Autobezit van huishoudens in samenhang met de woon- en de werklocatie

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Inhoud

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Veel huishoudens ervaren het bezit van een auto als een noodzakelijke basisbehoefte. Bovendien verschuift de beschikbaarheid van de auto voor het huishouden naar beschikbaarheid voor het individu. Dit paper analyseert de mate waarin kenmerken van de woon- en werklocatie van invloed zijn op beslissingen ten aanzien van autobezit, in het bijzonder waarom bepaalde huishoudens geen auto bezitten en andere huishoudens juist meerdere auto's bezitten. Expliciet wordt in de analyse de interactie tussen de partners betrokken, onderscheiden naar geenverdieners, alleenverdieners en tweeverdieners. De hypothese wordt getoetst met behulp van een serie logit modellen op basis van gedetailleerde data. Uit de analyses blijkt dat naarmate de dichtheden van de residential neighbourhood groter zijn en de afstanden tot het station kleiner, de kans groter is dat het huishouden geen auto heeft. Gekeken naar de rol van het werk, blijkt dat tweeverdieners vaker beschikken over een auto en vaker over twee auto's dan alleenverdieners. Bovendien laten tweeverdieners meer invloeden zien van de woon- en de werklocatie.

1. Introduction

The growth in day-to-day mobility in recent decades is due almost entirely to the growth in car use. Three-quarters of Dutch households now own at least one car, and one-fifth owns two or more. Car availability is thus shifting from households to individuals. This trend, which has been seen in the USA for some considerable time and results in a high degree of car-dependency, is now increasingly being observed in Europe. The literature indicates that the causes at macro level are increasing prosperity, the participation of women in the labour force and increasing distances between homes, workplaces and amenities. In terms of households, differences in car ownership are correlated to income, household structure, employment status and urban form (Claassen and Katteler, 1997; Dargay, 2002; Giulinano and Dargay, 2006; Bhat and Pulugarta, 1998; Harms, 2005; Bhat and Guo, 2006). This paper aims to contribute to the debate on urban form and travel behaviour by addressing households' car ownership decisions in relation to residential and work location.

Many households regard owning a car as a basic need. There are substantial differences in car ownership between different residential neighbourhood types. In low-density and rural areas the distances to amenities are greater and there is less public transport, with the result that there is a greater need to have a car than in more urbanised areas. Also, car ownership is more difficult and more expensive in urban areas, owing to more limited parking space, greater congestion, higher insurance premiums, and expensive parking at destinations and in some cases even near the home. In addition to residential location, work location is also a significant factor in car ownership decisions. The nearer the workplace, the greater the likelihood that commuting will be done by bicycle. Moreover, people are more likely to use public transport, when good public transport facilities exist between home and work. Many offices and industrial estates, however, are sited in fairly isolated locations on the periphery of urban areas, thus increasing the need for a car. In the case of dual-earner households both work locations have to be taken into account.

This paper examines the extent to which land use factors relating to the residential and work location affect households' car ownership decisions, in particular why particular households do not own a car, while others own more than one. The analysis looks explicitly at the interaction between the spouses, broken down into non-earners, single earners and dual earners.

The paper is organised as follows. The next section provides a brief international comparison of car ownership and a description of Dutch car ownership based on a long-term survey from Statistics Netherlands (1985-2005). The following section puts forward a conceptual framework based on a review of the literature and the authors' own arguments. As the available Dutch data series does not provide sufficient detail on residential and work location, the hypotheses were checked against the detailed 'Amadeus' survey in the North Wing of the Randstad Holland, part of the densely populated western conurbation. For this purpose a series of car ownership models were estimated using multinomial logistic regression. It was demonstrated that urban form attributes of the residential and work location affect car ownership decisions, including interdependencies between the working partners in the household.

