Essays on the economics of housing subsidies

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Chapter 4: Time-varying state dependency in tenure choice

1. Introduction

"Once an owner, always an owner?" is the question raised in the title of a study into housing choice in the Netherlands (Helderman, 2007). Both this study and a study by Feijten (2005) conclude that households are very unlikely to move back into rented housing once the move into the owner-occupied sector has been made. Similar results may are well documented in other countries as well, such as the United States (e.g. Börsch-Supan, 1990; Ioannides & Kan, 1996; Kan, 2000). This pattern is in fact very strong; casual empirical results for the Netherlands indicate that 81% of all owners that have moved in the period of 2006-2008 moved within the owner-occupied sector. In the rented sector 62% of all moving households in the same period moved into a new rented dwelling. These choice patterns suggest path dependence in housing choice. Path dependency is often referred to as the notion that "history matters". David (2001) gives a more formal definition of a path dependent process: "A path dependent stochastic process is one whose asymptotic distribution evolves as a consequence (function of) the process's own history."

In terms of an individual household's housing choice this implies that the outcome of the (in principle stochastic) tenure decision is influenced by the outcome of earlier tenure decisions. There is apparently an unobserved dynamic process in housing choice that results in a pattern in which previous tenure decisions prove good predictors of consecutive tenure decisions. Given the type of data often applied for tenure choice models, cross sections or aggregate time series, these processes are often not accounted for (Börsch-Supan, 1990). In this study we will use a series of cross sections with some limited backward looking data in order to test whether there is, and what could be the source of, path dependence in a heavily regulated housing market (specifically the Dutch). Since we lack true longitudinal observations, and therefore cannot test an actual path, we shall refer to the impact of previous tenure as state dependence; a term coined by Ioannides and Kan (1996). The term state dependence fits our analysis of our quasi-panel data well; our contribution is the notion that state dependence has a time-varying character.

2. Literature

There is a large body of literature on tenure choice of which an important share is empirical. The general idea behind tenure choice models is that households choose for owning or renting optimizing the expected utility derived from their decision. This is reflected in the empirical models in the literature: the tenure choice is usually modeled using a probit or logit regression on several explanatory variables. Often used explanatory variables include the relative cost of owning over renting (e.g. Bourassa & Hoesli, 2010), income and wealth (e.g. Haurin *et al.*, 1997; Henderson & Ioannides, 1983), marginal tax rates (e.g. Bourassa & Yin, 2006; Haurin & Gill, 2002), and some additional household characteristics (e.g. household composition, age of the head of household). Apart from practical issues such as availability in data, past tenure does not seem to fit within the general tenure choice model: in a well functioning (frictionless) market there is no reason why it would matter for expected

utility whether the household is currently owning or renting. Housing markets, however, are generally markets *with* frictions.

One example of such frictions is the cost of moving: moving house is costly, both in terms of expenses (e.g. costs involved with selling property, expenses made for moving) and psychologically (e.g. searching for new house, parting with familiar neighborhood, stress of selling property). Zorn (1988) therefore adds the costs of moving into his model. The model by Zorn is set up to model the joint decision to move and the tenure decision in the Korean housing market. In his model he specifies three variables for capturing the costs of moving, one of which is the past tenure of the household. Specifically, the past tenure is added to the model to capture the financial costs involved with leaving the previous residence, defined in Zorn (1988) as containing the costs of the termination of the lease or selling the property. The results reported suggest that when the household is currently owning, the likelihood of moving into ownership or renting is decreased; i.e. residential mobility decreases with home-ownership. In Rosenthal *et al.* (1996) previous tenure is also added to the model. In their specification the previous tenure controls for the costs of housing for previous home-owners following rollover provisions. They further mention that credit constraints may differ between previous and new owners. Previous tenure therefore corrects for potential differences in mobility rates. Rosenthal *et al.* (1996) find that previous home-owners are more likely to become owners than previous renters. Moreover, they report that previous owners consume more housing than previous renters. Ioannides and Kan (1996) and Kan (2000) report similar results with decreasing mobility for home-owners and, conditional on moving, increased probabilities of moving back into home-ownership: mobility and tenure choice decisions are thus state dependent. Taxability of capital gains and transaction costs are mentioned as possible explanations here as well.

Frictions in the housing market that have inspired previous researchers to investigate state dependence are often the result of governmental intervention: the rollover provision in Rosenthal *et al.* (1996) and Ioannides and Kan (1996) being a good example. In line with the more aggregate study of Fisher *et al.* (2003) the papers reviewed here show that institutions matter in housing choices. State dependence is the interpretation of Ioannides and Kan (1996) for the impact that past tenure has on tenure choice because of the institutional setup of the American housing market. State dependence implies an impact of past tenure on current tenure choice decision. The effect of institutions on households' decisions need not be constant over time, however (e.g. Gyourko & Linneman, 1996; Schutjens *et al.*, 2002). Using our quasi-panel we shall contribute to existing literature in testing whether and to what extend state depence is time-varying.

Institutions seem to be of key importance in explaining homeownership rates (Fisher *et al.*, 2003). Since the stringently regulated market of the Netherlands is so different from other markets we shall first briefly discuss the main institutions that may affect housing choice.

3. The institutional set-up of the Dutch housing market

In the short review of literature we thus find that there may be important time-dependent dynamics in tenure choice. We further find that the studies generally relate these findings to specific institutions in the housing market. The institutional set-up in the Netherlands has caused the owner-occupied and the rented sector to grow apart; each sector with a completely different set of interventions and corresponding economic incentives. In this section we do not deal with supply-side interventions: although the Dutch housing market has extremely strict zoning policy, this policy affects owners and renters alike and is unlikely to affect tenure decisions in the short term.

