

ON THE PARTICIPATION IN MEDIUM- AND LONG-DISTANCE TRAVEL: A DECOMPOSITION ANALYSIS FOR THE UK AND THE NETHERLANDS

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ABSTRACT

Social and economic benefits have accrued from medium- and long-distance travel, but at the expense of the environment. Since the travel behaviour literature tends to concentrate on short-distance trips or trips within daily urban systems, a better understanding of the factors shaping medium- and long-distance travel is needed. Using the 1998 National Travel Surveys for the UK and the Netherlands, the study reported here characterises medium- and long-distance travellers in terms of socio-economic attributes, time availability, day of travel, and land-use related factors. The results suggest that, in both countries, males and individuals with a higher socio-economic status are more likely to engage in medium- and long-distance travel. The analysis further shows that the overall structure of the urban system in combination with the size of the country and the local population density affect the participation in medium- and long-distance travel. Such factors should be considered explicitly in future studies of medium- and long-distance travel.

Key words: Medium- and long-distance travel, comparative study, UK, the Netherlands

INTRODUCTION

During the last few decades many countries have experienced a dramatic increase in mobility in terms of vehicle-kilometres travelled (see, for example, Bureau of Transportation Statistics 1998; Department for Transport, Local Government and the Regions 2001; Swedish Institute for Transport and Communications Analysis 2003). Technological innovations in transport and faster travel speeds are the main facilitators of this trend, allowing people to travel farther within relatively constant travel time budgets (Schafer 1998). One consequence of these processes is that the number of people travelling greater distances than the average size of traditional daily urban systems or metropolitan areas is increasing (Van der Laan 1998). This

type of travel is referred to as medium- and long-distance travel in this study.

Economic and social benefits can be expected from medium- and long-distance travel, along with environmental threats. Economically, this type of travel strengthens the links between different regions (Bureau of Transportation Statistics 1998) and facilitates the organisation of production in inter- and intra-company networks. Consequently, regions have more opportunities to become involved in networks and to profit from the mutual exchange of knowledge and creativity (Batten 1995). Medium- and long-distance travel is thus one of the factors at play in the on-going spatial integration process in Europe and elsewhere. Socially, medium- and long-distance travel enhances travellers' opportunities to access a wider range of facilities and

specialised services, such as healthcare, retail outlets, or social events, particularly in rural areas. Moreover, travel is necessary when going away on vacation, or taking a day-trip, and hence functions as a precondition for tourism activities (Mallett 1999a). Medium- and long-distance trips nonetheless cause severe damage to the environment, since travel distance is positively related to higher levels of energy consumption, the emission of air pollutants, and noise levels (Stead 1999). While their absolute number may be rather low, medium- and long-distance trips are responsible for more than one-fifth of all passenger-miles travelled in the United States (Bureau of Transportation Statistics 1998). Moreover, trips by private car and air travel collectively dominate the modal split for medium- and long-distance travel, contributing further to the negative impacts of this type of travel on the environment.

Although the increase in medium- and long-distance travel is widely acknowledged, empirical studies of this subject are few. The literature on travel demand analysis typically concentrates on trips within daily urban systems. In addition, the fact that this study compares medium- and long-distance travel in the UK and the Netherlands can be considered a contribution to the existing literature that draws mainly on US data. The value of this contribution derives from the fact that conclusions for the United States cannot be transposed directly to European countries where urbanisation patterns are different: cities came into existence when walking was the dominant mode of transport; the density of cities is higher; public transport is better developed; and car ownership rates are lower (Schwanen *et al.* 2002; Giuliano & Narayan 2003).

In this paper, we therefore examine the extent to which the participation in medium- and long-distance travel, compared with participation in short-distance travel, depends on the socio-economic characteristics of travellers, time availability and day of travel, as well as the characteristics of urbanisation patterns. The last set of factors in particular has rarely been taken into consideration in previous studies of medium- and long-distance travel. The impact of the three sets of determinants on medium- and long-distance travel was investigated separately for commute, business, and leisure trips

by private car and train, because we expected their effects to differ across trip purposes and transport modes. We concentrate on travel by private car and train because these are the dominant transport modes for medium- and long-distance domestic travel in Europe.¹

To gain more insight into the spatial variation in the participation in medium- and long-distance travel, we have analysed data from the 1998 UK and the Netherlands National Travel Surveys. While the two countries are at a similar stage of economic development, there are certain other differences that may affect the extent of medium- and long-distance travel. The very fact, for instance, that the area size of the UK is some 5.5 times larger than that of the Netherlands may result in more domestic medium- and long-distance trips in the former country. The urbanisation pattern is also different. In the UK a small number of large metropolitan regions such as Greater London and the Manchester area dominate the urban system (Parkinson, 1998). In contrast, the Netherlands is characterised by a relatively large number of cities of a moderate population size, located in densely populated areas at short distances from each other and linked by extensive road and rail networks. Most of these are concentrated in the western part of the country; together they constitute the Randstad Holland, which is often referred to as one polycentric urban region (Dieleman & Faludi 1998). Differences in local residential density are also rather small in the Netherlands. Taken together, these differences imply that employment opportunities and leisure facilities are spatially more dispersed in the Netherlands than in the UK; this dispersal may also affect the extent of medium- and long-distance travel.