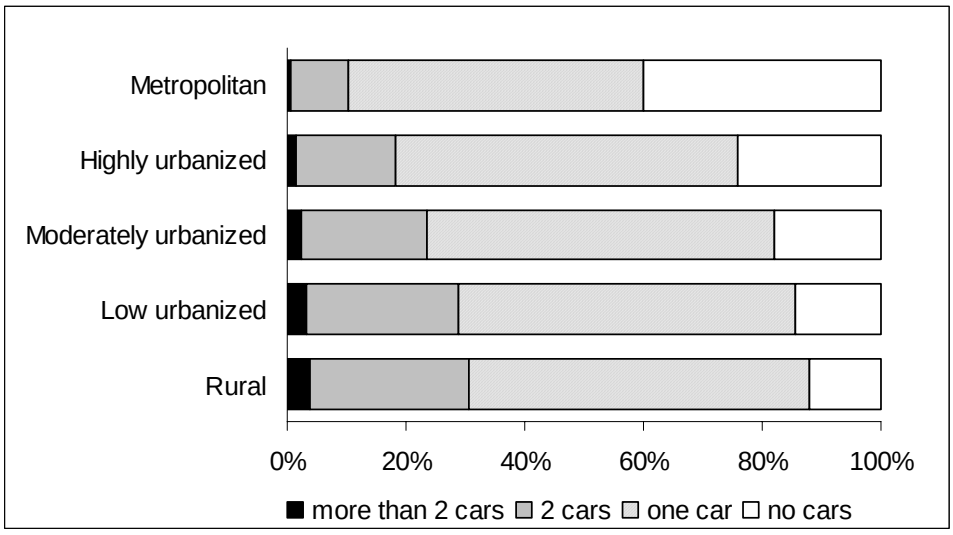
2. Exploration of car ownership

To frame the hypotheses, this section examines car ownership in the Netherlands. In 2002, the ratio of cars per capita was 424. Compared with the USA (776), Canada (550) and the neighbouring countries of Belgium (463), France (490) and Germany (541), this ratio is relatively low (source: Eurostat/DG TREN; UNECE, 2001). By far the most important explanation is probably the high level of cycle use. The Netherlands is flat and well suited to cycling, and the infrastructure is fairly well geared to cycling compared with that in other countries. As a result almost everyone has a bicycle, which is used for more than one-quarter of the journeys on average. An interesting point in comparison with many other countries is that a large amount of cycle use is utilitarian, for trips to the shops, commuting and to connect up with public transport; especially at the home end the bicycle appears to play a large role as an access mode with a share of 35 per cent (Rietveld, 2000). There are other explanations for the relatively low level of Dutch car ownership, however. Taxes on the purchase and use of cars are relatively high. The purchase tax on a car plus the VAT increases the price of a new mid-range car by over half, and the taxes on use, namely motor vehicle tax and fuel excise tax, are higher than in the neighbouring countries. The final explanation is the participation of women in the workforce, which has long remained fairly low in the Netherlands, resulting in less need for a second car.

The number of cars in the Netherlands is growing rapidly, however, from over 4 million in 1985 to about 7 million in 2005. These figures are particularly significant if we relate car

ownership to households. The proportion of car-free households has gradually fallen to 23 per cent, while at the same time the number of households with one car has declined in favour of households with more than one car: 20 per cent of households owned two cars, and 2 per cent even had more than two. As Figure 3 shows, there is a substantial correlation with the degree of urbanisation. There is hardly any variation in the number of households with one car but correspondingly more in households without a car or more than one car: in a highly urbanised area, i.e. the centres of the major towns and cities, 40 per cent of households do not own a car. Part of the explanation may lie in the concentration of low income groups, students and single-person households, but it is reasonable to assume that the high densities and better public transport are also contributory factors. In the rural areas the converse is the case: here almost a third of households have more than one car. This is probably due to the greater distances and less public transport. Even in highly urbanised areas, however, over 10 per cent of households own more than one car.

Figure 1 Distribution of cars per household, by degree of urbanisation (2005)



Source: Statistics Netherlands, 2006

3. Conceptual framework

As most households own one car and generally regard it as a basic necessity, deviations from this pattern are particularly interesting: what factors are involved in not owning a car and owning more than one car per household? In the case of both the first car and subsequent cars,

their purchase adds a certain utility, otherwise households would not buy them (Bhat and Pulugurta, 1998). Aside from attitude arguments such as status, the utility consists mainly in improved access. The extent to which individuals and households are limited in their need for access determines the need for a car, or an additional car. Conversely, other factors may restrict the purchase of a car.

First, the composition of the household is important, in particular the age group of any children it contains. Parents with children tend to engage in many activities, including extra shopping, school runs and visits to sports clubs. The more complex a household's travel pattern, the greater the need for a car, as it is usually faster and thus saves time. A car also facilitates complex combined journeys, e.g. involving taking and picking up children, going shopping and commuting (Maat and Timmermans, 2006). Second, the more participation in the labour force in the household, the smaller the likelihood that it will be car-free and the greater the probability that a second car will be purchased, as work is a necessary activity that has little time and place flexibility (Pas, 1996). Good access to the work location is essential, therefore. On top of this, work reduces the time available for other activities (Golob, 2000), increasing the importance of more efficient travel patterns. Indeed, second-car ownership occurs more among dual earners (Bhat and Pulugurta, 1998). Third, this too is offset by limiting factors. An obvious one is possession of a driving licence: married women in particular did not use to have one in many cases. Another limiting factor is household income: absence of a car is found mainly in the lowest income groups, whereas second cars tend to be found more where incomes are higher (Claassen and Katteler, 1997). A remarkable finding comes from Dargay (2001), who found that the decision to purchase a car when income rises is stronger than the decision to get rid of it when income falls.