On the demand side housing is strongly subsidized in the Netherlands. In 2006 the annual amount of subsidization reached nearly 30 billion euro, or 5.5% of GDP (Koning *et al.* 2006; Romijn & Besseling, 2008). This amount is roughly equally distributed over the owner-occupiers and renters. Therefore, households that move from one sector to the other may lose one subsidy, but gain another. The way this redistribution is organized, however, is completely different and the net benefit of potential subsidies depends per household on individual characteristics, of which income is by far the most important one. We shall first discuss how owner-occupiers are subsidized and whether this could lead to time-varying state dependence. Thereafter we shall discuss the most important institutions in the rented sector.

3.1 Institutions in the owner-occupied sector

Government intervention in the owner-occupied sector, at least on the demand side, is completely fiscal in nature. There are two main fiscal subsidies to home owners: mortgage interest deductibility and tax exemption for home equity. There is one main fiscal tax on owning and that is the transfer tax levied upon buying a dwelling.

Households that own their dwelling in the Netherlands are allowed to deduct all interest payments on their mortgage against their marginal income tax rate (Hilbers *et al.*, 2008). The Netherlands has a progressive income tax system, making interest deductions larger with increasing income (*ceteris paribus*). The deductibility of interest payments is restricted to the primary residential dwelling and (obviously) conditional upon owning a dwelling. The subsidy is unrestrictedly available to all home owners and decreases the user cost of owning.

The other main source of subsidization in the owner-occupied sector is the tax exemption of home equity (Hilbers *et al.*, 2008). Since households generally have their largest share of wealth in home equity and other financial assets are taxed, the tax exemption of home equity is an important subsidy. When capital gains are realized they remain untaxed; only the attributed return on the equity is taxed. The effects of rollover provisions as in e.g. Rosenthal *et al.* (1996) therefore do not apply in the Netherlands; the tax exemption merely lowers the user cost of owning.

Transaction costs are another important potential source of state dependence: selling a house is more costly than terminating a rent. Moreover, transaction costs for buyers are considerable: between 8% and 10% of the property value (Van Ommeren & Van Leuvesteijn, 2005). However, in the Netherlands transaction costs are typically born

by the buyer. Some of these costs, such as the legal fees and financing costs, are fiscally deductible against marginal income tax rate and, moreover, are identical for previous owners and previous renters. Transaction costs may therefore affect the tenure choice, but may not be expected to cause state dependence; the costs of buying are equal to current renters and owners.

Finally, an important factor in the owner-occupied sector is formed by credit constraints. In the Netherlands it is allowed to finance the dwelling over 100% with debt (Elsinga *et al.* 2009). This implies that the impact of credit constraints are comparatively lower. The only constraint that is firm in the Netherlands is the loan-to-income constraint that banks impose on households. Albeit this constraint has become firmer after the credit crunch of 2008, mortgages over 100% of value are still allowed. Access to the owner-occupied sector is therefore not classically credit constraint (i.e. with down payment requirements), but more income constraint. Households that are income constraint, but do have significant wealth may choose to invest their wealth into their property in order to fulfill the income constraint. Households, however, tend to have most of their wealth in home equity; those households that have significant shares of wealth in other assets tend to be high income households with additionally also important levels of home equity.

3.2 Institutions in the rented sector

Housing market institutions in the rented sector are much more regulatory in nature. Rents are regulated as is the access to the rented sector. Finally, depending on income households may qualify for housing allowances. In our analysis of the institutions we restrict ourselves to the regulated rented sector which contains 95% of all rented housing. The non-regulated sector is more accessible, but much more expensive; given the small size of this subsector we ignore it in our discussion. Regulations mentioned below do not apply to the non-regulated sector, however.

Access to the rented sector is restricted by two means: queues and income. Generally there is a queue for rented housing. The length of this queue in urban areas can easily reach 4 years, but in very high demand areas as Amsterdam is up to 10 years. Anyone may enter the queue at any given moment, regardless of eligibility for rented housing in the end. The actual access to the dwelling is determined upon *current* income only. Revisions of eligibility or rent level based on changes in income are prohibited. Only households with lower incomes have, given the queue, unrestricted access to the rented market. Households with middle and higher incomes cannot enter the rented sector; elderly households with low income, but high wealth *can* enter the rented market. Income is thus key in gaining access into the rented market: keeping the impact of income equal, there is no reason to assume that some households would have better chances at entering the rented market than others. The accessibility of the rented market may therefore, in a *ceteris paribus* econometric framework, not lead to time-varying state dependence with respect to tenure choice.

Rents are regulated in the Netherlands up to a certain rent level. All rental contracts that agree upon a rent below this level are under regulation. For an important share the rent level may not be set beyond the regulation boundary because of a too low quality level of the dwelling. For a significant share of the market, however, goes that the dwelling could be priced beyond the regulation threshold given its quality. Nonetheless, most dwellings, both low and high quality, are regulated (Conijn &

Schilder, 2011b). This is the result of the dominant position of social landlords in the Netherlands. Social landlords not only rent out low quality housing, but also high quality (and thus potentially non-regulated) housing; since these landlords are non-profit organizations rents are typically set below the regulation threshold. Private landlords are then forced by competition with the social landlords to follow these low rents since households prefer waiting over a higher rent. Regulated rents are well below any estimated measure of market rents in the Netherlands and on average are about 50% of that market rent; this subsidy is higher in high demand areas and does not exist in low demand areas (Conijn & Schilder, 2011b). This subsidy is available equally to all renters in any local housing market and significantly decreases user cost. Finally, conditional upon rent level and income, households may qualify for housing allowances. The exact system is rather complicated, but the general idea can be summarized as follows: the first X euro of rent need to be paid by the household regardless, the additional Y amount of rent is subsidized fully until a threshold. Beyond that threshold amount Z of rent paid is subsidized partly. An exact description of the thresholds can be found in Elsinga *et al.* 2007, p.79). The amount of subsidization spent on housing allowances is marginal compared to the amount of implicit subsidies following below-market rents. Housing allowances may however, especially for low income household, significantly lower user cost.

