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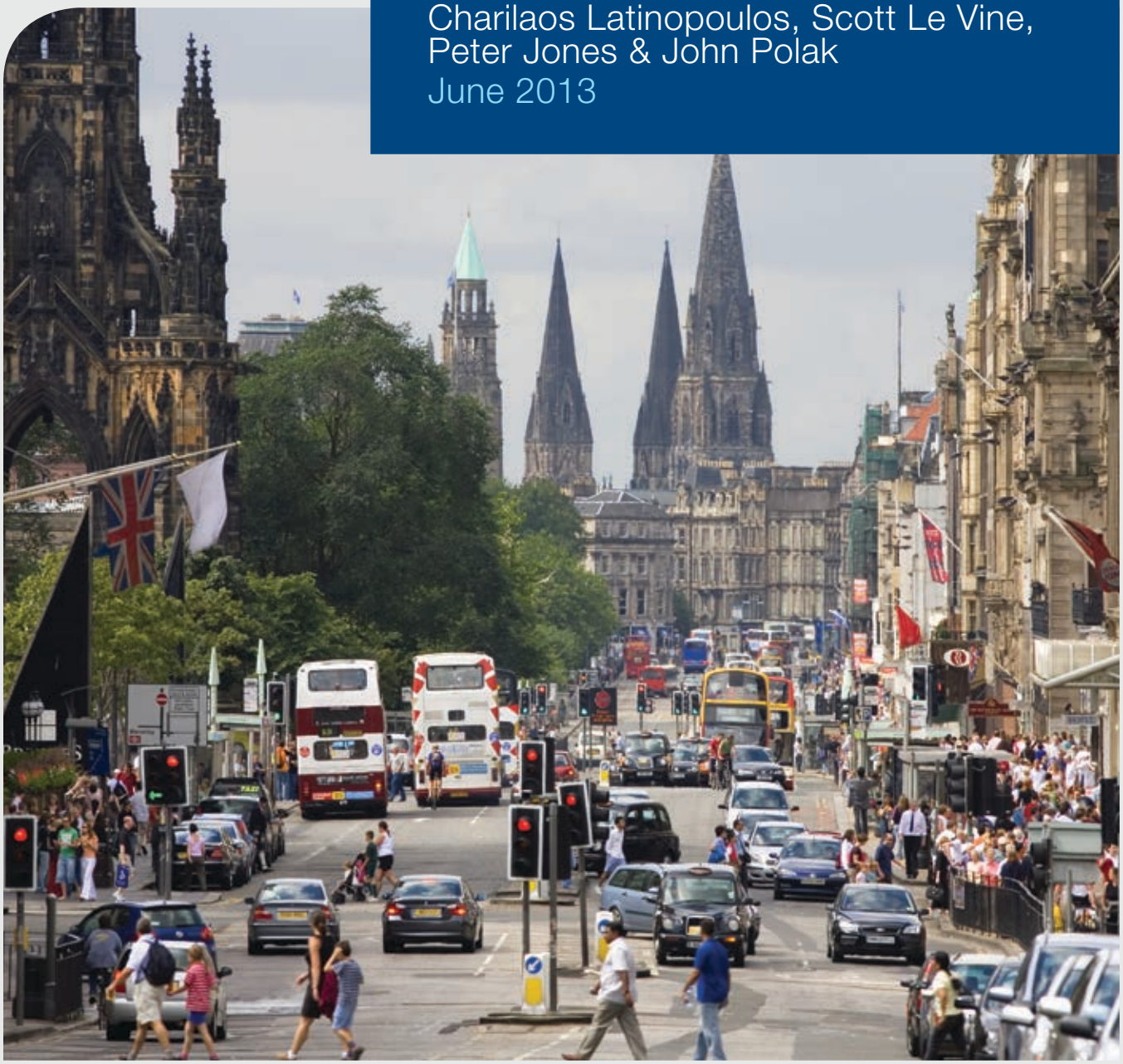
On the Move
Car, rail and bus travel trends in Scotland

Charilaos Latinopoulos, Scott Le Vine, Peter Jones & John Polak

June 2013



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The following reports have already been published (December 2012) and are part of the sponsors' ongoing work on travel trends in the UK:

- *On the Move: Making sense of car and train travel trends in Britain*
- *Technical Compendium: On the Move – Supporting Paper 1*
- *Rail Demand Forecasting Using the Passenger Demand Forecasting Handbook: On the Move – Supporting Paper 2*
- *National Rail Passenger Survey Data Analysis: On the Move – Supporting Paper 3*

The reports are available at www.racfoundation.org/research/mobility/on-the-move-main-research-page. A companion report on travel trends in Wales is forthcoming and will be made available on the same web page.

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The members of the Steering Committee were:

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Contents

Executive Summary

This report investigates a number of aspects of personal travel in Scotland, and examines:

1) Trends in car, bus and rail[1] travel (from the mid-1990s onwards), as captured (for the most part) by Britain's National Travel Survey (NTS) – the motivation being to assess the degree to which trends reported for Great Britain (GB) in the *On the Move* (Le Vine & Jones, 2012) companion report have occurred also in Scotland;

2) The properties of the Scottish Household Survey (SHS) as compared with the NTS – an important issue, as from January 2013 the NTS no longer covers Scotland;

3) The relationship between participation in online activities and personal travel, using the SHS; and

4) Trends in rail passenger satisfaction as recorded by the National Rail Passenger Survey (NRPS) – also for comparison against GB-wide trends reported in *National Rail Passenger Survey Data Analysis* (Preston & Jones, 2012).

1. Overall trends in car, bus and rail travel in Scotland, 1995 to 2010

At the aggregate level, NTS data for 2008/10 shows that 49% of the distance travelled by Scottish residents is as a car driver, and another 27% as a car passenger. By contrast, bus represents 8% of mileage and rail represents 6%. Because cars are used much more than bus and rail, relatively small percentage changes in car use can translate into large percentage changes in bus and rail use.

1.1 Car driving

A key question is whether car travel per person has continued to grow, as has historically been the case, or whether Scotland is experiencing 'peak car' – a sustained period of flat, or even downward-trending, levels of car use per person.

The National Travel Survey (NTS) and Scottish Household Survey (SHS) both show essentially flat trends in car use per person. For example, the NTS shows that average annual car driving mileage per person was 3,427 (1995/9 data) and 3,525 (2008/10 data), a difference of +3% which due to the small NTS

1 In this report, the term 'rail' refers to travel by National Rail services. Where urban rail services are concerned, this will be made clear in the relevant sections.

sample size in Scotland is not statistically significant. Traffic count data also show a slow steady growth in car traffic in Scotland over this time period, up to the 2008 recession (when there was a fall).

While men's driving mileage has been falling, women's has been increasing, owing primarily to more women driving, rather than an increase in mileage per female driver. For men the drop in average mileage per person from 4,985 in (1995/9 data) to 4,703 (2008/10 data) is a result of a decrease in average driving mileage per male driver. For women the average mileage has increased from 2,005 (1995/9 data) to 2,446 (2008/10).

Young men's car driving mileage has trended downwards more sharply than other demographic groups, but there is no evidence of young men's mileage switching modes to bus, rail, car passenger travel, or walking in lieu of car driving.

Car-driving journeys have been gradually lengthening, from an average of 8.4 (1995/9 data) to 8.7 miles (2008/10) per journey. Of the journey purposes, the NTS shows that the highest mileage is commuting to work (around 900 miles per person annually in the 2008/10 data period).

1.2. Licence-holding

Licence-holding has fallen for young people (particularly men), and increased for older people (especially women). The net effect has been a rapid increase in the average age of drivers, from 44 to 47 years old (1995/9 to 2008/10). More than half of people aged 17–29 who do not drive are either learning to drive or deterred from doing so by the costs of driving (24% of men and 16% of women report cost is the main reason they do not drive). This trend (a fall in the licence-holding rate for both sexes around the late 1990s, but more pronounced for men) has also happened GB-wide.

1.3 Company cars

As in the rest of Great Britain, there have been divergent trends in use of company cars and personal cars, with company car use trending down (a 21% fall in Scotland between 1995/9 and 2008/10) whilst personal car use has trended upwards (by 7%). The sharpest fall in company car ownership has been amongst professionals; their rail use tripled over the 1995/9 to 2008/10 time period, whilst their use of both personal and company cars decreased.

1.4 Bus and rail travel

Bus use per person has grown slowly (NTS data shows 557 and 571 miles per person in the 1995/9 and 2008/10 periods respectively). This rate of growth is statistically insignificant but a sustained modest upward trend (up to the 2008 recession) also appears in bus ticket-sales data.

Bus travel has grown for men, mainly because of bus users using the services more intensely (rather than more men travelling by bus). Women use buses more intensely than men, and middle-aged people travel by bus less than either younger or older people. Bus travel has risen most markedly amongst men aged 60 and over.

Rail use per person has grown (NTS data shows 346 miles per person for the 1995/9 data period and 405 miles per person for the 2008/10 data period), and a similar upward trend is seen in rail ticket-sales data. The SHS also shows an upward trend over time in rail travel per person. As in the rest of Great Britain, growth in rail use in Scotland has also been driven mainly by more people using rail (rather than a higher mileage per rail user). There is, however, some evidence from the SHS to suggest that Scottish residents are making longer distance journeys which may mean fewer, longer journeys for some, which is corroborated by ticket-sales data which show cross-border growth to have grown faster (from a much smaller base) than internal-to-Scotland rail-usage in the 2000s. Commuting mileage by rail has grown over time. In contrast to the pattern of bus travel, rail use is highest amongst people in middle age.

As with car journeys, bus journeys have been gradually lengthening since the 2000/4 period. Rail trips are several times longer on average than car and bus journeys.

Bus users live increasingly in car-owning households. More than twice as many rail users as bus users have their own car (defined as a car that they drive more than anyone else).

Personal incomes of bus users have increased rapidly since the late 1990s, although in 2008/10 they still stood at around half of those of car and rail users.

Bus users are also least likely to work full-time. Whilst commuting by rail has increased, use of bus services for commuting has fallen.

1.5 Use of multiple modes

The NTS provides insight into how being a car driver, bus passenger or rail passenger relates to being a user of the other two modes. In general, the overlap during the course of any given week is small with the proportion of people being: a car driver and using rail 4%; a car driver and using bus 7%; and a rail user and a bus user 3% (all based on 2008/10 data). These percentages would be higher if the period of observation was longer than a week.

The correlation between rail use and full-driving-licence-holding is positive, but the opposite was found for bus use and licence-holding.

2. Comparison between the National Travel Survey dataset and Scottish Household Survey data sets

As of 1 January 2013, the British NTS (which is based on a seven-day travel diary) no longer covers Scotland and Wales: it now takes place only in England. The Scottish government has been collecting data via the SHS – a large-sample general social survey – since 1999, and this survey includes a one-day travel diary element. With the withdrawal of the NTS, the SHS will be used in new ways to monitor travel trends in Scotland.

When the SHS is used to generate estimates of annual mileage by car driving, bus and rail, there is a substantial shortfall between its estimates and those from the NTS (for example, about 40% in the case of car driving). A large part of this shortfall is attributable to the methods that the SHS and NTS use to estimate journey distances, but after accounting for this there are still differences between the NTS and SHS estimates which are due to journey reporting rather than average journey lengths. It is worth noting that currently ongoing work at Transport Scotland will result in different calculations of journey length that are more appropriate for generating annual mileage estimates.

It is reassuring that the trend over time that the two datasets show for annual car-driving, bus and rail mileage per adult are broadly consistent.

In general, the annual averages estimated by the SHS are much less noisy than those in the NTS data series, but in the case of rail (an infrequently used mode of transport, with a few very long journey distances) the SHS seems more sensitive than the NTS to outlier datapoints which affect the calculation of average annual values.

One of the reasons that the SHS seems to be more sensitive to outlier datapoints than the NTS is that it uses a much wider range of weights to account for various biases. One option for remedying this oversensitivity would be to prepare an additional weighting scheme to complement the one currently in use, which would allow the analyst to decide how to trade off between bias on the one hand and sensitivity to outlier datapoints on the other.

Another more structural way to address this issue would be to ask SHS respondents to complete a longer-duration recall diary for long-distance journeys. This would not be overly burdensome, as most respondents will not have made long-distance journeys recently, and the longer period of time that is covered would allow for smaller grossing-up factors (for long journeys only) to calculate annual averages, and hence a reduction in sensitivity to outlier datapoints.

The SHS travel diary is only completed by adults, meaning that much less information is recorded regarding children's travel. Now that the NTS has been

withdrawn from Scotland, Transport Scotland may wish to consider some form of children's diary as part of the SHS.

Other possible enhancements to the transport component of the SHS are described in Section 3 of this report; one point to be kept in mind is that any revisions to the SHS do not necessarily need to maintain consistency with the NTS's design. Whilst compatibility is desirable, it is more important to design a survey that suits the needs of Transport Scotland, and other stakeholders within and outside of the Scottish government.

3. Establishing the relationships between online activity and physical travel

As the SHS is a general social survey, it collects much more detailed information on people's lifestyles – unrelated to their transport – than the NTS, or indeed than is standard practice for travel surveys internationally. Each year's SHS data contains thousands of pieces of information about respondents' wider lifestyles.

Because of the level of detail of information that it gathers regarding the ways people make use of the Internet, the SHS is particularly well suited to addressing the question of whether online activities are having a noticeable impact on people's travel patterns. Data from 2005/6 was used, and it must be kept in mind that since seven years is a long time in the world of the Internet, much has changed in the intervening years in how people use it.

Four segments of Internet usage were identified to characterise the patterns of people's online activity (based on which of the 17 types of online activities they take part in). Large differences in travel outcomes were found between the four segments of Internet users (and the fifth segment, non-users), but there were also major differences in their sociodemographic profiles.

To distinguish between confounding effects of 'profile' differences and effects actually due to participation in online activities, multivariate regression models were prepared. One models whether SHS respondents have a driving licence or not, and the other models their annual car-driving mileage.

After accounting for household income, sociodemographics and other baseline effects, use of the Internet was found to be associated with a *higher* probability of holding a driving licence. Being a 'narrow' user of the Internet – i.e. performing a small number of activities online – affected the likelihood of having a driving licence less than other Internet-usage patterns (where people perform more types of online activities).

The model of car-driving mileage also turned up interesting results. On average, using the Internet was associated with nearly 500 more driving miles per year

than not being an Internet user. What is more, beyond 5 hours per week of online activity we found a strong negative relationship between Internet use and driving mileage (i.e. the association with driving weakened from 5 hours upwards, until by 20 hours a week there was no positive association any longer).

In summary, the results suggest that a rise in the number of people making limited use of the Internet is linked to an *increase* in car driving, but that growth in time spent online is negatively linked to driving. We cannot be sure that these associations are causal (owing to the data and methods used), but they are suggestive. They make it clear that the relationship between travel and online activity is more complex than one simply substituting for the other.

The information that the SHS collects regarding people's use of the Internet varies from year to year, and as of 2012 the SHS does not collect detailed data about the specific types of online activities in which people participate. Amongst other minor design changes to the 'Internet portion' of the SHS, the listing of online activities used in 2005/6 could be updated to take account of recent trends (e.g. online social networking) and incorporated into future versions of the SHS. The finding that various types of Internet usage have very different links to personal travel suggests that it may make sense to do so.