Fourth, the main hypothesis of this paper is that residential and work location affect car ownership. As the figures in the previous section and in previous studies (e.g. Giuliano and Dargay, 2006; Schimek, 1996; Salon, 2006) show, there are substantial differences in car ownership between different residential neighbourhood types. We can assume that in low density and rural areas the distances from amenities are greater and there is less public transport, with the result that there is a greater need to have a car than in more urbanised areas. On top of this, car ownership is more difficult and more expensive in urban areas, owing to more limited parking space, greater congestion, higher insurance premiums, and expensive parking, both at destinations and in some cases near the home. Work location can be assumed to be an even more

significant factor in car ownership decisions than residential location. The nearer the workplace, the greater the probability that commuting will be done by bicycle. Public transport will only be used if the services are adequate, not only near the home but above all near the workplace; after all, at the home end the bicycle is usually available to connect up with public transport, whereas the last stageto the workplace usually has to be travelled on foot. The likelihood that the car will not be used can therefore be regarded as depending to a large extent on work location factors. The fact that many offices and industrial estates are sited in fairly isolated locations on the periphery of urban areas increases the need for a car.

In the case of dual-earner households we need to take both work locations into account. Bhat and Guo (2006) are among the few authors who include work location in their model, but they did not look at interaction within the household. Other authors have taken the household as the unit of analysis but not considered work location (Bhat and Pulugurta, 1998; Potoglou and Kanaroglou, 2006). This paper proceeds from the assumption that a household is more likely not to have a car if the spouses do not need one for commuting. In the case of people who go out to work this is the case if the workplace is within cycling distance, or the home and the workplace are accessible by public transport. We hypothesise that the probability of a second car is related mainly to whether the household has dual earners, and that it increases the less accessible the two workplaces are by bicycle or public transport. The likelihood increases still further with children in the household and higher incomes.

4. Data and method

This paper is one in a series of studies requiring detailed travel data and geographical positioning at a low level of scale. As the Dutch Travel Behaviour Survey does not provide sufficient detail, a special survey was carried out in the north wing of the Randstad in 2000. This region has a wide variety of urban forms, including the cities of Amsterdam and Utrecht, surrounding suburbs, a number of medium-sized and smallish towns and a few villages in the rural areas. The Amsterdam region is more densely populated and employed than the Utrecht region. One city, Almere, is a large polycentric ‘new town’, situated on an island of reclaimed land, and consequently somewhat isolated. A more detailed description is provided in Maat and Timmermans (2006).

The survey was conducted on individuals in households, but the unit of analysis was the household. For this study, therefore, we selected adults in complete households, i.e. single-person households and households of cohabitees and married couples in which both partners completed the questionnaire. As households were differentiated by interaction between men and women, in the case of cohabitees they were further selected by man-women relationships. Although the entire survey involved just under 3,000 respondents, the work location was only known in the case of 1,630 of them. Further selection by complete households finally left 1,222 respondents, divided up among 738 households, comprising 488 couples and 254 singles.

The respondents completed a questionnaire on individual and household factors and kept a diary for two days. The socio-demographic variables employed corresponded to those used in similar studies, obviously including age, gender and household composition. The dummy variable ‘couple’ indicated whether the respondent was cohabiting or single. Three dummies indicated the presence of children in the household, specifically under the age of 6, aged 6 to 12, and 13 to 18. These categories more or less reflect three stages of independence, namely pre-school, primary school and secondary school. Household income was broken down into below modal, between 1 and 2 times the modal, and more than 2 times the modal (modal income in the Netherlands at the time of the survey was around 50,000 guilders and is now around €30,000). For the sake of convenience we refer to these as the lower, middle and higher income groups respectively. We also indicate whether the respondent was in a non-earner, single-earner or dual-earner household, and there is a variable that indicates which partner has the longest working week. A dummy variable indicates whether the house is a single-family dwelling or a multi-storey apartment. The number of persons with a driving licence was not included, as this is a factor in car ownership level. Car ownership was measured as no car, one car, or two-or-more cars.