3.3 Synthesis

We have discussed the most important institutions that make up the Dutch housing market and influence housing choice. We have argued that the majority of these institutions only result in lower user cost. The impact subsidies have on user cost may influence the tenure choice of households depending on whatever set of subsidies generates the highest utility; the subsidies surely do not cause time-varying state dependence. There is no lagged impact of tenure upon user cost, so we may not expect to find any of such effects based on the institutional set-up in the Netherlands.

We furthermore argued that there is a major impact of income on housing choice: income is the crucial factor determining both access to the owner-occupied and the rented sector. In the owner-occupied sector the income constraint may be slightly relaxed by bringing in other assets into the dwelling. The impact, however, may not be expected to be too large as households' wealth typically consists of home equity.

4. Data and methodology

4.1 Data

We use multiple waves of the Dutch Housing Needs Survey. For this study we will use all waves held from 1986 onwards: 1986, 1990, 1994, 1998, 2002, 2006, and 2009. The survey is conducted using comparable questionnaires among a representative sample of Dutch households. Each questionnaire contains a large number of questions regarding housing, such as current and previous dwelling, price or rent of the current and previous dwelling, several dwelling characteristics, location, satisfaction with dwelling and location, household characteristics as composition and income. We are unable to identify whether a household appears in more than one wave; our dataset can therefore not be used for true longitudinal analysis.

Based on the datasets we have created a new dataset that includes all observations from all waves. For each observation we know whether it deals with a recently moved household or a non-mover household. Households that are recent movers are all households that have moved in the two years prior to the year of the wave: we thus include all observations from e.g. the 2009 wave, of which we have information on current housing status (all) and previous housing status (recent movers only, i.e. moved between 2007 and 2009). The final tenure choice model will thus be estimated using the information of recent movers only (i.e. recent movers from the 1982 wave, the 1986 wave et cetera), for we only have information on the previous tenure mode of these recent movers. We essentially reconstruct the tenure choice that recently moved households have made.

Our data is thus "backward looking". Most of the household characteristics, such as income and composition, are recorded in "current time". There is therefore a slight probability that these parameters have changed since the tenure choice. We assume, however, that all characteristics during the interview are representative for the situation when the tenure choice was made. This is a reasonable assumption given the fact that we only record the tenure choice back until two years prior to the wave and many characteristics are therefore unlikely to have changed dramatically. Moreover, in many a case of large changes the household might have anticipated the large change and therefore taken the *current* situation into consideration in the *past* tenure choice (e.g. a birth of a child resulting in a different household composition is unlikely to be unanticipated for given a move in the last two years).

4.2 Model

Tenure choice decisions are most valuable when studied taking into account the mobility decision simultaneously. We therefore apply a Heckman correction to our binary choice model (e.g. Greene, 2008). The selection equation and outcome equation are given in (1):

(1) $m_i^* = y_i\gamma + u_i$

$$m_i = \begin{cases} 1 \; if \; m_i^* > 0 \\ 0 \; if \; m_i^* \leq 0 \end{cases}$$

$$T_i^* = x_i\beta + \varepsilon_i \quad if \quad m_i^* > 0$$

$$m_i = \begin{cases} 1 \; if \; m_i^* > 0 \\ 0 \; if \; m_i^* \leq 0 \end{cases}$$

Where m_i^* is the predicted probability of moving, y_i is a vector of explanatory variables for predicting a move, γ is a vector of regression coefficients and u_i is an error term. m_i^* is predicted using the actual observations of a move, m_i. The outcome equation, on tenure choice, is then given with T_i^* being the predicted tenure choice of the household, given a vector of explanatory variables x_i and a vector of regression coefficients β, and is conditional on observing a move. The vector of explanatory variables is constructed using the generally reported important variables from empirical tenure choice literature. An overview is presented in Table 4.1:

Table 4.1: Overview of variables in tenure choice model

Previous tenure	1/0, 1 if owner
Relative cost	cost of owning / cost of renting
Income	household real current income
Age	age of the head of household
Cohort	based on year of birth of the head of the household
Lowest - 1910	1/0
1911 - 1920	1/0
1921 - 1930	1/0
1931 - 1940	1/0
1941 - 1950	1/0
1951 - 1960	1/0 (reference)
1961 - 1970	1/0
1971 - 1980	1/0
1981 - 1990	1/0
1991 - 2000	1/0
Marginal tax	attributed marginal tax rate
Low tax	1/0 (reference)
Middle tax	1/0
High tax	1/0
Education	highest level of education within household
Low education	1/0 (reference)
Middle education	1/0
High education	1/0
Urbanity	level of urbanity of location where household lives
Strongly urban	1/0 (reference)
Urban	1/0
Moderately urban	1/0
Rural	1/0
Strongly rural	1/0
Household composition	
Single (with/without child)	1/0 (reference)
Couple	1/0
Couple with children	1/0
Other	1/0
Type of income	main source of income
Income from job	1/0 (reference)
Entrepreneurial income	1/0
Pension	1/0
Welfare	1/0
Year	time dummy
Dummy for 1986, 1990	1/0 (2009 reference)
1994, 1998, 2002, 2006, 2009	
Interaction previous tenure*year	1/0, 1 if owner in year x
Region	40 regional dummies (1/0)

All but two variables reported in Table 4.1 are based on observations from the questionnaires. The marginal income tax rate and the relative cost are estimated variables. The procedures for these estimations are given in the appendix of this paper.

