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The Effect on Car Ownership of Changes in Household Size and Location – Descriptive analyses based on panel household data

by

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Abstract:

Based on a large household panel data set we describe the change in average car ownership of households experiencing changes in household size and of households moving between urban and rural areas. The descriptions show that there is an asymmetric effect on car ownership in the sense that downwards adjustments are less frequent than upwards adjustments after changes in specific socio-economic conditions. This can be interpreted as a ratchet effect in car ownership.

Key words: Car ownership, household panel data, household size, state dependence, ratchet effect

1. Introduction¹

A large number of studies has demonstrated that the level of car ownership is increasing with the size of the household and that the level of car ownership is lower in urban areas as compared with rural areas. Most of these studies are based on cross section data. It is often noted that cross section data provide information on the long-run effect on car ownership of changes in socio-economic characteristics like household size and changes in urbanisation/settlement patterns. However, it should be recognised that the adjustment over time in car ownership after changes in socio-

¹ The research and the construction of the database were supported by the Danish Environmental Research Programme and AKF. The authors are grateful for valuable comments to earlier drafts by John Thøgersen and Lars Gårn Hansen, as well as for excellent research assistance by Thomas Lundhede and Marianne Schiöppfe.

economic characteristics is not observed in a cross section, due to the lack of information on the history of the characteristics of each household unit. This has two implications. Firstly, because the adjustment process is a black box, it is not possible to make short-run forecast. Secondly, if it takes several years to adjust, then it is not certain that cross section studies really do reveal the true long-run relationships, because a large number of households at a certain point in time may still be adjusting to changes that have occurred in the past.

In this study we use a unique household panel data to describe the adjustment in car ownership to changes in household size and location. These variables are usually not devoted much attention in cross sectional studies of car holdings. This study shows that the picture is not quite as simple as assumed in cross sectional studies. The description also casts light on the extent to which there is asymmetry in the effect and the speed of adjustment. This can be used to illustrate, whether households with car ownership tend to keep their car despite changes in socio-economic characteristics, which normally would imply a lower level of car ownership. To give an example, households moving from an urban to a rural area will, on average, increase car ownership, but will households making the opposite move from rural to urban areas reduce car ownership to the same extent?

In the analyses we use a simple descriptive approach, where we follow average level of car ownership for a large number of households before and after changes in household size and before and after moves from urban to rural areas (and vice versa). This gives us a visual indicator of the effect and the adjustment speed. It is acknowledged that the approach has drawbacks. For example we do not estimate coefficients allowing us to perform forecasts, and the descriptive approach does not allow us to control for changes in other socio-economic variables that may have an impact on car ownership as it is possible in standard probit or logit models with discrete outcomes. However, we try to compensate for the latter problem by breaking the observations down in fairly homogenous groups (to the extent that this is possible). In addition, differences in income between the different groups are partly taken into account by using income elasticities for car ownership obtained from other sources.

It should, however, also be recognised that the statistical methods that are currently available to describe the dynamics of car ownership based on micro panel data, also have limitations. Thus, it may be difficult empirically to distinguish between state dependence (i.e. past car ownership increases the probability of car ownership in the future) and unobserved heterogeneity,² and the distinction will in any case be subject to arbitrary distributional assumptions with respect to the unobserved heterogeneity and the treatment of the initial observation. For general discussions of dynamic panel models, see e.g. Wooldridge (2002) or Heckman (1981), while applications of such models to car ownership can be found in Bjørner and Leth-Petersen (2004) and Kitamura and Bunch (1990). By this we do not mean that the descriptive graphs presented here are superior to dynamic discrete panel models, but we think that the descriptive analysis provides useful supplementary evidence for improving the understanding of transport behaviour.

A number of previous studies has used panel data to analyse car ownership. In addition to the two studies mentioned above, other examples include Thøgersen (2004), Meurs (1993), Golob (1990) and Goodwin (1988). However, to our knowledge all previous micro panel studies rely on information collected from surveys or travel diaries. These survey panels typically contain

² In the literature on dynamic discrete choice models persistence in the endogenous variable (say car ownership) related to unobserved heterogeneity due to time invariant differences in preferences has been labelled "spurious state dependence".

information for a relatively small number of respondents (cost of data collection), they are available only for a relatively short time period, and due to non-participation and attrition (self-selection) it is not certain that they are representative. The panel data applied in this study is based on information collected from official registers from which we have obtained annual household data for a relatively long time period (1992 to 2001). For each household we have information on car ownership as well as socio-economic characteristics like household size and municipality of residence. Data are collected for a random sample of 10% of the adult Danish population, covering more than 400,000 households each year. By nature there is no problem with non-response and attrition is limited to “natural” causes like death and emigration.

In the analyses we focus on the effect on car ownership following changes in socio-economic characteristics that has a discrete nature, so it is easier to identify a before and an after situation. More specifically, we describe the impact in car ownership for households moving from an urban area to a rural area (and vice versa) as well as the impact of changes in household size. Here we look at households having their first child in the observation period. We also analyse the impact on car ownership when two singles become a household and the household break-up due to separation. It appears from the analyses that households that have previously had a car do not reduce car ownership even though change in socio-economic conditions would imply a reduction in car ownership. This can be described as a ratchet effect in car ownership.

In the next section we describe the database. In section 3 we briefly present car ownership for different types of households using cross section data for a single year. In section 4 we make use of the panel nature of the data by looking at the change in car ownership following changes in socio-economic characteristics. In section 5 we relate the empirical observation to the literature on state dependence and habitual travel behaviour. Section 6 contains the conclusion.

2. Description of data

The panel database was constructed by linking information from different official registers via the CPR-number that is specific to each person in Denmark. Starting point was a random sample of 10% of the adult population. Information was collected for the selected person as well as his/her spouse/partner in order to obtain information at household level. Here a household is defined as a unit consisting of 1 or 2 adults and their children. Two adults living at the same address are considered to belong to the same household if they are married, or have common children, or if they are of the opposite sex and the age difference is less than 15 years (taking into account non-married couples living as if they were married). Households with two adults will subsequently be denoted *couples*, while households with 1 adult will be denoted *singles*.

Information about private car ownership was obtained from the Danish Central Register for Motor Vehicles, which contains records of the dates for start and stop of ownership for all owners during the life of a vehicle. The information is considered very reliable as it is used to collect annual ownership taxes. Based on this information we calculated the degree of private car ownership during the year for each individual and household. Company cars available to private households, but owned by a company was linked using information from the Danish tax register (as individuals with a company car in Denmark are to pay income tax on the benefits of having a car at their disposal). In the analyses presented we include both types of car holding (private ownership and company cars), denoted in the following as car ownership.

Socio-economic variables related to the household were extracted from the different official registers. Besides demographic information we also have information on income (before and after tax). Based on the municipality of respondents' home we define three levels of urbanisation, namely urban, intermediate and rural. Information on car ownership and other variables was available from 1992 to 2001.

For some of the analyses presented later different sub-samples were selected. The selection criteria will be described when relevant, but in all cases we have excluded adult individuals still living with their parents as well as joint households, i.e. where there are several households (singles and/or couples) living at the same address.³ Furthermore, we only include households that are in the database in the whole time period (balanced panel).

3. The impact of household size and location on car ownership using cross section data

As a point of departure we use cross section data for the year of 1996 to describe the relationship between car ownership versus household size and urbanisation. In figure 1, as well as in the other figures in the paper, the vertical axis is the average level of car ownership.⁴

It appears from the figure that households with children on average have higher levels of car ownership, while singles have lower average car ownership than couples. Finally, (single) females have lower levels of car ownership as compared with (single) males.

³ The latter restriction excludes e.g. three unmarried singles living at the same address. The motivation for this exclusion is that it may be unclear whether these three individuals (or two of them) is a joint household as opposed to being three independent singles.

⁴ To ease comparison with figure 3 and 4 car ownership in figure 1 is based on observations for individuals from 25 to 35 years of age in 1992 (corresponding to 29 to 39 years of age in 1996).