4. Trends in rail passenger satisfaction

Overall satisfaction with rail service (which is approaching 90% as a proportion of rail passengers) was found to generally be several percentage points higher in Scotland than elsewhere in GB, although over time the satisfaction levels in England and Wales have come closer to the Scottish level.

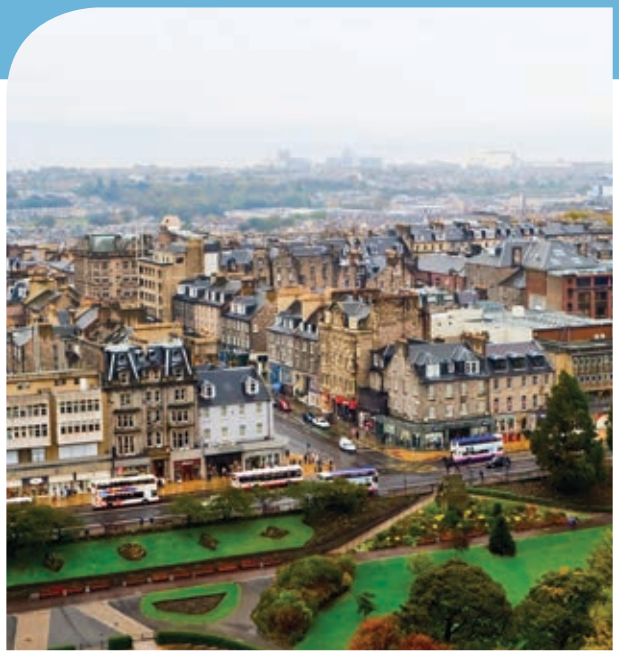
People travelling by rail for leisure purposes have the highest levels of satisfaction, followed by business travellers and then commuters.

Scottish rail travellers for many years reported the highest levels of satisfaction with punctuality relative to England and Wales, but recently Wales has caught up with the Scottish level. Satisfaction with the quality of connecting rail services has also tended to converge in recent years, whereas in years past satisfaction with this aspect of rail service tended to be somewhat higher in Scotland. This has happened despite Scottish satisfaction levels trending upwards, as those for England and Wales have trended higher at a faster rate.

Satisfaction with ticket prices has remained stable at just below 60% in Scotland, which is higher than that in England and similar to the rate in Wales. Women report levels of satisfaction with price that are several percentage points higher than men's levels of price satisfaction.

1. Introduction

This report examines trends in personal travel by car, bus and rail[1] in Scotland between the mid-1990s and late 2000s, using data both from the Scottish subset of the National Travel Survey (NTS) and the larger sample from the Scottish Household Survey (SHS). It also provides a comparison of the outputs of the two surveys, and using the SHS, the report examines relationships between Internet usage and travel behaviour.



It was prepared as part of a wider study of car and rail travel trends across Great Britain (GB), based primarily on analysis of the NTS, for a consortium of sponsors (the RAC Foundation, Transport Scotland, Independent Transport Commission and Office of Rail Regulation). Other reports in the series include:

1) summary report: *On the Move: Making sense of car and train travel trends in Britain* (Le Vine & Jones, 2012)*;*

2) a *Technical Compendium* containing figures and tables that were prepared but not included in the summary report (Le Vine et al., 2012);

3) *Rail Demand Forecasting Using the Passenger Demand Forecasting Handbook* (Worsley, 2012);

4) *National Rail Passenger Survey Data Analysis* (Preston & Jones, 2012); and

5) a study of Welsh travel trends – this will have a similar structure to this report on Scottish trends, in order to facilitate the drawing of comparisons.

1 In this report, the term 'rail' refers to travel by National Rail services. Where urban rail services are concerned, this will be made clear in the relevant sections.

1.1 Report structure

The report is organised into four main sections, which are followed by a conclusion:

- Section 2 investigates travel trends in Scotland, using data from Scottish residents who have taken part in the British NTS, from 1995 to 2010.
- Section 3 looks at the methodological differences between the British NTS and the SHS, and the implications for using the SHS to prepare estimates of annual mileage per capita.
- Section 4 makes use of the SHS data to investigate links between Internet usage and travel. This is possible as, in addition to its travel diary element, the SHS collects a set of detailed information about Internet usage.
- Section 5 presents results from the National Rail Passenger Survey (NRPS) which relate to passengers' experiences of rail services in Scotland, with some comparisons with England and Wales.
- Section 6 draws conclusions from the analysis.

Unless explicitly stated to represent an average across GB, results presented in this report pertain to Scotland.

1.2 Data and technical notes

The NTS has been undertaken on an ad hoc basis since the 1960s, and continuously since 1988. Prior to 2002, approximately 300 Scottish households were sampled annually; from 2002 this rose to about 750 households a year. NTS respondents take part in an interview that covers demographic data and mobility-related items such as car ownership, and compile a seven-day travel diary. All household members must take part for it to be considered a fully responding household. As of 1 January 2013, the NTS is an England only survey, as it is no longer carried out in Scotland and Wales.

The SHS is a general-purpose social survey, of which an important component is a one-day travel diary. It has been administered on a continuous basis since 1999, and underwent significant modification in 2007, which included recording of walking journeys under five minutes (or a quarter of a mile) that were previously not recorded. The travel diary is completed by one randomly selected adult in each household, rather than all household members as in the NTS.

The properties of the NTS and SHS travel diary datasets are compared in more detail in Section 3.

In calculating average annual values of distance travelled by car, bus and rail, the convention used was to sum across journey stages, as opposed to allocating all journey distance to the 'main mode' (the mode of travel used for the longest part of multimodal journeys). For a single-stage journey the calculation is identical, and for a multimodal journey this ensures that the appropriate distance is allocated to each mode used to complete the journey.

In view of the small annual sample sizes in the NTS (i.e. around 300 households per year up to 2001, and 750 per year thereafter), the data is aggregated into three- or four-year averages, thus: 1995/9, 2000/4, 2005/7, and 2008/10. Some comparable analyses are presented using SHS travel diary data, but these are only available between 1999 and 2008. The annual unweighted sample sizes of fully participating Scottish households and persons, and of their journeys in the NTS and SHS, are shown in Table 1.1 and Table 1.2 respectively. The SHS sample consisted of approximately 14,000 adults per year to 2006, a figure which then fell to about 12,000 in 2007 and 2008 as in those years households within a portion of the SHS sample were not requested to have a randomly selected adult report a travel diary.

Table 1.1: NTS unweighted travel diary sample sizes (Scottish residents)

	Households	Persons	Journeys
1995	318	760	12,362
1996	313	716	10,750
1997	244	574	9,128
1998	274	604	10,261
1999	287	628	10,414
2000	283	676	10,907
2001	308	698	11,756
2002	727	1,583	24,879
2003	784	1,813	28,532
2004	779	1,844	28,989
2005	815	1,922	30,412
2006	808	1,801	27,686
2007	813	1,817	27,282
2008	715	1,655	25,872
2009	750	1,615	24,225
2010	737	1,599	24,267

Table 1.2: SHS unweighted travel diary sample sizes

	Adults (16+)	Journeys
1999	13,783	28,396
2000	14,557	28,649
2001	14,643	28,519
2002	14,042	26,944
2003	13,968	26,790
2004	14,778	27,122
2005	14,071	24,658
2006	14,190	25,215
2007	12,242	20,519
2008	12,373	20,449

Many of the results in Section 2 (which is based on the NTS) are broken down by type of area. The NTS uses a spatial code that is based on the postcode sector that a household falls into (with 22 households being sampled from each selected sector), but this does not fully align with Scottish unitary authority boundaries; moreover, it differs from the standard Scottish government 6-fold and 8-fold urban/rural classifications that the SHS uses (The Scottish Government, 2013).

The Scottish government urban/rural classifications group all settlements of more than 125,000 people in the 'Large Urban Areas' category, whilst the spatial classes used in the NTS have more differentiation of large urban areas (as shown in Table 1.3). The Scottish government spatial classes are more differentiated for smaller settlements, and include a distinction (which the NTS categorisation does not cater for) between small towns and rural areas that is based on proximity to the nearest settlement with a population of over 10,000.

Table 1.3: Listing of NTS settlement size codes and Scottish government urban/rural classification (6-fold and 8-fold)

NTS spatial classes	Scottish government 6-fold urban/rural classification	Scottish government 8-fold urban/rural classification
1. Metropolitan built-up area 2. (Other) Urban over 250K population 3. Urban over 25K to 250K 4. Urban over 3K to 25K 5. Rural (fewer than 3K)	1. Large urban areas (over 125K population) 2. Other urban areas (10K to 125K) 3. Accessible small towns (3K to 10K, and within 30 minutes' drive of a settlement of 10K+) 4. Remote small towns (3K to 10K, and with a drive time of over 30 minutes to a settlement of 10K+) 5. Accessible rural (fewer than 3K, and within 30minutes drive of a settlement of 10K+) 6. Remote rural (fewer than 3K, and with a drive time of over 30 minutes to a settlement of 10K+)	1. Large urban areas (over 125K population) 2. Other urban areas (10K to 125K) 3. Accessible small towns (3K to 10K, and within 30 minutes' drive of a settlement of 10K+) 4. Remote Small Towns (3K to 10K, and with a drive time of between 30 and 60 minutes to a settlement of 10K+) 5. Very remote small towns (3K to 10K, and with a drive time of over 60 minutes to a settlement of 10K+) 6. Accessible rural (fewer than 3K, and within 30 minutes' drive of a settlement of 10K+) 7. Remote rural (fewer than 3K, and with a drive time of between 30 and 60 minutes to a settlement of 10K+) 8. Very remote rural (fewer than 3K, and with a drive time of over 60 minutes to a settlement of 10K+)

Table 1.4 shows that all of the City of Glasgow is in the 'Metropolitan built-up areas' NTS spatial category, but that this category also contains parts of several other unitary authorities (for example East Dunbartonshire and East Renfrewshire). The 'Urban over 250K' NTS spatial category aligns well (but not completely) with the City of Edinburgh unitary authority. Note that this correspondence table of NTS settlement size categories and unitary authority boundaries is only available from 2003 onwards.

Table 1.4: Correspondence between NTS settlement size codes and Scottish unitary authorities (units are postcode sectors sampled in the NTS since 2003)

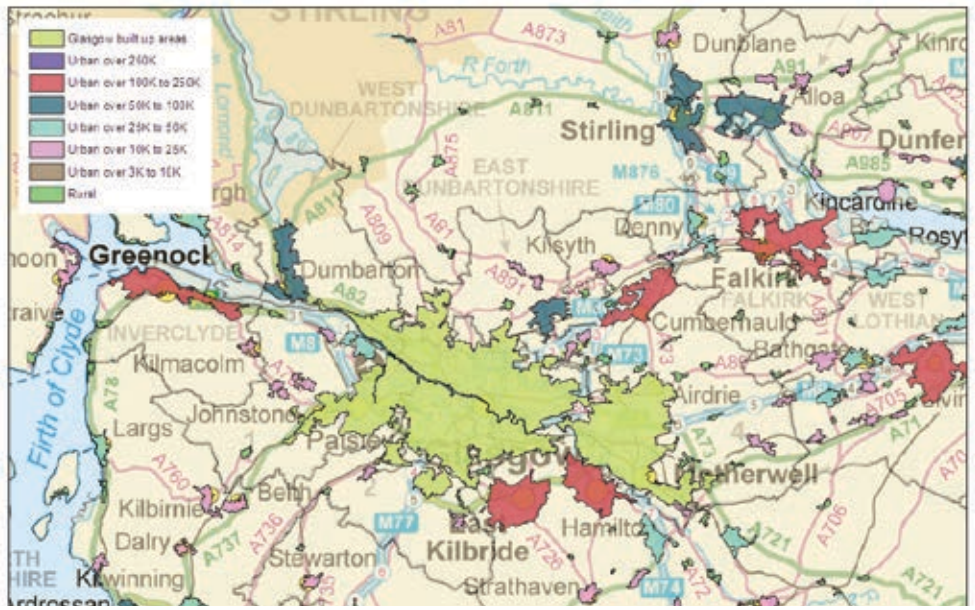
Scottish local authority area	Metropolitan built-up areas (Mainly Glasgow)	Urban over 250K (Mainly Edinburgh)	Urban over 25K to 250K	Urban over 3K to 25K	Rural
Aberdeen City			28		
Aberdeenshire				7	10
Angus			1	11	
Argyll and Bute				9	2
Clackmannanshire			1	4	
Dumfries and Galloway			4	2	8
Dundee, City of			6		
East Ayrshire			2		5
East Dunbartonshire	2		5	6	2
East Lothian		2		5	
East Renfrewshire	7			8	
Edinburgh, City of		46		2	
Falkirk			9	5	4
Fife			15	12	9
Glasgow, City of	55				
Highland			5	10	11
Inverclyde			9		
Midlothian				8	1
Moray					2
North Ayrshire			5	4	
North Lanarkshire	7		15	5	2
Perth and Kinross			4	6	2
Renfrewshire	2		4	2	
Scottish Borders				7	
South Ayrshire			8	2	
South Lanarkshire	11		12	4	2
Stirling			4	4	
West Dunbartonshire			8	4	
West Lothian			7	13	1
Unclassified	10	5	18	25	4

Notes: Units are postcode sectors sampled in the NTS since 2003. The NTS sample frame excludes the Scottish islands for practical reasons.

Source: Courtesy of Lyndsey Melbourne, Department for Transport (DfT)

Figure 1.1 shows a map of the NTS settlement size categories in Scotland. It uses the Glasgow area as an example to show the spatial distribution of the settlement size classes.

Figure 1.1: Map of the Glasgow area showing NTS settlement size categories



Source: Courtesy of Darren Williams, DfT

2. Car, Bus and Rail Patterns in Scotland: Analysis Using NTS data

Based on analysis of the Scottish sample of the British National Travel Survey, this section looks at how usage of transport has evolved since the mid-1990s in Scotland, focusing primarily on car driving, bus use and rail travel.

2.1 Overall travel trends

2.1.1 Travel in Scotland, and travel by Scottish residents

Table 2.1 investigates how much of the personal travel occurring within Scotland is undertaken by Scottish residents, as well as how much of the travel recorded by Scottish residents takes place within Scotland (rather than in the rest of Great Britain). This analysis is based on a simplified approach using straight-line distances between centroids of Britain's Government Office Regions. It shows that about 90% of mileage within GB by Scottish residents takes place within Scotland itself, and also that about the same percentage of all travel within Scotland is undertaken by Scottish residents.