5. Results

Using the data on actual household moving behavior we have constructed simple transition matrices containing the moving probabilities of households. The transition matrices can be found in the appendix of this paper. Given the transition matrices it is possible to estimate the probability of a household moving within the same sector. These probabilities are given for owners and renters in Table 4.2, along with the relative size of the owner-occupied sector:

Table 4.2: Probability of household moving within same housing sector

	Moved		Stock
	Own-own	Rent-rent	Own
1986	59%	71%	44%
1990	66%	64%	46%
1994	72%	57%	49%
1998	71%	59%	54%
2002	75%	61%	53%
2006	79%	61%	55%
2009	81%	62%	58%

Source: WBO / WoON 1986-2009

The results in Table 4.2 seem to be in line with the literature reviewed earlier. Owners are most likely to become owners and renters are most likely to become renters. The effect is stronger for owners, which is also in line with results presented in the empirical literature: households try to move up the property ladder and into ownership. We see furthermore that the share of owners that choose ownership again when moving increases over time. Table 4.2 thus supports the hypothesis of time-varying state dependence of tenure choice. The results in Table 4.2, however, are not taking into account (changing) market and household characteristics.

In order to correct for market and household characteristics as well as household mobility we estimate a probit tenure choice model with a Heckman correction[8]. The results of this procedure are given in Table 4.3:

[8] Estimated using the heckprob command in Stata v.12.

Table 4.3: Estimation results of tenure choice model with Heckman correction

		Coefficient	Std. Error	Sig (p)
Outcome equation: Tenure				
	Previous tenure	0.892	0.033	0.000
	Relative cost	0.017	0.038	0.662
	Income	0.450	0.018	0.000
	Marginal tax			
	Middle	0.327	0.024	0.000
	High	0.513	0.036	0.000
	Education			
	Middle	-0.166	0.013	0.000
	Low	-0.459	0.017	0.000
	Urbanity			
	Urban	0.100	0.021	0.000
	Moderately urban	0.244	0.022	0.000
	Rural	0.382	0.023	0.000
	Strongly rural	0.430	0.027	0.000
	Type of income			
	Business	0.158	0.022	0.000
	Pension	-0.373	0.024	0.000
	Social welfare	-0.456	0.020	0.000
	Starter	-0.532	0.019	0.000
	Birth year			
	1921-1930	-0.629	0.033	0.000
	1931-1940	-0.259	0.027	0.000
	1941-1950	-0.031	0.022	0.155
	1961-1970	0.214	0.018	0.000
	1971-1980	0.282	0.023	0.000
	1981-1990	0.389	0.034	0.000
	1991-2000	0.005	0.287	0.986
	Time			
	1986	0.085	0.037	0.023
	1990	0.272	0.035	0.000
	1994	0.299	0.036	0.000
	1998	0.295	0.027	0.000
	2002	0.171	0.027	0.000
	2006	0.031	0.029	0.283
	Interaction			
	Previous tenure 1986	-0.199	0.056	0.000
	Previous tenure 1990	-0.254	0.052	0.000
	Previous tenure 1994	-0.213	0.054	0.000
	Previous tenure 1998	-0.233	0.037	0.000
	Previous tenure 2002	-0.144	0.040	0.000
	Previous tenure 2006	-0.048	0.045	0.287
	Inverse Mills' ratio	0.438	0.037	0.000
	Constant	-6.162		
Selection equation: Move				
	Age	-0.916	0.007	0.000
	Household composition			
	Couple	0.075	0.007	0.000
	Couple/child	-0.353	0.006	0.000
	Other	-0.070	0.013	0.000
	Constant	2.414		

Source: WBO / WoON 1986-2009, own calculations

Since both the selection and outcome equation are estimated simultaneously standard fit measures, such as McFadden's pseudo R-square, cannot be computed. In order to give some idea about the model's predictive power we tabulate the observed and the model predicted tenure in Table 4.4. In general the tenure choice model predicts the observed tenure well. The model seems to become more accurate over time. This may in fact be a result of increasing state dependence in tenure choice: the groups of owners and renters becomes more distinct over time.

Table 4.4: Predictive power Heckman corrected tenure choice model

Overall		Predicted		
		Owner	Renter	Total
Observed	Owner	34.551	10.849	45.400
	Renter	8.703	26.342	35.045
	Total	43.254	37.191	80.445
Correct predictions	1986	71,0%		
	1990	72,4%		
	1994	73,9%		
	1998	75,7%		
	2002	76,5%		
	2006	79,8%		
	2009	80,0%		
	Total	75,7%		

Source: WBO / WoON 1986-2009, own calculations

The correlation between the error terms of the selection and outcome equation is significant. This implies that correcting for sample selectivity (household mobility) is needed. The coefficients in the selection equation have the expected signs: mobility decreases with age and the presence of children in the household. In the tenure choice equation the control variables also have the expected signs: income increases the probability of choosing home-ownership, with some non-linearity captured by the tax rates. Decreasing education leads to decreasing probabilities of home-ownership. Given the availability of rented housing in more rural areas we find that the probability of owning increases in more rural areas. We further find that households that have income from jobs, either regular salary or from business, have a larger probability of moving into home-ownership. Being a starter on the housing market significantly decreases the probability of home-owning. The cohort-dummies indicate that households of which the head was born in or closely after the post-war period have a higher probability of owning. The year fixed effects captured by the year dummies indicate an explosive increase in the move into owner-occupancy around the turn of the millennium. The results on the 39 regional dummies are not given in Table 3; only 5 are statistically significant at 5%. We added the variable to the model nonetheless in order to filter out regional variance not related to price from the regional price variable.

The key variable of interest in the model is the previous tenure variable: this variable shows a highly significant and positive coefficient. This indicates that, controlling for mobility and a handful of control variables, in line with literature there is state dependence in tenure choice decisions. The results in Table 4.3 indicate that being a

home-owner increases the probability of moving into home-ownership. Moreover, given the interaction terms with the year fixed effects we find that this state dependence increases over time, especially after the housing boom of 1998. Thus, over time, owners become even *more* likely to become home-owner when moving.