Figure 1

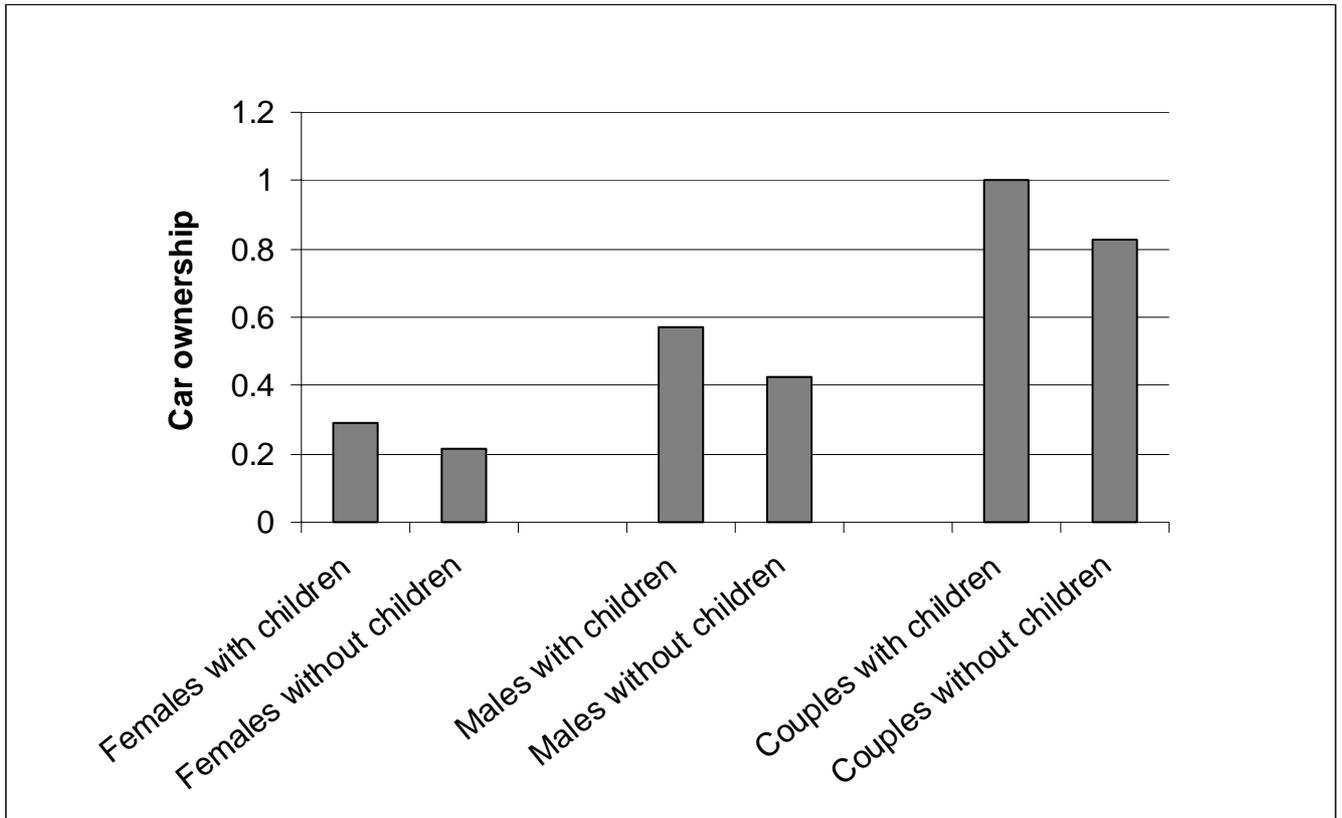
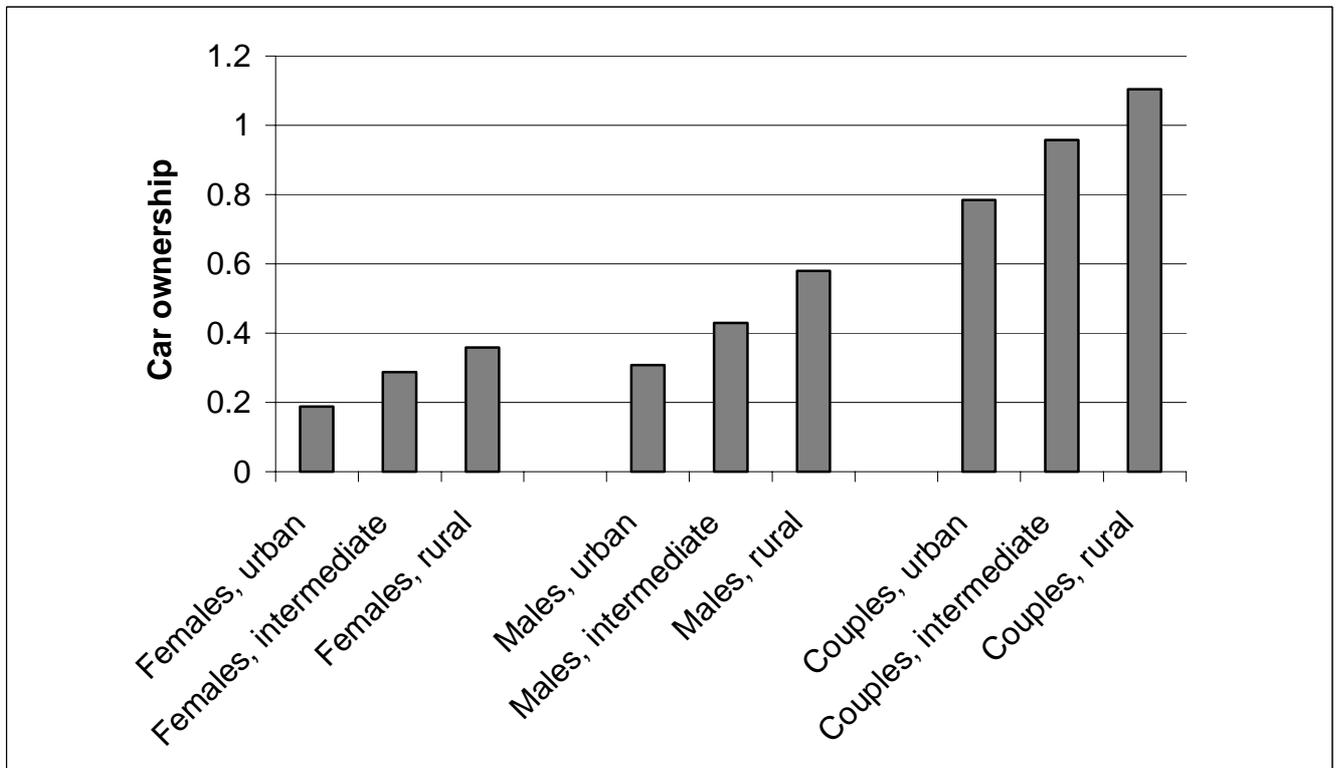


Figure2



The relationship between urbanisation and car ownership in 1996 is illustrated in figure 2, where it appears that car ownership is lowest in urban areas, highest in rural areas and in between in areas with intermediate level of urbanisation. This is as expected due to factors unobserved by us like different coverage of public transport in the different areas as well as differences in distances to work, school, shopping etc.

The differences in mean car ownership in figure 1 and 2 are all significant at the 1% level based on pair-wise t-tests.

4. Change in household size and location

4.1 Couples having their first child

To trace the impact of children, we focus in the following on the development in car ownership of couples having their first child. The change in car ownership for couples having their first child in the year of 1996 (and who do not have more children in the observation period) is illustrated in figure 3. In order to compare car ownership with other groups, the figure also illustrates the change in average car ownership for the following two “control” groups. i) couples with one (and only one child) in the period observed, and ii) couples without any children in the observed time period. In all cases we only include couples where the age of the females were from 25 to 35 years in 1992.

Graphs corresponding to figure 3 could also be shown for couples having children in other years. However, instead of presenting ten different graphs we choose to present an average effect for all years by normalising the year of birth to 0. This average effect is illustrated in figure 4. Main difference between figure 3 and figure 4 is that the latter contains information for a larger number of households having a child. For example, there are 195 couples having a child in 1996 (figure 3), but in figure 4 there are 1598 couples having their first child in year 0. However, it should be noted that the number of observations represented in the graphs for households having a child is highest at time zero, i.e. the number of households is reduced over (back in) time when households leave (enter) the panel. To obtain meaningful control groups with and without a child also in figure 4 a little consideration is called for. As shown in figure 3 car ownership increased over time in the two control groups (i.e. due to increase in age, income or other things that change in that phase of life). Thus, to get meaningful control groups in figure 4 showing a similar increase over time periods, weighted average car ownership was calculated based on the annual distribution in each time period of the households having a child.⁵

⁵ For example, if the couples having their child at time 0 consist at time -2 of 15% observations from 1997, 5% observations from 1996 and 10% observations from the other years, then the average car ownership in the two control groups at time -2 are calculated by applying the same weights to the different years.

