Recent Trends in Travel Behaviour and Passenger Transport Fuel Use: A Comparison of the Netherlands and the United Kingdom

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Abstract

The transport sector is the largest and fastest growing consumer of energy in Europe, which poses a serious threat to Europe's climate and environment. Over recent decades, increases in passenger and freight transport movements have both been responsible for this growth. These trends can be observed in most European countries including the Netherlands and the United Kingdom (UK), where per capita transport fuel consumption increased by 9% and 4% respectively in the relatively short period between 2000 and 2006 (and by 37% and 16% respectively between 1990 and 2006). In many ways, general travel patterns in these two countries have not changed substantially during this period: total travel distance, average travel speed and travel time have all remained fairly constant. What has changed, however, is car occupancy, the type and age of vehicles on the road and the average number of trips, all of which have contributed to changes in energy consumption in the passenger transport sector.

In this paper we focus on trends in individual mobility and related carbon dioxide (CO_2) emissions, which are a close proxy for fuel consumption and total greenhouse gas (GHG) emissions from transport. National travel data for the Netherlands and the UK from 2000 onwards are used to examine these trends. We construct a classification of individuals based on their travel patterns and related CO_2 emissions with the aim of identifying the key socio-economic characteristics of individuals with high and low CO_2 emissions. We then examine the extent to which these socio-economic characteristics are similar in both countries. Preliminary analyses reveal that in both countries around 10% of the population is responsible for almost half of all CO_2 emissions in the passenger transport sector. At the other end of the spectrum, half the population is responsible for only 10-20% of passenger transport-related CO_2 emissions. Substantial differences in individual transport CO_2 emissions are apparent according to socio-economic characteristics such as age, gender, income and employment status.

Introduction

Energy consumption and emissions of greenhouse gases (GHGs) from transport in Europe are increasing annually and show no signs of stabilising. Between 1990 and 2006, emissions of GHG emissions from transport increased by more than a quarter (26%) in Europe (EEA, 2008a), the large majority of which was produced by road transport. This increase in emissions is in stark contrast to the GHG reduction targets agreed under the Kyoto Protocol, where the target of an 8% decrease in GHGs between 1990 and 2008-2012 was agreed for the 15 Member States (EU15) that were part of the European Union in 1998 (when the Kyoto Protocol was signed). Fortunately for the Kyoto targets, emissions of GHGs from other sectors (e.g. industry, agriculture) have experienced decreases since 1990. However, further increases in emissions from the transport sector may thwart the achievement of the EU's GHG emission target under the Kyoto Protocol as well as the EU's longer-term target of a 20% reduction of its GHG emissions by 2020 compared to 1990. The substantial recent increases in transport fuel use also mean that fewer than half of all EU Member States expect to remain within their emission limits for the air pollutants set by the EU National Emission Ceilings Directive (EEA, 2008b). Addressing fuel consumption in the transport sector is therefore crucial for managing climate change and environment.

Studies suggest that the short-term elasticity between transport fuel prices and fuel consumption is around one third of the value of the long-term elasticity: typical elasticities are of the order of -0.2 over the short-term and -0.6 over the long-term (see for example Goodwin et al, 2004; Graham & Glaister, 2002; Johansson & Schipper, 1997).[1] Despite these moderately low elasticities, significant changes in fuel prices can still be expected to have noticeable effects on transport fuel consumption statistics (and consequently on GHG emissions) and/or changes in the modal shift, particularly in the longer-term. In the short-term, responses to increases in fuel prices are mainly likely to have impacts on mode choice (e.g. switching from motorised to non-motorised modes for certain journeys) and travel frequency for less essential journeys (e.g. recreation, shopping for non-essential goods). In the medium and long term, on the other hand, responses to increases in fuel prices can be more extensive and include changes in vehicle type (e.g. by choosing a more efficient car, alternative fuel), mode shift (e.g. switching from private to public transport), changes in destination (and/or origin) (e.g. by choosing a different place to shop, work, socialise or live) or reducing the number of journeys (e.g. by combining trips or cutting down on certain activities).

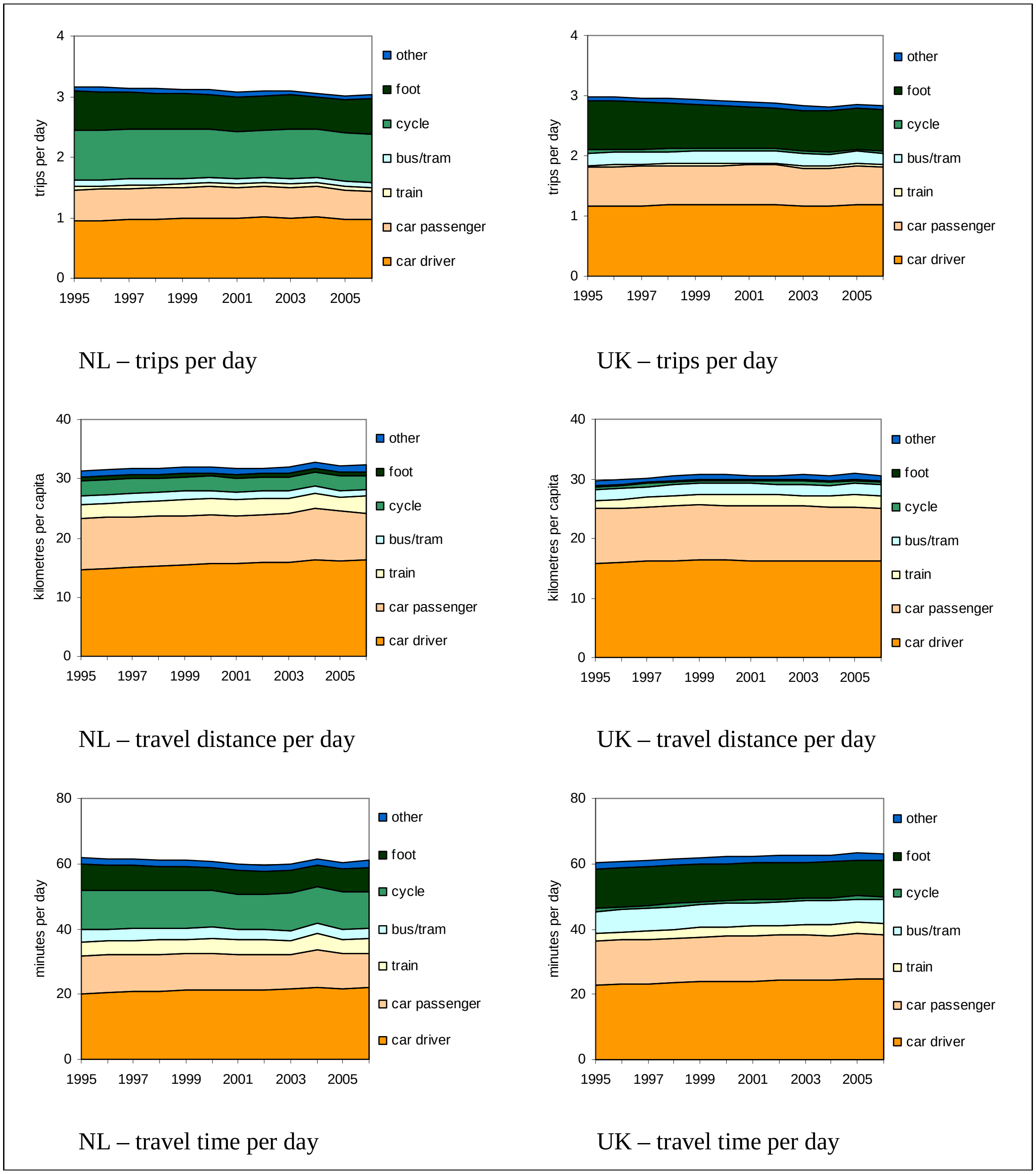
[1] The sensitivity of changes in transport fuel prices is measured using elasticities, defined as the percentage change in consumption of a good caused by a one-percent change in price. Thus, an elasticity of -0.6 for transport energy consumption with respect to transport energy prices means that a 1% increase in energy prices results in a 0.6% reduction in transport energy consumption.

