How much to drive, and how much to use public transport, are modelled as three- and two level decisions, respectively, based on micro-data for Sweden. The choices whether to have a car, whether to drive given access to a car, and how much to drive given that the individual drives at all are then estimated using a three equation model. Also after correcting for other variables, such as income, men are driving much more, and using less public transport, compared to women. People living in big cities are less likely to drive, but those who do are on average driving about as much as others. Age and access to company cars are also important determinants for travel behaviour, but being a member of an environmental organization is not. Driving increases with income, but to a lower degree compared to most aggregated studies on national level. The difference is explained in a model with income-dependent structural changes, implying that it becomes more difficult to live without a car when average income increases. This indirect effect is found to be of a similar size as the ordinary income elasticity typically found in cross-section analysis within a country or region.

I. INTRODUCTION

The aim of this paper is to estimate both individual (as opposed to household) annual driving-distance by car and the annual number of public-transport trips, as functions of explanatory variables such as income, age, sex etc. In the driving-distance case, the travel choice is modelled as a three-level decision. The first decision is whether to have a car or not, the second whether to drive or not given that the household has a car, and the third is how much to drive given that the individual drives at all. For public transport, the first decision is whether to use public transport at all, and the second decision is how much to travel given a positive public-transport use.

It is of interest to know the determinants of individual travel behaviour for several reasons. First, from a policy perspective it is important to know the consequences of various measures. For example, proposed increases of fuel taxes, or other transport-related taxes or charges, are almost always followed by distributional discussions, both regarding income groups and regions. Second, they may be of interest from a gender and age perspective; and third, it is interesting to see whether or not attitudes towards the environment matter for actual travel behaviour.

This study is based on data from the Household Market and Non-market Activities (HUS) survey, which includes a representative Swedish sample of 3240 individuals (adults) in 1922 households, conducted in 1996. The survey consists of two parts: A panel survey, addressed to respondents who have been interviewed before, and a supplementary survey addressed to young people in the households who were born between 1975 and 1977, as well as certain new household members who had not previously been interviewed. For the panel survey (about 95% of the respondents), a combined contact and main interview was conducted by telephone, after which a self enumerated questionnaire was sent out to each respondent by mail. For the supplementary survey, the respondents were not
interviewed by telephone until they had been interviewed personally.

Section II provides a descriptive picture of the travel pattern and Section III aims at explaining this pattern by means of econometric analysis. Section IV discusses and tries to explain the large differences found between income elasticities of car use in cross-section analysis within a country, on the one hand, and cross-section between countries or time-series analysis on the other. Section V summarizes and provides some concluding remarks for policy.

II. DESCRIBING THE TRAVEL PATTERN

Annual private driving distance

About 95% of the total sample (3065 individuals), answered the driving-distance question. Table 1 reports the annual driving distance for the whole sample, as well as for various sub-samples divided on men and women; big cities, intermediate cities and other areas; whether the household has access to a car or not; whether the individual is driving or not; and whether the household has access to a so called company car or not.

It follows that men have a much larger mean driving-distance than women, and that this difference depends both on the mean driving-distance for those who drive and on a larger fraction of non-drivers among women, which is consistent with earlier research such as Polk (1998). It also can be seen that the driving-distance is consistently larger in all sub-groups for those who have access to a so called company car, i.e., a car that is paid by the firm and for which the driver has virtually zero marginal cost on private trips. The fraction of non-drivers is larger in big cities, but the mean driving distance for drivers is about the

---

Table 1. Annual private driving distance in km*10

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std.</th>
<th>Median</th>
<th>No. zeros</th>
<th>Max</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole sample</td>
<td>1092</td>
<td>1587</td>
<td>1000</td>
<td>25%</td>
<td>20000</td>
<td>3065</td>
</tr>
<tr>
<td>Given household has a car</td>
<td>1222</td>
<td>1637</td>
<td>1000</td>
<td>16%</td>
<td>20000</td>
<td>2597</td>
</tr>
<tr>
<td>Given positive driving distance</td>
<td>1453</td>
<td>1681</td>
<td>1000</td>
<td>16%</td>
<td>20000</td>
<td>2305</td>
</tr>
<tr>
<td>Given a positive driving distance and a company car</td>
<td>2303</td>
<td>1817</td>
<td>2000</td>
<td></td>
<td>20000</td>
<td>365</td>
</tr>
</tbody>
</table>