According to the literature, medium- and long-distance trips are usually defined on the basis of physical distance. Unfortunately, there is no commonly defined minimum distance, as the thresholds used in various national travel surveys make clear: 100 miles (167 km) for the United States (Bureau of Transportation Statistics 1998); 50 miles (83 km) for the UK (Office for National Statistics 1998); 100 km for Sweden (Swedish Institute for Transport and Communications Analysis 2003), Norway (Denstadli & Hjorthol 2002), and the European long-distance travel mobility survey (Dateline Consortium

2003). In this study, we have arbitrarily defined medium- and long-distance trips as those greater than 50 km (one-way, door-to-door distance). This threshold was chosen on the basis of the average size of metropolitan areas in both the UK and the Netherlands (see also Rickard 1988).

The remainder of this paper is organised as follows. The next section consists of a review of the existing literature on the determinants of participation in medium- and long-distance travel. In the third section the research methodology and the datasets used are described; the fourth section introduces the main characteristics of medium- and long-distance travel engagement in the UK and the Netherlands. The results of a series of multivariate analyses are presented in the fifth section. The paper ends with some conclusions and implications for policy-making.

PREVIOUS RESEARCH

In this section, we first review the relevant literature on the determinants of medium- and long-distance travel and then discuss the factors that we hypothesise influence the participation in this type of travel.

Numerous studies have indicated that travellers' socio-economic attributes are among the most important determinants of short-distance trips (see, for example, Hanson & Hanson 1981; Lu & Pas 1999; Stead *et al.* 2000). These factors also play an important part in influencing medium- and long-distance travel behaviour. Drawing on data from the American Travel Survey 1995, Mallett (1999b) shows that men engage in trips longer than 100 miles more frequently than women do, mainly because they make more than twice as many business trips. Men also take more trips for outdoor recreation. These differences are explained by women's lower income and employment rates as well as their tendency to be mainly responsible for household maintenance and childcare tasks. With respect to mode choice, women tend to use public transport for these trips more often than men do (Mallett 1999b).

Apart from gender, socio-economic status is an important determinant of medium- and long-distance travel. Higher-income, highly-educated, full-time employed travellers as well as people in higher-level occupations tend to

engage in medium- and long-distance travel more often. Participation in these trips is also positively associated with the possession of a valid driving licence and car ownership (Annitori *et al.* 1998).

The literature is more equivocal with respect to the impact of the presence of children on the propensity to engage in medium- and long-distance travel. Mallett (1999b) asserts that the presence of children reduces the frequency of trips longer than 100 miles to a greater extent for women than for men, but O'Neill & Brown (1999) point out that the presence of children does not affect the frequency of these trips in married households. Previous research also suggests that participation in medium- and long-distance travel increases with age, but decreases after the age of 65. However, people aged 65 and older spend more time at their destinations than any other age group (Georggi & Pendyala 1999).

When considering the spatial variation in the participation in medium- and long-distance travel, Mallett (1999a) shows that, in the United States, inhabitants living in rural areas conduct these trips more frequently than the residents of urban areas do. He also finds that people from urban areas use rail more often than others because of the greater accessibility of rail in urban areas. O'Neill & Brown (1999) estimate the number of trips generated per Transportation Analysis Zone (TAZ) in the United States and report that households in non-metropolitan areas on average generate more medium- and long-distance non-business trips per year than their counterparts in metropolitan areas. Another spatial factor mentioned by Algiers (1993) is that owners of a summerhouse participate in medium- and long-distance travel more frequently. He also indicates that the total population, the number of employees, and the population density cannot fully differentiate between different destinations for private trips, but to a certain extent they can explain the probability of choosing a specific destination for business trips.

Although previous work has made a substantial contribution to our understanding of factors influencing medium- and long-distance travel participation, at least two gaps in the existing literature can be identified. The first of these is that the influence of the spatial setting has not been studied in detail. When they are

taken into account, spatial differences have often been represented as a dichotomy distinguishing metropolitan from non-metropolitan locations, or urban from rural areas. In this paper we hypothesise that the structure of the national urban system, the size of the country, and local population density influence the level of participation in medium- and long-distance travel.

With respect to the structure of the urban system, a distinction can be drawn between countries such as the UK (where one or just a few cities or metropolitan areas dominate the urban system in terms of population, employment, and the supply of (specialised) facilities) and countries such as the Netherlands (where no city or metropolitan area dominates the whole system and activities). In the latter type of system, activities and potential destinations are more evenly distributed across polycentric urban areas. At the same time, individual urban areas may specialise in specific functions. This type of system may induce more medium- and long-distance travel, because residents or employees in one urban area may have to travel to other urban areas to visit specific destinations that cannot be found in their place of origin. Medium- and long-distance trips may constitute a viable alternative to many travellers, particularly if distances between urban areas are not too large.

The size of the country may also be associated with engagement in medium- and long-distance travel: in larger countries, the number of medium- and long-distance trips to domestic destinations may be greater. Because the UK is 5.5 times bigger than the Netherlands, this greater size may offset the expected influence of urban structure when the two countries are compared. Finally, local population density may act as an indicator of the number of opportunities and activity locations locally available. Hence we expect residents of high-density areas to participate more frequently in short-distance than in medium- and long-distance travel. Because differences in density are greater in the UK than in the Netherlands, as we described in the introduction, we expected a greater impact of the local residential environment on the participation in medium- and long-distance travel for British than for Dutch travellers.