In line with expectations we find that there is significant state dependence in tenure choice decisions of households. These results are in line with the reviewed literature, however, cannot be explained by institutions, like in the United States. An obvious alternative explanation could be given in terms of unobserved heterogeneity: there might be a taste for home-ownership that we cannot explain within our model, e.g. a preference for independence. The fact that we find that state dependence increases almost over the entire period of our findings at least partly dismisses explanations on this line. We therefore take a look into the two most likely explanations for this phenomenon: (i) the demand for certain levels of quantity of housing that is only available in either of both sectors, and (ii) the role of home equity in progressing through the market.

Households may have different tastes for housing consumption. Although the Dutch rented market is highly regulated and predominantly social, it does service households up to middle income levels. The rented sector furthermore contains a variety of types of properties, including single-family units. Nonetheless, the average quality of housing in the Dutch rented market is far less than in the owner-occupied sector. Households that have demand for higher quality housing are therefore restricted to owning their property. Moreover, the divide between the owner-occupied and rented sector has allegedly increased over time: our time-varying state dependency findings might simply be the result of this quality divide between both sectors. In order to test this we model households' housing demand in our basic model. We estimate housing demand by the value of the actual housing bundle consumed i.e. the value of the property the household currently lives in. This may be seen as a valid approximation of housing demand as in the outcome equation we only observe households that have recently moved; we may therefore assume that their housing consumption is reasonably reflecting their housing demand. We can only do so in the last three waves of our data, due to data limitations. The results are presented in Tables 4.4 (baseline model without housing demand, 2002 – 2009) and 4.5 (baseline model including housing demand, 2002 – 2009).

Table 4.5: Estimation results of baseline tenure choice model with Heckman correction 02-09

		Coefficient	Std. Error	Sig (p)
Outcome equation: Tenure				
	Previous tenure	0.994	0.037	0.000
	Relative cost	-0.262	0.603	0.664
	Income	0.772	0.033	0.000
	Marginal tax			
	Middle	0.142	0.040	0.000
	High	0.241	0.064	0.000
	Education			
	Middle	-0.249	0.022	0.000
	Low	-0.608	0.035	0.000
	Urbanity			
	Urban	0.062	0.036	0.088
	Moderately urban	0.147	0.037	0.000
	Rural	0.250	0.044	0.000
	Strongly rural	0.247	0.051	0.000
	Type of income			
	Business	0.123	0.038	0.001
	Pension	-0.432	0.055	0.000
	Social welfare	-0.627	0.036	0.000
	Starter	-0.561	0.025	0.000
	Birth year			
	1921-1930	-0.624	0.088	0.000
	1931-1940	-0.159	0.068	0.020
	1941-1950	0.066	0.047	0.165
	1961-1970	0.195	0.036	0.000
	1971-1980	0.339	0.041	0.000
	1981-1990	0.325	0.056	0.000
	1991-2000	0.403	0.416	0.332
	Time			
	2002	0.183	0.037	0.000
	2006	-0.100	0.048	0.036
	Interaction			
	Previous tenure 2002	-0.150	0.046	0.001
	Previous tenure 2006	-0.098	0.054	0.070
	Inverse Mills' ratio	0.176	0.065	0.007
	Constant	-8.847		
Selection equation: Move				
	Age	-1.000	0.011	0.000
	Household composition			
	Couple	0.148	0.010	0.000
	Couple/child	-0.292	0.010	0.000
	Other	-0.154	0.026	0.000
	Constant	2.740		

Source: WBO 2002, WoON 2006, WoON2009, own calculations

We will not discuss all coefficients for these Tables. The most important variables in our model are the previous tenure variable and the time dummy interacted previous tenure variables. We find economically similar results in both specifications. The coefficient on previous tenure hardly changes with the adding of housing demand. The interaction dummies also do not change importantly. Moreover, the results are in line with the general baseline model from Table 4.3. The predictive power of the model is given in similar style as before in Table 4.6. The model's predictive power is also in line with the complete model.

Table 4.6: Predictive power Heckman corrected tenure choice model 02-09

Overall		Predicted		
		Owner	Renter	Total
Observed	Owner	9.496	2.815	12.311
	Renter	2.696	11.213	13.909
	Total	12.192	14.028	26.220
Correct predictions	2002	77,8%		
	2006	79,3%		
	2009	80,1%		
	Total	79,0%		

Source: WBO 2002, WoON 2006, WoON2009, own calculations

Housing demand does significantly increase the probability of owning. The results, however, do not change significantly when not modeling housing demand in the selection equation (which may be expected given the non-significance of correlation of error terms that is indicated through the inverse Mills' ratio in Table 4.7).

Table 4.7: Estimation results of tenure choice model with Heckman correction, housing demand 02-09

		Coefficient	Std. Error	Sig (p)
Outcome equation: Tenure				
	Previous tenure	0.918	0.037	0.000
	Relative cost	-0.486	0.622	0.434
	Value	0.812	0.029	0.000
	Income	0.636	0.033	0.000
	Marginal tax			
	Middle	0.181	0.041	0.000
	High	0.191	0.065	0.004
	Education			
	Middle	-0.196	0.023	0.000
	Low	-0.501	0.037	0.000
	Urbanity			
	Urban	-0.042	0.037	0.263
	Moderately urban	0.013	0.039	0.732
	Rural	0.033	0.045	0.474
	Strongly rural	0.010	0.053	0.848
	Type of income			
	Business	0.006	0.039	0.871
	Pension	-0.415	0.058	0.000
	Social welfare	-0.635	0.037	0.000
	Starter	-0.504	0.025	0.000
	Birth year			
	1921-1930	-0.528	0.093	0.000
	1931-1940	-0.147	0.072	0.041
	1941-1950	0.039	0.050	0.432
	1951-1960	0.178	0.038	0.000
	1961-1970	0.342	0.046	0.000
	1971-1980	0.330	0.062	0.000
	1981-1990	0.268	0.426	0.529
	1991-2000	0.616	0.042	0.000
	Time			
	2002	0.616	0.042	0.000
	2006	-0.055	0.049	0.262
	Interaction			
	Previous tenure 2002	-0.130	0.048	0.007
	Previous tenure 2006	-0.055	0.056	0.325
	Inverse Mills' ratio	-0.063	0.072	0.388
	Constant	-16.221		
Selection equation: Move				
	Value	-0.189	0.007	0.000
	Age	-0.967	0.011	0.000
	Household composition			
	Couple	0.195	0.010	0.000
	Couple/child	-0.213	0.010	0.000
	Other	-0.122	0.026	0.000
	Constant	4.834		