Table 2.1: Percentage of travel in Scotland that is by Scottish residents, and percentage of travel by Scottish residents that takes place in the rest of Great Britain

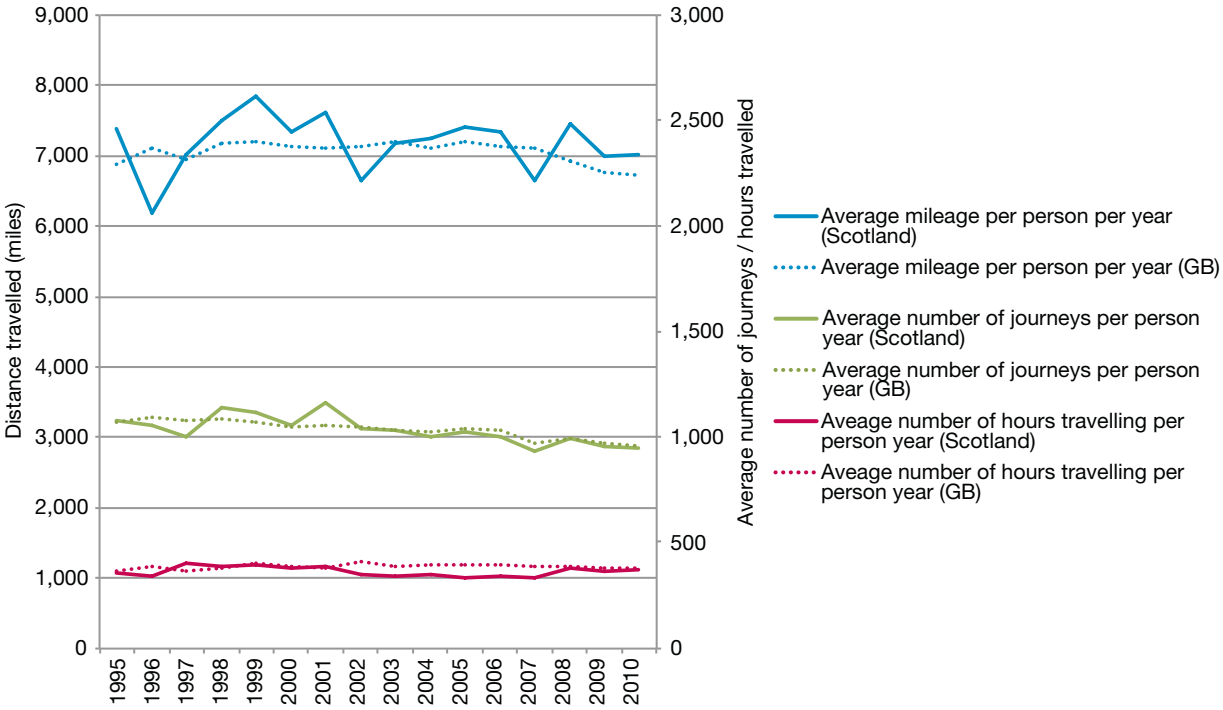
Year	Of travel (mileage) within GB by Scottish residents, the percentage that occurs within Scotland	Of travel (mileage) within Scotland, the percentage that is undertaken by Scottish residents (as opposed to residents of the rest of Great Britain)
1995/9	91%	90%
2000/4	90%	92%
2005/7	91%	91%
2008/10	92%	92%

Source: NTS

2.1.2 Key travel indicators

Figure 2.1 shows trends in annual trip (journey) numbers, distances travelled and travel times per year, comparing figures for Scotland (shown as solid lines) with Great Britain as a whole (the dotted lines). Between 1995/9 and 2008/10, recorded annual journey rates in Scotland fell by 9% (comparable with the reduction in Great Britain as a whole), while average annual distance and hours travelled have remained stable overall.

Figure 2.1: Average distance, number of journeys, and hours travelling per person per year



2.2 Travel trends by mode of transport

2.2.1 Annual mileage by mode of transport

Table 2.2 shows changes in annual mileage by various modes of transport, between 1995/9 and 2008/10, showing also the standard error associated with each estimate. Estimated car-driving mileage has been basically flat (a very small increase over time is seen, even during the recession beginning in 2008, but this increase is well within the margin of error). Motorcycle mileage has trended upwards in each of the periods shown (with a recent rapid rise), but the small sample sizes mean the data is 'noisy'.[2] Other modes have shown more

2 In this context, noisy refers to random fluctuations that obscure or do not contain meaningful time trend.

fluctuation, while walking distances have consistently fallen over time. Overall, comparing 2008/10 with 1995/99, rail mileage per person in Scotland has increased by 17%, taxi/minicab by 7%, bus by 3% and bicycle by 10%. Over the same period, car passenger mileage fell by 6% and walking by 13%.

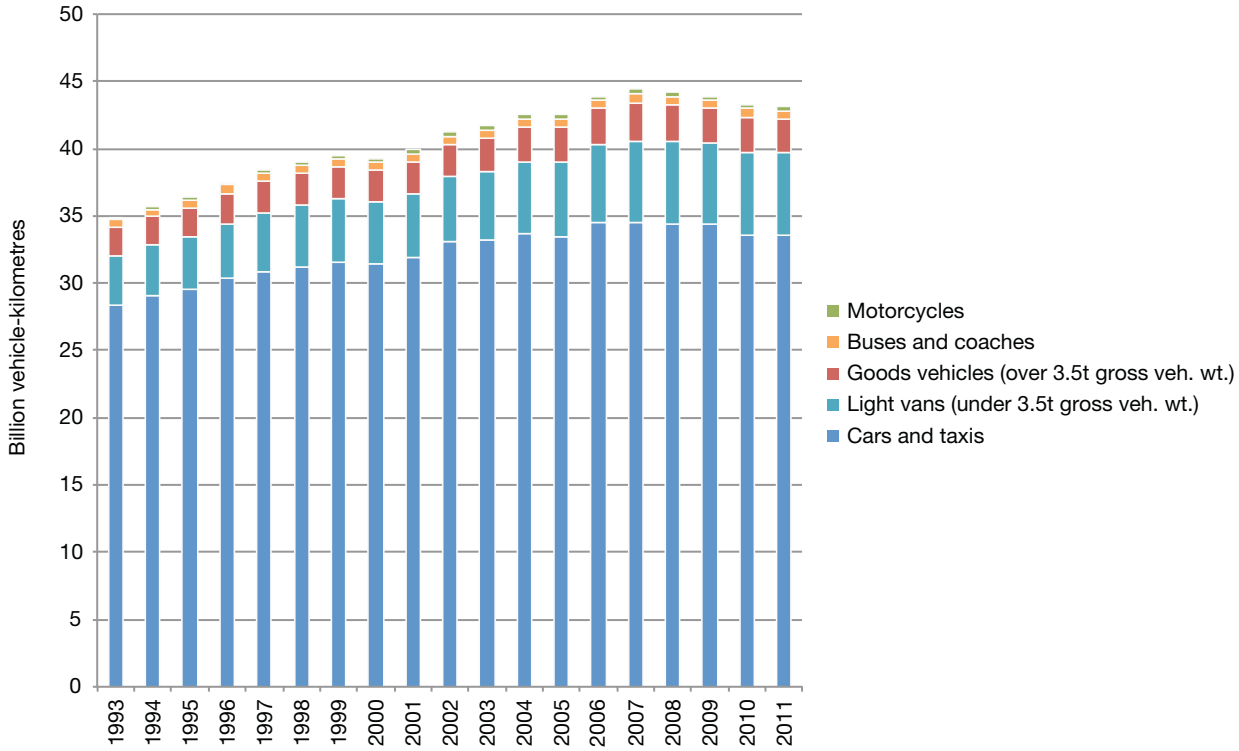
Table 2.2: Average annual mileage per person by mode of travel, Scottish residents

Mode	1995/9	2000/4	2005/7	2008/10
Car driving	3,427 (112)	3,441 (82)	3,480 (90)	3,525 (92)
Car passenger	2,049 (67)	2,142 (54)	1,938 (56)	1,920 (54)
Bus	557 (29)	459 (19)	519 (25)	571 (24)
Rail	346 (38)	339 (25)	442 (35)	405 (35)
Other public transport	296 (60)	285 (41)	302 (46)	256 (40)
Walking	219 (6)	216 (4)	191 (5)	190 (5)
Other private transport	181 (23)	145 (17)	151 (18)	158 (24)
Taxi/minicab	56 (4)	65 (6)	70 (6)	60 (4)
Motorcycle	14 (7)	20 (5)	21 (6)	43 (10)
Bicycle	30 (5)	27 (3)	25 (3)	33 (4)
Sum (all modes)	7,174 (151)	7,140 (109)	7,137 (122)	7,161 (120)

Source: NTS (standard errors in brackets)

Figure 2.2 shows road traffic count data for Scotland; this data series shows that car traffic (which includes taxis, as they are not separately identified in the raw count data) increased steadily until the onset of the recession.

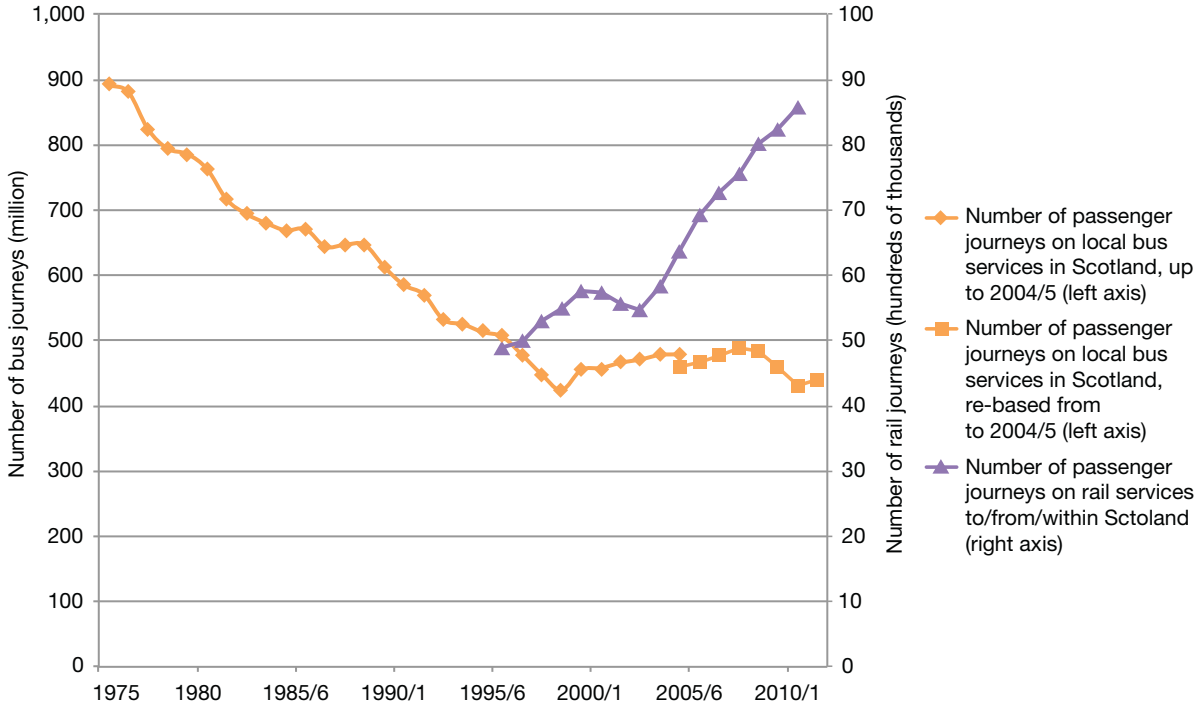
Figure 2.2: Road traffic levels



Source: DfT road traffic counts

Figure 2.3 shows the time trend in the number of bus and rail journeys in Scotland, based on data provided by service operators. Since 2002/3 this data shows rail travel to have grown robustly year-on-year, even during the recession-affected period since 2007/8. The number of bus journeys in Scotland reported by local bus service operators has grown at a slower rate than rail, and the upward trend in bus travel was reversed with the onset of the recession and has yet to attain the peak level seen in 2007/8.

Figure 2.3: Aggregate number of local bus and rail journeys in Scotland, according to service-operator data



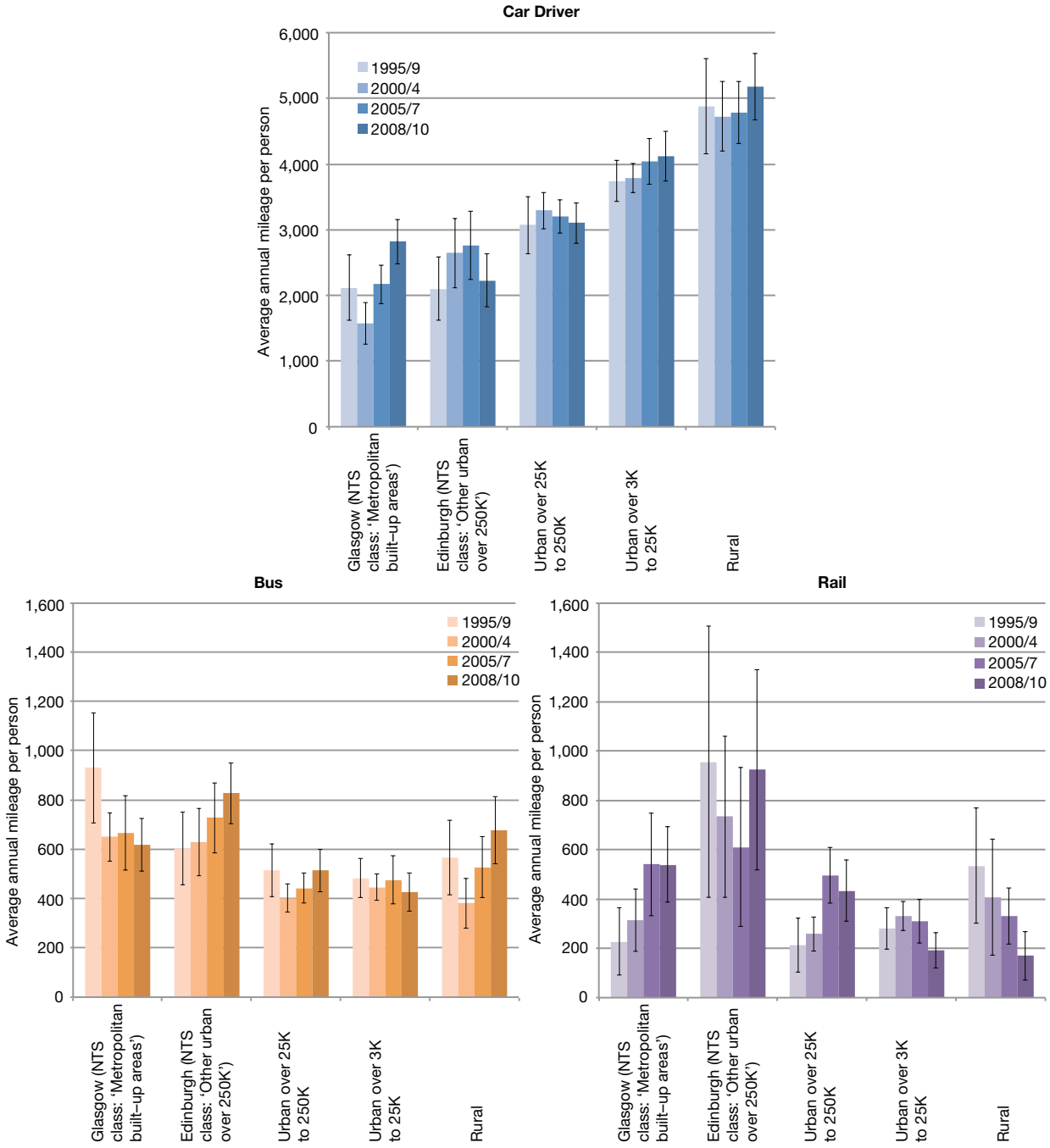
Source: DfT (2012) and ORR (2012)

2.2.2 Differences in mileage by type of area

Figure 2.4 shows how car driver, bus and rail travel has changed over the four time periods, broken down by the residential settlement size categories that the NTS uses.