Men: all responses | 1571   | 1860  | 1200   | 11%       | 20000  | 1532  |
| Given a car       | 1693   | 1893  | 1500   | 4%        | 20000  | 1342  |
| Given Q > 0       | 1769   | 1900  | 1500   |           | 20000  | 1284  |
| Given Q > 0 and Company car | 2585   | 1897  | 2000   |           | 20000  | 280   |

Women: all responses | 615    | 1060  | 200    | 38%       | 15000  | 1533  |
| Given a car       | 719    | 1106  | 500    | 28%       | 15000  | 1255  |
| Given Q > 0       | 1000   | 1192  | 1000   |           | 15000  | 903   |
| Given Q > 0 and Company car | 1374   | 1098  | 1000   |           | 5000   | 85    |

Big city: all responses | 1029   | 1541  | 750    | 31%       | 20000  | 666   |
| Given a car       | 1218   | 1636  | 1000   | 20%       | 20000  | 514   |
| Given Q > 0       | 1516   | 1696  | 1200   |           | 20000  | 413   |
| Given Q > 0 and Company car | 2626   | 2562  | 2000   |           | 20000  | 74    |

Intermediate city: all responses | 1101   | 1531  | 1000   | 21%       | 17000  | 1321  |
| Given a car       | 1186   | 1541  | 1000   | 14%       | 17000  | 1179  |
| Given Q > 0       | 1382   | 1580  | 1000   |           | 17000  | 1012  |
| Given Q > 0 and Company car | 2222   | 1523  | 2000   |           | 10000  | 177   |

Other areas: all responses | 1121   | 1680  | 1000   | 25%       | 15000  | 1078  |
| Given a car       | 1271   | 1754  | 1000   | 16%       | 15000  | 904   |
| Given Q > 0       | 1508   | 1815  | 1000   |           | 15000  | 762   |
| Given Q > 0 and Company car | 2219   | 1641  | 2000   |           | 10000  | 114   |

---

2 ‘Big cities’ are the three biggest cities in Sweden: Stockholm, Göteborg and Malmö, with surroundings About 27% of the respondents (and the population) live in big cities, 53% live in ‘intermediate cities’, and the remaining 20% live in ‘other areas’.

3 The employee must tax for this benefit, however, but their marginal cost is zero for private trips. The system is now (after the survey was made) changed in Sweden and the intention is that individuals should pay their own variable costs for private trips. However, it appears that most users have chosen the (still-existent) alternative where their variable costs for private trips are zero.
same as for those living in the countryside and in smaller cities.

**Public-transport use**

About 97% of the total sample (3134 individuals), answered the public-transport question. Table 2 reports the annual number of trips (weekly number of trips on average, multiplied by 50) for the whole sample, as well as for various sub-samples.

As much as 72% report no public-transport trips per week. Women tend to use public transport to a larger degree, but men tend to make slightly more trips on average if they use public transport at all. Furthermore, availability of a private car consistently decreases the mean number of public-transport trips, which is expected. As is also expected, a larger fraction of people use public transport in big cities, where such transport is more readily available. However, for those who actually use public transport, the number of trips per time unit is about the same on average in all sub-groups.

### III. Econometric Analysis

Many of the questionnaires were incomplete, primarily due to incomplete responses on income. Therefore, the econometric estimations include only 2504 responses out of 3240 in the whole sample. However, using a standard t-test this study cannot reject the hypothesis of equal means in the smaller sample and the whole sample, for either the annual driving distance or the annual number of public-transport trips.