The second contribution this study makes is to assess the influence of time availability and

day of travel on participation in medium- and long-distance travel. To the best of our knowledge, these elements have not previously been taken into consideration by any study to date of medium- and long-distance travel. We expected that travellers experiencing fewer space-time constraints in a day (as reflected in the engagement in work(-related) activities and household chores) might be more likely to engage in medium- and long-distance travel. While we recognise that the number of maintenance trips can also be a function of the tendency to undertake medium- and long-distance trips, we anticipated that the causal link in the opposite direction would be the stronger of the two. Many household maintenance trips – especially chauffeuring trips – are fixed in space and time, which tends to reduce opportunities for trips over longer distances. There is a vast literature that has shown how women's opportunities for commuting over longer distances and working full-time are reduced through their household and childcare obligations (Turner & Niemeier 1997; Kwan 2000).

We expected that the impact of travellers' socio-economic characteristics, time availability, urbanisation patterns and spatial factors on the participation in medium- and long-distance travel would vary across travel purposes. The impact of time availability is, for instance, likely to be greatest for leisure trips, because these are more discretionary than commuting or business trips. However, gender differences may be smaller for leisure trips than for commuting or business trips, because spouses may be more inclined to engage in leisure activities together. These and other expectations are rooted in previous research about the determinants of travel behaviour in the Netherlands and the travel demand analysis literature in general (see, for example, Dieleman *et al.* 2002; Schwanen *et al.* 2002, 2004). We have therefore drawn a distinction between commuting, business and leisure travel in the empirical analysis described in the fourth and fifth sections. We first turn to a description of the operationalisation of the concepts and data used for the empirical analysis.

RESEARCH DESIGN

Our empirical analysis has been conducted at the person level; the analysis compares

medium- and long-distance travellers with short-distance travellers. A medium- and long-distance traveller is defined as a person making at least one trip of 50 km or more on a given day; a short-distance traveller is someone who engages only in trips shorter than 50 km (self-reported, door-to-door distances). The participation in medium- and long-distance travel has been analysed with the help of cross-tabulations and binary logit modelling.

The analysis is conducted separately per trip purpose and transport mode. Three trip purposes are discerned: commuting to work, business travel, and leisure (recreation, sports, visiting family and friends). With respect to transport modes, the analysis is restricted to travellers using the private car and train; other modes (aeroplane and bus, for example) are excluded because they constitute less than four per cent of the medium- and long-distance trips in both the UK and the Netherlands.² Another reason for exclusion is that information on air travel is not collected directly in the Netherlands National Travel Survey.

Potential explanatory variables have been selected on the basis of the relationships identified in the literature. Nonetheless, the selection of potential determinants is constrained by the availability of certain variables in both datasets. In the end, we defined three sets of explanatory variables: socio-economic attributes, day of travel and time availability and urbanisation pattern (Table 1). The socio-economic factors considered are age, gender, household income, household composition and an index for car availability. The categorical variable household composition is based on three household characteristics: the size of the household, the number of adults in the household participating in the labour market, and the presence of children below the age of 12. The following categories are distinguished: single person, one-worker couple, two-worker couple, one-worker family, two-worker family, family with more than two workers, and other households. The interactions of gender and household composition have also been taken into consideration. These have been included because the magnitude of gender differences is known to depend on the type of household; they are often largest in households in which young children are present (see, for example, Turner & Niemeier

1997; Mallett 1999b). Car availability is measured as the ratio of the number of cars to the number of valid driving licences in the household; car availability is set at zero for a person who has no driving licence (Hanson & Hanson 1981).

To represent the day of travel, we have employed three dummy variables: commuting day, weekday and weekend day. A commuting day is defined as a day on which the person in question makes at least one commute trip. Note that this last variable is not included in the model for commuting presented in the fifth section. The number of maintenance trips (shopping, personal business, dropping off and/or picking up persons/goods) a person makes on the day of inquiry is used as an indicator of time availability.

The physical urban structure is encapsulated in the variable *local population density* (the number of persons per hectare) measured at the level of the local authority district (UK) and the municipality (NL). This variable is used for two reasons. It is the dimension of urban form that has received most attention in the academic literature about the link between land use and travel (see, for example, Newman & Kenworthy 1989; Giuliano & Narayan 2003). In addition, while having a significance of its own, local population density can also be considered a proxy for other factors that affect travel patterns, but are more difficult to measure, such as the level of land-use mixing and availability of public transport (Ewing 1995) as well as the level of traffic congestion (Dunphy & Fisher 1996).

The data for this study are derived from the 1998 national travel surveys from the UK and the Netherlands. The UK National Travel Survey (UK NTS) was commissioned by the Office for National Statistics (Department of the Environment Transport and the Regions 1998). A sample of 5,040 addresses was randomly selected from the postal code address file. The resulting database comprises information about 15,000 individuals and 360,000 trips. The UK NTS employs two methods: face-to-face interviews carried out using computer assisted personal interviewing (CAPI) and a seven-day travel diary. The analysis focuses on the level of the day, so that a single individual could be represented up to seven times in our analysis.