This paper presents an exploratory analysis of the short and medium term effects of changes in transport fuel prices since 2000 in two European countries: the Netherlands and the UK. A comparison between these countries is interesting for a number of reasons, not least because data from national travel surveys in these countries are relatively comparable in many ways. In addition, the Netherlands and the UK have similar levels of car ownership and consume similar amounts of energy per capita in the transport sector (Table 1). Passenger transport accounts for more than half of transport energy consumption in both countries (Netherlands Environmental Assessment Agency, 2008; CfIT, 2007) and the great majority of passenger transport emissions originate from road-based transport. The total number of trips per person, the total distance travelled per capita and the total time spent travelling per person per day are very similar in the Netherlands and the UK (Figure 1). There are however some important differences between the two countries with respect to various other transport and energy characteristics. In the Netherlands, more than a quarter of all passenger trips are made by bicycle (26%) whereas the proportion of cycling trips in the UK is very low (just above 1%). Just under a half of passenger trips in the Netherlands are by car (48%) while in the UK, almost two-thirds of all trips are by car (63%). Between 2000 and 2005, the real price of transport fuel (inclusive of all taxes and corrected for inflation) increased substantially in the Netherlands: 18% and 16% for petrol and diesel respectively. The increase in the price of petrol in the Netherlands was much higher than across Europe as a whole (Figure 2). In the UK, on the other hand, the real price of transport fuel dropped between 2000 and 2005 (in 2000, both petrol and diesel prices were already substantially higher than the European average): petrol prices fell by 7% in real terms and diesel by 5% (Figure 2).

Table 1. Selected Transport and Energy Statistics for the Netherlands and the UK, 2006 (source: European Commission, 2008; Eurostat, 2008)

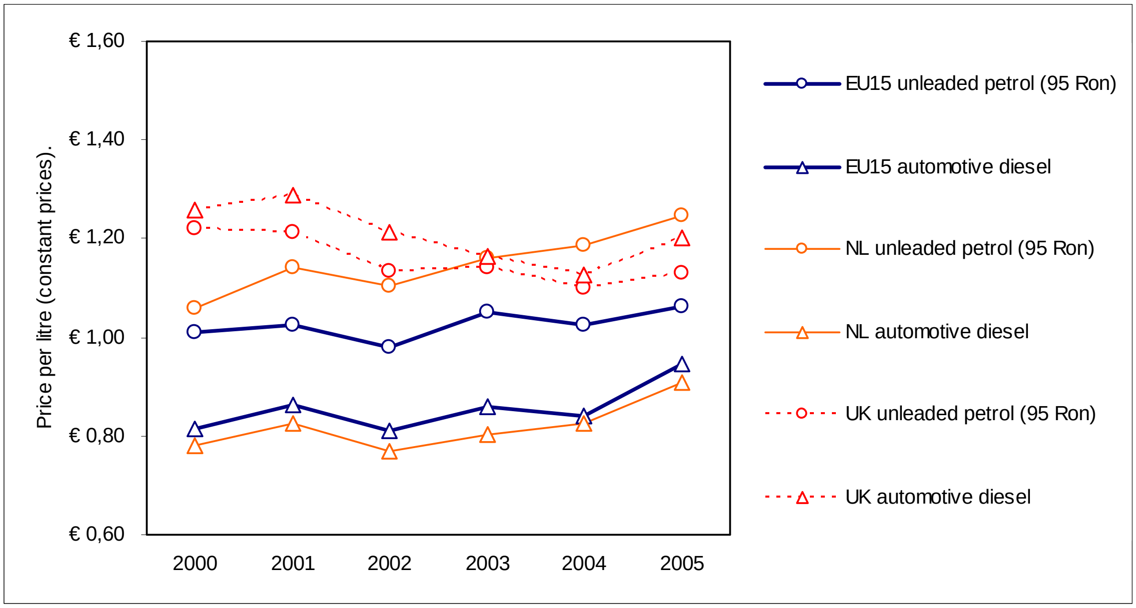
	Netherlands	United Kingdom	EU27
Car ownership (passenger cars per 1000 inhabitants)	442	471	466
Transport energy consumption per capita (MJ)	40.0	38.8	31.4
• road	29.4	27.7	25.8
• air	9.5	9.0	4.4
• rail	0.4	1.0	0.8
• inland water	0.7	1.2	0.5