In general, car-driving mileage has an inverse relationship with population size, being seen to increase steadily as one moves from the largest cities to the rural areas, approximately doubling in distance per person over this range; since the recession, mileage seems to have dropped, but the decrease is not statistically significant. Although much less marked, the opposite relationship is found between settlement size and bus mileage. Rail usage per person by residents of Edinburgh is much higher than by those in the Glasgow area, although this result could be a result of how the boundaries are drawn.

Figure 2.4: Average annual mileage, car driving, bus and rail, by settlement size

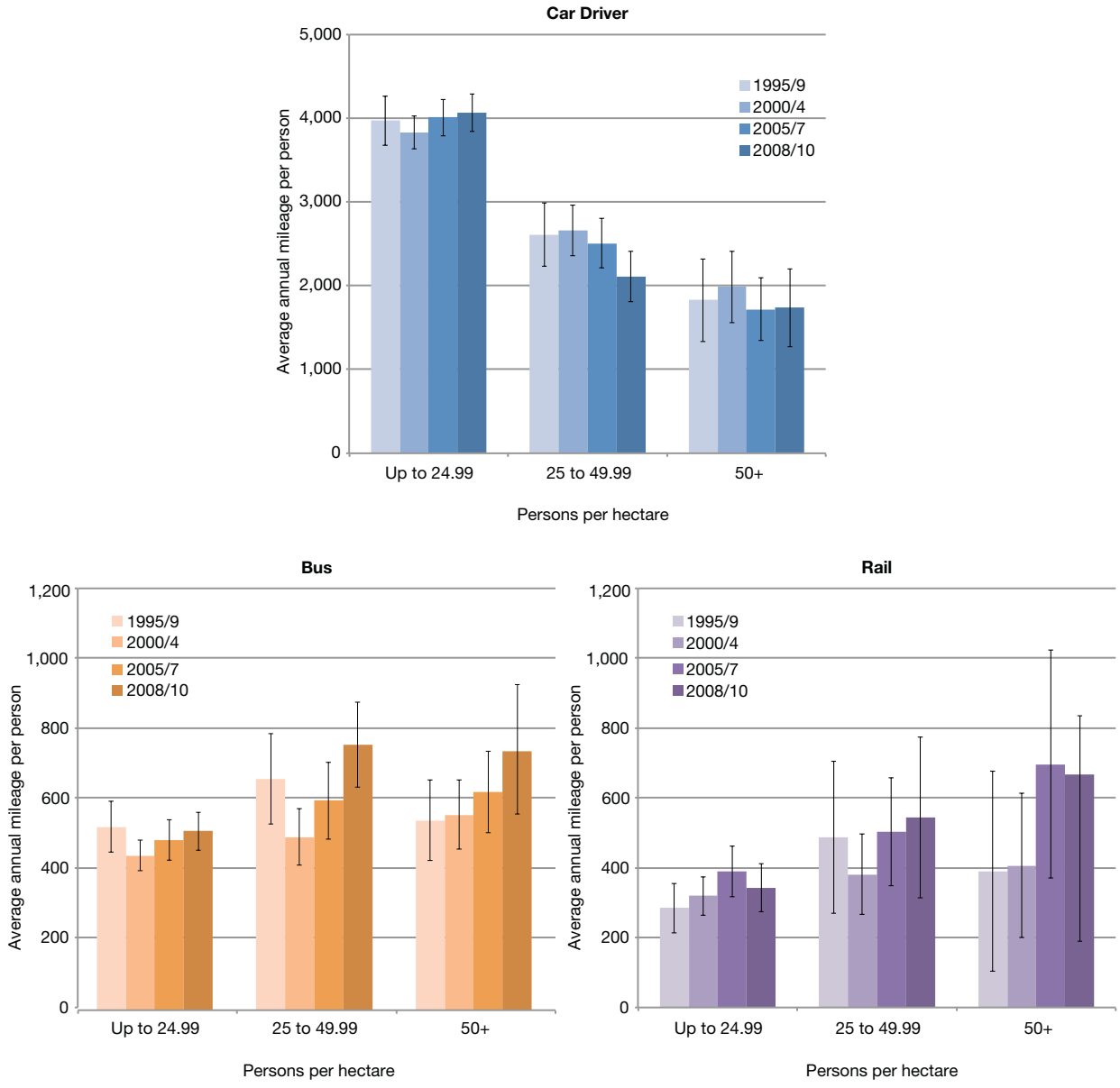


Source: NTS (error bars: 95% confidence interval)

One must be cautious about drawing inferences from the trends shown in Figure 2.4, as in many cases the differences are within the confidence intervals. However, there has been a statistically significant fall since 1995/9 in rail usage by rural residents, as well as an increase in rail usage in the Glasgow built-up area and the 'Urban 25K to 250K' class. Bus usage seems to have risen in the 'Edinburgh' spatial class.

In Figure 2.5 the equivalent relationship is shown between neighbourhood density and annual mileage per person by mode. Average car-driving distance is approximately twice as much in the low-density areas (those with less than 25 persons per hectare) as in the high density ones (which accommodate over 50 persons per hectare). Average annual mileages by bus and rail are lowest in low-density areas, but the relationship between the public transport modes and residential density is much weaker than in the case of the car. In 2008/10 the correlation between residential density (persons/hectare) and average car-driving mileage was –0.14; whereas it was only +0.05 and +0.07 for bus and rail respectively.

Figure 2.5: Average annual mileage, car driving, bus and rail, by density of postcode sector (persons/hectare)



Source: NTS (error bars: 95% confidence interval)

2.2.3 Trends in average distances and speeds, by mode

In this section we look at trends in average distance per journey, by mode. Table 2.3 shows that car-driving journeys have been gradually lengthening since 1995/9 (from 8.4 to 8.7 miles), and that the same trend emerges for bus journeys since the 2000/4 period. rail trips are several times longer on average than car and bus journeys, but as the data is noisier the trend over time is not as clear.

Table 2.3: Average journey distance (miles/journey) for car driving, bus and rail

Period	Car driving	Bus	Rail
1995/9	8.4 (0.1)	5.1 (0.1)	36.2 (2.7)
2000/4	8.5 (0.1)	4.9 (0.1)	26.9 (1.2)
2005/7	8.7 (0.1)	5.2 (0.1)	30.0 (1.3)
2008/10	8.7 (0.1)	5.7 (0.1)	29.9 (1.5)

Source: NTS (standard errors in brackets)

Travel speeds decreased for car journeys up to the 2005/7 period, but there is no clear trend over time in speeds by bus or rail (Table 2.4). Rail journeys have the fastest average speeds of the three modes (an average of around 40 mph in 2008/10).

Table 2.4: Average travel speed (mph) by car, bus and rail

Period	Car driving	Bus	Rail
1995/9	26.8 (0.02)	14.2 (0.03)	46.2 (0.13)
2000/4	26.2 (0.02)	12.3 (0.02)	37.4 (0.07)
2005/7	25.9 (0.02)	13.0 (0.02)	38.5 (0.07)
2008/10	26.4 (0.02)	14.1 (0.02)	40.2 (0.08)

Source: NTS (standard errors in brackets)

2.3 Factors underlying the changes in travel by mode

Changes in the average annual mileage per head-of-population for a particular mode can result from two separate factors (or a combination of them):

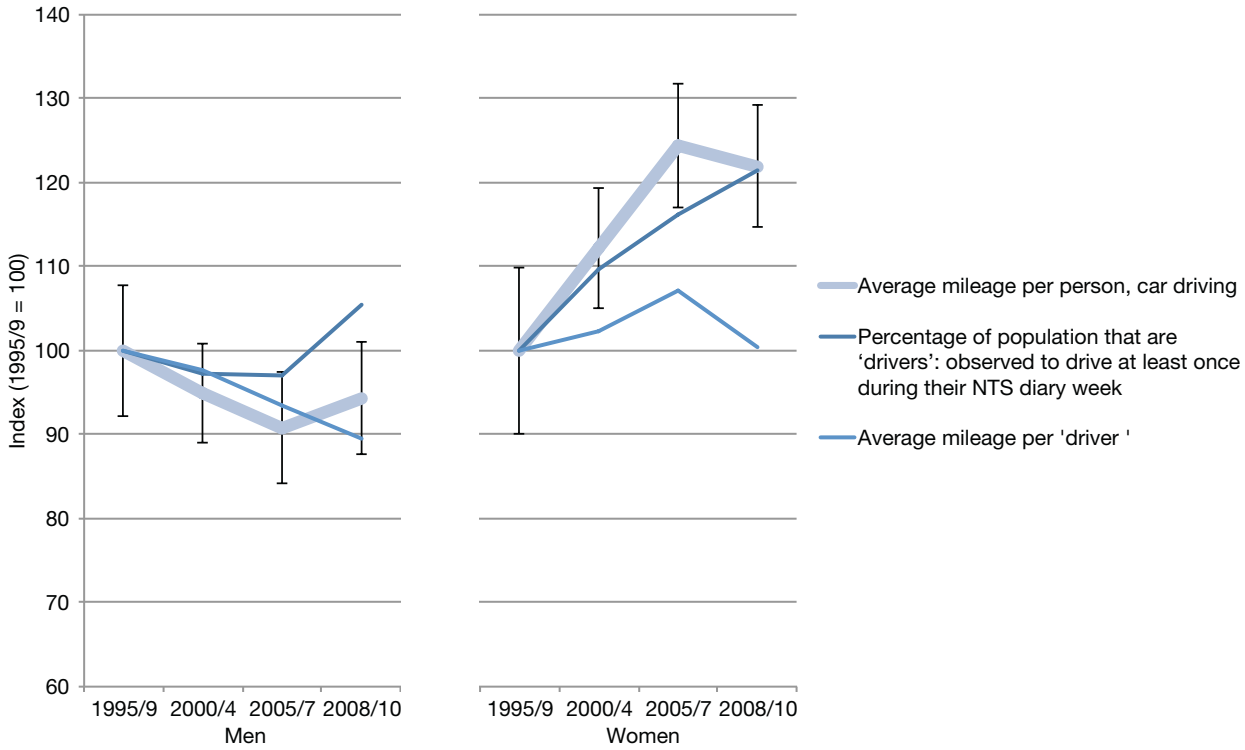
- a change in the proportion of the population using that mode ('market penetration'); and
- a change in annual mileage per user ('intensity of use').

Here we look at the contribution of these two components to the observed changes in the average per-person car-driving, bus and rail mileage over time. Figures 2.6, 2.7 and 2.8 show, disaggregated by gender, the findings for car-

driving, bus and rail mileages respectively, in terms of changes since 1995/9, which is used as the base period.

From Figure 2.6 it can be seen that for men the average mileage per person (shown by the thicker line in each graph) has fallen over time (from 4,985 in 1995/9 to 4,703 in 2008/10), mainly as a result of a decrease in average mileage per male driver. The average mileage per woman has increased by over 20% (from 2,005 in 1995/9 to 2,446 in 2008/10), and this is due similarly to an increase in the number of women driving. Overall (both genders combined) driving mileage per person per year increased from 3,427 to 3,525 over this time period.

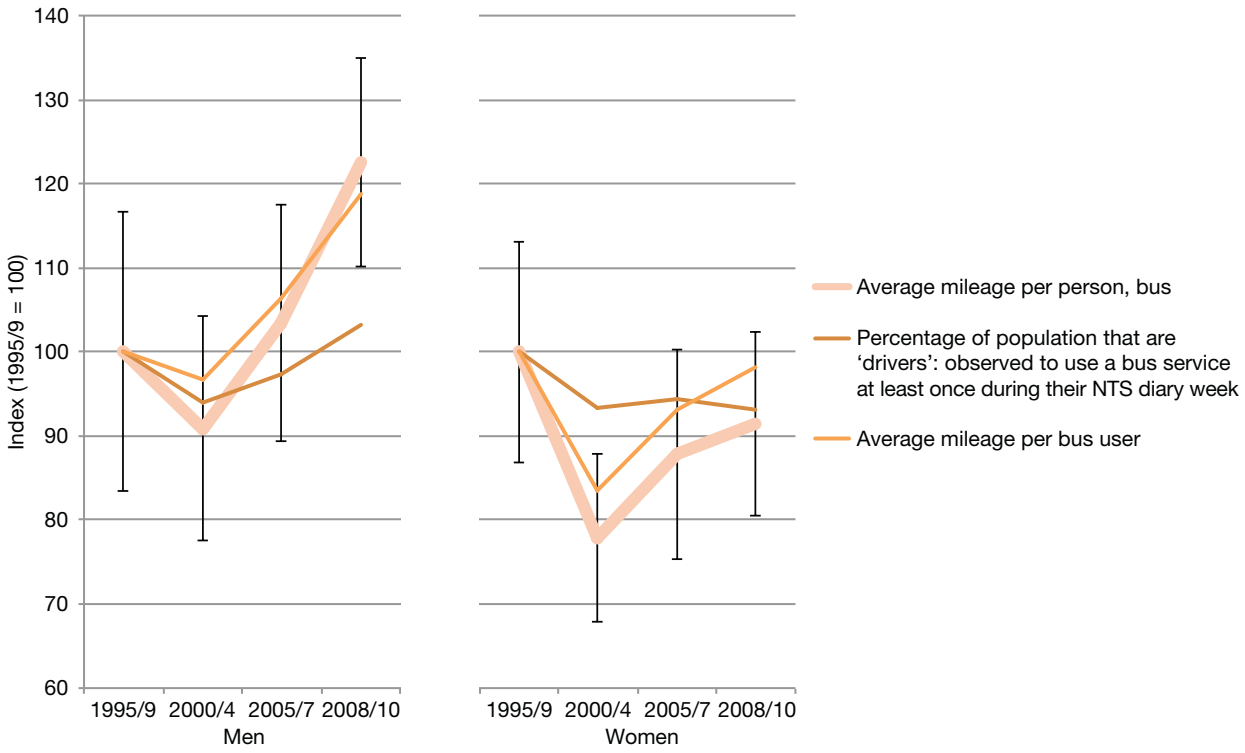
Figure 2.6: Changes in the proportion of NTS respondents who drove a car during their NTS diary week, and in car-driving mileage per driver, by gender



Source: NTS (95% confidence intervals are shown for index of average driving mileage per person)

Figure 2.7 presents the equivalent figures for bus usage. Over the four time periods, we observe the opposite trend to car usage: men's bus mileage has increased by around 20% and women's is lower in 2008/10 than in 1995/9, by about 10%. In the case of men, this is due mainly to an increase in average mileage per bus user, rather than a higher market penetration. Women's bus use has trended up since 2000/4, although the trend is not statistically significant as it is for men.