The urban form indicators were available for both the residential and work locations of both partners where applicable: we used urban density, urban level and distance from a railway station. Urban density was measured on three levels of geographical scale, namely within a 400-metre, 2.5-kilometre and 10-kilometre radius of the residential or work location: we refer to these as micro, meso and macro scale respectively. The urban level indicates whether the home is in a core city, a suburb or an area with a low level of urbanisation. Distance from a railway station was examined as a continuous variable and a discrete variable, namely more or less than 2 kilometres from the home (cycling distance) and 400 metres from the workplace (walking

distance). Distance and travel time to work was also examined, and there is a variable that indicates which partner has the longest travelling distance.

The analysis used multinomial logistic regression models. The parameters were expressed as odds ratios, i.e. the probability of a household not having a car in relation to that of it having one car (one car is the reference category). If the odds ratio is higher than 1 the probability of there being no car is higher, and vice versa. This also applies to the likelihood of there being at least two cars in relation to the likelihood of one. The pseudo R^2 shown is from Cragg and Uhler and is comparable to an R^2 value in linear regression.

5. Results

An initial analysis broadly confirms the expectations (Table 1). Couples are more likely to have a car, and of course a second car, than singles. Indeed, the number of cars per person is higher among couples. If we classify couples by the number of earners per household we find that dual earners are less likely not to have a car and more likely to have a second car. Interestingly, there is more likely not to be a car if the woman is the breadwinner and more likely to be a second car if the man is the breadwinner. This may be related to the fact that men generally earn higher incomes.

The average figures relating to residential environment show a clear correlation with car ownership, especially where micro residential density is concerned. The correlation with workplace density is not so strong. The correlation between car ownership and commuting distance differs between men and women: in households with two cars men travel greater commuting distances, whereas female single earners travel less if there are two cars; female dual earners travel more if there is no car, which may be related to other factors such as age. Where women have the longest commuting distance there is more likely not to be a car; where men travel the longest distance there is more likely to be one car, or two cars.

Logistic regression models were used to test the hypothesis that car ownership depends on both residential and work location factors. As the number of work locations included in the models depends on the number of partners who go out to work, separate models were estimated for single earners and dual earners. To gain a better understanding of the role played by work location, models were first estimated for all the respondents with only socio-demographic and residential location factors (I), a model for single earners (II), and a model for

dual earners (III). Models were then estimated including work location, for single earners (IV) and dual earners (V). Table 3 shows the models, which compare no car and two-or-more cars with the reference category of one car per household. The models include micro density and distance from a railway station for the residential and work location, the urban form indicators that best explain car ownership, in line with Bhat and Guo (2006). Other factors were nevertheless also tested, viz. density at meso and macro level, mix of uses, and urban level, but because of the correlations between them it was not possible to include all indicators together in the models. Table 2 shows how these other factors evaluate.

In order to describe car ownership for all respondents, Model I does not include work locations. Only a small number of household factors were identified as being significant. The presence of children was expected to increase the probable number of cars, but this could not be proved. Other factors do however display the expected effects: singles and the lower income groups are more likely not to have a car, whereas couples are of course more likely to have two, as are the higher income groups. A single-family dwelling reduces the likelihood of there being no car: although this includes some effects of income and household size, it makes most sense to explain it by the fact that there is usually more room for a car near a single-family dwelling. The residential environment is seen to have a major effect: the higher the density of the residential environment, the greater the probability that the household will not have a car. The separate models for single earners (II) and dual earners (III) show similar signs, but their explanatory power is much stronger in the case of the single-earner model. Probably the choice is fairly straightforward for this group, whereas the choice facing dual earners is more complicated. There are some interesting differences between the two models: single earners are more likely to have a second car if there is a young child in the family and if they live in a single-family dwelling.

The models that include work location (IV and V) display a somewhat better model fit, which shows that this factor does have some influence. Density was not observed to have any significant effects, though distance from the station was: the greater the distance between the station and the workplace of male dual earners, the higher the probability of there being a second car. Lastly, we tested the influence of number of days worked or distance from the workplace and whether there were interdependencies between the partners, but the models did not confirm the observations from the univariate tests.