Figure 1. Comparison of Travel Trends in the Netherlands and the UK, 1995-2006 (source: Statline, 2008; DfT, 2008a)



Given these different changes in transport fuel prices in the Netherlands and the UK since 2000, increases in the former and decreases in the latter, we examine changes in passenger travel trends in these two countries from 2000 onwards in order to try to unravel the effects of fuel price changes on passenger transport-related CO_2 emissions (a close proxy for transport fuel consumption) in the short and medium term. We also explore the influence of individual socio-demographic characteristics on the transport CO_2 emissions. We examine who produces the most emissions, who produces the least, how these emissions are divided across society and how similar this distribution is across the two countries. We focus solely on CO_2 emissions from passenger transport and do not consider emissions from freight transport.

Figure 2. Trends in transport fuel prices (at constant prices) in the Netherlands, the UK and the European Union (EU27), 2000-2005 (source: Eurostat, 2008)



We draw primarily on data from the Dutch and UK National Travel Surveys (NTS) which both provide detailed information about individuals, households and their trips on an annual basis. The Dutch NTS data have been collected continuously by Statistics Netherlands since 1978 using travel diaries. For each year up to 1993, the NTS recorded 1-day travel data for approximately 10,000 households, 20,000 individuals (and more than 80,000 trips). During 1994 and 1995 the NTS was extended to include substantially more respondents. The UK NTS has been carried out as a continuous 7-day travel survey since 1998 (before then, data was collected periodically in 1972/73, 1975/76, 1978/79 and 1985/86). Since 1998, the UK NTS covers every month of the year and contains an annual sample of over 5000 addresses. Because of comparability issues, we only analyse UK NTS data from 2000 and 2004 in this paper: the UK NTS survey data currently available after 2004 do not contain as much detail about the engine size of vehicles owned by each household.

Emissions of CO_2 per person were calculated using information from NTS data about each trip (mode, distance, fuel type, engine size, vehicle age, occupancy and speed) together with vehicle emission factors from COPERT, a computer programme to calculate emissions from road transport developed for the European Environment Agency (Ntziachristos & Samaras, 2000). All journeys for each respondent were subject to this calculation. In order to make the results more comparable between the two countries, journeys for just one day of the week (selected at random) were analysed from the UK NTS (details for just one day are recorded in the Dutch NTS whereas details for a week are recorded in the UK NTS). In this approach, the CO_2 emissions were calculated based on the distance travelled for each trip and the journey characteristics, such as travel speed and vehicle occupancy. Each vehicle type has its own equation based on its age, fuel type and operating speed. For example, the amount of CO_2 emissions of gasoline light duty vehicle (<3.5t) produced after 1996 is calculated according to the equation ($0.0621V^2 – 9.8381V + 601.2$) grammes of CO_2/km (where V = vehicle operating speed). Seventeen different equations (based on vehicle age and type) were used in this study. For journeys by public transport modes, information about mode and distance only were used to calculate CO_2 emissions using typical emission factors for the Netherlands according to analysis by van den Brink & van Wee (1997) and for the UK according to figures from Transport Direct (2008) – an online travel planning service jointly funded by the UK Department for Transport, the Welsh Assembly and the Scottish Government. Journeys by foot and cycle were assumed to entail no CO_2 emissions. Emissions from air travel unfortunately had to be omitted from the analysis due to insufficient data in the NTS surveys concerning journeys by this mode. This is regrettable since air transport is a rapidly growing sector and a significant contributor of greenhouse gases (mainly CO_2), which have a disproportionately high impact on climate change as a result of being released at higher altitudes (Penner et al, 1999).

General trends in travel behaviour and CO_2 emissions

In the Netherlands, general travel patterns in did not change substantially between 2000 and 2005 (or indeed in the longer term between 1990 and 2005). The total number of trips per person, the average distance travelled and average travel time remained more or less constant since 2000. On average, each person made 3 trips per day, travelled 32 kilometres and spent 60 minutes travelling (Figure 1). What did change somewhat during this period was the distance travelled by car, which increased by 0.5 kilometres per person, and the distance travelled by public transport (rail and bus/metro), which experienced a corresponding fall during this period. According to our calculations of individual CO_2 emissions based on the Dutch NTS data for 2000 and 2005, these changes resulted in a slight increase in emissions per capita by around 6% (Table 2).

In the UK, the total number of trips per person, the average distance travelled and average travel time remained more or less constant between 2000 and 2005, and also in the longer term between 1990 and 2005 (Figure 1). Overall passenger travel patterns in the UK between 2000 and 2005 were remarkably similar to those in the Netherlands. In the UK, the average person made 2.8 trips per day, travelled 32 kilometres and spent 63 minutes travelling (Figure 1): 0.2 fewer trips per person per day than in the

Netherlands and 3 minutes more spent travelling. Looking across individual modes, a few changes during this period are apparent: an increase in the distance travelled by car drivers (by 0.3km) and by train passengers (0.8km), and a decrease in the distance travelled by car passengers (0.2km). In sum, these changes amount a very slight increase in car-based travel distance, a reduction in the average occupancy of car journeys and an increase in public transport (train) distance. This is somewhat in contrast to our calculations of individual CO_2 emissions based on the UK NTS data for 2000 and 2004, which indicate a slight decrease in individual CO_2 emissions per capita by around 5% (Table 2). The most likely reasons for this slight drop in CO_2 emissions relate to changes to the car fleet and the total number of journeys. In terms of the car fleet, there was a large increase in the proportion of diesel-engined cars in the UK vehicle parc between 2000 and 2004: 13% of all cars were diesel in 2000; 19% in 2004 (DfT, 2008b). In addition, there was also a slight decrease in the average age of the car fleet and CO_2 emissions per car (ibid). The fact that there were slightly fewer journeys per capita (on average) in 2004 compared to 2000 means that CO_2 emissions due to engine start-ups were also lower.