Source: WBO 2002, WoON 2006, WoON2009, own calculations

The model's predictive power is again summarized in a tabulation of observed and predicted tenure. The results are given in Table 4.8.

Table 4.8: Predictive power Heckman corrected tenure choice model with housing demand, 02-09

Overall		Predicted		
		Owner	Renter	Total
Observed	Owner	9.362	2.571	11.933
	Renter	2.249	10.145	12.394
	Total	11.611	12.716	24.327
Correct predictions	2002	79,5%		
	2006	80,0%		
	2009	81,2%		
	Total	80,2%		

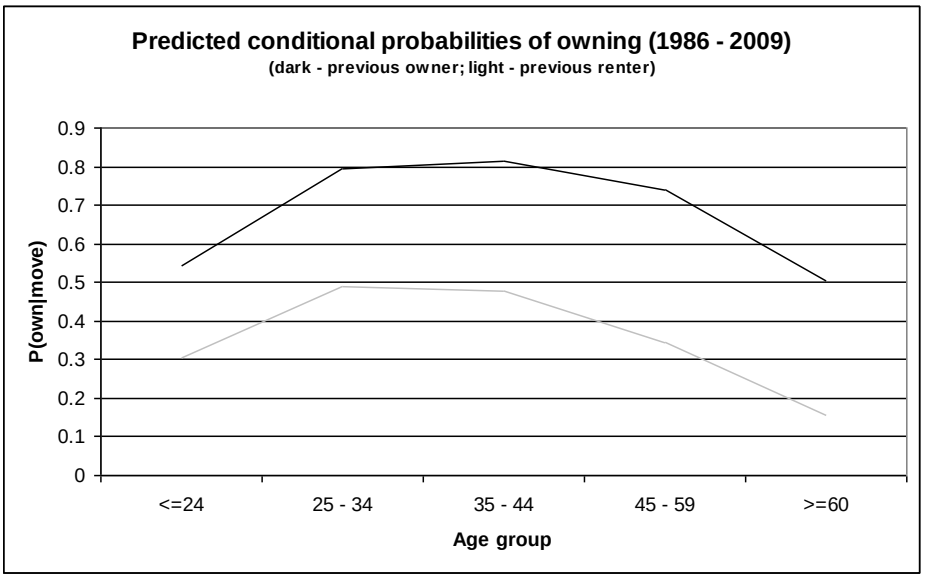
Source: WBO 2002, WoON 2006, WoON2009, own calculations

Given the results presented in Tables 4.5 and 4.7 we may conclude that housing demand is not an important driver of our state dependency results. The insignificant impact of the selection equation when modeling consumption does imply that when taking into account the demand for housing, the question whether or not a household has recently moved becomes irrelevant. This might be the result of the fact that the selection equation captures the general dynamic of renters being more mobile than owner-occupiers. Taking into account the demand for housing, given the setup of the Dutch housing market, captures that dynamic: increasing demand reduces the probability of moving.

We also proposed the impact of home equity as an important driver for our state dependency results. The main idea behind the impact of home equity is that if households wish to move up the housing ladder, they will need home equity as income will not suffice to obtain a full mortgage. Moreover, empirical results by Venti and Wise (1990) and Conijn and Schilder (2010) indicate that households indeed do not spend their home equity, but rather keep it in their dwellings. Given these findings we hypothesize that time-varying state dependency might be the result of households rolling over home equity into (new) dwellings. Owners will therefore remain owners (despite not being forced to do so by institutions); renters, having no home equity, are then forced to consume their housing services in the rented sector. Initial evidence for this has already been presented in the baseline model in the negative coefficient for starters (also with no home equity).

We cannot test this assumption directly by estimating a model with (previous) home equity since this is collinear with the previous tenure. We can, however, estimate a model with total wealth (i.e. home equity *plus* other, non-housing, wealth). We only have an estimate for total wealth for the wave of 2009. The variables relating to time have therefore been removed from the model; all else is equal to the previously presented models. Based on the Heckman-corrected tenure choice models we predict conditional probabilities of becoming an owner. First we present the predicted probabilities for the entire time-period (i.e. the baseline model). Then the probabilities for the wave of 2009 are given: once including a correction for total wealth and once without a correction for total wealth.