Figure 3

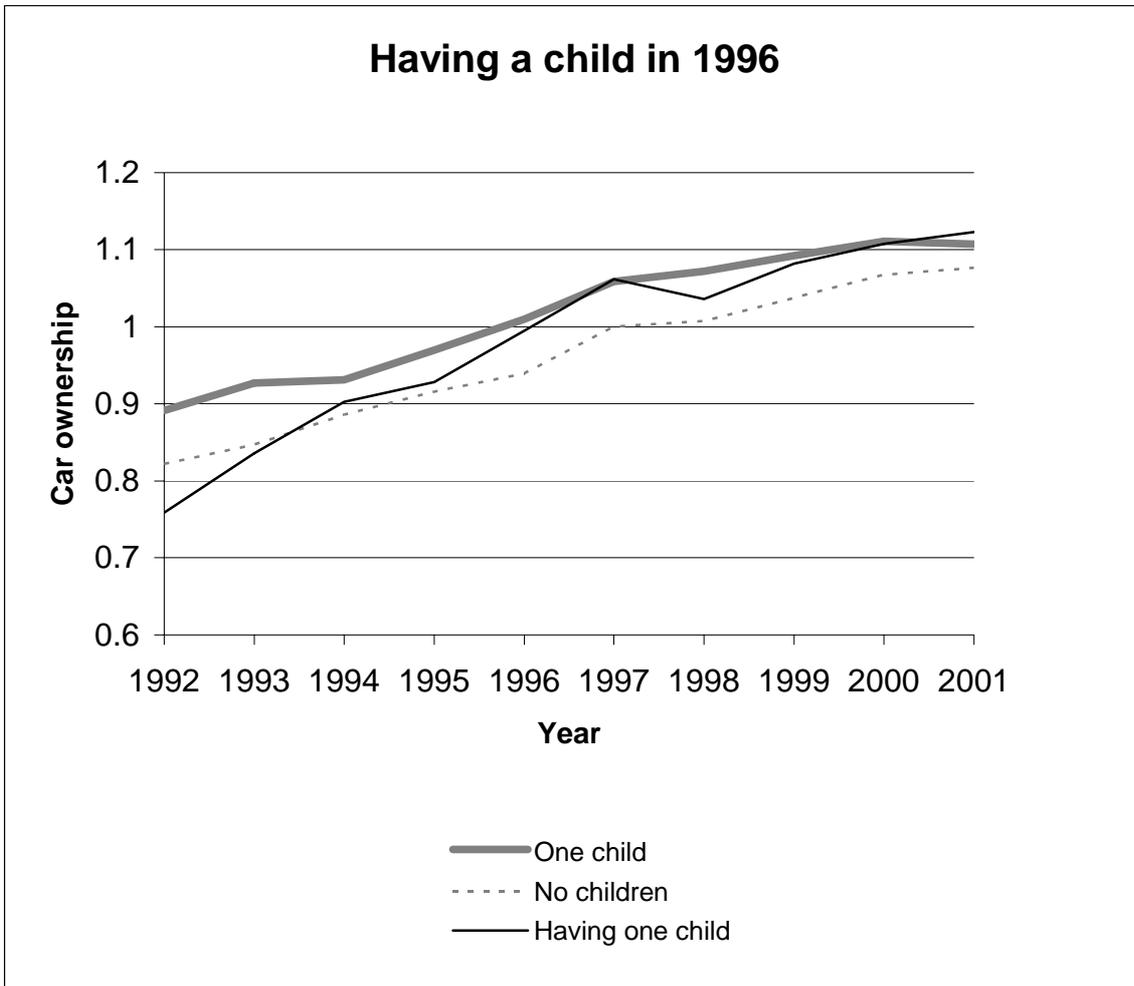


Figure 4

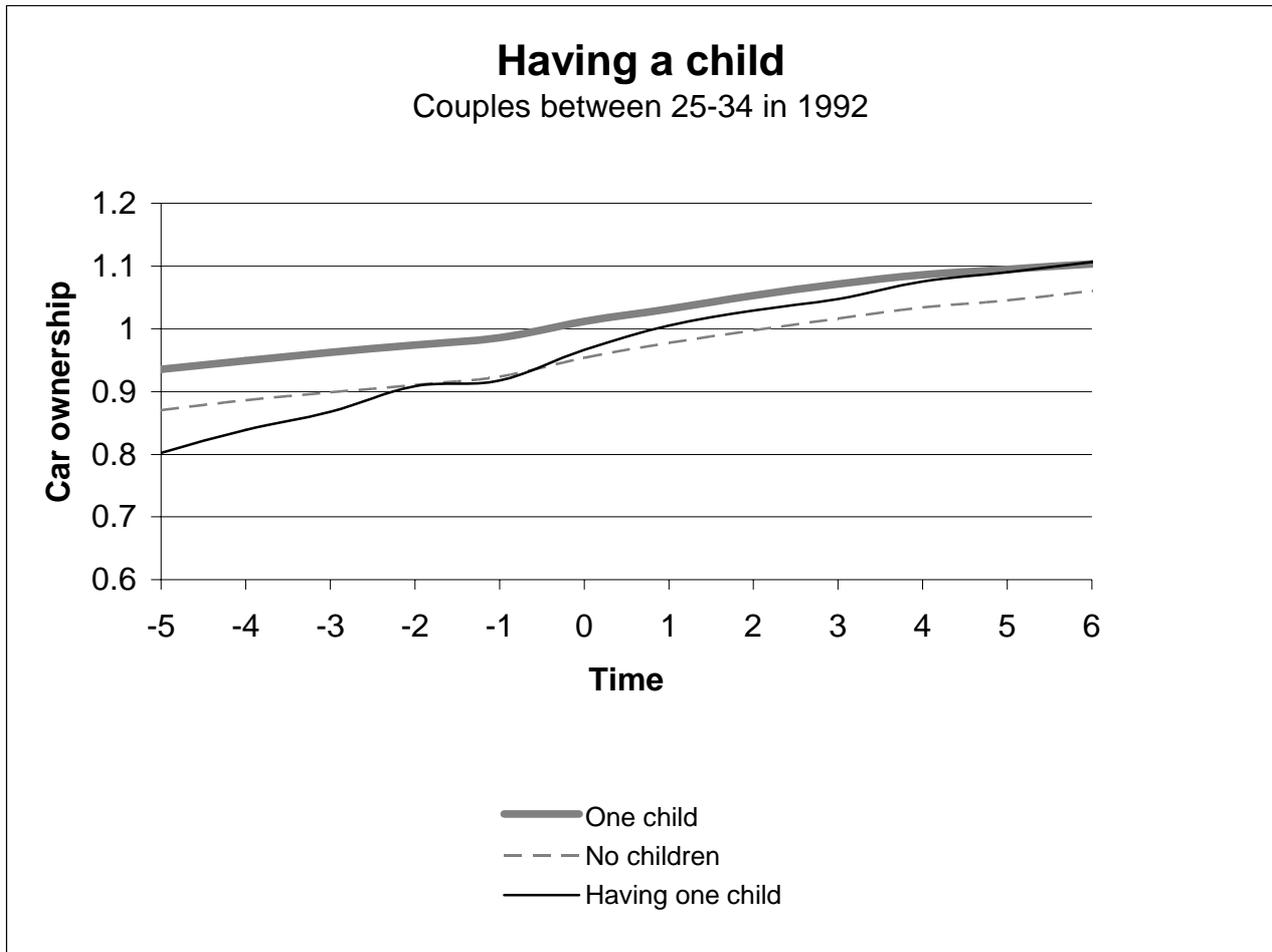


Figure 3 and 4 both show that car ownership is higher for couples with one child as compared to couples without children, but it does not appear that having a child has any short term impact on car ownership. Rather, car ownership of couples having their first child increase gradually over the whole time period to catch up with households with one child. A similar pattern can be found for couples having their second child (not shown here). There are two possible interpretations. The first is that having children does not really have any effect on car ownership. Instead there may be other things correlated with having children that tend to increase car ownership. The second interpretation is that the adjustment process is very slow. Couples planning to have a child may start slowly “adjusting” car ownership several years before the baby is born, and this continues several years after the child is born.

In appendix 1 table A1.1 we have included some descriptive statistics at time -2 and time +3 related to the samples in figure 4 in order to see if the control groups have different socio-economic characteristics as compared with the couples having a child etc. However, it does not appear that there are important differences in the socio-economic characteristics of couples without children, couples having a child and household having one child in the whole time period. In any case there does not appear to be any short term impact of having a child. Potentially, this may be due to oppositely directed impacts on car ownership of having a child. On the one hand, children increase the need for a flexible mode of transportation, but on the other hand, there are also considerable

expenses associated with children, which makes it difficult also to afford a car. Dynamic panel models for car ownership based on the same data (Bjørner and Leth-Petersen, 2004) also suggested that children do not have a short term impact on car ownership after controlling for a number of other socio-economic characteristics.