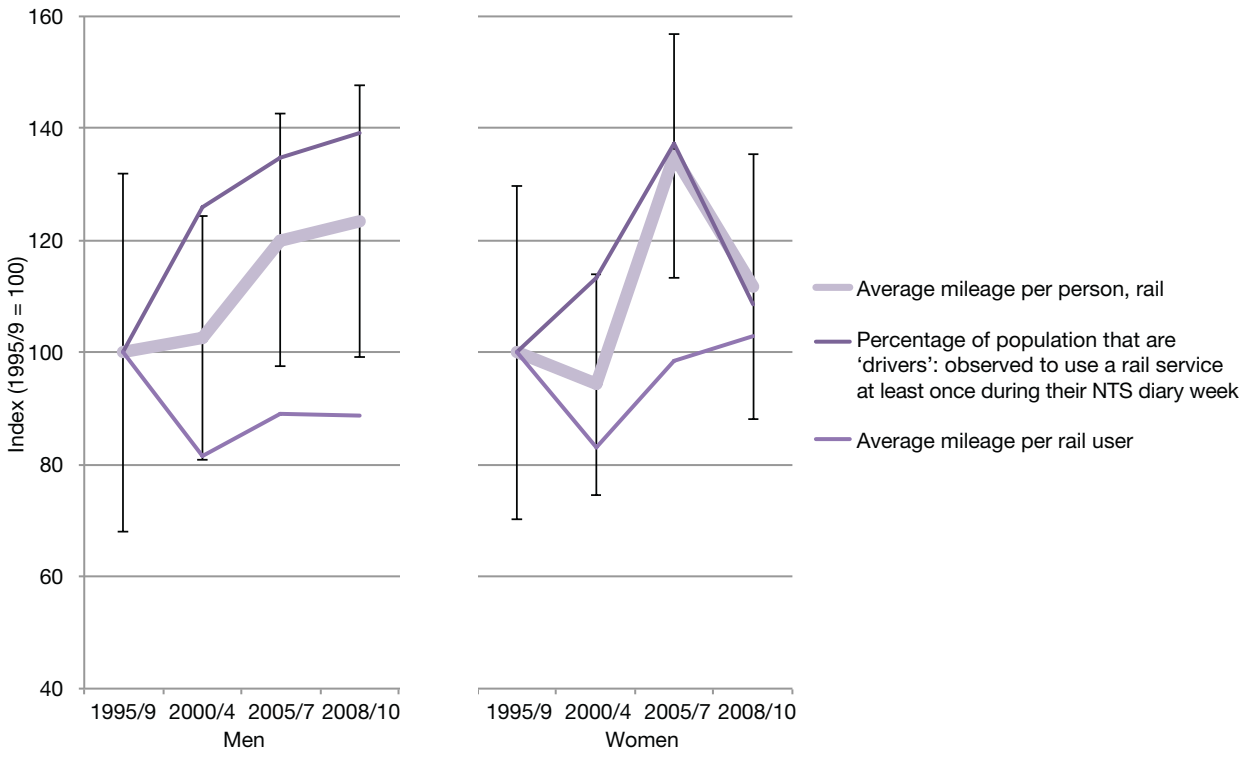
Figure 2.7: Changes in the proportion of NTS respondents who used a bus during their NTS diary week and in bus mileage per user, by gender



Source: NTS (95% confidence intervals are shown for index of average bus mileage per person)

Finally, Figure 2.8 shows the same data for rail, the first point to note being the wide confidence intervals. What can be seen is that both for men and women, the main driver of rail growth has been an increasing proportion of the population travelling by train, rather than an increased mileage per user – as found across Great Britain as a whole.

Figure 2.8: Changes in the proportion of NTS respondents who used rail during their NTS diary week and in rail mileage per user, by gender



Source: NTS (95% confidence intervals are shown for index of average rail mileage per person)

The next three tables look at how being a car driver, bus passenger or rail passenger relates to being a user of the other two modes. These analyses are based on the all-ages population, including both children and adults.

Table 2.5 shows what proportion of the population report being a car driver and using rail during their diary week. Here we see that the proportion of people using both modes is small, at 3–4%, and that about the same percentage used rail but did not drive. The proportion of those driving a car but not using rail increased from 39% in 1995/9 to 43% in 2008/10 – and those not reporting using either mode of travel has decreased over time (down from 54% in 1995/9 to 49% in 2008/10).

Table 2.5: Cross-tabulation of car driving and rail use

Period	Car driver but not rail user	Car driver and rail user	Rail user but not car driver	Neither rail user nor car driver
1995/9	39% (1%)	3% (<0.5%)	4% (<0.5%)	54% (1%)
2000/4	40% (1%)	3% (<0.5%)	4% (<0.5%)	52% (1%)
2005/7	41% (1%)	4% (<0.5%)	5% (<0.5%)	51% (1%)
2008/10	43% (1%)	4% (<0.5%)	4% (<0.5%)	49% (1%)

Source: NTS (standard errors in brackets)

Corresponding figures for car and bus users are shown in Table 2.6. Again, the proportion of respondents using both modes is quite small – although higher than for rail – at between 5% and 7%. Those driving a car but not using bus have increased as a proportion of the population over the four time periods, from 37% to 41%, while the proportion of those not using either mode has dropped from 32% to 29% – mainly since the start of the recession.

Table 2.6: Cross-tabulation of car driving and bus use

Period	Car driver but not bus user	Car driver and bus user	Bus user but not car driver	Neither bus user nor car driver
1995/9	37% (1%)	6% (<0.5%)	25% (1%)	32% (1%)
2000/4	38% (1%)	5% (<0.5%)	24% (1%)	33% (1%)
2005/7	39% (1%)	6% (<0.5%)	23% (1%)	32% (1%)
2008/10	41% (1%)	7% (<0.5%)	23% (1%)	29% (1%)

Source: NTS (standard errors in brackets)

Finally, Table 2.7 shows the third cross-tabulation, of bus and rail usage. Again, the overlap is very small: only 3% of respondents use both modes; 4% use rail and not bus, while two thirds use neither mode – none of these percentages show any clear trend over time. The relationship between bus use and rail use therefore does not seem to have changed significantly over time, in contrast to the interactions between car driving and these two public transport modes.

Table 2.7: Cross-tabulation of rail and bus use

Period	Rail user but not bus user	Rail user and bus user	Bus user but not rail user	Neither rail user nor bus user
1995/9	3% (<0.5%)	3% (<0.5%)	27% (1%)	66% (1%)
2000/4	4% (<0.5%)	3% (<0.5%)	26% (1%)	67% (1%)
2005/7	5% (<0.5%)	4% (<0.5%)	26% (1%)	66% (1%)
2008/10	4% (<0.5%)	3% (<0.5%)	26% (1%)	66% (1%)

Source: NTS (standard errors in brackets)

2.4 Mode user profiles

Next we look at the profiles of the respondents who travel as car drivers, bus passengers, and rail passengers – we investigate how these differ between modes, and how they compare to the adult Scottish population as a whole, at the four periods of time. As previously, a respondent is classed as a 'user' of a mode of transport if they report using it in their NTS diary week at least once. The results are shown in Table 2.8.

First let us look at the changing characteristics of the sample as a whole, between 1995/9 and 2008/10. Over this period, the population aged by 1.4 years, there was a 3 percentage point increase in those working full-time (up from 35% to 38%) and a 4 percentage point decline in the prevalence of living with children (down from 43% to 39%). Having a car in one's households increased noticeably (up from 72% to 79%), and the proportion of 'main drivers'[3] of a car also increased by seven percentage points (from 35% to 42%). Both personal and household incomes grew by 20–25% in real terms. We now compare user profiles of each mode against this background trend.

The average age of car drivers has increased considerably, from 43.7 to 47.0 years old, between 1995/9 and 2008/10, in contrast to the situation with users of bus and rail. The percentage of car drivers who are female increased by three percentage points (from 42% to 45%), decreasing by a similar amount for bus and twice as fast for rail (down from 57% to 51%), although the latter decrease has not been smooth.

As car ownership has risen in Scotland, the proportion of bus users who have a car in their household has increased, from 48% to 56%; again, the situation regarding rail is less clear. The percentage of users of all three modes who are 'main drivers' has also increased. In 2008/10 more than twice as many rail users (38%) as bus users (18%) are 'main drivers'.

A much higher percentage of car drivers (58% in 2008/10) than bus users (27%) work full-time; at 54% in 2008/10, the proportion of rail users who do so is approaching the figure for car drivers. The 4 percentage point drop in the proportion of car drivers living in households with children matches the overall trend (although from a lower base). There has been a larger drop among bus users (down from 40% to 32% living with children), with the rail user profile showing no consistent trend.

The highest average personal incomes are found amongst car drivers (£21,420 in 2008/10). The highest rates of increase in personal incomes since the late 1990s have been amongst bus users, although in 2008/10 they still stood at about half those of car and rail users, at £10,761.

The percentage of users whose household owns their residence (as opposed to renting or living rent-free) is highest amongst car drivers (82% in 2008/10) followed by rail users (67%) and then bus users (56%). The percentage living in a flat (rather than a terraced, semi-detached, or detached house) is now over twice as high among bus and rail users (at around 40% in 2008/10) as among car drivers (18%).

3 A main driver is someone who drives a car/van more than anyone else drives that vehicle.

Table 2.8: User profiles for car driving, bus usage and rail usage

Indicator	Year group	Car drivers	Bus users	Rail users	Scottish population (all-ages within NTS sample)
Average age	1995/9	43.7 (0.4)	39.6 (0.7)	36.5 (1.3)	38.9 (0.4)
	2000/4	45.3 (0.3)	38.4 (0.5)	36.6 (0.8)	38.4 (0.3)
	2005/7	46.2 (0.3)	40.2 (0.6)	36.2 (0.9)	39.6 (0.3)
	2008/10	47.0 (0.3)	40.7 (0.6)	35.7 (0.9)	40.3 (0.3)
% female	1995/9	42% (1%)	62% (2%)	57% (3%)	52% (1%)
	2000/4	45% (1%)	61% (1%)	54% (2%)	52% (1%)
	2005/7	46% (1%)	60% (1%)	57% (2%)	51% (1%)
	2008/10	45% (1%)	59%(1%)	51% (3%)	52% (1%)
% who have cars in household	1995/9	98% (<0.5%)	48% (2%)	72% (3%)	72% (1%)
	2000/4	99% (<0.5%)	52% (1%)	75% (2%)	76% (1%)
	2005/7	99% (<0.5%)	53% (1%)	75% (2%)	76% (1%)
	2008/10	99% (<0.5%)	56% (1%)	72% (2%)	79% (1%)
% who are 'main drivers' of a car	1995/9	80% (1%)	10% (1%)	32% (3%)	35% (1%)
	2000/4	85% (1%)	13% (1%)	34% (2%)	39% (1%)
	2005/7	86% (1%)	16% (1%)	36% (2%)	40% (1%)
	2008/10	84% (1%)	18% (1%)	38% (2%)	42% (1%)
% who work full-time	1995/9	61% (1%)	25% (1%)	47% (3%)	35% (1%)
	2000/4	59% (1%)	26% (1%)	46% (2%)	36% (1%)
	2005/7	60% (1%)	25% (1%)	48% (2%)	37% (1%)
	2008/10	58% (1%)	27% (1%)	54% (3%)	38% (1%)
% living in a household with children	1995/9	36% (1%)	40% (2%)	33% (3%)	43% (1%)
	2000/4	34% (1%)	41% (1%)	35% (2%)	43% (1%)
	2005/7	32% (1%)	38% (1%)	38% (2%)	42% (1%)
	2008/10	32% (1%)	32% (1%)	33% (2%)	39% (1%)

(Continued on next page)

Indicator	Year group	Car drivers	Bus users	Rail users	Scottish population (all-ages within NTS sample)
Average **personal** income (2010 prices)	1995/9	£18,838 (£414)	£7,995 (£299)	£15,246 (£1,250)	£11,157 (£229)
	2000/4	£21,381 (£335)	£9,633 (£285)	£17,192 (£886)	£13,084 (£196)
	2005/7	£21,828 (£353)	£9,914 (£304)	£16,823 (£868)	£13,806 (£218)
	2008/10	£21,420 (£349)	£10,761 (£319)	£19,834 (£1,000)	£14,000 (£222)
Average **household** income (2010 prices)	1995/9	£37,873 (£644)	£25,650 (£655)	£40,332 (£2,042)	£31,077 (£407)
	2000/4	£42,986 (£534)	£29,512 (£589)	£44,618 (£1,412)	£36,084 (£349)
	2005/7	£44,746 (£596)	£30,135 (£641)	£42,157 (£1,494)	£37,606 (£389)
	2008/10	£43,913 (£587)	£30,482 (£663)	£48,659 (£1,711)	£37,527 (£395)
% who head their household (highest income in household)	1995/9	62% (1%)	44% (2%)	47% (3%)	46% (1%)
	2000/4	62% (1%)	45% (1%)	44% (2%)	46% (1%)
	2005/7	62% (1%)	44% (1%)	48% (2%)	47% (1%)
	2008/10	62% (1%)	47% (1%)	51% (3%)	48% (1%)
% who own their residence	1995/9	82% (1%)	53% (2%)	72% (3%)	64% (1%)
	2000/4	84% (1%)	56% (1%)	78% (2%)	69% (1%)
	2005/7	83% (1%)	58% (1%)	70% (2%)	68% (1%)
	2008/10	82% (1%)	56% (1%)	67% (2%)	68% (1%)
% living in a flat	1995/9	18% (1%)	37% (1%)	32% (3%)	26% (1%)
	2000/4	17% (1%)	39% (1%)	29% (2%)	26% (1%)
	2005/7	17% (1%)	40% (1%)	32% (2%)	27% (1%)
	2008/10	18% (1%)	40% (1%)	39% (2%)	28% (1%)

Source: NTS (standard errors in brackets)

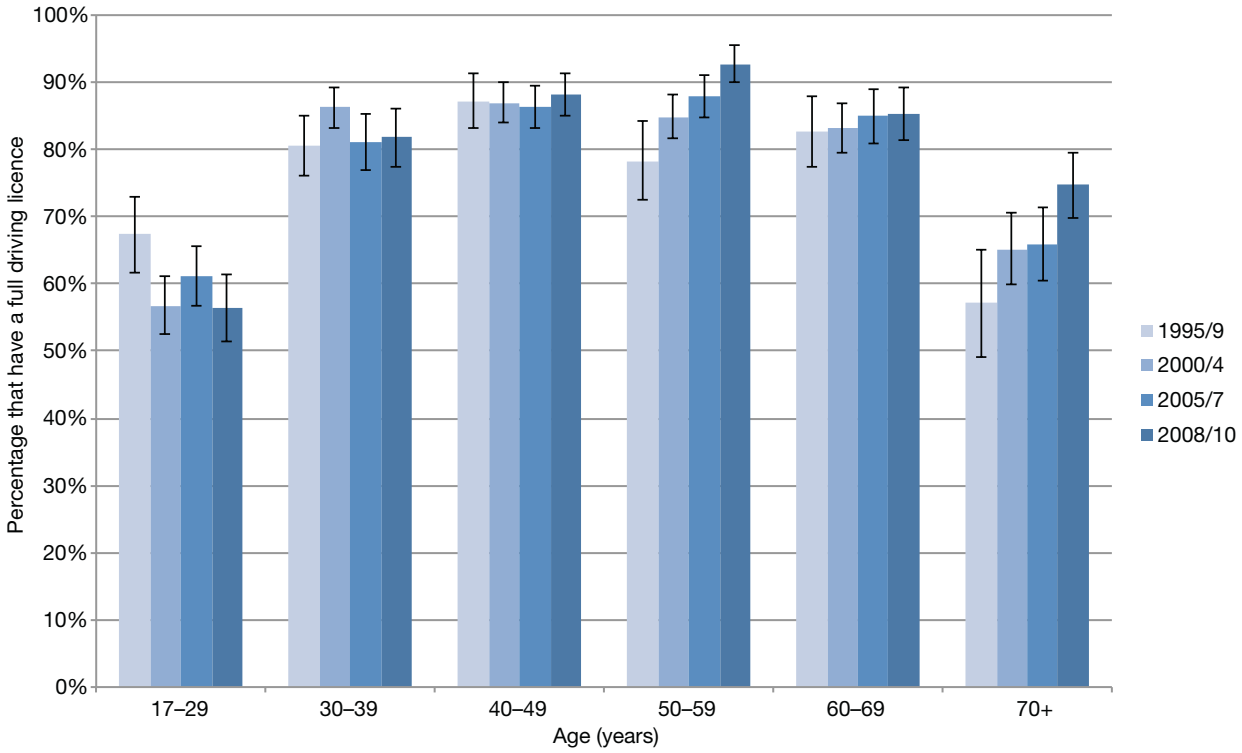
2.5 Patterns of driving licence ownership

2.5.1 Relationship with age and gender

Figure 2.9 shows that for young men below age 30, licence-holding fell from the level of the late 1990s in Scotland. This decrease took place mainly

between 1995/9 and 2000/4, and their rate of licence-holding has been stable since. Licence-holding has increased amongst men in later life, owing to the aging of cohorts of men who are more likely to be licensed than previous generations.

