

# Dual car ownership: the role of intra-household interaction, the commute and the spatial context

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## Abstract

In this study it is assumed that in households with two partners, the purchase of a second car is a means to give both partners full access to driving. A car is thus no longer a household good, but an individual transport mode that allows both partners to travel independently of each other. Since this involves additional costs, it can also be assumed that households do this primarily if it is necessary for commuting. Data were collected in urban regions of seven countries around the North Sea (2014). This approach increases generalizability, although country comparison was not an objective. Logit models were estimated on couples and dual earners with at least one car. Household and individual characteristics for both partners were collected, including characteristics of work and car. The models show that dual earners are more likely to opt for an extra car. Income and the residential environment, including parking space play a role. Households tend to own an extra car if a company car is provided by their employer. Intra-household interaction shows that not only the own commute and work location characteristics exert an influence, but especially the sum of work location characteristics of both partners, for example if both have free employer-provided parking space. Limited influence of attitudes suggests that purchase is a functional decision. Households own an extra car simply because it is provided by their employer. This suggests that car dependency can be avoided by addressing workplace accessibility.

## 1. Introduction

In Europe, as elsewhere, car use has continued to grow, despite decades of mobility policies to keep growth under control (Gössling and Cohen, 2014). Widespread car ownership is an important driving force of social and economic life in modern societies. Rapid growth in car ownership is observed not only in emerging countries such as China and India, but also in Europe (Eurostat, 2019). Here, it is the trend towards multiple cars per household that now drives further growth. At present, it is highly uncertain how car ownership will evolve. Further growth is possible, as electric vehicles eventually become cheaper than current fuel-based cars and gradual automation makes driving accessible to more people (e.g. Legacy et al., 2018), although fully autonomous driving is likely to be far away. On the other hand, ride-sharing (such as Uber) and car sharing initiatives may reduce ownership.

Car ownership has been recognised as a key determinant of the travel behaviour of households, which is not surprising, as no other transport mode is so flexible. For daily use, cars are generally faster than other travel modes on most distances, are able to use a finely meshed network and can be parked almost on the doorstep of any destination. All other modes have serious limitations in either covering distances or reaching destinations directly. Accordingly, car owning households have more flexible activity patterns (e.g. Salomon and Mokhtarian, 2001; Bhat and Pulugurta, 1998).

The role of cars in shaping travel behaviour is significant because households purchase their cars in order to be able to realise their desired activity patterns. They are constrained however, by household composition, labour participation, residential and work locations. The more complex the household situation is, for example due to dual-earnership and long commute times, the more cars can help to cope with these constraints. Hence, in a hierarchy of choices, car ownership can be considered as a mediating link, between constraints and daily travel needs (Ben-Akiva and Atherton, 1977; Van Acker and Witlox, 2010).

Households with two partners are mutually dependent with regard to the use of the car. If both partners want to use the only car simultaneously, for example if the bicycle or public transport is not an option for either partner, they may consider a second car. The purchase of a second car is a fundamental change for households because the car no longer functions primarily as a household good (Maat and Timmermans, 2009), but as an individually available good, just like a bicycle. The analogy with the telephone is obvious, where the emphasis of the home telephone also shifted to individual telephones.

Many studies have been conducted into car ownership, usually by explaining the number of cars owned by households (see next section). However, little attention has yet been paid to the view that the purchase of a second car by households with two household heads, in particular dual-earners, gives individual freedom with respect to car use. The present study is based on the hypothesis that dual-earner couples opt for a second car if both have to commute and accessibility by other modes of transport takes (considerably) more time or effort. The study also assumes that the built environment has an important role to play, for example because of the availability of parking spaces on the home and work sides of both partners.

Not taken into account are second cars which are unavailable to partners but owned by children living at home, as well as situations in which only one partner has access to cars, which means they do not contribute to the individual car availability of the other partner.

Insight into mechanisms behind individual car ownership is needed for a number of reasons. Individual car availability increases the likelihood of car dependency, partly through habituation, partly because society will adapt to it. Further growth in car ownership leads to more use of space and more car use, with detrimental consequences for society and the environment. Further knowledge helps to develop other solutions for the accessibility needs of households.

## **2. Brief literature discussion**

Many studies show a positive relationship between car ownership and the number of adults in the household, which is even stronger when they have a job (Caulfield, 2012; Anowar et al., 2016; Kim and Mokhtarian, 2018; Clark et al., 2016). Although income appears to be related to car ownership (Van Acker and Witlox, 2010; Kim and Mokhtarian, 2018), it is still a complicating factor. While the need for a car can be felt, income can be a barrier. On the other hand, wealthy households can buy a second car without a direct need. The presence of children is often a reason for car ownership (Clark et al., 2016; Oakil et al., 2014). The effect of children with a driving licence, but without a car is hardly addressed by the literature.