#### Econometric models

The dependent variables, driving-distance and public-transport use, are censored since they are zero for a large fraction of the observations; hence, a basic ordinary least square (OLS) regression would be biased. The most commonly used model to deal with this problem is perhaps still the standard one-equation Tobit (type 1) model. However, this model is very restrictive, for example since it is based on the assumption that the choice whether to drive or not is explained by the same variables, and in relative terms to the same extent, as how much to drive. But whether to have a car or not is a quite different decision, compared to the decision how much to drive given that you have a car. Therefore, two and three equation models, where the decision processes are modelled separately, are more appropriate.

The first specification used is that of Cragg (1971), where the probability of a zero observation is assumed to be independent of the regression model for the positive observations. Therefore, in the driving-distance case, the three decisions – whether to have a car or not, whether to drive or not given a car, and how much to drive given a driving-distance larger than zero – are estimated separately. In the public-transport case, the two decisions – whether to use public transport or not, and how many trips to make given a positive use of public transport – are estimated separately. The selection equation, concern-
ing whether to travel or not, is estimated by a Probit model and given by:

\[ d^* = x'\gamma + u \]  

(1)

where \( x' \) is the vector of independent variables, \( \gamma \) is the associated parameter vector to be estimated, and \( u \) is the error term. Only the sign of \( d^* \) is observed, and in our case \( d^* \) is either zero or positive. The structural equation, how much to travel, is a truncated regression model estimated by maximum likelihood:

\[ Q^* = x'\beta + \varepsilon \]  

(2)

where \( Q = 0 \) if \( d^* = 0 \); \( Q = Q^* \) if \( d^* = 1 \). The expected number of trips, given a positive number, is given by:

\[ E[Q|Q > 0] = \left| x'\beta + \sigma \lambda(x'\beta/\sigma) \right| \]  

(3)

where \( \lambda(z) = (\phi(z))/\Phi(z) \) is Mill’s ratio, where \( \Phi(z) \) and \( \phi(z) \) are the standard normal distribution function and the standard normal density function, respectively. In the driving distance case, we have instead two independent Probit equations followed by the truncated regression based on the observations with a positive driving-distance.

The assumption of independence can be questioned, however. Assume for example that both the probability of an annual driving distance larger than zero (given a car), and the actual distance driven (given a positive driving distance), depend positively on income (which is reasonable). The second (structural) effect can then be assumed to depend negatively on the first effect, since one may assume that individuals who change from zero to a positive driving distance would drive less (on average) than those who had been driving all the time. This would be the result if the error terms \( \varepsilon \) and \( \mu \) were positively correlated. It is not equally clear why the first two Probit stages would be correlated, however.

In the public-transport case, the expected sign from income in the second stage is not obvious, since higher income will both allow more trips but it will also allow a switch to more expensive modes (e.g. by private car). Still, at least for the purpose of comparison, we will assume (or test for) a correlation between the error terms also in the public-transport case.

The other sequenced model estimated is therefore a Tobit type 2 model (Amemiya, 1981), where a covariance parameter \( \rho \) between the error terms \( u \) and \( \varepsilon \) is estimated. Then this study has a selection equation:

\[ d^* = x'\gamma + u \]  

(4)

and a structural equation

\[ Q^* = x'\beta + \varepsilon \]  

(5)

where again \( Q = 0 \) if \( d^* = 0 \) and \( Q = Q^* \) if \( d^* > 0 \). A covariance parameter between the error terms is estimated:

\[ \text{Cov} [\varepsilon, u] = \rho \]  

(6)

implying that the expected number of trips, given a positive number, is given by:

\[ E[Q|Q > 0] = |x'\beta + \rho \sigma \lambda(x'\beta/\sigma)| \]  

(7)

This model is estimated using Heckman’s (1979) two-step estimation procedure, where the selection equation (the Probit) is estimated by maximum likelihood and the structural equation is estimated by ordinary least squares. In the driving distance case, this study first estimates a Probit for having a car in the household or not, and then independently, given a car, estimate a Tobit 2 for the driving distance decisions. The Tobit 2 model would collapse to the Cragg model for \( \rho = 0 \), if this study disregards the fact that the second step in the Cragg is estimated by a truncated regression.4

Estimating annual driving distance

Table 3 reports the estimated marginal effects for the models discussed.