Figure 2.9: Percentage of men holding a full car driving licence, by age, Scottish residents

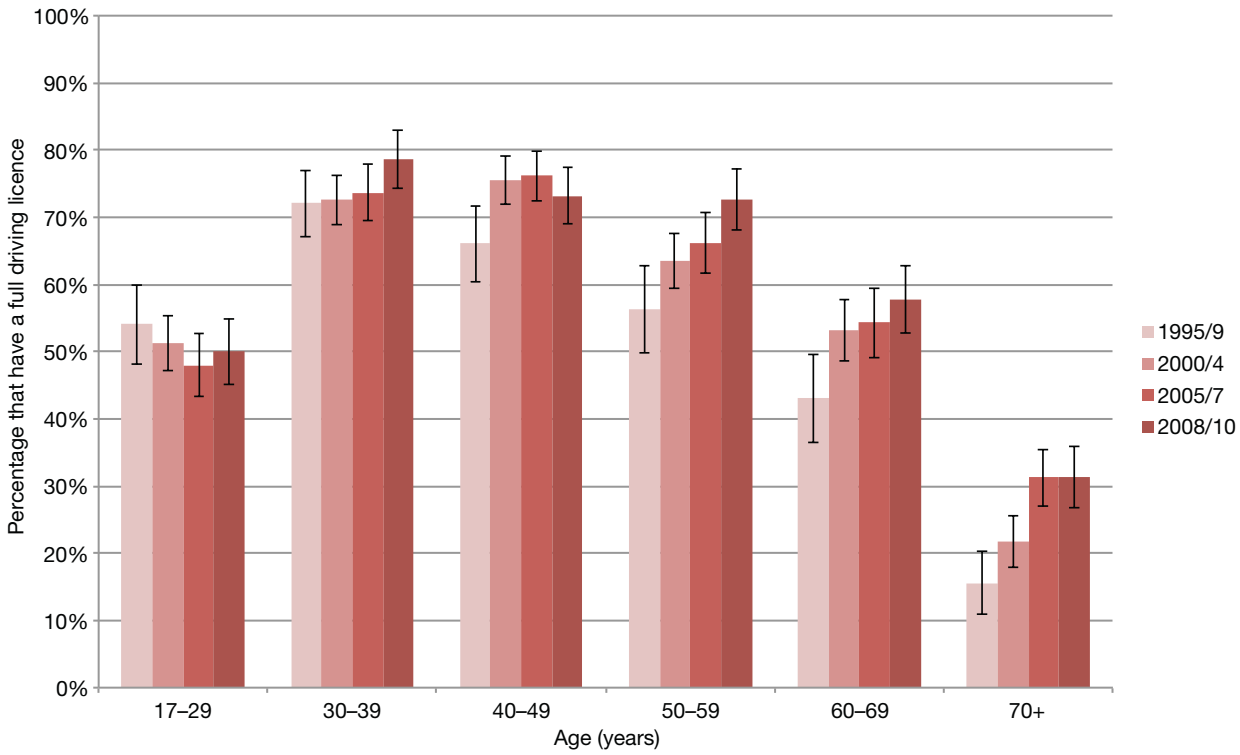


Source: NTS (error bars: 95% confidence interval)

Comparable relationships for women are shown in Figure 2.10. Amongst women between 17 and 29 years old, licence-holding fell by 5 percentage points between 1995/9 and 2008/10, which is slightly more than half of the decrease for men of the same age group (9 percentage points). This trend (a fall in the rate for both sexes around the late 1990s, but more pronounced for men) has also happened GB-wide.

Looking towards middle age, we see that whereas the peak rate of licence-holding is well over 90% for men and currently relates to those in their 50s, for women the peak penetration of licence-holding comes in their late 30s and is over ten percentage points lower. As in the case of men, the general trend has been an increase in licence-holding rates above the age of 50 (approximately), although this trend is much stronger among women.

Figure 2.10: Percentage of women holding a full car driving licence, by age, Scottish residents



Source: NTS (error bars: 95% confidence interval)

2.5.2 Reasons for not having a driving licence

Since 2006 the NTS has asked a question about the reasons why adults without driving licences (and not currently learning to drive) do not have one. From 2006 to 2008 this set of questions was only asked of people who do not plan to learn to drive in the future; in 2009 this began to be asked of all adults aged 17 upwards who did not have a full driving licence and were not learning to drive.

Respondents are asked to select, from a list, all factors that contributed to them not driving, and were then asked to indicate which was the main reason.

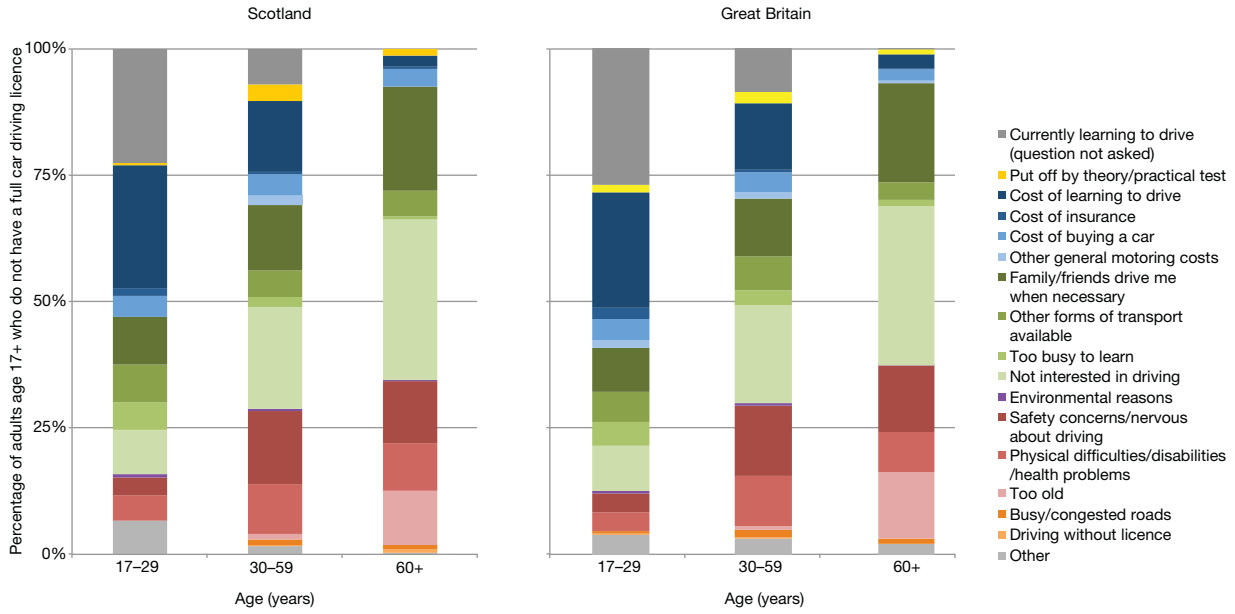
Figures 2.11 and 2.12 show the results from the Scottish NTS respondents in 2009/10, broken down by age band and gender respectively. (For comparison, both figures show the results for both Scotland and Britain. Numbers referenced in the text refer to the Scottish results.) The percentage shown in these charts is the proportion of all adults who do not have a full car driving licence, so along with the stated 'main reason' for not driving, these charts also show the proportion who said they were learning to drive at the time of the NTS interview.

Figure 2.11 shows that amongst young Scottish adults (under the age of 30), nearly a quarter (23%) of those without a full driving licence were learning

to drive. Another 30% said they were deterred by one of the types of costs associated with driving, with the cost of learning to drive the most prevalent. So more than half of young adults who do not drive are either learning to or are deterred by the costs.

The reasons for not driving change as one moves up the age bands, so that the majority (53%) of those aged 60 and over said that they do not drive either because they are not interested in driving or are because they are driven by friends/family when necessary.

Figure 2.11: Main reported reasons for not driving, by age band, for Scotland (L) and GB (R)

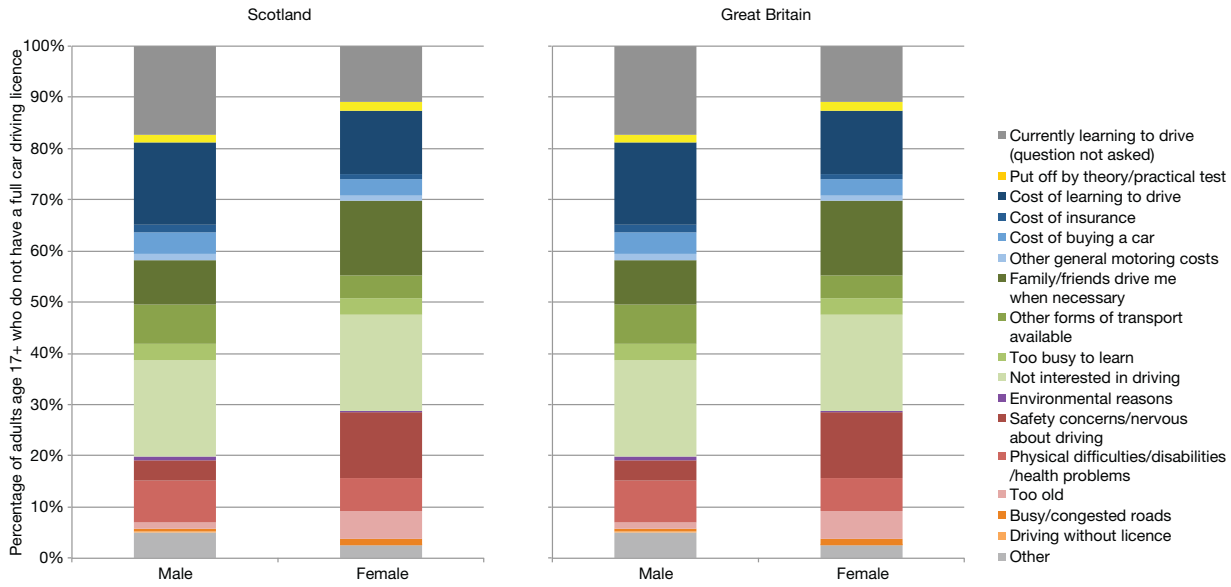


Note: Sample sizes for each age group in Scotland: 243, 265 and 312 respectively; and for GB: 2,797, 2,783 and 2,556.

Source: NTS

Figure 2.12 shows differences between the genders in why people do not drive. Unlicensed Scottish men are more likely than unlicensed women to be learning to drive (12% vs 8%) or to say that one of the costs of driving is the main reason they do not drive (24% of men vs 16% of women). Women are more likely to say they are driven by family/friends when necessary (17% vs 10% for men), or have safety concerns / are nervous about driving (13% vs 4% for men).

Figure 2.12: Main reported reasons for not driving, by gender, for Scotland (L) and GB (R)



Note: Sample sizes for Scotland: 244 men, 576 women; and for GB: 2,496 men, 5,640 women.

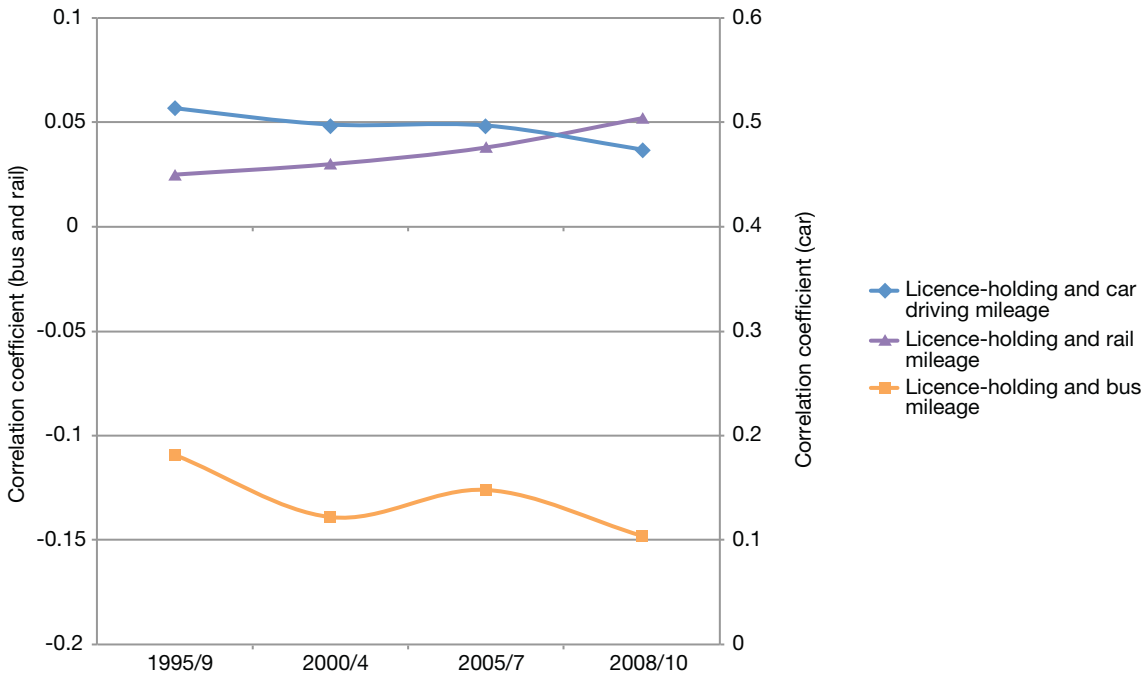
Source: NTS

2.5.3 Correlations between licence-holding and use of car, bus and rail

Figure 2.13 investigates how correlations between licence-holding and car, bus and rail use have changed over time. The analysis is based on individuals (persons) as the unit of analysis, using data from each NTS diary on their reported mileage for the three modes of transport.

A number of results from this analysis are noteworthy. The largest correlation, not surprisingly, is between licence-holding and car-driving mileage, although it appears that this relationship may be very slightly weakening over time. (Note that for presentation purposes this curve shows the correlation scaled down by a factor of 10 – i.e. from approximately 0.5 to 0.05 in Figure 2.13.) There is a small correlation between rail use and licence-holding, but one that increases over time, and a low negative correlation with bus mileage.