Table 2. Average passenger transport CO_2 emissions per person per day in the Netherlands and the UK

	2000 (g CO_2)	2005 (g CO_2)	Change 2000-2005
Netherlands	3817	4044	+6%
UK	5124	4879 [2]	- 5%

Our calculations indicate that average CO_2 emissions per capita remain substantially higher in the UK than in the Netherlands. In 2000, CO_2 emissions per capita in the UK were more than one-third higher than in the Netherlands (34%). In 2004/2005, emissions in the UK were still more than 20% higher than in the Netherlands. These differences can mainly be explained by fact that longer distances are travelled by foot and bicycle in the Netherlands (0.6 and 2.5 km per day respectively compared to 0.5 and 0.2 km per day in the UK) and shorter distances are covered by car (the difference is 0.8 km per day between the Netherlands and the UK) and also public transport to a small extent. The temporal changes in CO_2 emissions in the two countries appear at first sight to be counterintuitive with the literature on the elasticity of transport energy consumption with respect to transport energy prices. In the case of the Netherlands, where transport energy prices experienced substantial increases between 2000 and 2005 (more than 16%), individual CO_2 emissions per capita increased by 6%. In the case of the UK on the other hand, where transport energy prices fell in real terms between 2000 and 2005, individual CO_2 emissions per capita decreased over this period by 5%. We conclude that various other factors in addition to transport energy prices have played a role in influencing these changes in individual CO_2 emissions. Energy prices are clearly not the only influence on travel activity and transport energy use: influences will also include a range of other costs (e.g. vehicle purchase tax,

[2] UK figures for 2004.

insurance costs, charges for road use, parking fees, public transport fares). Changes in consumer spending power clearly also play a key role in influencing travel activity and transport energy use.

Classifying individual CO_2 emissions

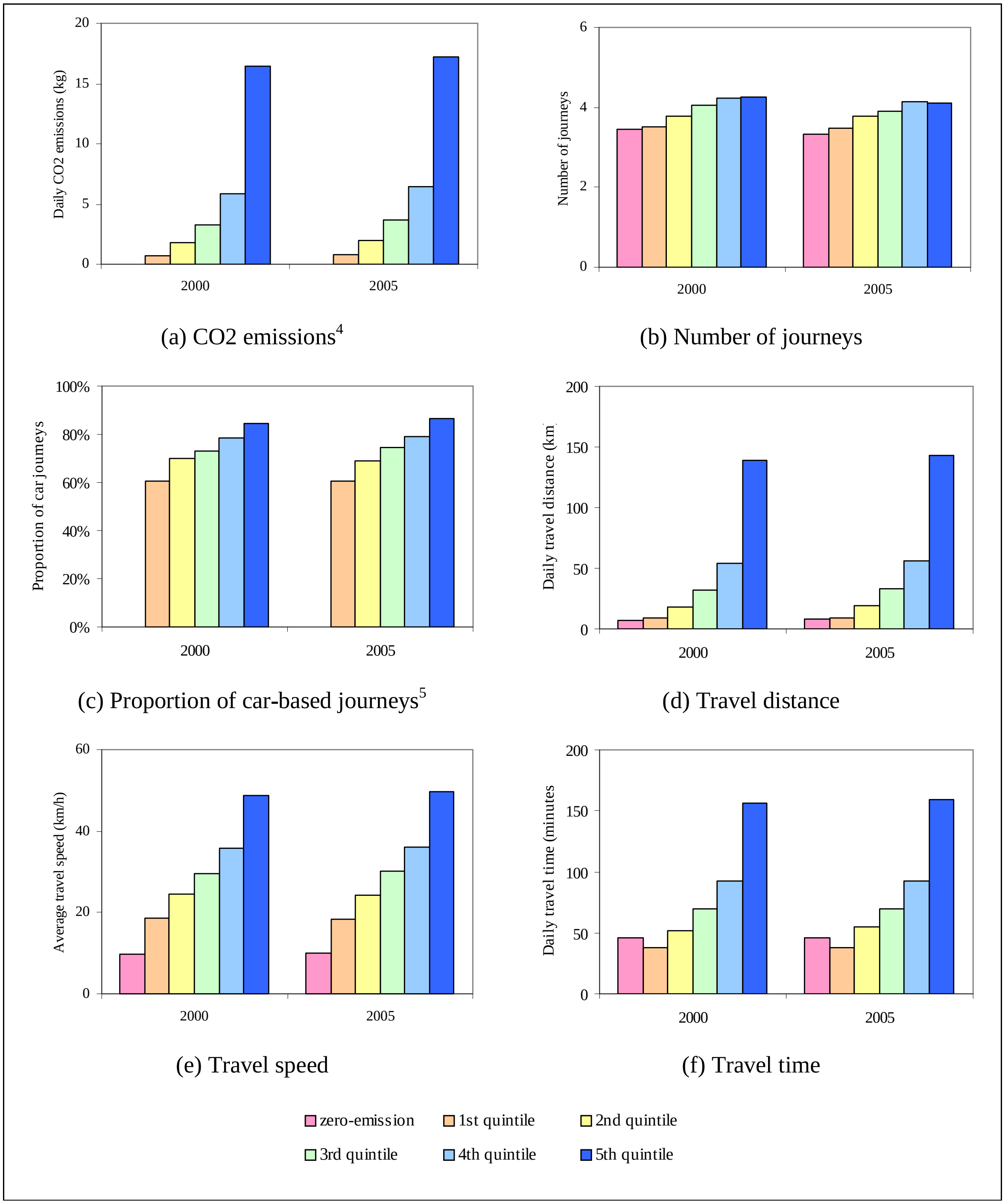
Having looked at some of the general trends in travel patterns and CO_2 emissions in the Netherlands and the UK since 2000, we now make a simple classification of individuals based on their CO_2 emissions and examine how emissions have changed over time within each group in both countries. Here we differentiate between five groups (quintiles) of individuals based on their daily transport CO_2 emissions. A sixth group containing 'zero emission' travellers is also identified: individuals in this group made all their journeys recorded in one day by non-motorised modes (i.e. by foot or bicycle).[3]