The Lambda-coefficient for Tobit 2 has the expected sign but is insignificant and this study can consequently not reject the Cragg model. However, this does not necessarily imply that the ‘true’ model is close to a Cragg specification, or that the correlation between the error terms in the two steps is unimportant, since the Probit stage explained the selection somewhat poorly, which is unfortunately quite common with this type of model. (The goodness of fit for the Probit equation is relatively low, with a likelihood ratio index of 0.13.)

Starting with the choice whether to have a car or not in the household this study finds that the marginal effect (of variables in log-form) associated with household income is positive and significant as expected. A 1% increase in household income (per equivalent adult) would increase the probability of having a car by about 0.034%.5 But it seems more important to have a partner with income per se, for this choice. The probability increases further with the number of children, which seems reasonable even

4 The difference in result from the case with a standard OLS in the second stage was always negligible, however.

5 It is likely that very low reported incomes are positively correlated with positive transfers from the central or local government, which we have not been able to measure. Therefore, this study includes both a dummy variable for individuals with an annual income lower than 20,000 SEK, and a variable equal to the product of the dummy variable and income. Thus, all reported income parameters, and elasticities, are associated with individuals with an annual income higher than 20,000 SEK. (£1 = 15 SEK, 31 May 2001.)
though the disposable income per person normally decreases with the number of children. The probability increases with age but decreases with age squared, implying a maximum probability at about 45 years \((0.0033/2^2 \times 0.000037) = 45\).

For single adult households, men have a larger probability than women of having a car. The probability is significantly lower in big and intermediate cities but independent of education. The choice to drive or not, given a car in the household, follows a similar pattern. This choice, however, is at least partly an individual choice, for which it is intuitively possible that also individual income (and not only household income) could be important. Indeed, in this study it is found that only the individual income matter for the choice whether to drive or not. The probability with respect to age reaches again its maximum at about 45 years. Living in big cities decreases this probability, but having access to a company car increases it.

The reported marginal effects, and their corresponding \(t\)-values, for the Cragg and Tobit 2 models have the same interpretation, and the differences between them are generally quite small. The reported marginal effect with respect to income can be interpreted as elasticities for dependent variables in log form, evaluated at sample mean, i.e. at the mean of the log of driving distance. For example, a 1% increase in after-tax income, holding the income of a possible partner constant, would imply an expected increase in driving distance by about 0.3% in the Tobit 2 case. A corresponding increase of the partner’s income would be expected to increase the driving distance by only slightly more than 0.02%. If income increases by 1% for both of them this study would have the sum of these effects on driving. Hence, it can be seen that for an individual’s own driving distance it is again the individual income, rather than the household income, that matters. For a dummy variable, such as sex, we have that men have about 70% longer driving distance, given that the person drives at all. The pattern with regards to age is the same here as well, and the effects of living in cities are insignificant. Having a company car increases the expected driving distance by about 50%.

Being a member of an environmental organization implies no significant effects on either the choice of having a car, or whether to drive or how long to drive. If anything, there may be a small positive effect on the choice to drive given a car. This may seem surprising since these organizations often argue forcefully in favour of various measures to reduce private car use.