Figure 2.13: Correlation amongst driving licence-holding, car-driving, bus and rail mileage, at the person-level



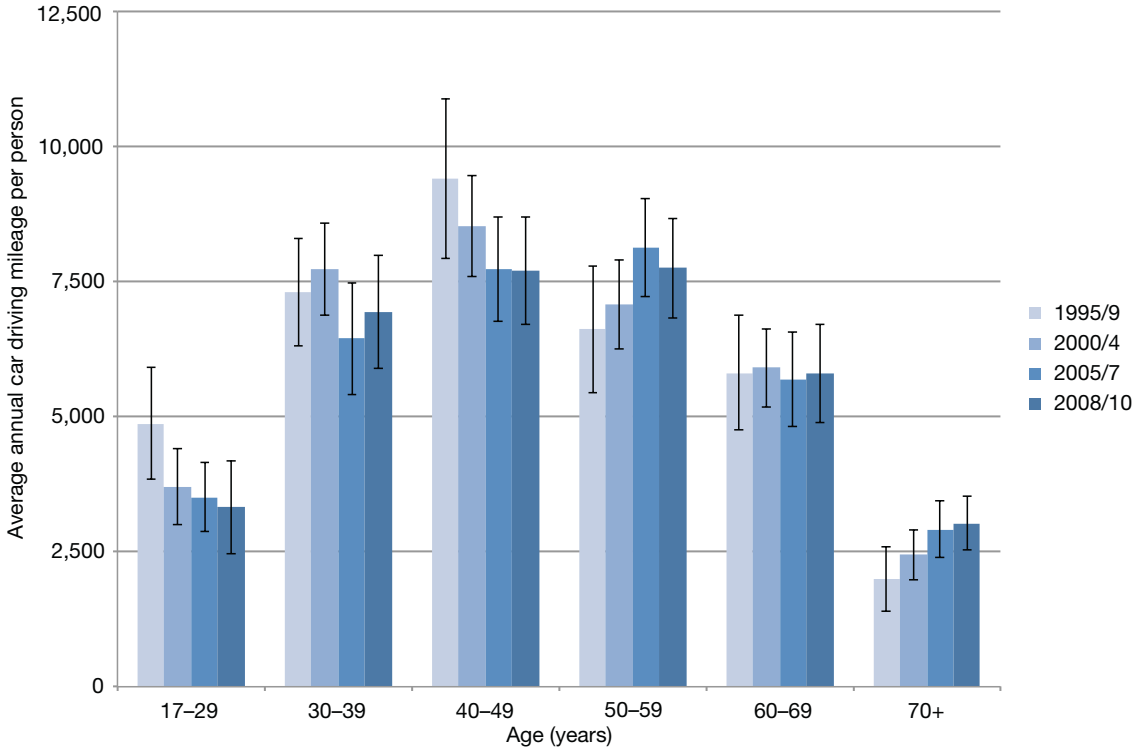
Source: NTS

2.6 Differences in travel patterns, by age and gender

2.6.1 Annual car-driving mileage

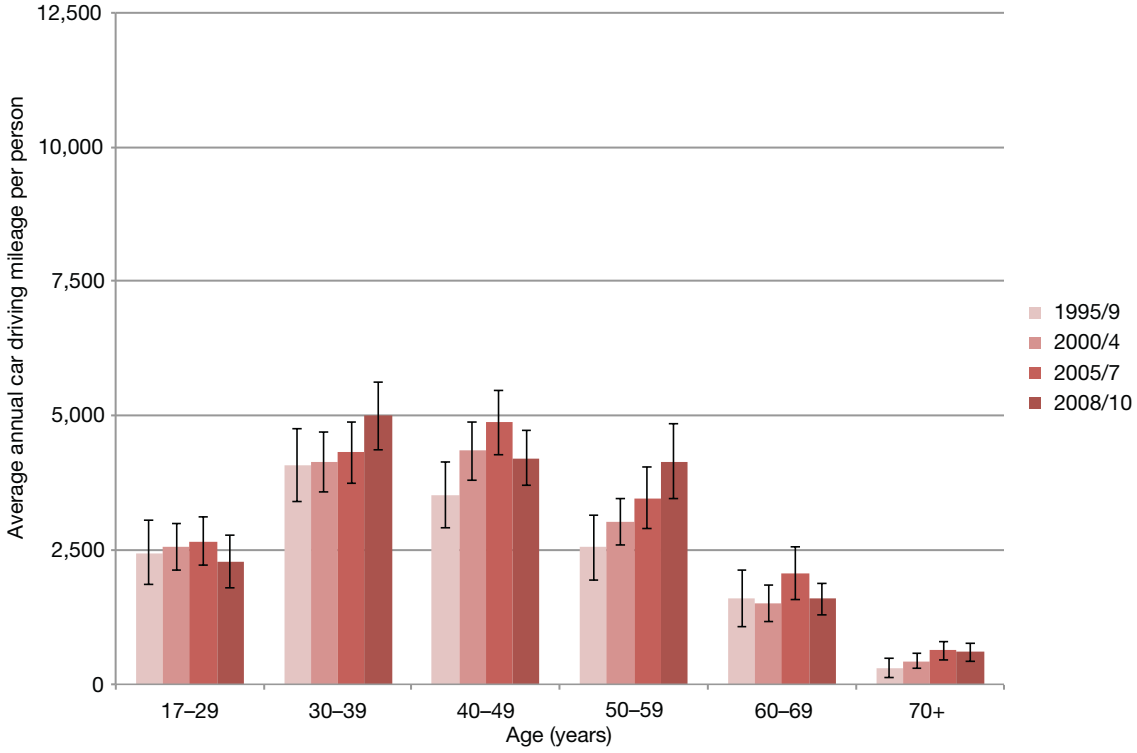
Figures 2.14 and 2.15 show average annual car-driving mileages for men and women respectively, of various ages, over time. As with licence-holding (see Figures 2.9 and 2.10), driving mileage per person is low in early adulthood and higher in middle age, but the drop-off after middle age is sharper for driving mileage. This means that older licence-holders tend to drive fewer miles on average than younger licence-holders.

Figure 2.14: Average annual car-driving mileage of men, by age, Scottish residents



Source: NTS (error bars: 95% confidence interval)

Figure 2.15: Average annual car-driving mileage of women, by age, Scottish residents



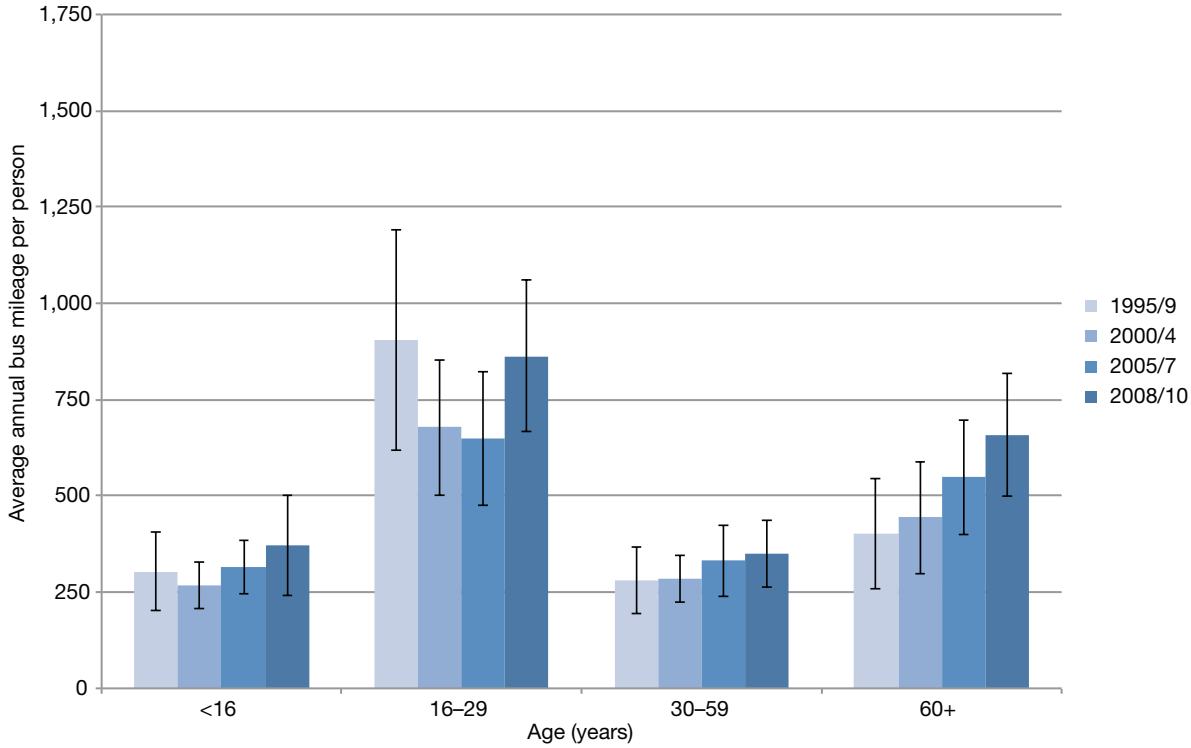
Source: NTS (error bars: 95% confidence interval)

Comparing 1995/9 to 2008/10, there has been a statistically insignificant (due to sample size) reduction in men's driving for age categories below the age of 50 and growth from this age up. For women this point of inflection is around the age of 30.

2.6.2 Annual bus mileage

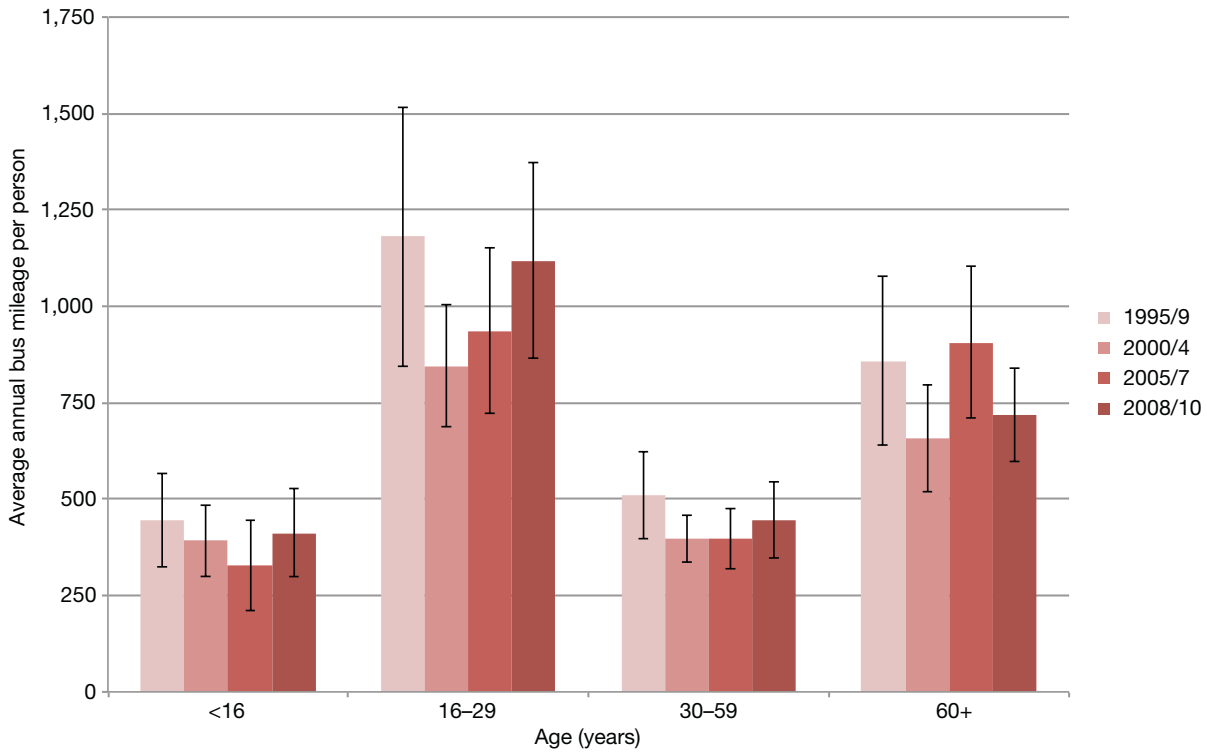
Trends in annual bus travel mileage show very different patterns from those of car driving (see Figures 2.16 and 2.17 for men and women respectively). For both sexes, bus usage is lowest in middle age and higher on either side. Among men there has been significant growth in bus mileage for those aged 60 or over; the trends over time are not clear for women.

Figure 2.16: Average annual bus mileage (men), by age, Scottish residents



Source: NTS (error bars: 95% confidence interval)

Figure 2.17: Average annual bus mileage (women), by age, Scottish residents

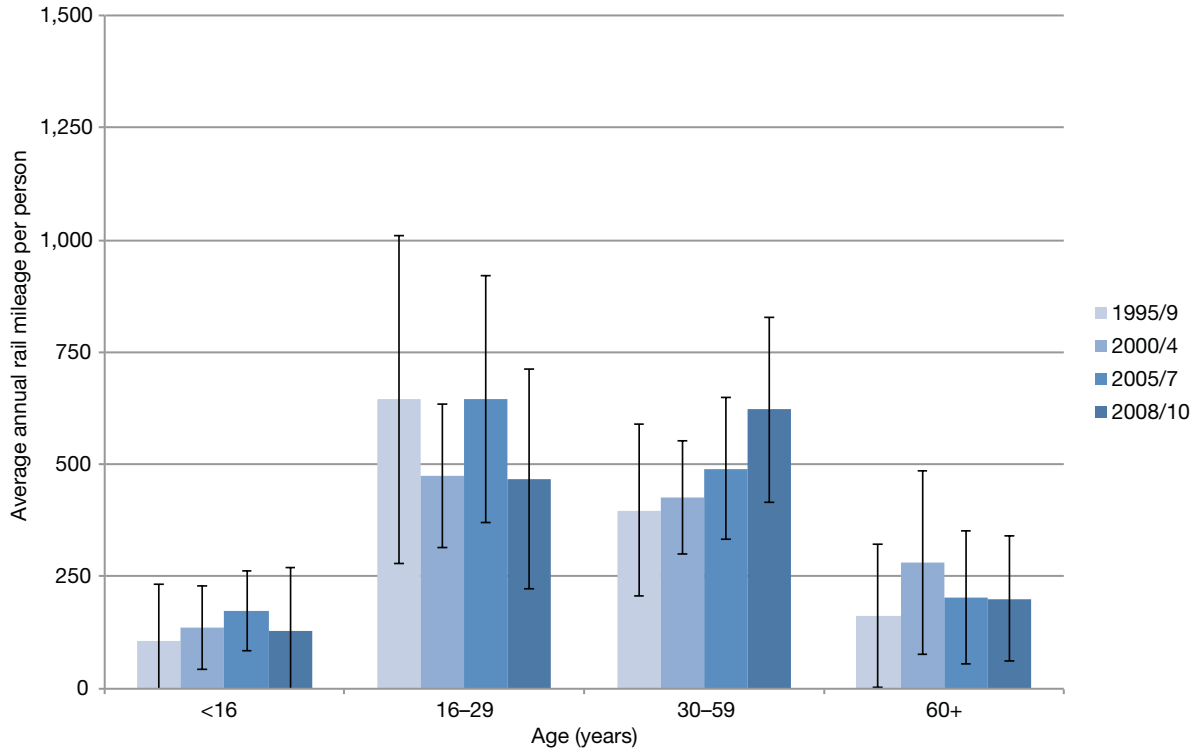


Source: NTS (error bars: 95% confidence interval)