Looking first at the Netherlands, we see that the proportion of individuals in the 'zero emission' group is approximately one-third of all respondents (32% in 2000 and 33% in 2005). Moreover, given the fact that individuals making no journeys on the day of the survey were excluded from this analysis, we can say that above one third of the Dutch population on any random day consumes no transport fuel. In the first quintile (i.e. individuals with the lowest CO_2 emissions), average levels of CO_2 emissions for this group are around one-fifth of the average for all travellers (Figure 3a). In the highest quintile (i.e. individuals with the highest CO_2 emissions) on the other hand, average levels of CO_2 emissions for this group are more than 4 times higher than the average for all travellers. What is also noticeable is a large jump (both in 2000 and 2005) in CO_2 emissions in the fourth and fifth quintiles. We observe an increase in the average number of journeys when looking across the five quintiles, although there are only small differences in the average number of journeys between the fourth and fifth quintile (Figure 3b). An increasing proportion of car-based journeys can also be seen across the five quintiles (Figure 3c). Similarly, total daily travel distance and speed also increase across the five quintiles (Figures 3d & 3e). Average travel times also increase across the five quintiles although we also observe that the average travel time of individuals in the 'zero emission' group is higher than the first quintile (Figure 3f).

In the UK, the proportion of individuals in the 'zero emission' group is less than one-tenth of all respondents (7% in 2000 and 8% in 2004): much lower than in the Netherlands (see above). Observations about the travel characteristics of the different groups in the case of the UK are similar to those for the Netherlands. In the first quintile (i.e. individuals with the lowest CO_2 emissions), average

[3] Individuals in the 'zero emission' group all made one or more journey. Individuals making no journeys on the day of the survey were excluded from this analysis.

Figure 3. Comparison of Travel Trends in the Netherlands, 2000-2005



(a) CO2 emissions[4]

(b) Number of journeys

(c) Proportion of car-based journeys[5]

(d) Travel distance

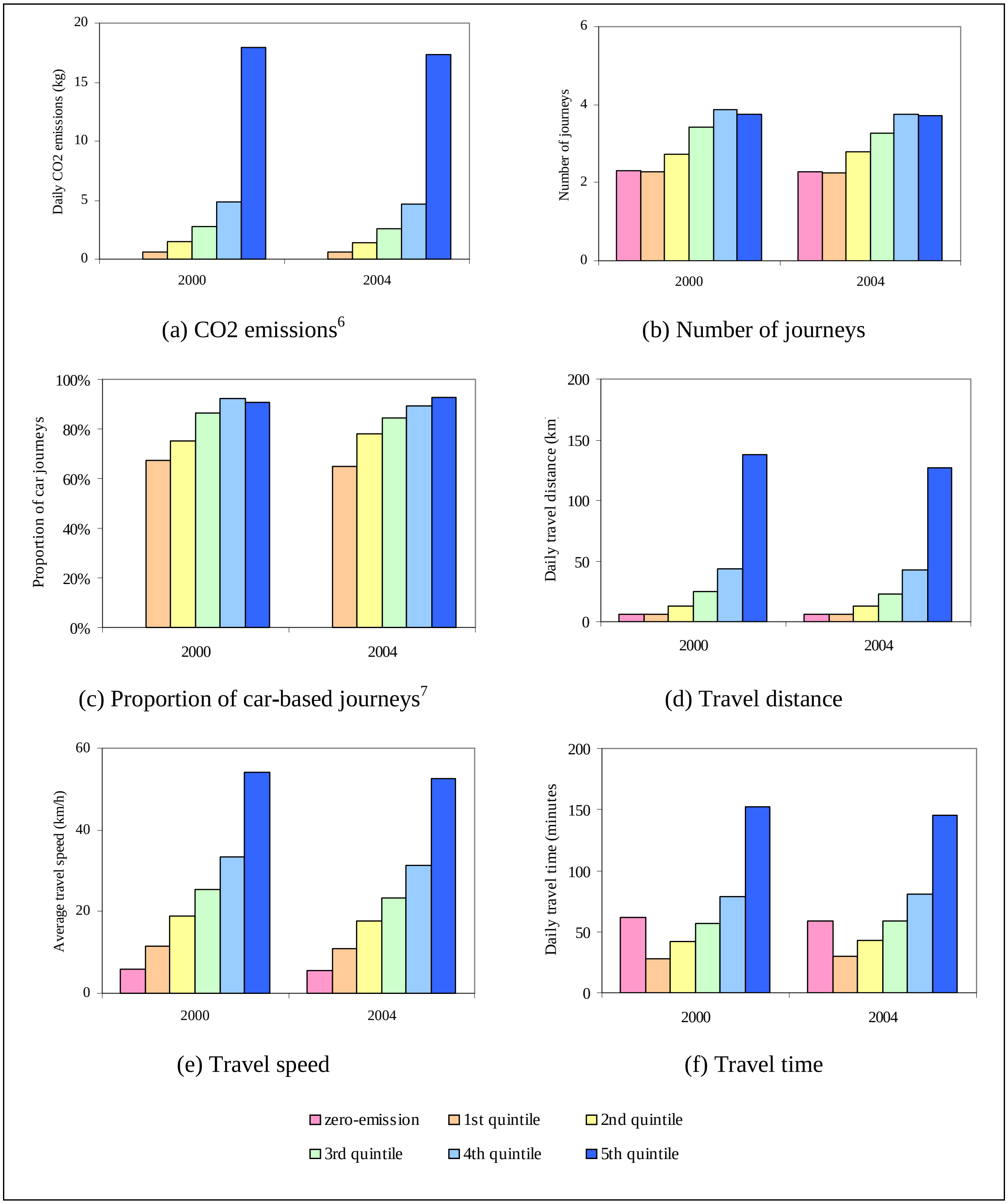
(e) Travel speed

(f) Travel time

[4] The CO_2 emissions for the zero-emission category is (by definition) zero and this category is not therefore visible on Figure 3(a).

[5] The proportion of car-based journeys for the zero-emission category is 0% and this category is not therefore visible on Figure 3(c).

Figure 4. Comparison of Travel Trends in the UK, 2000-2004



[6] The CO_2 emissions for the zero-emission category is (by definition) zero and this category is not therefore visible on Figure 4(a).