**The income-elasticity of driving**

In order to obtain the overall income-elasticity of the expected driving distance we simply differentiate the log of the expected \(Q\) with respect to the log of income (cf. McDonald and Moffitt, 1980). It follows that:

\[
E[Q] = \Pr[Car > 0] \Pr[Q > 0] Car > 0] \Pr[Q > 0] E[Q|Q > 0] \tag{8}
\]
and hence that the income-elasticity is given by:

\[
\frac{\partial \ln E[Q]}{\partial \ln y} = \frac{\partial \ln[\Pr[Car > 0] \Pr[Q > 0|Car > 0]E[Q|Q > 0]]}{\partial \ln y} = \frac{\partial \ln[\Pr[Car > 0]]}{\partial \ln y} + \frac{\partial \ln[\Pr[Q > 0|Car > 0]]}{\partial \ln y} + \frac{\partial \ln(E[Q|Q > 0])}{\partial \ln y} \frac{\Pr[Car > 0]}{Pr[Q > 0|Car > 0]} + \frac{\partial \ln(E[Q|Q > 0])}{\partial \ln y} \frac{\Pr[Q > 0|Car > 0]}{Pr[Q > 0|Car > 0]}
\]

Note that the last term in (9) is not strictly identical to the reported marginal effects in Table 3, which are instead given by \((\partial E[\ln Q|Q > 0])/(\partial \ln y)\). Still, assuming that \(E[\ln Q|Q > 0] \approx \ln E[Q|Q > 0]\) this study gets in the Tobit 2 case the overall income elasticity for a change in income of both the individual and the partner as 0.038/0.85 + (0.090 – 0.0061)/0.89 + 0.295 + 0.023 = 0.46 < 1. Hence, although car driving increases with income, the ratio between driving distance and income decreases strongly with income.

### The income-elasticity of public-transport use

In a similar way as for driving distance, we can calculate the income-elasticity of the expected number of public-transport trips from Table 4. In the Tobit 2 case we have that the income-elasticity is given by \((-0.037 + 0.014)/0.28 – 0.058 – 0.068 = -0.21\). In this calculation the number of cars is treated as given. Including the indirect effect from the fact that the number of households with access to a car will increase we should add a term given by \(-0.203/0.28\)\(\times0.038/0.85 = -0.03\). The overall income-elasticity, taking the indirect effect of cars into account for the Cragg and Tobit 2 estimations, are then equal to about \(-0.25\). This result should be used with care, however, since the statistical significance of some factors is rather poor.

### IV. MICRO VERSUS MACRO STUDIES OF CAR USE

The income elasticities in this study are of the same order of magnitude as in other comparable disaggregated studies based on micro-data. De Jong (1990) found an overall income elasticity of private mileage equal to 0.63 for Holland, where about 50% were due to effects of car ownership. De Jong (1997) found again a similar result for Holland but also a car-use income elasticity of 0.38 for Norway, and Bjorner (1997) obtained a car-use income elasticity of 0.42 for Denmark.
(1976) reported a car ownership income elasticity of about 0.3 for the UK.

It is interesting to compare these income elasticities with studies based on aggregated data on national level, which often find an income elasticity of car use of about unity (or higher). For example, Johansson and Schipper (1997) found income elasticities of about 1.2, where almost all were due to changes in the number of cars, based on both cross-sectional variation and time-series variation for a data-set consisting of 12 OECD countries. Further, gasoline-demand studies often find an income-elasticity of demand larger than unity (see e.g. Dahl and Sterner, 1991 or Sterner et al. 1992). Since the gasoline-demand income elasticity is equal to the travel-demand elasticity plus the elasticity of fuel intensity per kilometre driven, and the latter is often rather small (Johansson and Schipper, 1997; Dahl, 1995), the implicit travel-demand income elasticities are large also in these studies.