The residential environment has been extensively researched and appears to be related to car ownership from various points of view (Cao et al., 2007), including the supply of parking space and parking costs (Giuliano and Dargay, 2006). Van Acker and Witlox (2010) and Cao et al. (2019) found that distance to city centre also plays a role, in addition to neighbourhood level determinants, and

supply of public transport (e.g. Caulfield, 2012; Habib, 2015). Zegras (2010) demonstrated that the purchase of the first car is mainly determined by socio-economic factors, while subsequent cars are more dependent on the built environment. Contrary to the effect of the number of workers in the household, relatively little attention is paid to the commute and characteristics of the work location. Some studies include potential employment accessibility (e.g. Bhat and Guo, 2007), however, no studies have been found that include characteristics of the work locations of both partners. A complicating factor that has rarely been researched, but has a direct impact, is whether employees get a company or leased car through their employer. For employees, this is financially more beneficial than buying a car themselves (Van Ommeren & Gutiérrez, 2013).

Finally, several authors report the importance of attitudes, such as the extent to which people feel positive about car use. It has been shown that residential self-selection plays a role in this (Mokhtarian & Cao, 2008). Recently, Kim and Mokhtarian (2018) convincingly demonstrated that “auto-oriented” people tend to own more cars with higher incomes, while “urbanites” are more sensitive to the built environment.

### **3. Data**

The data were collected by a survey conducted in urban regions around the North Sea, i.e., the UK, Norway, Sweden, Denmark, Germany, the Netherlands and Belgium (NSR, 2014). The international approach enhances the generalizability of the results. Comparison between countries is however, not an objective of the study. The survey was conducted among households in an existing panel, among households with at least one car. A total of 2,739 households completed the survey, of which 1,737 are couples; the remaining households include single households (without a partner), with or without children or with other housemates. Same-sex couples were excluded as male-female interactions were modelled. Among the couples, 938 households have a second car, of which 642 are dual earners. The online survey was conducted with a household head and consisted of general household questions and individual questions about the respondent and, in the case of couples, his or her partner.

Socio-demographic household variables are household type (single or couple), presence of children living at home; presence of children with a driving licence; and net monthly household income. For both partners, gender, age, the possession of driving license and work status were asked. Both partners had to indicate whether they have exclusive or the shared use of the first, and if present, the second car. It was also asked which partner is the main user or whether there is shared use for each car, and whether the children also drive the parents' cars. Any other cars were not taken into account. Attitudes were measured by using 7-point Likert scales, and include the perception of a car as a status symbol, or purely as a means of transport, as well as environmental and health concerns.

The residential location is a perceived classification (with the help of a schematic map) of inner city, city neighbourhood, outskirts or suburb, and village or countryside. The housing type is perceived as apartment, row or town house, semi-detached, and detached house. The availability of parking space was requested for both cars, here distinguished between own garage/carport versus public parking. Perceived accessibility by bicycle and by public transport were requested in ordinal classes.

Characteristics of the commute and work locations were asked. A distinction was made between respondents who work from home, who have one or more permanent external work locations, or who regularly change workplaces. The commuting distance is available in classes, where a distance within 10 kilometres was considered bikeable. The work location was classified into the same categories as the residential location. It was indicated whether commuters travel within or between

inner cities as an indication of whether public transport availability. The parking situation at the work location was requested in detail, but here limited to having free employer provided parking.

#### 4. Model results

The availability of a second car in the household was estimated by developing binary logit models, with the effects represented as odds ratios (OR). A model with all respondents, i.e. both singles and couples, is not shown as it does show that couples are more likely to have an extra car, but the main purpose of this study is to explain whether households purchase a second car for commuting purposes. Therefore, the model in Table 1 is only estimated for couples, with both working and non-working partners, i.e. excluding work characteristics. The McFadden  $R^2$  of 24% indicates a good model fit.

Table 1. Binary logit model of the availability of second car in couple households

	Odds Ratio	P-value
Dual earner couple	1.55	0.001
Net monthly household income	1.42	0.000
Both partners have driving license	7.07	0.000
Children drive parents' car	1.65	0.009
Company car in the household	7.64	0.000
Dwelling type (apartment = ref.cat)	0.00	0.000
Row house, town house	1.34	0.087
Semi-detached	1.34	0.151
Detached, villa	4.54	0.000
Parking in own garage or own lot	0.57	0.000
Bicycle friendliness res. neighbourhood (unfriendly = ref.cat.)	0.00	0.000
Hardly friendly	0.46	0.034
Fairly friendly	0.40	0.005
Completely friendly	0.37	0.003
	0.00	0.000
Residential location type (inner city = ref.cat.)	0.00	0.000
City neighbourhood	1.40	0.099
City edge/outskirts	1.31	0.185
Village/rural area	1.83	0.006
	0.00	0.000
Attitude: car is just a travel means	0.93	0.050
Attitude: health	0.82	0.000
Constant	0.17	0.000

N=1570, McFadden  $R^2$ =24%

The OR suggests that dual earners are more likely to have a car. A higher household income (which, of course, is also more common among dual earner couples) shows that income can be a limitation for car ownership. If one partner does not have a driving licence, the second car is useless to that partner, and this is evidenced by a high odds ratio for this variable. At the same time, the lack of a driving license indicates that the urgency for a second car is apparently insufficient. The other results in this model are fairly similar to the following model and are discussed below.