[7] The proportion of car-based journeys for the zero-emission category is 0% and this category is not therefore visible on Figure 4(c).

levels of CO_2 emissions for this group are around one-tenth of the average for all travellers (Figure 4a). In the highest quintile (i.e. individuals with the highest CO_2 emissions) on the other hand, average levels of CO_2 emissions for this group are more than 5 times higher than the average for all travellers. There is a very marked jump (both in 2000 and 2004) in CO_2 emissions in the fourth and fifth quintiles. The average number of journeys increases across the five quintiles, although there are only small differences in the average number of journeys between the 'zero emission' group and the first quintile, and between fourth and fifth quintile (Figure 4b). An increasing proportion of car-based journeys can also be seen across the five quintiles (Figure 4c). More than 90% of trips are car-based in the highest quintile. Total daily travel distance and speed also increase across the five quintiles (Figures 4d & 4e). Average travel times also increase across the five quintiles although we also observe that the average travel time of individuals in the 'zero emission' group is higher than the first three quintiles (Figure 4f).

The zero-emission categories in both the Netherlands and the UK share a number of common socio-economic characteristics (Tables A1-A4):

- a high proportion of younger respondents (under the age of 25)
- a low proportion of middle-aged respondents (aged 40-64)
- a low proportion of respondents in full-time work
- a high proportion of respondents not in work
- a high proportion of students
- a low proportion of respondents with high incomes
- a high proportion of respondents with low incomes
- a high proportion of respondents without a car

In addition, a steady gradation in various socio-economic characteristics across the five quintile groups can be observed (e.g. by gender, age, employment status, education and car ownership). There are however also a small number of differences in the socio-economic characteristics of the zero-emission categories in the Netherlands and the UK. In the Netherlands for example, there are more women than men in the zero-emission category whereas the opposite is true in the UK. A relatively high proportion of respondents above retirement age (65) can be found in the zero-emission category in the Netherlands but this is not the case in the UK.

Elsewhere we tested relationships between individual CO_2 emissions and socio-economic variables for all the Netherlands by means of simple regression analyses, using CO_2 emissions as the dependent variable (Stead & Susilo, 2007).[8] Whilst the R^2 values for the analyses are all quite low, the results

[8] Regression analysis was carried out using data for all individuals except those in the zero-emission category.

show consistency across different years. Three socio-economic variables are consistently the best predictors of CO_2 emissions in the following order of importance: car availability; full-time employment and income. The regression analyses confirm that individuals without full-time employment, with no car availability and with a low level of income are much more likely to be found in the lower quintiles, whereas individuals with full-time employment, car availability and a high level of income are much more likely to be found in the higher quintiles. Car availability is consistently the most significant predictor of individual CO_2 emissions, and its influence on individual CO_2 emissions has increased over time. Income is also a good predictor of individual CO_2 emissions: people with higher incomes are responsible for considerably more transport-related CO_2 emissions. Related to this, people in full-time and part-time work account for considerably more CO_2 emissions than others. The results of the regression analyses do not change substantially if land-use variables are also introduced: the four socio-economic variables identified above (car availability, income, full-time employment and gender) remain the best predictors of individual CO_2 emissions and the R^2 values for the analyses remain quite similar.

Conclusions

Like most other countries, transport energy use and CO_2 emissions in the Netherlands and the UK continue to grow and may thwart the achievement of the national GHG emission target agreed under the Kyoto Protocol as well as the European Union's recent greenhouse gas reduction target for 2020. Whilst car-based journeys dominate CO_2 emissions from passenger transport in these two countries, fewer that half of all journeys in the Netherlands are made by car and less than two-thirds of all journey in the UK are by car. In other words, certain journeys produce a disproportionately high amount of CO_2 emissions while other journeys produce zero emissions.

This paper has analysed Dutch and UK National Travel Survey data to identify trends in transport-related CO_2 emissions over time and to examine the relationships between individual CO_2 emissions and socio-economic variables. During this period, general travel patterns in both the Netherlands and the UK have not changed substantially despite changes in the cost of transport fuel. The changes in CO_2 emissions in the Netherlands and the UK appear at first sight to be counterintuitive with the literature on the elasticity of transport energy consumption with respect to transport energy prices. In the case of the Netherlands, where transport energy prices experienced substantial increases between 2000 and 2005, individual CO_2 emissions per capita increased. In the case of the UK on the other hand, where transport energy prices fell in real terms between 2000 and 2005, individual CO_2 emissions per capita decreased over this period. We conclude that various other factors in addition to transport energy prices have played a role in influencing these changes in individual CO_2 emissions. Energy prices are clearly not the only influence on travel activity and transport energy use: influences will also include a range of other costs (e.g. vehicle purchase tax, insurance costs, charges for road use, parking fees, public transport fares). Changes in consumer spending power clearly also play a key role in influencing travel activity and transport energy use. It could also be that energy efficiency improvements in the transport sector might have had ‘rebound effects’ on energy demand, where for example the money saved as a result of energy efficiency is spent on additional energy-consuming activities or appliances (see for example Herring & Sorrell, 2008).

The proportion of individuals with zero-emissions from transport is substantially different in the Netherlands and the UK, reflecting the difference in the modal split in the two countries, particularly the use of the bicycle. By classifying respondents into one of six categories according to their travel-related CO_2 emissions (one category for individuals with zero CO_2 emissions and five groups of individuals in quintiles according to their total CO_2 emissions from personal travel), we reveal a number of common socio-economic characteristics between the same groups in the two countries. We also reveal some key socio-economic differences between the six groups. People in the highest quintile produce than four or five times the average amount of CO_2 emissions whilst those in the lowest quintile produce less than a third of the average amount of CO_2 emissions. The difference in average CO_2 emissions between the highest and lowest quintile is typically more than 20-fold. There is thus a relatively large proportion of people producing very low quantities of CO_2 emissions, and a small proportion of people producing the majority of the emissions: half the population is responsible for less than 20% of transport-related CO_2 emissions whilst another 20% of the population is responsible for more than half of all travel-related CO_2 emissions. Similar observations have been reported by other studies in the UK (Anable et al, 1997; Brand & Boardman, 2008) and in the United States (Greening et al, 1997). Individuals with zero or low CO_2 emissions are typically the young, the elderly, the unemployed, the less well educated, less well paid and non-car owners. Individuals with high CO_2 emissions on the other hand are typically better educated, in full-time work, well paid and car-owners.