4.2 Singles becoming couples and couples becoming singles

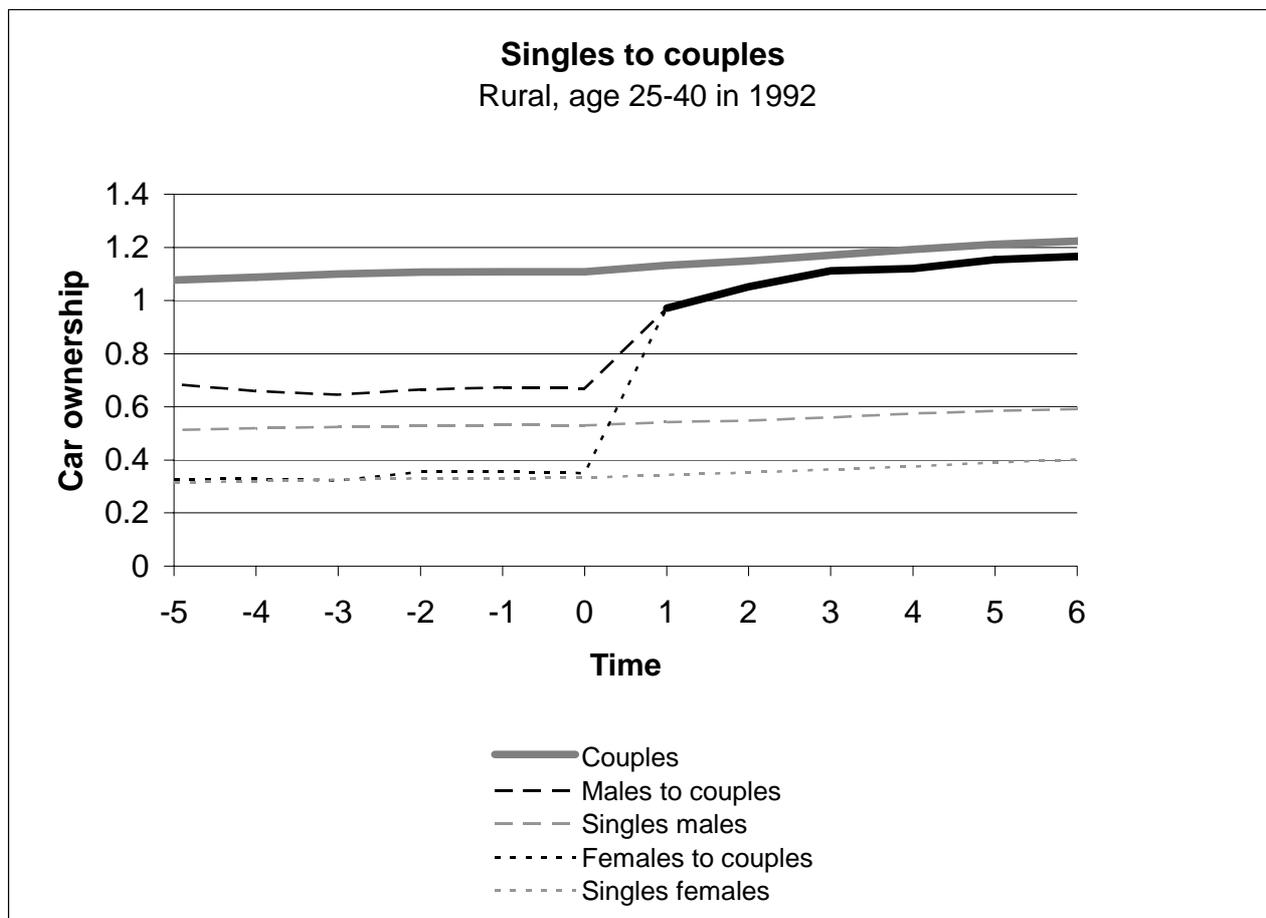
Next we follow car ownership after changes in the number of adults in the households. First we look at two singles becoming a couple and subsequently when couples separate and become singles. As changes in number of adults involve changes in location for one of the involved we control for potential impact from degree of urbanisation by looking only at individuals/couples that live in rural areas.⁶ To control for age effect we look at individuals moving together, who in 1992 were between 25 to 40 years old in 1992, and moved together at some point during the observation period. For individuals separating we analyse the cohort which was between 40 and 55 years old in 1992. We look at different cohorts because moving in together typically occurs early in life, while separation is more frequently observed at a higher age.

The average level of car ownership for men and women becoming a couple from time 0 to 1 is illustrated in figure 5. It appears that there is a sharp increase in car ownership from time 0 to 1, but this sharp increase only follows from the fact that the new partner may have had a car. At time 1 average car ownership of the couple is just below 1, which corresponds to the sum of average car ownership of men and women at time 0. At time 1, the car ownership of the new couples is somewhat lower than average car ownership of households with two adults throughout the observation period (average of this group at time 1 is 1.13). The figure indicates that the average car ownership of new couples over time catches up with the car ownership of the couples in the control group.

Prior to becoming couples, the females had average car ownership levels in the same range as other females who stay singles. However, it appears that men that later move together with a partner have higher levels of car ownership than men that stay singles. The difference in average car ownership is about 0.1 for these two groups of men (corresponding to about 20% difference). This difference could derive from differences in preferences for car ownership or due to differences in the socio-economic characteristics of the single men (later joining with a partner) as compared with the single men staying single. In appendix 1, table A1.2 descriptive statistics for the different groups represented in figure 5 at time -2 and +3 show that the single men that later join a partner have 16% higher income compared with the single men staying single. Two Danish studies using micro cross section data (Bjørner and Leth-Petersen, 2004, and Fosgerau and Nielsen, 2002) suggest that the income elasticity of car ownership is between 0.2 and 0.5. These elasticities indicate that no more than half of the difference in car ownership between the two groups of single men can be explained by the difference in income.

⁶ The qualitative conclusions for singles/couples in rural areas also apply to singles/couples in urban areas, see appendix 2.

Figure 5



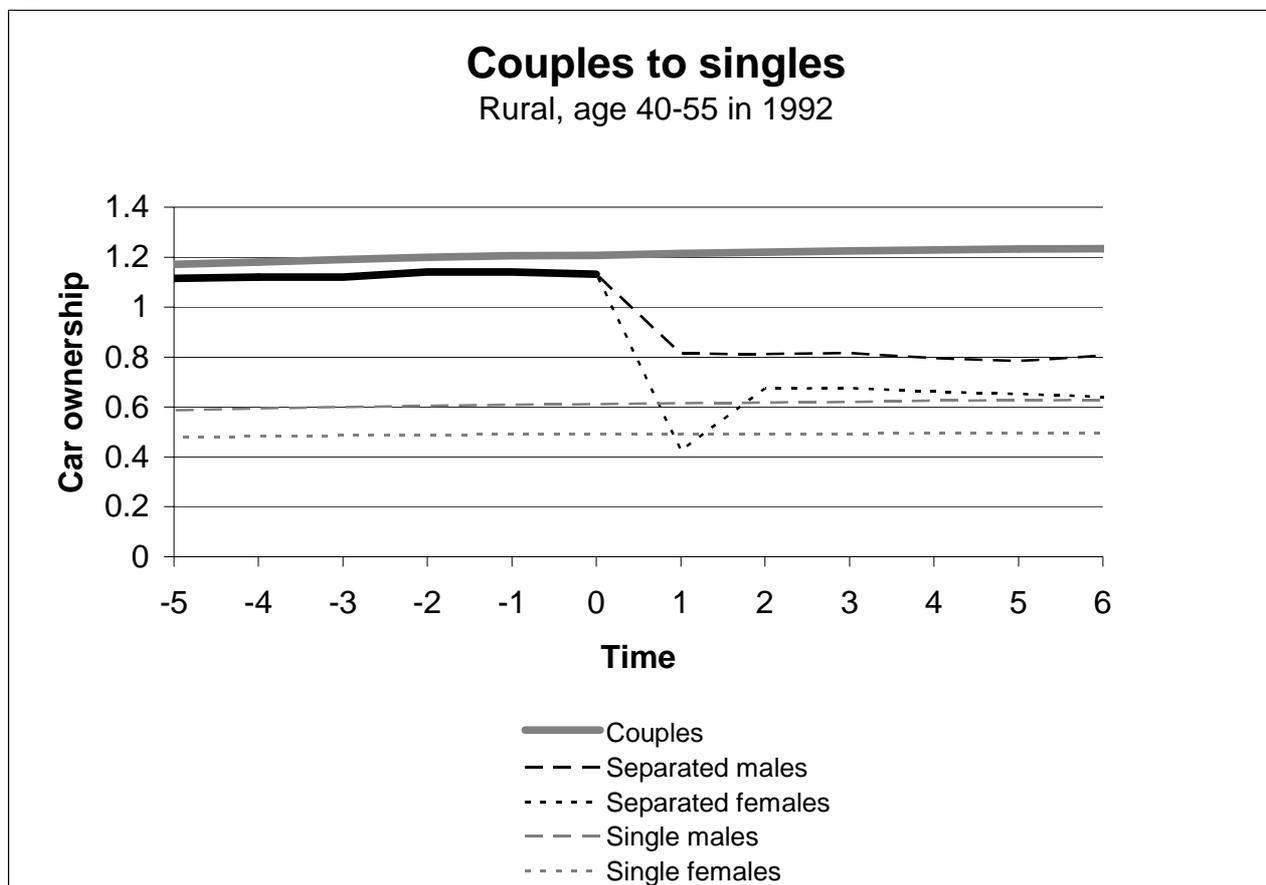
Turning now to effect of separation, we focus in figure 6 on the age groups that were between 40 and 55 years old in 1992 and who lived in rural areas both before and after the separation. For all groups represented in figure 6 average car ownership is higher as compared with figure 3, which is due to the higher age for the individuals/couples being analysed. Before couples separate they tend to have slightly lower average car ownership as compared to couples not separating. Descriptive statistics in appendix 1 suggest that this difference may derive from lower household income for the couples that later separate as compared to the steady couples.⁷