Table 1. *Explanatory variables.*

Category	Variable name	Description
Socio-economic attributes	Age	18–29 years
		30–49 years
		50–64 years
		65 years and over
	Gender	Male
		Female
	Household income	Low income
		Medium income
		High income
	Household composition	Single worker
		One-worker family
		Two-worker family
		Family, more than two workers
		Other type of household
Day of travel and time availability	Travel day	Weekday (Monday through Friday)
		Weekend day (Saturday or Sunday)
	Car availability index	Commuting day (at least one commuting trip has been made)
		Ratio of the number of cars to the number of valid driving licences in the household; set to zero if person has no driving licence
Urbanisation pattern	Population density	Less than 10 persons per hectare
		10 to 19.99 persons per hectare
		20 to 34.99 persons per hectare
		35 persons per hectare and over

Statistics Netherlands collected the data for the Netherlands National Travel Survey (abbreviated as *OVG* in Dutch). The *OVG* employed two methods (Statistics Netherlands 1999): telephone interviews (CATI) and a one-day travel diary. Approximately 70,000 households participated in this survey, resulting in a database of some 130,000 individuals and more than 500,000 trips. The UK and the Netherlands' NTSs both contain information on the characteristics of trips as well as some details on the personal and household characteristics of travellers, and geographical information about the origin and destination of individual trips. Travel distances were reported by the respondents in both datasets.

For the analysis, only individuals who undertake at least one trip on the day of inquiry have been selected. Although trips abroad are available in both databases, we left them out of consideration because the information about distance for such trips is incomplete. Travel distances for international trips are only

recorded up to the departure point of the international leg of the trip in the UK and up to the border of the country in the Netherlands. In addition, overnight trips are not considered here because these are not recorded in the Netherlands' NTS. We have also excluded trips undertaken by travellers younger than 18 years old, since we believe that their decisions to engage in medium- and long-distance trips are frequently related to their parents' decisions.

DESCRIPTIVE ANALYSIS

Comparatively few travellers use the private car or train to engage in medium- or long-distance travel in either the UK or the Netherlands: seven per cent and 12 per cent respectively (Figure 1). Comparing the proportion of medium- and long-distance travellers for each trip purpose, we find that the proportion of medium- and long-distance travellers is highest for business purposes. Table 2 shows that the number of

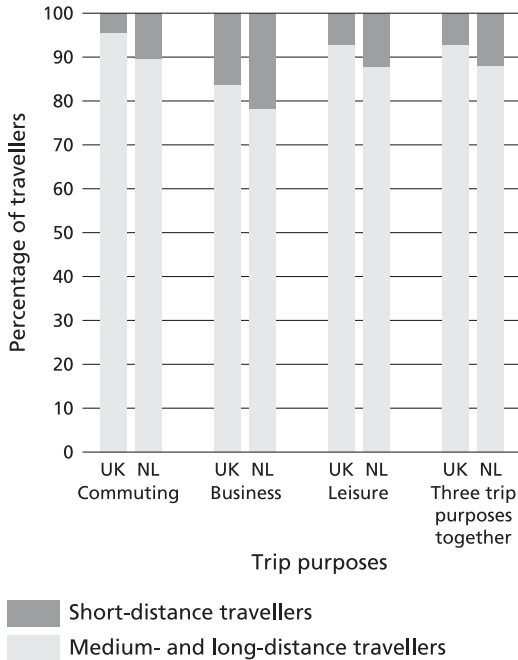


Figure 1. Percentage of medium- and long-distance travellers stratified by trip purpose and country.

travellers engaging in this type of travel is higher in the Netherlands, irrespective of socio-economic status and density. Although not shown here, additional analysis indicated that British medium- and long-distance travellers make more of such trips per person than do Dutch medium- and long-distance travellers.

With respect to age, the results show that travellers in the over-65 category participate in medium- and long-distance trips less than any other group. Two explanations can be given. The majority of people in this age group are retired, resulting in far less medium- and long-distance commuting and business travel. Especially for individuals aged 65 years and older, the physical limitations that come with age may make travel in general and medium- and long-distance travel in particular less convenient. Although they make only a small number of medium- and long-distance trips, additional analysis shows that, on average, the elderly in both the UK and the Netherlands spend more time at destinations than do other age groups. This finding is in line with US evidence (Georggi & Pendyala 1999).

Table 2. Percentage of medium- and long-distance travellers stratified by socio-economic factors and population density in the UK and the Netherlands.

	UK	NL
Age		
18–29 years	7.5	12.9
30–49 years	8.3	11.5
50–64 years	6.9	12.8
65 years or more	3.7	9.7
Gender		
Male	9.3	14.7
Female	4.9	8.6
Household income		
Low or medium income	4.1	9.9
High income	9.2	13.1
Household composition		
Single worker	8.0	15.5
One-worker couple	6.8	13.7
Two-worker couple	9.4	13.6
One-worker family	8.8	11.2
Two-worker family	7.5	11.4
Family, more than two workers	7.8	10.9
Other household types	7.9	10.4
Population density		
Less than 10 pers/ha	8.2	11.7
10–19.9 pers/ha	5.9	11.8
20–34.9 pers/ha	6.8	11.9
35 pers/ha and over	4.7	13.2

Note: A medium- and long-distance traveller is defined as a person who makes at least one trip that is longer than 50 km one-way.

As expected, men engage more in medium- and long-distance travel than women do. Interestingly, gender differences are larger in the Netherlands than in the UK, which may reflect differences in labour participation between the countries: approximately 60 per cent of British women are active in the labour market and work on a full-time basis, against 45 per cent of Dutch women (International Labour Organisation 2002). Abundant evidence is available that part-time jobs tend to result in shorter commutes (see, for example, Madden 1981; Schwanen *et al.* 2004). With respect to income, the results for both the UK and the Netherlands show that medium- and long-distance travellers are over-represented among high-income households, which is consistent with previous studies (Mallett 1999b; Georggi & Pendyala 1999).