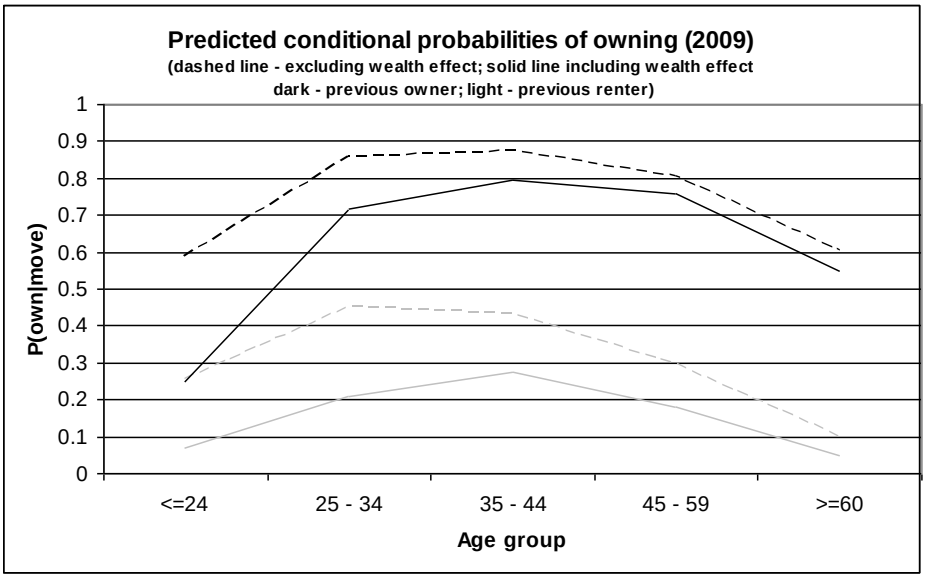
Figure 4.1: Conditional probability of becoming a home-owner by age group and previous tenure



Source: WBO / WoON 1986-2009, own calculations

Figure 4.1 clearly displays a sort of life-cycle effect in housing tenure choice: households are increasingly likely to become home-owners up to some period in life (age group 35 - 44) after which the likelihood of moving into the owner-occupied sector decreases significantly. The shape of the predicted lines are in line with what may be expected based on the general (household) life-cycle theory. The difference in probabilities of becoming an owner between owners and renters is in line with general findings so far and confirms the state dependence in tenure choice.

Figure 4.2: Conditional probability of becoming a home-owner by age group and previous tenure



Source: WoON 2009, own calculations

Figure 4.2 displays a very similar pattern of probabilities as Figure 4.1. The dark lines represent the previous owners' probability of becoming home-owner again after a move. As is the case for the entire period, we observe an increase of likelihood in the

early years of the household and a decreasing probability of moving into the owner-occupied sector as the household progresses in age. The light gray lines display the similar pattern for renters. Also as for the entire period we observe an important difference between owners and renters in the likelihood of becoming home-owner, thus confirming state dependence in tenure choice.

Figure 4.2, however, also displays the different probabilities of becoming home-owner within previous tenure class based on whether the model corrects for total wealth. The wedge between the predicted probabilities based on either model can be interpreted as an indicator of the importance of wealth in the tenure choice decision. Thus, if the difference between the two solid lines decreases compared to the difference between the dotted lines, a part of the state dependence can be attributed to wealth. This, however, is only the case for the youngest age group. In older age groups we find opposite or no effects, implying that wealth cannot explaining state dependence.

6. Conclusion

We find strong evidence for the existence of state dependency in the Dutch housing market. Our findings are in line with international literature in that we find an effect of previous tenure on the current tenure decision. We furthermore find that the impact of state dependency on households' tenure choice decisions increases over time: state dependency therefore seems have increased over the past two decades.

Contrary to international literature we have no institutions that could be seen as the main driver of state dependence. We therefore test two broad hypotheses that may help explain state dependence and its development over time. The first test entails a test of housing demand; households with high demand for housing can only consume housing in the owner-occupied sector. Our test indicates, however, that housing demand can not explain the strong state dependency in our results. A second hypothesis that we test is that home equity gives households an incentive to roll over home equity in a new dwelling: the argument is based on empirical results by Venti and Wise (1990) and Conijn and Schilder (2010). There is no clear economic reason why home equity should encourage state dependency. Nonetheless, we find that households that have older heads, and presumably more home equity, indeed are significantly more likely to make state dependent housing decisions. Home equity thus seems to, at least partially, cause state dependence in tenure choice decisions. We can only indirectly test this hypothesis because of lack of direct wealth data. Further research into the question why there is (time-varying) state dependency in tenure choice is thus needed.

Appendices

Appendix A: estimation of control variables

We estimate two control variables to add to our model: the marginal income tax rate and the relative cost of owning over renting. In this appendix we shortly describe how both variables have been created.

Marginal tax

The marginal tax rate of a household determines its potential benefit from the tax treatment of owner-occupied housing. The higher the marginal tax rate, the higher are also the potential gains from owning. The marginal tax rate is not given in our dataset. De Vries and Boelhouwer (2009) use the average marginal tax rate used to predict the fiscal benefit from owning and set it at 40.5%. Koning *et al.* (2006) find the average marginal tax rate to be 44%. According to Boelhouwer *et al.* (2004) "tax conditions for home owners in the Netherlands were very stable during the last few decades" and they apply a marginal tax rate of 40.5%. Applying a constant marginal tax rate in a tenure choice model gives no satisfactory results: effects caused by the fiscal treatment of the owner-occupied dwelling are then most likely to be captured by income. There is, however, a potential non-linear effect resulting from the different marginal tax rates households have.

The tax system in the Netherlands changed dramatically in 2001. The system before and after 2001 are very hard to compare. Nonetheless, the average tax payer's marginal rate has been relatively stable over time, despite the change. We therefore take the post-2001 system and see which income percentiles qualify for the low rate, which households qualify for the average rate and which households are taxed according to the high rate. In the three waves after 2001 roughly 20% of all households have an income that would qualify for the low rate, and roughly 25% of all households qualify for the high rate. All others are in between at the average rate. We extrapolate these groups to qualify households in earlier waves into either of three groups, based on their applicable income percentile. This thus results in three dummy variables that capture a potential non-linear effect of income on tenure choice resulting from the fiscal treatment of the owner-occupied dwelling.