Explaining the elasticity differences

A possible explanation for larger income elasticities in aggregated studies may be that structural changes follow from increased income over time. For example, when a large fraction of the population has access to a car, the infrastructure of roads, shops and various institutions adapts, making it more difficult to live without a car. Consider the following simple model to illustrate this: Assume that travel demand \( Q \) is a function of private income and infrastructure, we have

\[
Q = q(y, S)
\]

where \( S \) is an index of the (non)accessability of the infrastructure so that

\[
\frac{\partial q}{\partial y} > 0, \quad \frac{\partial q}{\partial S} > 0
\]

The infrastructure, in turn, is a result of both market forces and political decisions. Consider for example the development of shops. People (naturally) prefer lower prices and high accessibility (e.g. shops close to where they live), but there is typically a tradeoff between the two since fewer bigger shops in general can manage to have lower prices. In this tradeoff, people with cars would generally prefer a situation with lower prices and lower accessibility compared to the preferences of people without cars. Hence, when more people have access to cars and are driving, the more is \( S \) likely to increase by the basic laws of supply and demand. \( S \) may also depend directly on income since, for example, higher income tends to imply a higher living area per individual, and hence a more scattered living. Political decisions often go in the same direction, i.e., public planning is (at least to some extent) reflecting individual preferences and tend over time to be more and more adapted to a society with cars, when a larger and larger fraction of the population is driving. Thus, this study can write \( S = s(Q, y) \) where

\[
\frac{\partial s}{\partial Q} > 0, \quad \frac{\partial s}{\partial y} > 0
\]

Substituting this into (10) gives

\[
Q = q(y, s(Q, y))
\]

Hence, travel demand depends on income directly, and indirectly through changes in the infrastructure. Total
implicit differentiation of (11) with respect to income gives that:
\[
\frac{dQ}{dy} = \frac{\partial q}{\partial y} + \frac{\partial q}{\partial S} \frac{dQ}{dy} + \frac{\partial q}{\partial S} \frac{dQ}{dy}
\]
(12)

implying the following total marginal effect of travel with respect to income:
\[
\frac{dQ}{dy} = \frac{\partial q/\partial y + \partial q/\partial S \partial s/\partial y}{1 - \partial q/\partial S \partial s/\partial Q}
\]
(13)
or in elasticity form
\[
\sigma_y^{\text{tot.}} = \frac{\frac{\partial q}{\partial y} Q + \frac{\partial q}{\partial S} \frac{y Q}{\partial s/\partial Q} + \frac{\partial q}{\partial S} \frac{y Q}{\partial S/\partial Q}}{1 - \frac{\partial q}{\partial S} \frac{y Q}{\partial S/\partial Q}} = \sigma_y^{\text{part.}} + \sigma_y^{xy}
\]
\[
= \sigma_y^{\text{part.}} + \sigma_y^{xy} + \frac{\frac{\partial q}{\partial S} \frac{y Q}{\partial S/\partial Q}}{1 - \frac{\partial q}{\partial S} \frac{y Q}{\partial S/\partial Q}} \left( \sigma_y^{\text{part.}} + \sigma_y^{xy} \right)
\]
\[
= \left( \sigma_y^{\text{part.}} + \sigma_y^{xy} \right) \left( 1 + \Omega \right) = \sigma_y^{\text{part.}} + \sigma_y^{i}
\]
(14)

In the cross-section case within a country, where everybody has a similar infrastructure (i.e., with a low level of segregation),
\[
\sigma_y^{\text{part.}} = \frac{\partial q}{\partial y} \frac{y Q}{Q}
\]
is measured, i.e. the partial income elasticity for a fixed infrastructure. But in the case of time-series, or cross-section between countries with different (mean) incomes, this study is measuring \(\sigma_y^{\text{tot.}}\), i.e. the income elasticity including indirect effects through endogenous infrastructure changes. There are two different effects working in the same direction of increasing the estimated income-elasticity compared to disaggregated analysis within a country. The first may be denoted the indirect travel demand income elasticity
\[
\sigma_y^{xy} = \frac{\partial q}{\partial S} \frac{y Q}{\partial y/\partial Q}
\]
measuring the percentage change in travel due to a 1% change in income through the changes in the infrastructure due to this income increase. Hence, this term is due to infrastructure changes directly through an income increase, and hence not through increased transportation per se. The factor
\[
\Omega = \frac{\frac{\partial q}{\partial S} \frac{y Q}{\partial Q}}{\left( 1 - \frac{\partial q}{\partial S} \frac{\partial s/\partial Q}{\partial s/\partial Q} \right)}
\]
on the other hand, is due to the fact that the infrastructure changes due to increased transportation, e.g. through an increased number of out-of-town shopping centres and fewer local stores when travelling by car increases. Since the empirical results typically indicate a total income elasticity \(\sigma_y^{\text{tot.}}\) of about 1, and a partial income elasticity \(\sigma_y^{\text{part.}}\) of about 0.5, the overall effect due to a changed infrastructure
\[
\sigma_y = \sigma_y^{\text{tot.}} - \sigma_y^{\text{part.}} = \sigma_y^{xy} + \Omega (\sigma_y^{\text{part.}} + \sigma_y^{xy})
\]
would correspond to an income elasticity of about \(1 - 0.5 = 0.5\). The relative importance of income induced \(\sigma_y^{xy}\) versus travel induced \(\sigma_y^{xy}\) changes in infrastructure is still an open question, however.