Parallel to figure 5 there is a sharp drop in car ownership from time 0 to 1, which simply is a result of the two separated individuals dividing their car stock between them. The drop is about twice as large for women as compared with men, which shows that men tend to keep the car after separation (from figure 5 it also appeared that they were more likely to bring a car into the relationship). From time 1 to 2 there is a sharp increase in car ownership for women, which compensate for part of the decrease in females' car availability experienced after the separation. Thus, it appears that a substantial part of the separated women buys a car the year after separation. After year two it appears that car ownership of the separated females remains well above car

⁷ In appendix table A1.3 it appears that income at time -2 is 10% lower for the couples separating at time 0 as compared with couples not separating. If we assume that the income elasticity of car ownership is 0.5, this corresponds to 5% difference in average car ownership, which is about the difference in car ownership of the two groups of couples at time -2 in figure 6.

ownership of the females that were single in the whole time period. The same is the case for men.⁸ Calculated 95% confidence intervals (not shown) for the means represented in figure 6 show that the differences in car ownership of separated females/males as compared to the single females/males are significant.⁹

Figure 6



The persistent difference in car ownership for separated men and females as compared to the men and females that were single in the whole period (and therefore also have had less experience with car ownership) suggests that there is state dependence in car ownership.¹⁰

4.3 Moving between rural and urban areas

The cross section evidence illustrated in figure 2 shows that car ownership is higher in rural areas as compared to intermediate and in particular urban areas. In the following we explore this observation

⁸ It appears in appendix table A1.3 that the separated men had about 20% higher income as compared with the single men at time 3. Subject to an income elasticity of 0.5 this difference may explain no more than a third of the difference in car ownership. However, note that there is no difference in average income of separated and the permanent-single females.

⁹ The 95% confidence intervals to the mean car ownership of the changing individuals/couples in figure 4, 5 and 6 are generally about ± 0.02 to 0.04 (smallest close to time 0, where the sample sizes are largest).

¹⁰ Before separating, the couples actually had lower average car ownership as compared with couples not to separate, which actually would indicate that they should have lower levels of car ownership after separation compared with their new control groups.

by focusing on moves between rural and urban areas, because the most pronounced changes in car ownership are likely to occur in these situations. Households moving more than one time between these areas are not included. Moving may be a result of separation or singles becoming couples. To control for change in the number of adults we therefore only look at moves for individuals that were single in the whole time period, and households consisting of a couple over the whole time period (e.g. we do not include individuals that move due to separation or marriages). It appears that there are relatively few households that move between urban and rural areas. Therefore it is not reasonable to control for age effect by looking at a subset of the movers within a particular age cohort.

The average car ownership for couples moving from urban to rural areas (and vice versa) is illustrated in figure 7, while the corresponding changes for singles are shown in figure 8. Figure 7 and 8 do not give as clear a picture of the impact of moves as were found in the above section on singles becoming couples and couples becoming singles. This may be due to the relatively low number of moves observed and/or the heterogeneity in age etc between the different groups illustrated in table 7 and 8.¹¹

As noted earlier the number of moving households represented in the graphs is reduced when time increase/decrease away from zero, so part of the variations in average car ownership may derive from reduction in the heterogeneous sample. However, it appears from figure 7 that couples moving from urban to rural areas increase car ownership relatively sharply from time 0 to 2, and catch up on the car ownership of the rural couples during the next 3 to 4 years.

¹¹ There are only 899 couples moving from rural to urban areas (see appendix 1 table A1.4). The number of singles moving between these areas is even lower (table A1.5). The 95% confidence intervals of the mean car ownership of the movers are about ± 0.02 to 0.04 for couples, but it is as wide as ± 0.05 to 0.1 for singles moving. It also appears from the appendix tables that the average age of the movers in many cases is different from the control groups, which further emphasises that figure 7 and 8 should be interpreted with some caution.