In the Netherlands, the number of medium- and long-distance travellers varies substantially by household type. Dutch singles participate in medium- and long-distance trips most frequently, followed by couples and families. The reason for this order is that travellers younger than 30 are overrepresented among singles in the Netherlands. Young adults are known to have the highest job turnover rates, and are hence more likely than other households to choose their residential location strategically on the basis of the spatial distribution of all potential employers instead of on the basis of a specific job location (Madden 1981; see also Giuliano 1998). As a consequence, they may be obliged to commute over long distances. In addition, singles depend on persons outside the household for social interaction, and this requires travelling. For the UK we find that two-worker couples engage in medium- and long-distance travel the most, which might be related to the fact that such households are on average more career-oriented than families (Pazy *et al.* 1996), as well as the fact that individuals in households without children tend to have fewer time constraints restricting travel opportunities (Dijst 1999).

As Table 2 indicates, the percentage of medium- and long-distance travellers is lower in areas of higher population density in the UK. This is in contrast with the situation in the Netherlands, where the most densely populated areas generate the highest number of medium- and long-distance travellers. We believe that the reason for this contrast lies in the differences in urbanisation patterns between the two countries, so that spatial opportunities are spatially more concentrated in the UK than in the Netherlands. While persons living in lower-density areas in the UK are likely to travel over long distances if they decide to visit a destination in a large metropolitan area, the relatively greater dispersion of opportunities in the Netherlands implies that even urbanites may have to cover long distances to visit specific opportunities located in another urban area. Because urban areas are not only limited in size but are also rather close to one another, the Dutch urbanisation pattern thus appears to offer 'stepping stones' to clusters of opportunities located outside the metropolitan area of residence.

MULTIVARIATE ANALYSIS

While it is suggested in the previous section that the extent of medium- and long-distance travel is related to travellers' socio-economic attributes and population density, the descriptive results should be considered preliminary because no account has been taken of the interrelationships among the explanatory variables. Because the impact of potential determinants may vary across trip purposes and transport modes, we present here the results of a series of binary logit models stratified by country, trip purpose (commuting, business and leisure), and transport mode (private car and train). In every model, the short-distance traveller is taken as the reference category; the coefficients shown in Tables 3 to 5 convey the influence of each factor on the probability of being a medium- and long-distance traveller relative to the likelihood of being a short-distance traveller.

The model fit is indicated by the adjusted likelihood ratio index ρ^2 (for further details, see Ben-Akiva & Lerman 1985). This indicator, which always falls in the 0–1 range, is corrected for differences in the number of determinants included. It can therefore be compared across models. The adjusted likelihood ratios for the models presented in Tables 3 to 5 suggest that the independent variables tend to explain a fair share of the variation in medium- and long-distance travel participation. Their magnitude is comparable to those reported in many studies analysing short-distance trips. Nevertheless, there are differences in the explanatory power of the predictor variables in the models presented here; in the UK, the explanatory variables can explain a fair share of the variation in the dependent variable, especially for medium- and long-distance commuting and business travel by train.

Medium- and long-distance commuting – In both the UK and the Netherlands, the effects of income and gender on the propensity to make at least one medium- and long-distance trip are fairly strong for both the private car and public transport (Table 3). A higher income results in a greater propensity to participate in medium- and long-distance commuting. This tendency might be related to the type of occupation; high-income workers tend to hold

Table 3. Binary logit models stratified by country and transport mode: medium- and long-distance commuting.

	UK				NL			
	Private car		Train		Private car		Train	
	B	t-statistic	B	t-statistic	B	t-statistic	B	t-statistic
Age: 30–49 years	0.244	3.6						
Female	-1.251	-12.2	-1.349	-7.7	-1.303	-15.5	-0.786	-6.5
High income	0.880	9.1	1.588	6.6	0.336	5.7	0.437	2.9
Single worker							0.581	3.1
One-worker couple			0.740	2.3			0.648	3.0
Two-worker couple			0.628	3.6			0.394	2.9
One-worker family			1.540	6.7				
Two-worker family					-0.241	-2.5		
Family, more than two workers	0.344	2.7						
Other type of household	-0.199	-2.5						
Female: single worker			0.897	2.4	0.826	4.4		
Female: one-worker family	0.977	1.9						
Female: two-worker family	-0.524	-2.2						
Female: family more than two workers	-1.937	-2.7			-2.060	-2.9		
Car availability index			1.597	8.5	0.167	2.4	0.541	3.9
Weekend day	-0.336	-2.8						
No. of maintenance trips	-0.226	-5.5			-0.312	-8.0		
Less than 10 pers/ha			2.173	8.6				
10 to 19.99 pers/ha	-0.274	-2.7	0.881	2.9			0.278	2.2
35 pers/ha and over	-0.579	-4.7	-1.142	-3.3				
Constant	-3.439	-34.1	-5.747	-16.5	-2.209	-29.2	-2.103	-12.8
No. of observations	25,379		4,771		18,394		2,379	
-2 Loglikelihood at constant	8478.9		2007.1		11498.2		2205.4	
-2 Loglikelihood at convergence	7920.6		1388.6		10927.9		2114.3	
Number of variables	13		11		8		8	
Loglikelihood at constant	-4239.5		-1003.6		-5749.1		-1102.7	
Loglikelihood at convergence	-3960.3		-694.3		-5464.0		-1057.2	
χ^2	558.3		618.6		570.3		91.1	
ρ^2 (market share base)	0.066		0.308		0.050		0.041	
Adjusted ρ^2 (market share base)	0.063		0.297		0.048		0.034	
Short-distance traveller (%) (coded as reference category)	90.6		82.5		96.0		94.6	
Medium- and long-distance traveller (%)	9.4		17.5		4.0		5.4	

specialised jobs and higher positions and may have paid the price of career advancement in terms of spatial flexibility and longer commutes (Van Ham *et al.* 2001).