Table 1 Descriptives

No. of cars per household (incl. percentage)	No car		One car		Two+ cars		Total	
Singles								
Non-earner	22	(46%)	26	(54%)	0	(0%)	48	(100%)
Earner (man)	26	(35%)	48	(64%)	1	(1%)	75	(100%)
Earner (woman)	61	(47%)	70	(53%)	0	(0%)	131	(100%)
Couples								
Non-earning partners	6	(15%)	20	(50%)	14	(35%)	40	(100%)
Male breadwinner	7	(9%)	40	(49%)	35	(43%)	82	(100%)
Female breadwinner	3	(14%)	9	(43%)	9	(43%)	21	(100%)
Dual earner family	39	(11%)	204	(60%)	98	(29%)	341	(100%)
Total	164	(22%)	417	(57%)	157	(21%)	738	(100%)
All households								
Residential micro density	0.20		0.12		0.09			
Residential meso density	0.21		0.14		0.10			
Residential macro density	0.08		0.06		0.05			
Density/mixture	0.24		0.22		0.18			
Distance to railway station	15.91		19.16		27.71			
Workplace density man	10.92		13.00		13.33			
Workplace density woman	12.59		9.95		9.85			
Single income household								
Commuting distance man	21		19		-			
Commuting distance woman	12		19		-			
Dual income household								
Commuting distance man	22		25		29			
Commuting distance woman	21		15		16			

Table 2 Urban form at various levels of scale

	No car		Two/more cars		
Land use indicator	exp(B)	sign.	exp(B)	sign.	ML R^2
Micro density	35.69	0.00			0.323
Meso density	15.24	0.00	0.07	0.02	0.322
Macro density			0.00	0.00	0.311
Density/mixture	8.31	0.07	0.01	0.00	0.316
Entropy	4.48	0.02			0.308
Distance to railway station	1.01	0.00	0.00	0.00	0.312
Urban level (reference: suburbs)					0.327
Core city	1.78	0.01			
Low urbanized	0.46	0.00			

Table 3 Logistic models of car ownership

	(I) All households				(II) Single earner household				(III) Dual earner households				(IV) Single earner households				(V) Dual earner households			
	No car		Two+ cars		No car		Two+ cars		No car		Two+ cars		No car		Two+ cars		No car		Two+ cars	
	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	exp(B)	sign.	EXP(B)	sign.
Householdtype couple	0.53	0.01	55.44	0.00	0.402	0.05	40.26	0.00	0.00	0.00	0.00	0.00	0.42	0.07	59.39	0.00	0.000	0.00	0.00	0.00
Children (reference: no children)																				
< 6 years															3.75	0.03			0.00	0.00
6 - 12 years																			0.00	0.00
12 - 18 years																				
Income group (reference: middle incomes)																				
Lower income group	4.05	0.00			3.424	0.00			4.62	0.01			3.47	0.00			4.503	0.01		
Higher income group			1.75	0.01			2.58	0.04			1.94	0.02			3.18	0.02			2.02	0.01
Single family dwelling	0.66	0.09					10.72	0.05							17.92	0.02				
Residential density	33.07	0.00			39.347	0.00			25.81	0.07	0.00	0.01	41.10	0.00			20.370	0.10		
Distance to railway station																				
Home			1.01	0.00			1.02	0.02	0.96	0.05					1.03	0.00	0.963	0.09		
Workplace	•		•		•		•		•		•				0.96	0.00	•		•	
Workplace man	•		•		•		•		•		•		•		•				1.20	0.03
Workplace woman	•		•		•		•		•		•		•		•					
ML R^2				0.332				0.508				0.179				0.553				0.205
N				729				305				336				305				336

• not included in the model
reference category = one car

6 Conclusions

Car use begins with car ownership. Many households regard owning a car as a basic necessity. Also, car availability is gradually shifting from households to individuals. This paper defines car ownership as no car, one car per household or more than one car per household; the latter amounts to individual car ownership. We tested the hypothesis that car ownership is correlated to the urban form of both the residential and work location. This implies, moreover, that there is interaction between the spouses, especially if both of them go out to work. A series of logitic models based on detailed data were used to test the hypothesis.

The analyses showed that the larger the density of the residential neighbourhood and the smaller the distance from the station, the higher was the probability of the household not having a car. This is consistent with the theory as set out in the literature. Looking at the role played by work, we found that dual earners were more likely to have a car and more likely to have two cars than single earners. None of the effects of density were significant, however; the probability of a second car was only higher, the farther away from the station the male partner in a dual-earner household worked. This could mean that a male partner is more likely to feel the need for a second car than a female partner. The interaction between partners was further tested by examining whether it mattered who had the longest commuting distance, but this did not have any observable effect.

Summarizing, residential location factors influence whether a household has a car or not. There is a correlation between household partners' participation in the labour force and car ownership; moreover,dual workers show more influences of urban form, including the work environment.

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