Figure 7

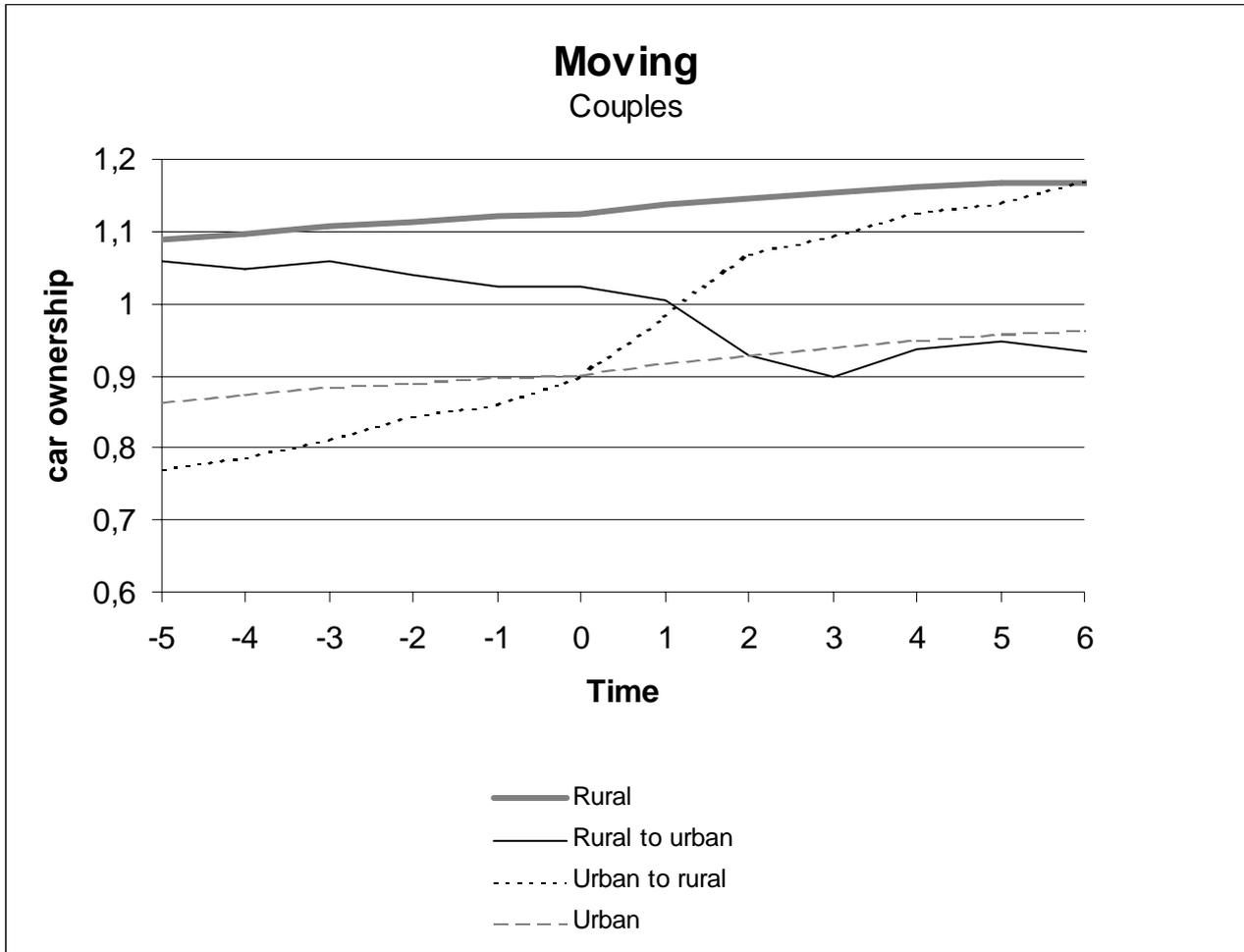
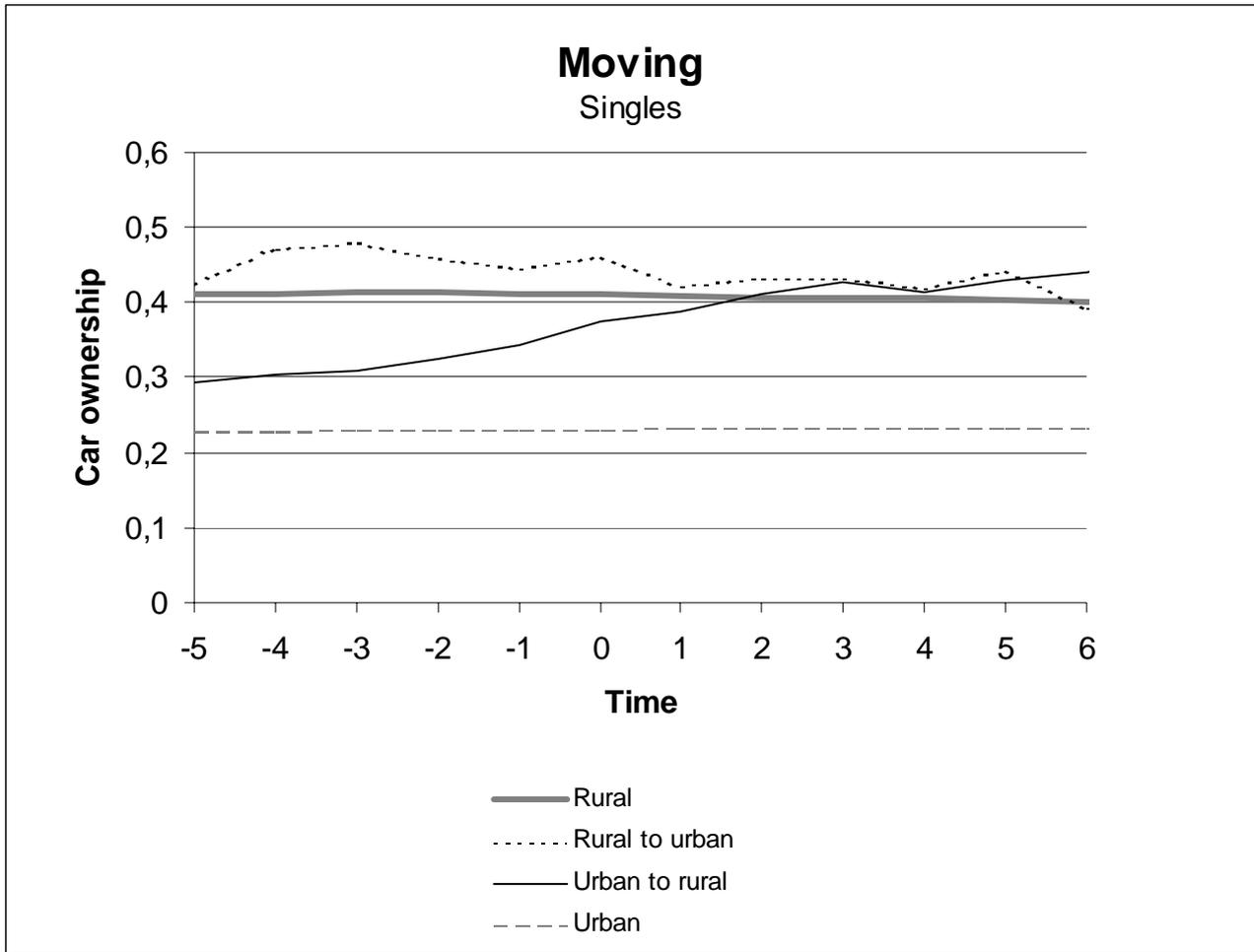


Figure 8



Couples making the opposite move from rural to urban areas have relatively low levels of car ownership before moving. This is despite the fact that the rural couples who later move have considerably higher income than the rural couples not moving (see appendix 1 table A1.4) The drop in car ownership following the move to urban areas is relatively small as compared to the increase in car ownership of couples moving from urban to rural areas. The same applies for singles in figure 8. Actually, it does not appear that singles moving from rural areas to urban areas reduce car ownership at all. By and large it seems that the households moving between rural and urban areas find it easier to increase car ownership than to decrease car ownership. This provides further support for a ratchet effect in car ownership.

5. Discussion of empirical results

In the following we will briefly relate the empirical observations to the literature on state dependence in econometric discrete choice models (e.g. Heckmann, 1981 and Wooldridge, 2002) and the literature on habitual travel choices by behavioural scientists (e.g. Gärling and Axhausen, 2003).

Drawing on Heckmann (1981) state dependence is present if households who have experienced car ownership in the past are more likely to have car ownership in the future because preferences or

economic constraints have been altered as a result of the past car ownership. Persistence in car ownership may also derive from unmeasured time invariant variables that influence the probability of car ownership both in the past and in the future (unobserved heterogeneity), but this type of persistence in choice should not be interpreted as true state dependence. In the case of car ownership economic constraints may be altered because of transaction cost associated with selling a car as a private seller usually experiences a loss when selling a car. In empirical models of state dependence a lagged dependent variable – lagged car ownership in this case – is included in the models to measure or control for the impact of state dependence (Bjørner and Leth-Petersen, 2004 and Kitamura and Bunch, 1990).

It seems that behavioural scientists describe habitual travel behaviour in a way that is similar to state dependence, though emphasis in the explanation for the habitual choice is linked to the need for simple decision rules in a world characterized by imperfect information.

It has been recognised by behavioural scientists that it is difficult from descriptive research on repeated travel choices to draw conclusions on the significance of habits. Thus, if the same travel choice is observed repeatedly, this does not necessarily imply that the behaviour is habitual. The reason for repeating the behaviour may simply be that the same rational choice is repeated with the same outcome (e.g. Gärling and Axhausen, 2003). To get around this dilemma, we identify households where change in a socio-economic condition should lead to change in the level of car ownership. If these households do not change their average car ownership to the extent expected after comparing with relevant control groups, this implies that there is state dependence in car ownership.

It is emphasised by behavioural scientists that it may have important derived implication for the choice of policy instruments whether car ownership is largely determined as repeated deliberate (rational) choices weighing the pros and cons of buying and keeping a car or instead largely due to a habitual choice (e.g. Gärling and Axhausen, 2003). In the first case, economic instruments like car or gasoline taxes can be expected to be effective instruments with respect to reducing car ownership. In the latter case, it seems that persuasive communication potentially could be an important policy instrument, perhaps in particular when combined with other inducements to break the habit of car use like temporary free transit tickets or bicycles etc, see. e.g. Møller and Thøgersen (forthcoming) and Fujii and Kitamura (2003).

The asymmetric adjustment to changes in socio-economic conditions of the household suggests that there is state dependence in car ownership, but it is unclear whether this should be attributed to preferences being changed or to transaction costs (or to fixed unobserved differences in characteristics). The change in car ownership after separation illustrated in figure 6 implies, however, that the state dependence cannot solely be attributed to transaction costs. Firstly, a substantial share of the women experiences a sharp drop in car availability shortly after separation, which lowers their average car ownership to a level below the females that were singles in the whole observation period. Part of these separated women buys a car the year after the separation. Thus, these women do not simply hold on to a car they already have. Instead they choose to buy cars so that their average car ownership become higher as compared to the females that were single in the whole observation period. Secondly, it also appeared on figure 6 that there is a long term deviation between car ownership levels of the separated as compared with the permanent singles. If this deviation only derived from individuals hanging on to their car due to transaction costs one would expect a slow convergence over time due to scrapping of the cars over time. For men there is no

indication of convergence, which implies that the separated men replace their old scraped cars even though they had an opportunity to adjust down to the car ownership level of single men.¹²

6. Conclusion

From a large micro panel dataset we have identified households with changes in important socio-economic variables like number of adults in the household, children born and urban or rural location. The time dimension of the data has been exploited by looking at average car ownership before and after the changes occurred. The analysis is merely descriptive, but we do control for changes in other socio-economic factors by focussing on different age cohorts and when analysing the impact of for example changes in urbanisation we control for the number of adults by making separate analyses for singles and couples etc. Differences in income between different groups are partly taken into account by using income elasticities of car ownership found in other studies based on Danish micro data.