Relative cost ratio

The relative cost of owning over renting is an important variable for explaining tenure choice. We follow Bourassa and Hoesli (2010) in applying a regional relative cost variable. We first create the relative cost variable by estimating for each household its user cost. This is done in line with Conijn and Elsinga (1998):

(2) $UC_o = I + i*(V-M) + r*V + o*V + PT + PI + Tc + (d-a)*V + F$

(3) $UC_r = R - HA$

I = mortgage interest paid
i = required rate of return on invested equity
(2.8% : 4 required return - 1.2 tax exemption on income from investments)
r = risk premium (2%)
V = value of the property (as assessed for tax purposes)
M = mortgage
o = percentage value of maintenance (0.9%[9])
PT = property taxes (levied by municipalities; on average 0.1%[10] of V)
PI = property insurance (on average 0.1%[11] of V)
Tc = attributed transaction costs (0.5%: 0.2%[12] + 0.3%[13] attributed transfer tax)
a = (expected) appreciation rate (long term annual average taken; 3%[14])
d = depreciation (1%[15])
F = net fiscal benefit mortgage interest deductibility
R = rent paid
HA = housing allowance

We use actual observations from our dataset for all parameters of user cost of the above mentioned formulas, except for *Tc* and *(a-d)*; in those cases we applied a constant percentage of the property value.

The second step of estimating relative cost involves scaling the total user cost to a constant quality consumption unit. This can normally be done using a representative property. However, one of the difficulties in the Dutch housing market is that the difference in average quality between the owner-occupied and the rented sector is so large that a representative average dwelling is inconceivable. The Dutch government, however, has a "rental points system" that is used for setting maximum rent levels under regulation: this system is used to create a constant quality housing consumption unit. The rental points system is a simple score card that attributes points for housing characteristics as floor space and type of dwelling and for the quality of the surroundings, like the proximity to public transport and the availability of schools. Romijn and Besseling (2008) estimate these scores and find a proper fit in the rental sector of their estimate and the actual points as given in the data of 2006. Their

[9] In line with Koning *et al.* (2006).
[10] This is the lower bound reported in Van den Noord (2005); ours is estimated using observations of property taxes levied and house values in the database.
[11] This is in line with Koning *et al.* (2006) and is estimated using observations of property insurance paid and house values in the database.
[12] In line with Koning *et al.* (2006): based on average transaction costs and an average tenancy spell.
[13] Based on Koning *et al.* (2006): Table 1, p. 10.
[14] In line with Koning *et al.* (2006).
[15] Based on an average of the economic depreciation in the owner-occupied sector reported in Conijn (1995) and for the rental sector reported in Conijn and Schilder (2011); 0.83% and 1.3% respectively.

estimates can be extrapolated to the owner-occupied sector in order to come up with the equivalent quality scores of owner-occupied housing. We use the score card syntax from Romijn and Besseling (2008) to do so. Now, the user cost of each household can be scaled to 1 quality unit by dividing total user cost from (2) and (3) by the quality points. We take the regional average score for each of 40 COROP-areas; these are regional areas used by Statistics Netherlands and are very constant over time. The regional relative cost can thus be estimated as follows:

$$(4) \qquad \left(\frac{\overline{(U_{o,i} / Q_i)}_l}{\overline{(U_{r,j} / Q_j)}_l} \right)_l$$

Equation (4) simply says that the relative price ratio of region *l* is the ratio of the regional average user cost of owning per quality unit of all owners in region *l* over the regional average user cost of renting per quality unit of all renters in region *l*.
Our dataset comprises the waves of 1986 through 2009. Not all waves contain all the necessary data to estimate the user cost of owning correctly. We therefore extrapolate the complete ratio to the other waves. The numerator is adjusted using a regional hedonic house price index created from a dataset of the Dutch Association of Brokers and Real Estate Experts (NVM). The index used can be found in Schilder and Conijn (2010) and is estimated for each of the 40 regions separately with annual time dummies. The denominator is adjusted using an index created from the annual rent price adjustments set by the government and is taken from Statistics Netherlands.

Appendix B: transition matrices

Unconditional probabilities

1986		Destination		
		Owner	Renter	Not moved
Origin	Owner	3%	2%	95%
	Renter	4%	9%	87%
	Starter	25%	75%	0%

1990		Destination		
		Owner	Renter	Not moved
Origin	Owner	4%	2%	93%
	Renter	5%	8%	87%
	Starter	27%	73%	0%

1994		Destination		
		Owner	Renter	Not moved
Origin	Owner	4%	2%	95%
	Renter	4%	5%	91%
	Starter	28%	72%	0%

1998		Destination		
		Owner	Renter	Not moved
Origin	Owner	8%	3%	89%
	Renter	9%	12%	79%
	Starter	28%	72%	0%

2002		Destination		
		Owner	Renter	Not moved
Origin	Owner	8%	3%	89%
	Renter	5%	8%	87%
	Starter	30%	70%	0%

2006		Destination		
		Owner	Renter	Not moved
Origin	Owner	7%	2%	91%
	Renter	6%	9%	86%
	Starter	30%	70%	0%

2009		Destination		
		Owner	Renter	Not moved
Origin	Owner	7%	2%	92%
	Renter	6%	9%	85%
	Starter	33%	67%	0%

Source: WBO / WoON 1986-2009

Conditional probabilities

1986		Destination	
		Owner	Renter
Origin	Owner	59%	41%
	Renter	29%	71%

1990		Destination	
		Owner	Renter
Origin	Owner	66%	34%
	Renter	36%	64%

1994		Destination	
		Owner	Renter
Origin	Owner	72%	28%
	Renter	43%	57%

1998		Destination	
		Owner	Renter
Origin	Owner	71%	29%
	Renter	41%	59%

2002		Destination	
		Owner	Renter
Origin	Owner	75%	25%
	Renter	39%	61%

2006		Destination	
		Owner	Renter
Origin	Owner	79%	21%
	Renter	39%	61%

2009		Destination	
		Owner	Renter
Origin	Owner	81%	19%
	Renter	38%	62%

Source: WBO / WoON 1986-2009