The model in Table 2 has been estimated for dual earner households where both partners have a driving licence, i.e. for households who have the option to obtain individual flexibility by means of a second car. The number of available households meeting all the conditions and having no missings in the independent variables is 655. The role of income turns out to be less pronounced than in the

previous model, as all households have a double income. Families in which children have a driving licence are more likely to have a second car, perhaps because this reduces the risk of a conflict of interest. Particularly striking is the role of the company car, for which the odds ratio is almost 10 times higher. Commuters who have a company car at their disposal will be expected to make use of it, so in principle this car is rarely available to the other partner, so it is more obvious to buy a second car for the other partner. Also, a company car costs little for the user, so income can be used for a second car.

Table 2. Binary logit model of the availability of second car in households with dual earners with driving licence

	Odds Ratio	P-value
Net monthly household income	1.30	0.003
Children drive parents' car	1.61	0.088
Company car in the household	9.62	0.000
Dwelling type (apartment = ref.cat)		
Row house, town house	1.72	0.047
Semi-detached	1.96	0.035
Detached, villa	5.24	0.000
Parking in own garage or own lot	0.43	0.000
Bicycle friendliness res. neighbourhood (unfriendly = ref.cat.)		
Hardly friendly	0.24	0.050
Fairly friendly	0.18	0.010
Completely friendly	0.16	0.008
Work within biking distance		
For one partner	0.55	0.009
For both partners	0.37	0.000
Free parking at work location		
For one partner	1.38	0.237
For both partners	2.31	0.001
Commuting inside or between inner cities		
For one partner	1.31	0.339
For both partners	0.49	0.005
No fixed worklocation(s)		
For one partner	1.90	0.036
For both partners	1.23	0.781
Attitude: health	0.75	0.000
Constant	7.68	0.013

N=655, McFadden R<sup>2</sup>=26%

The residential environment appears to be of great influence. Occupants of an apartment are the least likely to own an extra car. Residents of single-family dwellings more often have a second car and that becomes more likely with more space around the house, especially if the house is detached. The negative effect for parking on the own parcel could be an indication that public parking space is limited; this is especially the case for apartments with semi-private parking facilities. Contrary to the model with all households, the residential location type within the urban area is not significant. Another significant aspect of the neighbourhood is its bicycle friendliness, which makes a second car less likely.

The effects of the work location are as expected. The effects should be read as the effect for one partner (relative to none) and the effect for both partners (relative to none). It appears that if one partner works at a bikeable distance, the chance almost halves, and if both partners work at a bikeable distance, it drops further. It is quite conceivable that these values would be even smaller

had they been measured for a shorter cycling distance, since 10 kilometres is fairly long. Furthermore, it should be noted that a short distance may also indicate walking or using urban public transport. The negative effect of commuting within or between inner cities is probably due to the fact that inner cities are often better connected by public transport than neighbourhoods outside them and have lower parking supply and/or higher parking costs. The parking situation at the work location is interesting: the effect for one partner is insignificant, but if both partners can easily park, the odds ratio more than doubles.

Finally, regarding the attitudes, neither the status of a car nor a concern with the environment is of influence. This suggests that the purchase of a second car is quite a functional choice. Only one attitude has an effect: the more people consider their health, the lower the odds ratio for an extra car.

## **5. Conclusions and recommendations**

This paper assumes that in households with two partners, the purchase of a second car is a means to give both partners full access to driving. A car is thus no longer a household good, but an individual transport mode that allows both partners to travel independently of each other. Since this involves additional costs, it can also be assumed that households do this primarily if it is necessary for commuting. Indeed, the models showed that dual earners are more likely to opt for an additional car. This is even more the case for work locations with too long to cycle distances. At the same time, the availability of parking space at home and both work locations is also necessary, as well as enough income to afford an extra car.

On the other hand, it is also possible that commuters prefer to travel by car anyway, unless they are constrained. The stimulating availability of free parking space on the employer's property suggests this. In any case, the limited influence of attitudes suggests that the purchase of a second car by dual earners is primarily a functional decision. Finally, the role of the availability of a company car in increasing the chances of owning a second car is striking.

Recommendations for policy can be clear. Second cars are largely purchased out of the need to be able to reach the work location. Providing access to work locations with active modes or public transport will reduce dependency. The results also highlight the need for employer targeted policies such as providing compensation for purchasing (e-)bikes or using public transport for work commute trajectories. Perhaps even the need for company cars can be reduced in this way. This is important, because the trend towards individual car availability breeds car dependency and even more car travel.

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