Results suggest that there is a ratchet effect in car ownership, which may derive from e.g. increased dependency of car ownership or change in preferences in favour of car ownership. Thus, when singles become a couple their (joint) average car ownership level increases, so that couples generally have higher car ownership levels as compared with singles. Couples who later separate also appear to have higher car ownership levels than singles, but after separation the divorced/separated singles have significantly larger car ownership levels as compared to singles. The difference between the divorced/separated and the singles not having lived with a partner in the period observed persist several years after the year of separation. This suggests that the observed state dependence can not be attributed to transaction cost. Results also show that it is often the male that keep the vehicle after divorce/separation, while women buy a car shortly after the separation. This confirms that the state dependence is not primarily a result of transaction cost, because transaction cost would deter the separated women from buying a car.

The change in car ownership of households moving between urban and rural areas also suggests that there is a ratchet effect. The relative small number of households experiencing changes in urbanisation gives less clear-cut results, but it seems that there is a smaller decrease in car ownership when moving from rural to urban areas as compared with the increase on car ownership when moving from urban to rural areas.

Two implications of the above observation are worth noting. First implication is that the precision of micro econometric models of car ownership can be improved with the inclusion of historic information on the individual. Thus, it is not sufficient to distinguish between singles and couples, because car ownership of singles depends on their former civil status (as an indicator of past car ownership). The same is true with respect to urbanisation and possible also other socio-economic variables not included in this analysis. With respect to making long-run forecast in car ownership levels based on demographic forecast it also seems that the speed of change in family structure may have long term impact on car ownership levels. Thus, if individuals in the future tend to marry and divorce earlier and/or more frequent the results here suggest that such a shift in household transformation will increase car ownership (even if the share of couples and singles is the

¹² For these arguments to hold it must of course be assumed that there is no persistent unobserved heterogeneity between the changers and their control groups that can explain the differences in the levels of car ownership (i.e. unobserved heterogeneity that is not a function of past car ownership levels).

same). The same seems to be the case if moves between urban and rural areas speed up. It also appears that in some situations it is insufficient in dynamic choice models to capture state dependence by just including car ownership lagged one period as explanatory variable. Consider the separated females. Just after separation their car ownership level dropped sharply, followed by an increase in the following year. Car ownership of recently separated males followed a different pattern implying that adjustment is so different between different groups of households, that it cannot be captured by a single parameter to lagged car ownership.

Second implication is with respect to the use of policy instruments. Policy instruments have not been explicitly addressed in the analysis but the choice of policy instruments is related to the factors determining car ownership. If socio-economic constraints (including the budget restriction) are the primary determinants of car ownership it would favour the use of economic policy instruments altering say the budget restriction. On the other hand, if the choice of car ownership is partly determined by habits, it seems that there is a larger potential for policies aiming directly at breaking the habit of car use. These would include issues of temporary free transfer ticket or free bicycles etc. to dedicated car user. The descriptive statistics presented in the paper implies that at least part of the state dependence should be attributed to change in preferences, though the underlying causes of the observed changes in car ownership levels following changes in household size and location is a subject for future research.

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Appendix 1. Descriptive statistics for the samples at time -2 and +3

The appendix contains descriptive statistics for key socio-economic variables for the households with a change in household size or location, as compared with the relevant control group of time -2 and time +3. As an example in table A1.1 it appears that the average household income (after tax) of couples that two years later have a child is 300,000 DKK, while the average income of couples without children in the observation period at the same time was 290,000 DKK. The average income of couples having a child was 352,000 DKK three years after having their child, while the income of couples with a child (in the whole period observed) was 343,000 DKK. The number of couples at time -2 that later have a child from time 0 to 1 is also given in the table (1,357).

The total number at time 0 of couples that have one child from time 0 to 1 is given in the top of table A1.1 (1598). This is the maximum number of “changing” household represented in the figure 4. When time increase (decrease) away from time 0 the number of changes represented in the graphs becomes smaller as households leave (enter) the time period.

Table A1.1 Having a child (couples with female between 25-34 years of age in 1992)

1598 couples having a child from time 0 to 1				
Time	-2		+3	
	No children	Having a child	Having a child	With one child
HH income after tax (in 1,000 DKK)	290	300	352	343
Age	35	32	36	39
Gender (share of female)	0.5	0.5	0.5	0.5
Share with children below 18 years	0	0	1	1
Share with children above 17 years	0	0	0	0
Share living in urban areas	0.36	0.43	0.41	0.35
Share living in rural areas	0.54	0.48	0.50	0.55
Share living in intermediate areas	0.10	0.09	0.09	0.10
N	1,722	1,357	1,260	1,678

Table A1.2 Singles to couples (living in rural areas, age 25-40 in 1992)

2,073 new couples from time 0 to 1						
Time	-2		-2		+3	
	Single female (permanent)	Female who becomes couple	Single male (permanent)	Male who becomes couple	New couples	Couples (permanent)
HH income after tax (in 1,000 DKK)	126	129	141	163	313	340
Age	36	34	36	34	36	38
Share with children below 18 years	0.55	0.55	0.00	0.00	0.64	0.86
Share with children above 17 years	0.05	0.06	0.04	0.04	0.03	0.13
N	1,125	529	1,420	564	1,850	13,623

Table A1.3 Couples to singles (living in rural areas, age 40-55 in 1992)

2,700 couples separated from time 0 to 1						
Time	-2		+3		+3	
	Couples (permanent)	Couples to separate	Separated females	Single females (permanent)	Separated males	Single males (permanent)
HH income after tax (in 1,000 DKK)	315	289	144	139	182	150
Age	50	51	54	54	53	54
Share with children below 18 years	0.33	0.32	0.14	0.10	0.10	0.03
Share with children above 17 years	0.30	0.24	0.17	0.14	0.13	0.04
N	35,175	1,954	1,272	2,022	673	1,707

Table A1.4 Moving couples

	899 couples moving from 0 to 1				3,083 couples moving from time 0 to 1			
	Rural to urban.				Urban to rural			
Time	-2		+3		-2		+3	
	Rural	Moving	Moving	Urban	Urban	Moving	Moving	Rural
Income after tax (in 1,000 DKK)	281	322	318	321	296	276	315	300
Age	48	47	49	52	49	41	44	51
Gender (share of females)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Share with children below 18 years	0.45	0.40	0.38	0.37	0.40	0.39	0.54	0.39
Share with children above 17 years	0.17	0.15	0.10	0.13	0.14	0.09	0.04	0.16
N	43,685	513	732	83,326	83,326	2,253	2,577	43,685

Table A1.5 Moving singles

	254 singles moving from time 0 to 1				460 singles moving from time 0 to 1			
	Rural to urban				Urban to rural			
Time	-2		+3		-2		+3	
	Rural	Moving	Moving	Urban	Urban	Moving	Moving	Rural
Income after tax (in 1,000 DKK)	108	126	143	121	114	121	128	114
Age	61	51	53	60	57	54	58	64
Gender (share of females)	0.7	0.6	0.6	0.7	0.7	0.6	0.6	0.7
Share with children below 18 years	0.07	0.20	0.09	0.07	0.05	0.09	0.09	0.05
Share with children above 17 years	0.05	0.07	0.05	0.04	0.04	0.05	0.03	0.04
N	17,137	123	208	15,297	15,297	352	365	17,137

Appendix 2. Singles becoming couples and couples becoming singles (all urban)

Table A2.1 Singles to couple (living in urban areas, age 25-40 in 1992)

Time	3,077 new couples from time 0 to 1					
	-2		-2		+3	
	Single females (permanent)	Females who become couple	Single males (permanent)	Males who become couple	New couples	Couples (permanent)
HH income after tax (in 1,000 DKK)	126	130	129	148	313	357
Age	36	34	35	33	36	38
Share with children below 18 years	0.47	0.45	0.03	0.04	0.64	0.84
Share with children above 17 years	0.05	0.03	0.00	0.01	0.03	0.01
N	2,137	964	1,745	795	1,850	18,260

Table A2.2 Couples to singles (living in urban areas, age 40-55 in 1992)

Time	2,225 couples separating from time 0 to 1					
	-2		+3		+3	
	Couples (permanent)	Couples to separate	Separated females	Single females (permanent)	Separated males	Single males (permanent)
HH income after tax (in 1,000 DKK)	340	313	146	142	183	146
Age	50	51	54	54	53	53
Share with children below 18 years	0.30	0.29	0.14	0.10	0.09	0.02
Share with children above 17 years	0.26	0.18	0.15	0.12	0.12	0.04
N	21,761	11,760	1,086	3,411	606	2,234

Figure A2.1 Singles to couples (living in urban areas, age 25-40 in 1992)