Women are in general less likely to engage in medium- and long-distance commuting in both countries. Nevertheless, there are differences between women in the various household types. Working women without a partner engage in medium- and long-distance commuting more frequently than other women. However, women seem to differ between the UK and the Netherlands in the mode they use for long-distance commuting: whereas female single workers in the UK tend to make more use of the train, their Dutch counterparts rely more on the private car. In the UK, the larger number of workers per family also reduces the likelihood of women engaging in medium- and long-distance commuting by private car. Similarly in the Netherlands, women in families with more than two workers have the lowest propensity to commute medium- and long-distance by private car. Three explanations for this finding can be given. First, as mentioned earlier, women are more likely to work part-time and are therefore less likely to commute over long distances. Second, women are still responsible for the majority of household tasks, so women are subject to more time pressure than men are (Kwan 2000). Third, women may have less access to a private car and less bargaining power in within-household negotiations about car use. Various studies of short-distance travel have indicated that, in situations of competition for car use within the household, the vehicle is more often allocated to the male partner (see, for example, Pazy *et al.* 1996; Schwanen & Mokhtarian 2005).

In both countries, the influence of age is not very clear once other factors have been taken into consideration. The results reveal that British commuters in the 30–49 age bracket are more likely to engage in medium- and long-distance commuting by private car, but the reasons for this finding are unclear. Perhaps it is a generation effect, showing that younger generations travel longer distances than preceding ones. As expected, the tendency to commute over longer distances decreases as commuters have to make more trips for household maintenance.

We also find that car availability is positively associated with the propensity to engage in

medium- and long-distance commuting both by private car and public transport. While the effect for commuting by car is consistent with expectations, the effect for public transport is at first sight counterintuitive. Two possible explanations for this finding can, however, be given. First, the car availability index employed here is positively correlated with income and may take over part of the income effect. The household income variables in the NTSs are rather crude. For the Netherlands, for instance, almost 50 per cent of the households fall in the highest income bracket (Schwanen *et al.* 2002). The car availability index may therefore function as a more refined indicator of income and purchasing power. Second, at least in the Netherlands, many long-distance commuters tend to be oriented towards jobs located in city centres or employment concentrations near intercity train stations. Even if people have a car available, they may not use it for their long-distance commute trips because public transport is a reasonable alternative to the car and is often cheaper (no parking fees, financial compensation for train trips by employers, and so forth).

Although population density does not have a statistically significant effect in the Netherlands, it is a relevant factor in the UK. The results indicate that British commuters residing in densely-populated areas are less likely to undertake medium- and long-distance commuting trips. As previously argued, this finding may reflect the concentration of jobs and work opportunities within such areas. Furthermore, the model suggests that public transport is used more frequently for medium- and long-distance travel in lower-density areas in the UK. This finding appears to reflect the relatively poor service level of local public transport in such areas (Stead *et al.* 2000). If residents in low-density areas in the UK decide to use public transport, they do so to reach opportunities at a considerable distance.

Note that the explanation offered by the model for medium- and long-distance commuting by public transport in the UK is relatively high, as comparison of the adjusted likelihood ratio indices makes clear. That results almost exclusively from the inclusion of local population density in the model. Apparently, density is a very strong predictor of the use of public transport for commuting.

Medium- and long-distance business travel – In both the UK and the Netherlands household income, gender, and car availability are important determinants of the propensity to engage in medium- and long-distance business travel (Table 4). As expected, the likelihood of engaging in medium- and long-distance business trips is greater for men, high-income households, and travellers with a high level of car availability. In contrast, the role of household composition is limited. In the UK, the interactions of gender with household composition nonetheless suggest that women in two-worker families are less inclined to participate in medium- and long-distance business trips by private car. This result is not replicated exactly for the Netherlands; there we find a higher inclination of conducting medium- and long-distance business trips by public transport among women in two-worker couples. In other words, in the Netherlands the propensity to engage in medium- and long-distance business travel is also relatively low among working mothers (as well as among single women). Overall then, the results for both countries suggest that working mothers tend to engage less in medium- and long-distance business trips, which may just be the result of time constraints imposed by domestic obligations, or may also reflect a different orientation towards the labour career (Pazy *et al.* 1996; Kwan 2000).

In the UK the relationship between the propensity for medium- and long-distance business travel and age follows a non-linear pattern: the inclination increases up to the age of 30–49 years, but then declines. For the Netherlands, no statistically significant effects could be detected. Furthermore, the number of maintenance trips a traveller makes is negatively related to the propensity to engage in medium- and long-distance business trips. The results also indicate that medium- and long-distance business trips by private car are more likely to be made during weekdays than on weekend days. Three of the four models also include negative effects for the variable commuting day. This finding indicates that travellers engaging in one or more medium- or long-distance business trips do not visit their workplace on the same day. Apparently, business trips consume so much time, trips to the office are foregone.

As for commuting, in the Netherlands, the effect of population density is not strong. The

two models for the Netherlands only include one statistically significant coefficient; this shows that travellers residing in the lowest-density areas have the greatest propensity to engage in medium- and long-distance business trips by public transport. In the UK, the likelihood of business travellers engaging in medium- and long-distance travel is significantly lower in higher-density areas, which can be explained by the strong concentration of both the population and firms in a small number of metropolitan areas.