In addition to direct physical changes there may exist what may be considered to be sociological explanations related to possible evolutions of social norms and conventions. Although often overlooked, these ideas are far from novel in economics (see Mason, 1998). For example, already Adam Smith noted that women in England required better clothing to appear in public without shame than did women in Scotland. In the case of transportation today it may in many countries be considered necessary to have access to a car in order to function normally, and people may be excluded from normal social interaction if they do not (cf. Veblen, 1899; Sen, 1985; Galbraith, 1991; and Brekke and Howarth, 2000). Such mechanisms would thus also work in the direction of increasing the income elasticity gap between aggregated and disaggregated studies. More research is clearly needed in this area.

V. CONCLUSIONS

In this paper, annual individual driving distance by car and number of trips by public transport are analysed. It is shown that even after correcting for other variables, such as income, men are driving considerably more, and using less public transport, compared to women, also in a country like Sweden, which is often considered to have a relatively high degree of gender equality. As one would be inclined to believe, people living in big cities are less likely to drive than people living in the countryside. Hence, the frequent statement that people in the countryside would on average suffer harder from fuel-price increases (and similar measures) seems correct. However, it is also shown that this effect is not as large as is often claimed, and that in fact drivers’ mean driving distance is about the same in city areas as in the countryside.

Driving increases with income similar to other cross-section studies within a country or region, but the elasticity
is much lower compared to most aggregated studies on national level. This difference, it is argued, is probably largely due to structural effects and a simple theoretical model is developed to illustrate this. For policy considerations it is of course important which income elasticity to choose. For example, if the purpose is to estimate the distributional effects within a country of a certain policy measure, the lower elasticity (such as the one in this study) should be used. Hence, using an income elasticity based on aggregate data on a national level would tend to under-estimate possible negative distributional welfare effects. If, on the other hand, the purpose is mainly to forecast the future long-run traffic changes based on various assumptions on income growth, the estimated elasticities in this paper (and similar) offer little help.\footnote{In this case it may also be important to take the influence of different age cohorts into account; see for example Jansson (1989).}

Contrary to what is implicitly assumed in many applied studies, we have seen that individual income, and not only household income, is important for explaining transport demand of different modes. It seems that in partner relations where income differ, the one with a larger income has a much larger probability of using the car, and the one with a lower income has a larger probability of using public transport. This indicates that it may sometimes be questionable to see the household as the only relevant economic subject in this type of analysis.

Age is also found to be an important explanatory variable and both the probability of driving and the expected annual driving distance reach a peak at about the age of 50, whereas the probability of using public transport reaches a minimum at about the same age. Having access to a so-called company car increases the private driving distance dramatically, which is expected since the marginal cost is then close to zero. Being member of an environmental organisation had no significant effect either on driving or on public-transport use. This indicates that even if the government (or other authorities) would be successful in changing people’s attitudes in favour of environmental values, and against private-car use, the actual effects in terms of a changed travel pattern may be smaller than anticipated.

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