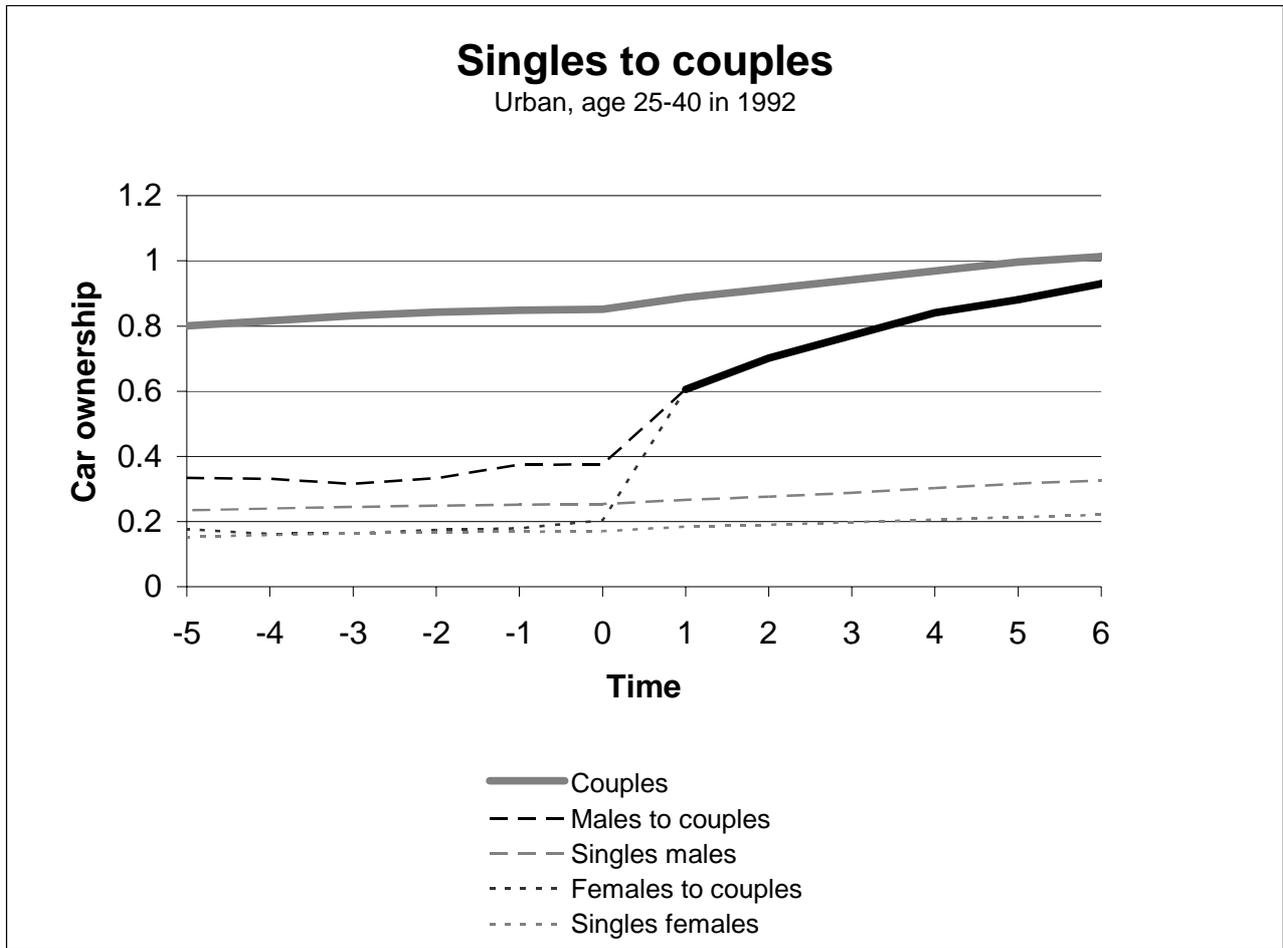
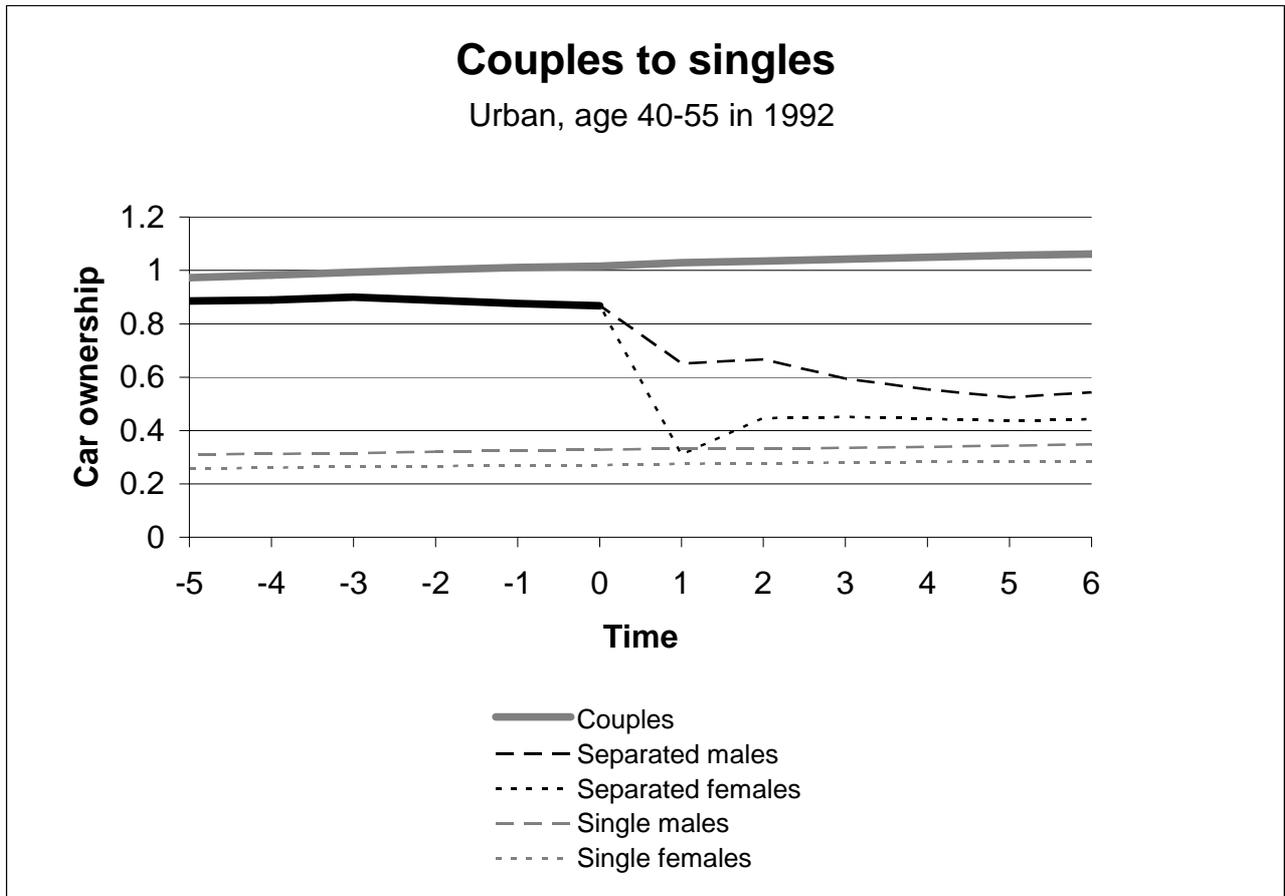


Figure A2.2 Couples to singles (living in urban areas, age 40-55 in 1992)



Dansk sammenfatning

Beskrivende analyser af påvirkningen af bilrådighed efter ændringer i familiestørrelse og urbaniseringsgrad

De fleste tidligere analyser af bilejerskab er foretaget ved brug af tværsnitsdata eller aggregerede tidsserier. I dette paper foretages analyser baseret på registerdata, som gør det muligt at følge de enkelte familers bilrådighed over tid.

I analyserne fokuseres på at beskrive, hvordan bilrådigheden påvirkes efter ændringer i familiestørrelse og efter flytninger mellem by og land. Analysen viser, at der er en form for skraldeeffekt i bilejerskabet i den forstand, at tilpasninger til en situation, som typisk forbindes med lavere bilrådighed, sker langsommere og i mindre omfang end tilpasninger den modsatte vej. Som et mere konkret eksempel kan nævnes følgende. Familier med to voksne har oftere bil end enlige. Kvinder og mænd, der er blevet separeret, har imidlertid større gennemsnitlig bilrådighed end kvinder og mænd, der ikke har været i parforhold. Dette kan dels skyldes, at de separerede kvinder og mænd har vænnet sig til at have bil, da de var i parforhold, og dels at der er transaktionsomkostninger i forbindelse med at afhænde en bil.

Ved flytninger mellem land og by findes lignende tegn på en skraldeeffekt i bilejerskabet. Familier, der flytter fra by til land, får ofte en bil, mens familier, der flytter den modsatte vej, ofte beholder bilen i en længere årrække.