Medium- and long-distance leisure travel – Although the propensity to participate in medium- and long-distance leisure trips is slightly greater for men and for travellers from high-income households than for women and lower-income travellers, the impacts of gender and income are not as strong as for commuting and business travel (Table 5). The more limited gender differences may reflect the fact that male and female spouses frequently engage in medium- and long-distance leisure trips jointly. The impact of household composition is similar to that for mandatory trip purposes. Somewhat unexpectedly, in the Netherlands the coefficient for the car availability index is negative in the model for the private car. This finding can be explained as follows: people with poor or no access to a private car do not travel much by car for short distance trips; however, if they need to travel over longer distances for leisure purposes – for instance in the case of family obligations – they may take a ride with friends or relatives. They may only travel by car on special occasions, in particular on occasions that are far away and poorly served by public transport.

The estimated coefficients indicate further that the inclination to engage in medium- and long-distance leisure travel tends to fall with age in the UK. This situation contrasts with that in the Netherlands, where travellers aged over 50 engage more in this kind of travel in particular by private car. Seniors older than 65 tend to engage less in medium- and long-distance leisure trips by train relative to short-distance train trips for leisure purposes. The fact that seniors tend to make relatively many medium- and long-distance leisure trips is indicative of the ‘third age’ (Schwanen *et al.* 2001): they may

Table 4. *Binary logit models stratified by country and transport mode: medium- and long-distance business trips.*

	UK				NL			
	Private car		Train		Private car		Train	
	B	t-statistic	B	t-statistic	B	t-statistic	B	t-statistic
Age: 30–49 years	0.288	4.2						
Age: 65 years and over	-1.063	-3.6						
Female	-1.415	-8.6	-0.819	-3.3	-0.901	-7.1	-1.894	-4.0
High income	0.664	7.4	1.023	2.7	0.599	5.5	1.019	2.7
Single worker					0.480	3.0		
One-worker couple	0.427	2.8						
Family, more than two workers					-0.781	-3.5		
Female: single worker	0.751	3.2						
Female: two-worker couple	0.725	3.4					1.491	2.3
Female: two-worker family	-0.623	-2.2						
Car availability index	0.606	5.7	1.147	3.7	0.244	2.3		
Weekend day	-0.287	-2.4			-0.730	-3.9		
Commuting day	-0.870	-13.0			-0.947	-11.3	-0.992	-3.1
No. of maintenance trips	-0.383	-10.5			-0.406	-7.2	-0.531	-2.3
Less than 10 pers/ha			2.011	7.4			0.722	2.3
10 to 19.99 pers/ha			1.570	4.1				
35 pers/ha and over	-0.369	-3.4						
Constant	-1.860	-13.9	-3.879	-8.7	-1.080	-7.7	-0.176	-0.5
No. of observations	7,721		642		4,053		224	
-2 Loglikelihood at constant	6827.9		594.3		4123.0		307.5	
-2 Loglikelihood at convergence	5989.5		458.8		3809.4		253.7	
No. of variables	14		6		9		7	
Loglikelihood at constant	-3413.9		-297.2		-2061.5		-153.8	
Loglikelihood at convergence	-2994.8		-229.4		-1904.7		-126.8	
χ^2	838.3		135.5		313.6		53.8	
ρ^2 (market share base)	0.123		0.228		0.076		0.175	
Adjusted ρ^2 (market share base)	0.119		0.208		0.072		0.130	
Short-distance traveller (%) (coded as reference category)	79.4		55.8		83.8		82.6	
Medium- and long-distance (%)	20.6		44.2		16.2		17.4	

have retired from the labour force, no longer have children living at home, and are in good physical condition.

The results for the UK again suggest that travellers living in the lowest-density areas have the highest propensity to undertake medium- and long-distance trips by both private car and public

transport. It appears that UK city residents are more frequently attracted by leisure facilities within the city or metropolitan region itself, hence medium- and long-distance travel for them are unnecessary. For the Netherlands, the coefficients indicate that the probability of medium- and long-distance travel by public

Table 5. Binary logit models stratified by country and transport mode: medium- and long-distance leisure trips.