One of the implications of the results is that the reduction of CO_2 emissions in the upper quintile by a given proportion (e.g. 20%) will lead to a larger reduction of CO_2 emissions than a reduction of CO_2 emissions by the same proportion in all four other quintiles combined. Achieving reductions in any quintile, especially the upper quintile, is not likely to be easy however, particularly given current attitudes to energy savings in the transport sector across Europe (see Stead, 2007 & 2008). Various instruments (e.g. fuel pricing, vehicle inspection and maintenance programmes) are considered to be regressive which may therefore affect the greatest emitters the least. Achieving reductions in the upper quintile requires a targeted approach using policies that are specific to the characteristics of the individuals in this category (e.g. multiple car owners, regular car-drivers, frequent flyers), such as taxation on multiple car ownership, incentives for shared vehicle ownership, reductions in speed limits and fiscal incentives for using alternative modes of transport.

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Table A1. Socio-economic and travel characteristics of respondents in the Netherlands, 2000

	Zero-emission group	Quintiles according to CO_2 emissions					*Total*
		1	2	3	4	5	
Male	44.3%	45.1%	47.0%	49.3%	53.9%	64.7%	*49.5%*
Age 24 or younger	39.8%	36.3%	28.5%	22.9%	17.8%	12.9%	*28.9%*
Age 25-40	22.0%	30.6%	33.1%	37.4%	42.4%	47.2%	*32.9%*
Age 40-64	22.8%	20.8%	26.1%	29.4%	31.1%	33.6%	*26.4%*
Age 65 or older	15.4%	12.3%	12.3%	10.2%	8.7%	6.3%	*11.7%*
Full-time worker	18.9%	25.8%	32.0%	40.9%	50.4%	64.7%	*35.0%*
Part-time worker	8.8%	10.2%	11.6%	13.1%	13.7%	10.6%	*10.8%*
Student	29.6%	20.7%	16.0%	13.2%	9.4%	6.5%	*18.5%*
Non-worker	42.7%	43.3%	40.4%	32.8%	26.5%	18.2%	*35.6%*
Higher education	11.2%	11.9%	13.9%	17.0%	22.0%	31.7%	*16.7%*
Tertiary education	42.4%	46.7%	54.6%	59.0%	60.6%	56.7%	*51.3%*
Secondary education	22.3%	13.0%	12.0%	10.5%	8.0%	5.4%	*13.8%*
High income	4.6%	5.9%	7.7%	9.9%	13.5%	23.3%	*9.6%*
Medium income	48.6%	48.4%	55.2%	60.5%	64.2%	62.3%	*55.0%*
Low income / No income	46.8%	45.7%	37.1%	29.6%	22.3%	14.4%	*35.3%*
Number of household members	3.22	3.31	3.14	3.05	2.97	2.85	*3.11*
Households with dependent children	39.8%	48.2%	39.1%	34.0%	30.8%	27.8%	*37.2%*
Households with car	37.6%	51.5%	63.8%	73.1%	81.8%	88.1%	*60.7%*
Number of trips/day	3.44	3.51	3.77	4.04	4.23	4.26	*3.79*
Travel time (minutes)	46.2	37.5	52.2	69.9	92.1	156.6	*70.2*
Travel distance (km)	7.4	8.7	18.3	31.6	54.4	139.2	*36.5*
Travel speed (km/hour)	9.9	18.6	24.7	29.4	35.9	48.7	*24.5*
Travel by car	0.0%	60.3%	70.0%	73.2%	78.4%	84.3%	*49.6%*
Travel by non-motorized modes	100.0%	24.8%	18.7%	15.3%	11.7%	8.0%	*42.6%*
Daily CO_2 emissions (grams)	0	731	1824	3311	5864	16475	*3817*
CO_2/km	0	125	139	140	139	139	*92*
Number of cases (N)	36390	15469	15173	15169	15270	15270	*112741*

Table A2. Socio-economic and travel characteristics of respondents in the Netherlands, 2005

	Zero-emission group	Quintiles according to CO_2 emissions					*Total*
		1	2	3	4	5	
Male	44.6%	46.0%	46.3%	49.6%	53.6%	65.6%	*49.7%*
Age 24 or younger	39.1%	36.2%	26.6%	21.0%	15.5%	10.8%	*27.6%*
Age 25-40	18.7%	25.4%	29.7%	32.8%	38.0%	43.8%	*29.0%*
Age 40-64	25.3%	24.1%	28.7%	33.7%	36.1%	38.7%	*30.0%*
Age 65 or older	16.9%	14.3%	14.9%	12.4%	10.5%	6.7%	*13.5%*
Full-time worker	17.3%	22.5%	29.5%	37.7%	47.4%	64.2%	*32.8%*
Part-time worker	9.1%	11.0%	13.6%	14.9%	16.0%	11.4%	*12.0%*
Student	29.6%	19.9%	16.0%	13.0%	9.2%	5.3%	*18.2%*
Non-worker	44.0%	46.6%	40.9%	34.4%	27.4%	19.1%	*37.1%*
Higher education	11.6%	11.8%	15.6%	18.3%	24.2%	33.6%	*17.7%*
Tertiary education	45.6%	47.7%	55.4%	61.1%	62.4%	57.6%	*53.1%*
Secondary education	20.0%	12.0%	11.5%	9.1%	6.5%	4.1%	*12.3%*
High income	5.2%	6.6%	9.2%	11.6%	16.0%	25.6%	*11.0%*
Medium income	44.8%	47.2%	54.5%	60.9%	64.0%	62.4%	*53.5%*
Low income / No income	50.0%	46.2%	36.3%	27.5%	20.0%	12.0%	*35.5%*
Number of household members	3.13	3.21	3.07	2.95	2.88	2.85	*3.04*
Households with dependent children	38.7%	46.8%	37.0%	31.3%	28.2%	28.9%	*35.8%*
Households with car	41.3%	52.1%	67.1%	76.8%	86.0%	92.2%	*63.8%*
Number of trips/day	3.33	3.47	3.78	3.91	4.14	4.11	*3.70*
Travel time (minutes)	45.8	38.1	55.2	69.9	92.4	158.8	*70.7*
Travel distance (km)	7.7	9.1	19.4	33.2	55.8	143.5	*37.6*
Travel speed (km/hour)	10.1	18.4	24.1	30.1	36.0	49.7	*24.6*
Travel by car	0.0%	60.6%	68.9%	74.3%	78.8%	86.4%	*49.6%*
Travel by non-motorized modes	100.0%	29.3%	21.2%	15.4%	12.4%	8.1%	*43.8%*
Daily CO_2 emissions (grams)	0	789	1982	3618	6424	17253	*4044*
CO_2/km	0	128	140	147	149	139	*95*
Number of cases (N)	16414	6748	6774	6727	6744	6748	*50155*

