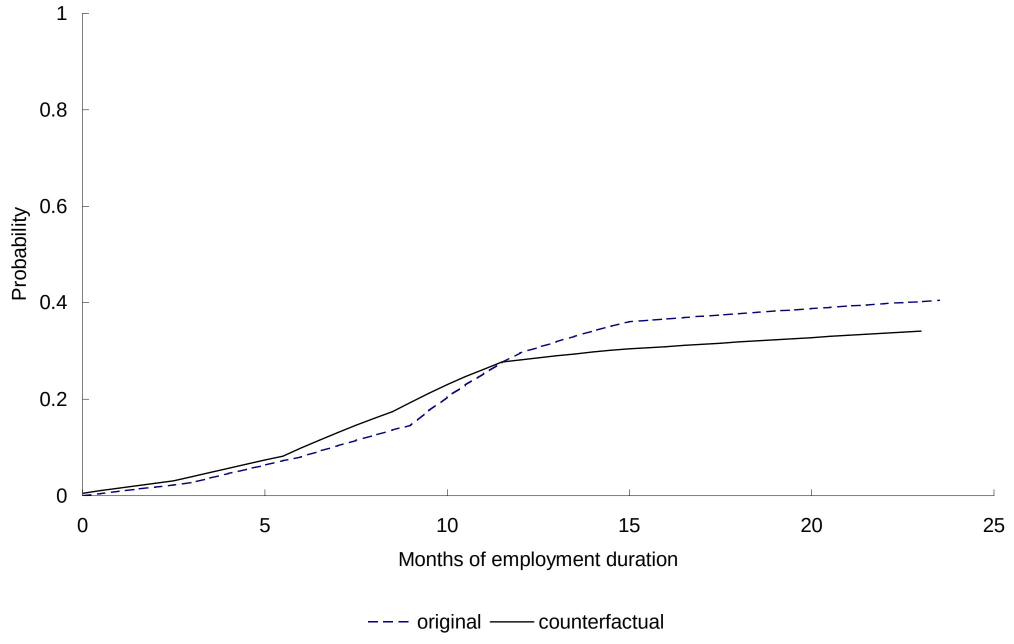

Figure A.6 Actual and counterfactual probability to receive an acceptable job offer from local labour market for renters.

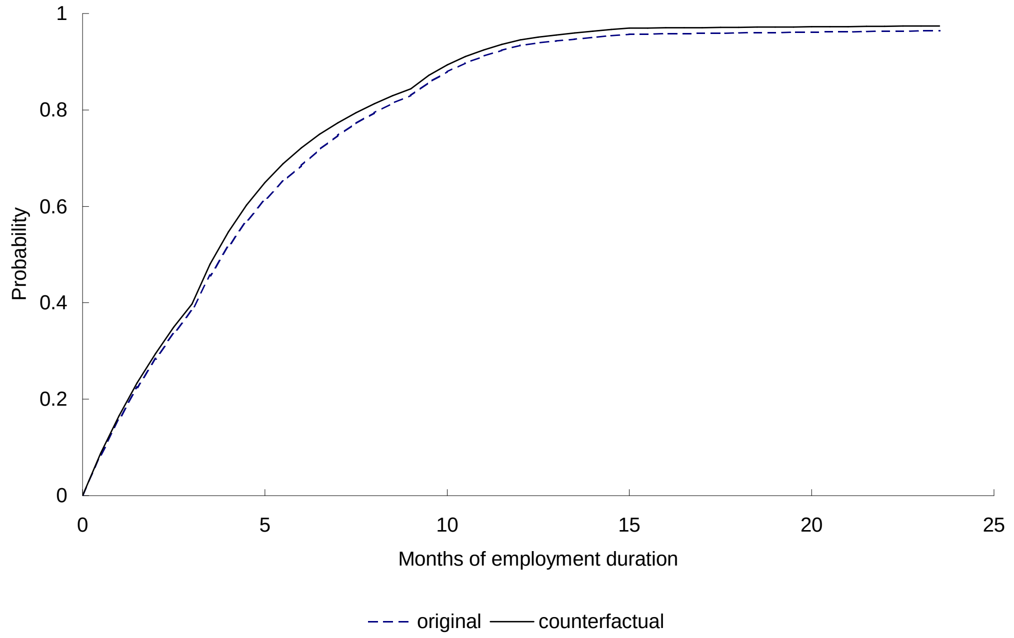

Figure A.7 Actual and counterfactual probability to receive an acceptable job offer from non-local labour market for renters.