	UK				NL			
	Private car		Train		Private car		Train	
	B	t-statistic	B	t-statistic	B	t-statistic	B	t-statistic
Age: 18–29 years			0.590	4.7	-0.163	-2.6		
Age: 30–49 years					-0.202	-4.2		
Age: 50–64 years	-0.189	-3.8						
Age: 65 years and over	-0.449	-6.7					-0.337	-2.4
Female	-0.188	-4.6			-0.136	-3.2		
High income	0.530	11.3	0.976	8.1	0.327	7.0		
Single worker	0.379	4.8			0.368	3.7		
Two-worker couple	0.215	3.9						
One-worker family					-0.473	-4.3		
Two-worker family	-0.277	-4.4			-0.338	-3.5		
Family, more than two workers					-0.346	-3.0		
Other type of household					-0.111	-2.1		
Female: single worker							0.639	3.0
Car availability index	0.153	2.8	1.258	9.3	-0.130	-2.3	0.535	4.0
Weekend day	0.363	8.7	0.360	3.1	0.210	4.7		
Commuting day	-1.206	-17.3	-0.759	-3.6	-0.923	-13.5	-0.615	-3.9
Number of maintenance trips	-0.296	-13.8	-0.332	-3.1	-0.286	-12.9	-0.333	-4.9
Less than 10 pers/ha	0.410	8.3	0.794	6.1			0.651	5.3
10 to 19.99 pers/ha							0.357	2.5
20 to 34.99 pers/ha	0.268	4.0	0.444	2.9				
Constant	-2.902	-37.1	-4.113	-30.9	-1.658	-21.1	-0.977	-9.3
No. of observations	38,698		6,582		24,896		1,774	
-2 Loglikelihood at constant	20332.8		2916.2		17882.8		2187.0	
-2 Loglikelihood at convergence	19148.5		2578.6		16436.9		2086.7	
No. of variables	14		9		14		8	
Loglikelihood at constant	-10166.4		-1458.1		-8941.4		-1093.5	
Loglikelihood at convergence	-9574.3		-1289.3		-8218.4		-1043.3	
χ^2	1184.2		337.6		1445.9		100.3	
ρ^2 (market share base)	0.058		0.116		0.081		0.046	
Adjusted ρ^2 (market share base)	0.057		0.110		0.079		0.039	
Short-distance traveller (%) (coded as reference category)	89.2		69.3		92.6		94.2	
Medium- and long-distance traveller (%)	10.8		30.7		7.4		5.8	

transport is also higher in low-density settings. As for commuting in the UK, two explanations can be put forward. First, travellers residing in low-density areas frequently have to travel over a long distance to reach (high-order) leisure facilities concentrated in high-density areas which are typically well-served by public transport. Second, people in more urbanised areas make more short-distance leisure trips by public transport (Dieleman *et al.* 2002), thereby lowering the share of medium- and long-distance trips in the total number of leisure trips by public transport. This implies a lower probability of engaging in a medium- and long-distance trip for an individual public transport user residing in an urban area.

CONCLUSIONS AND DISCUSSION

In this study we have sought to assess the extent to which participation in medium- and long-distance travel depends on travellers' socio-economic situation, day of travel, time availability and the urbanisation pattern. While medium- and long-distance travel can be expected to bring several benefits to society, including economic growth and social participation, it is also environmentally burdensome. The percentage of medium- and long-distance travellers in the total number of travellers may not be very large, at only 12 per cent in the Netherlands and seven per cent in the UK, but it should be recognised that the consequences of this relatively small percentage of medium- and long-distance travellers are greater than the proportions suggest. This is because medium- and long-distance travel is responsible for a much larger part of the environmental impacts of the transport sector.

The empirical evidence in this study suggests that gender, role in the household, and income are important determinants of participation in medium- and long-distance commute and business travel. In both the UK and the Netherlands males, women in households without children, full-time workers and people from high-income households are more likely to engage in medium- and long-distance travel for commuting or business. For leisure travel, gender and household composition are less relevant, presumably because males and females within households frequently undertake such medium- and long-distance trips jointly.

The analysis has also suggested that the overall structure of a country's urban system and size and the local population density play a part in the participation in medium- and long-distance travel. Urbanisation patterns dominated by large metropolitan areas and characterised by a sharp contrast between high- and low- population densities, as in the UK, imply that travellers residing in low-density areas have to travel greater distances to reach opportunities concentrated in large metropolitan areas. On the other hand, city dwellers tend to participate in short-distance rather than medium- and long-distance travel because they can find ample opportunities within a relatively short distance from their homes.

In contrast, a moderate polycentric urbanisation pattern characterised by many medium-size cities and a relatively balanced distribution of the population, as in the Netherlands, seems to stimulate travellers' participation in medium- and long-distance travel. Since opportunities are more dispersed across areas in this type of pattern, Dutch travellers are obliged to cover long distances to reach those opportunities while the proximity of urban areas to one another makes medium- and long-distance travel more acceptable. In other words, the Dutch urbanisation pattern offers 'stepping stones' to clusters of opportunities outside the area of residence, and thereby enhances the overall frequency of medium- and long-distance travel.

We have further found that the determinants of medium- and long-distance travel participation do not differ much across transport modes. At least in this study, the decision to engage in medium- and long-distance travel by both private car and train is primarily dependent on the socio-economic characteristics of the travellers. The differences between medium- and long-distance travel by train and by car are most directly related to household composition and interactions of gender and household composition. This finding suggests that the division of labour within households and hence car allocation mechanisms play a part in mode-choice decisions for medium- and long-distance trips.

Various avenues for future research can be identified on the basis of the results of this study as well as its limitations. As emphasised in the introduction, medium- and long-distance trips

account for a sizeable proportion of the adverse impacts transport makes on the environment. If policy-makers seek to mitigate such effects, it is pertinent to obtain further insights into the factors that drive mode choice decisions for such trips. More research is warranted about the influence of urban form on medium- and long-distance travel, for instance by using more detailed indicators of urban form than the population density measure employed here. Furthermore, in the light of the ongoing globalisation trends and the continuing integration process in Europe, it is also important to scrutinise in detail the medium- and long-distance journeys within a European context and between cities in different countries. Although domestic trips will continue to be important, it is international trips that are most likely to increase in number in the near future.

Notes

1. Using data on domestic and international long-distance travel (trips over 100 km one-way) within and between European countries (Dateline Consortium 2003), we were able to verify that 97 per cent and 89 per cent of the domestic long-distance trips are undertaken by private car and train in the Netherlands and the UK, respectively.
2. These numbers are based on our own calculations using the UK and the Netherlands National Travel Survey 1998.

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