Table A3. Socio-economic and travel characteristics of respondents in the UK, 2000

	Zero-emission group	Quintiles according to CO_2 emissions					*Total*
		1	2	3	4	5	
Male	53.8%	43.9%	44.4%	44.2%	53.4%	61.7%	49.8%
Age 24 or younger	43.1%	40.3%	31.1%	22.3%	20.1%	17.7%	27.5%
Age 25-40	23.1%	21.4%	28.3%	35.3%	40.8%	38.1%	32.1%
Age 40-64	19.8%	19.5%	24.6%	29.3%	27.9%	32.8%	26.3%
Age 65 or older	14.0%	18.8%	15.9%	13.2%	11.3%	11.4%	14.1%
Full-time worker	25.0%	22.9%	32.8%	43.9%	50.8%	57.2%	40.3%
Part-time worker	11.9%	10.9%	13.6%	15.7%	15.0%	10.0%	13.0%
Student	4.5%	3.2%	3.0%	1.9%	1.6%	1.1%	2.4%
Non-worker	58.6%	62.9%	50.5%	38.4%	32.6%	31.7%	44.4%
Higher education							
Tertiary education							
Secondary education							
High income	9.5%	8.3%	13.1%	18.4%	24.8%	36.3%	19.4%
Medium income	13.3%	15.6%	21.4%	27.1%	28.6%	25.1%	22.8%
Low income / No income	47.1%	45.5%	44.0%	41.7%	34.7%	27.8%	39.3%
Number of household members	2.31	2.07	1.97	1.90	2.05	1.89	2.00
Households with dependent children	52.9%	49.6%	45.0%	39.8%	46.1%	40.2%	44.8%
Households with car	65.5%	74.0%	81.8%	92.0%	94.7%	92.8%	85.5%
Number of trips/day	2.32	2.28	2.74	3.42	3.86	3.76	3.14
Travel time (minutes)	61.4	28.2	41.6	57.1	78.5	152.2	70.7
Travel distance (km)	6.1	5.5	13.0	24.3	43.7	137.4	41.9
Travel speed (km/hour)	6.8	16.8	23.3	29.4	36.2	49.3	29.2
Travel by car	0.0%	67.1%	75.0%	86.2%	92.1%	90.9%	76.2%
Travel by non-motorized modes	100.0%	8.8%	3.4%	2.7%	1.8%	2.4%	10.9%
Daily CO_2 emissions (grams)	0	610	1490	2733	4864	17970	5124
CO_2/km	0	134	129	127	128	172	128
Number of cases (N)	420	1052	1055	1049	1052	1052	5680

Table A4. Socio-economic and travel characteristics of respondents in the UK, 2004

	Zero-emission group	Quintiles according to CO_2 emissions					*Total*
		1	2	3	4	5	
Male	52.1%	42.5%	45.0%	46.9%	50.9%	59.6%	49.2%
Age 24 or younger	43.6%	38.4%	33.0%	29.7%	21.9%	19.3%	29.7%
Age 25-40	25.0%	19.9%	25.7%	30.0%	35.3%	37.5%	29.3%
Age 40-64	19.0%	21.6%	24.9%	26.1%	29.6%	32.6%	26.3%
Age 65 or older	12.5%	20.1%	16.4%	14.2%	13.1%	10.7%	14.7%
Full-time worker	24.2%	23.3%	34.2%	38.9%	47.2%	56.3%	38.7%
Part-time worker	11.3%	11.1%	12.3%	13.7%	14.0%	11.1%	12.3%
Student	4.5%	3.2%	2.8%	2.5%	2.5%	1.7%	2.7%
Non-worker	60.1%	62.4%	50.7%	45.0%	36.2%	30.9%	46.3%
Higher education							
Tertiary education							
Secondary education							
High income	11.4%	10.2%	17.1%	19.6%	28.8%	38.5%	21.9%
Medium income	14.6%	18.9%	23.0%	25.2%	26.1%	24.8%	22.9%
Low income / No income	43.6%	41.6%	37.8%	36.3%	32.4%	25.2%	35.4%
Number of household members	2.24	2.04	2.01	2.04	2.03	1.98	2.04
Households with dependent children	53.9%	47.9%	46.4%	45.2%	44.0%	42.5%	45.9%
Households with car	60.9%	72.7%	84.5%	90.9%	93.3%	93.0%	84.8%
Number of trips/day	2.29	2.24	2.78	3.28	3.75	3.72	3.08
Travel time (minutes)	59.1	30.3	42.8	58.4	80.7	144.8	70.4
Travel distance (km)	5.6	5.6	12.5	22.9	42.3	126.7	39.0
Travel speed (km/hour)	6.2	16.0	22.4	27.6	34.4	48.3	27.8
Travel by car	0.0%	65.1%	77.9%	84.5%	89.2%	92.6%	75.2%
Travel by non-motorized modes	100.0%	8.7%	4.0%	3.0%	2.3%	2.1%	11.9%
Daily CO_2 emissions (grams)	0	584	1420	2577	4637	17358	4879
CO_2/km	0	129	132	132	133	184	130
Number of cases (N)	1187	2657	2657	2657	2657	2657	14473