2.6.3 Annual rail mileage

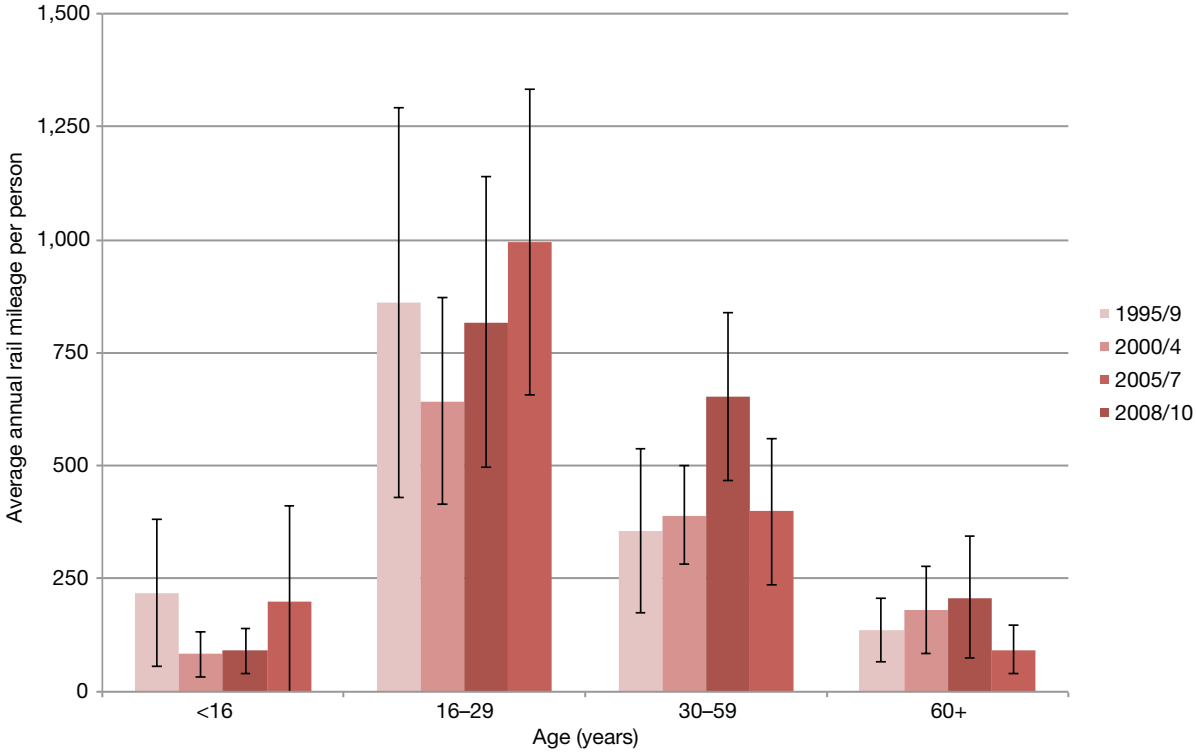
The trends in rail mileage estimated from the NTS are highly variable, owing to the very small numbers of rail users in the Scottish NTS data, but some broad trends can nevertheless be observed. Rail mileage has been rising in each time period for men aged 30–59 while the trend over time is less clear for the other age groups (Figure 2.18). For women, rail mileage is highest in the 16- to 29-year-old age class, and no age group has shown sustained period-on-period growth, nor reductions, in rail use (Figure 2.19).

Figure 2.18: Average annual rail mileage (men), by age, Scottish residents



Source: NTS (error bars: 95% confidence interval)

Figure 2.19: Average annual rail mileage (women), by age, Scottish residents



Source: NTS (error bars: 95% confidence interval)

2.7 Young men's travel

2.7.1 Licence-holding

On the Move identified young British men, in particular, as exhibiting recent behaviour which countered past trends. Three aspects are examined here, for the Scottish sample: licence-holding, personal income and travel behaviour.[4]

Licence-holding (shown in Table 2.9) fell amongst young men in Scotland, as has been found in the rest of Great Britain. In Scotland, full driving licence ownership dropped from 74% in 1995/9 to 63% in 2008/10. There has recently been an increase in the rate of provisional licence-holding in the most recent data, up from 15% in 2005/7 to 20% in 2008/10 but this is not statistically significant. During the 2000s, the proportion of young men with neither form of car driving licence has remained stable, at around 17%.

What this means is that there has not simply been a shift from holding a full licence to holding a provisional one by young men. If we look at the British data (with a much larger sample size), we see that of the 15% decrease in those holding a full licence among men in their 20s, about half (7 percentage points of this) can be accounted for by a shift to provisional-licence-holding.

Table 2.9: Percentage of men aged 20–29 by licence-holding status, Scottish residents

Period	Scotland			Britain		
	Percentage of men in their 20s with a full car driving licence	Percentage of men in their 20s with a provisional car driving licence	Percentage of men in their 20s with neither	Percentage of men in their 20s with a full car driving licence	Percentage of men in their 20s with a provisional car driving licence	Percentage of men in their 20s with neither
1995/9	74% (3%)	14% (2%)	12% (2%)	80% (1%)	9% (1%)	12% (1%)
2000/4	67% (2%)	16% (2%)	17% (2%)	70% (1%)	13% (<0.5%)	17% (1%)
2005/7	68% (2%)	15% (2%)	18% (2%)	68% (1%)	13% (1%)	20% (1%)
2008/10	63% (3%)	20% (2%)	17% (2%)	65% (1%)	16% (1%)	19% (1%)

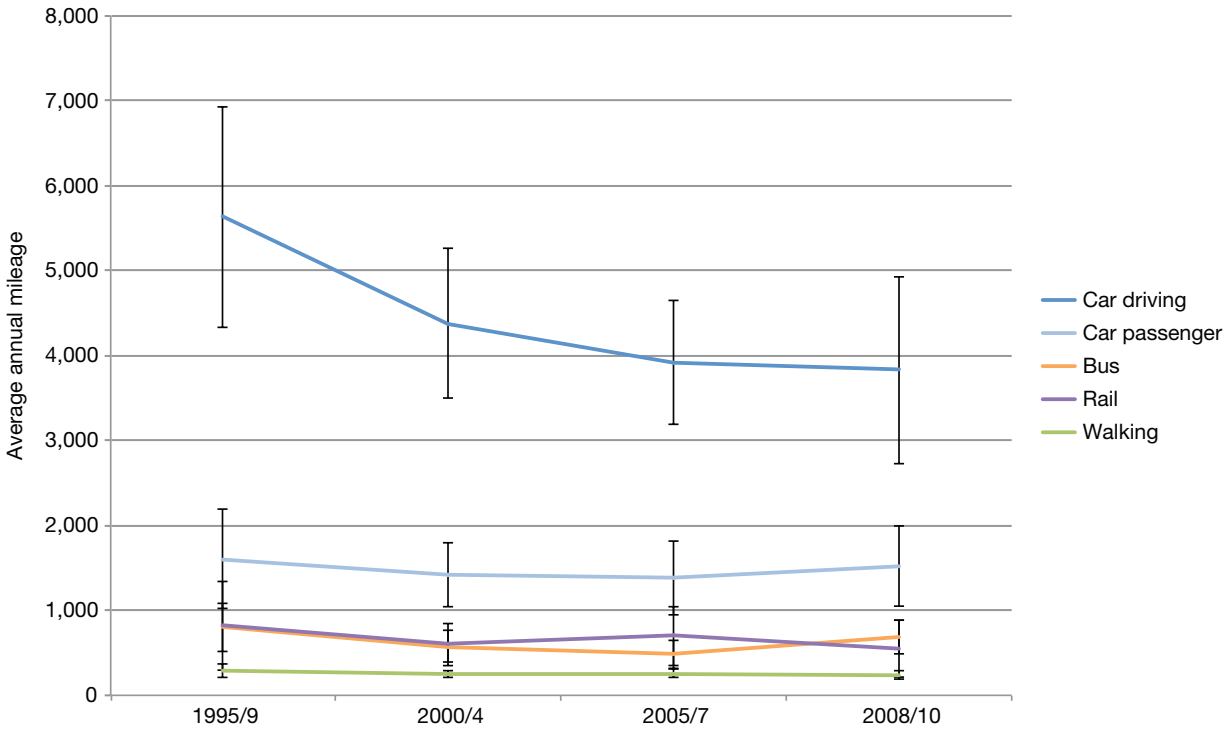
Source: NTS (standard errors in brackets)

4 The NTS sample sizes of men in their 20s who gave successful interviews are 190, 391, 364 and 271 respectively for 1995/9, 2000/4, 2005/7, and 2008/10. The sample sizes for travel diary analyses are (respectively for the same years) 153, 318, 309 and 233. The smaller sample sizes for the travel diary data are due to some responding households performing interviews successfully but some or all household members not successfully completing the travel diary.

2.7.2 Patterns of travel by mode

Looking now at their general travel behaviour, Figure 2.20 shows the trends in car driving, bus and rail mileage (and miles travelled on foot and as a car passenger) by Scottish men in their 20s, between the mid-1990s and late 2000s. The mean estimate from the NTS is that their driving mileage fell 32% between 1995/9 and 2005/7.[5] However, there is no evidence of a shift of mileage from car driving to bus or rail – or to being a car passenger, or walking – none of these modes exhibit major change from their levels in the late 1990s.

Figure 2.20: Average annual mileage by car driving, car passenger, bus, rail and walking, men aged 20–29



Source: NTS (error bars: 95% confidence interval)

Table 2.10 compares these Scottish trends with those in Great Britain as a whole, between 1995/9 and 2008/10. Over this period, the drop in young men's car-driving mileage in Scotland has been less than in Great Britain as a whole (32% vs 41% as noted in the footnote); this contrast has been particularly pronounced since the start of the recession, when young men's mileage fell by 16% across Britain but by a statistically insignificant 2% in Scotland.

5 Due to the small sample size the difference in the Scottish sample is not statistically significant. The 32% fall in Scotland compares with a 41% fall for GB, which is highly statistically significant.

Table 2.10: Average annual mileage, men aged 20–29, car driving, bus, and rail, Scotland and GB

Period	Scotland			Britain		
	Car driving	Bus	Rail	Car driving	Bus	Rail
1995/9	5,634 (592)	804 (131)	820 (238)	6,411 (180)	325 (22)	646 (59)
2000/4	4,381 (411)	560 (100)	616 (104)	4,912 (118)	458 (24)	857 (53)
2005/7	3,922 (341)	486 (79)	698 (162)	4,497 (121)	449 (27)	753 (51)
2008/10	3,828 (478)	686 (86)	550 (145)	3,783 (109)	482 (26)	740 (47)

Source: NTS (standard error in brackets)

Finally, Table 2.11 looks again at licence ownership, and examines how the annual driving mileage of fully licensed young men has changed over time. What it shows is that, alongside the reduction in their ownership of full driving licences (shown in Table 2.9), the number of miles that licensed young men are driving has fallen by 21% between 1995/9 and 2008/10, although bearing in mind the sample size, this effect is not statistically significant.

Table 2.11: Average annual car-driving mileage per licence-holding man aged 20–29, Scottish residents

Period	Average annual driving mileage amongst full-licence-holding men in their 20s
1995/9	7,712 (741)
2000/4	6,802 (585)
2005/7	6,092 (475)
2008/10	6,062 (713)

Source: NTS (standard error in brackets)

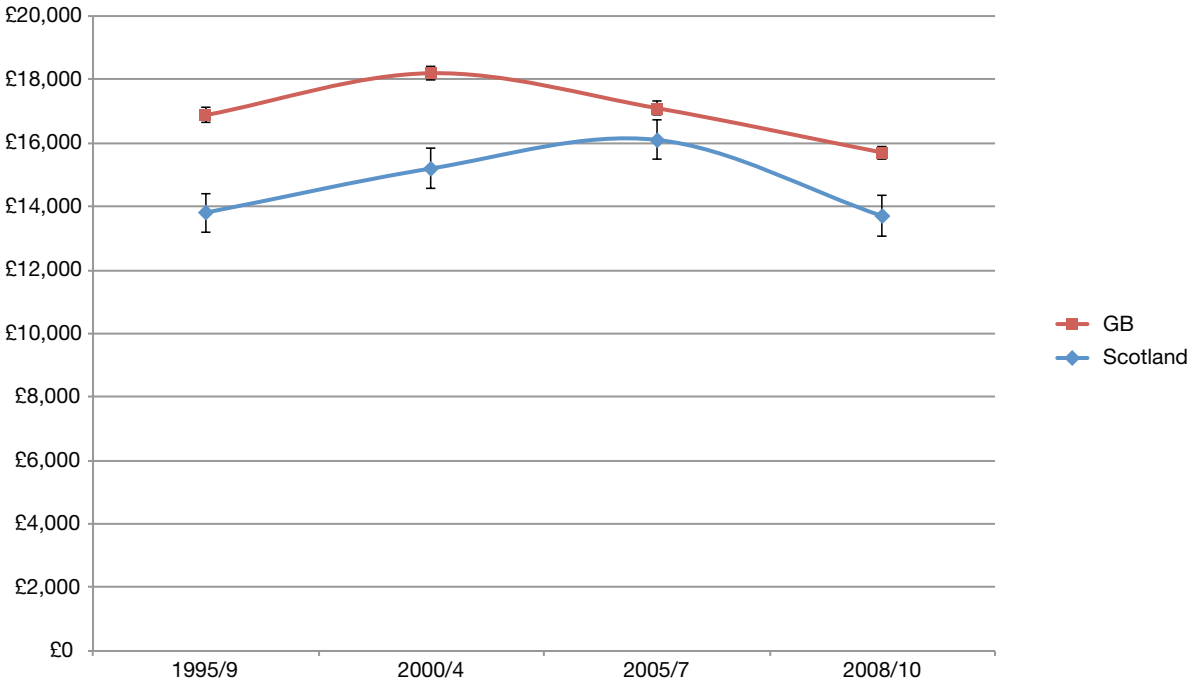
2.7.3 Personal incomes and other sociodemographic characteristics

On the Move found that the sharp drop in car use by young British men coincided with other important changes in their economic and sociodemographic circumstances. In this section we examine the evidence for similar sorts of relationships in Scotland.

Figure 2.21 begins by comparing annual personal income of young men in Scotland with the GB average. This shows that, while their incomes are lower than the GB average, prior to the recession there was a trend towards convergence between Scotland and Great Britain as a whole. There seems, however, to have been a sharper fall in Scotland in 2008/10, though these results should be treated with caution because the NTS, as well as being based on small sample sizes, is not explicitly designed to track income levels over time.

This is noteworthy, because rising income levels have, at least in the past, been associated typically with increasing car use. Whilst both young men's income levels and their car-driving mileage have trended down across GB, the situation in Scotland is somewhat different.[6] In Scotland their car use (see Figure 2.20) seems to have trended down since the late 1990s despite their incomes rising until the 2008 recession.

Figure 2.21: Average annual personal income, men aged 20–29



Source: NTS (error bars: 95% confidence interval)

Whilst income is a strong predictor of how much – and how – one travels, other sociodemographic characteristics are also important. Table 2.12, which lists various demographic characteristics alongside their relationship to young Scottish men and the distance that they drive, shows that the percentage of young men with various personal attributes which are typically associated with high levels of car use (working full-time, living without parents in a house that one owns) has trended down, whilst the ranks of those in other categories, ones associated with low levels of car use (being a student, being unmarried, living in a large city), have swelled in proportionate terms.

6 This finding at the GB-scale in the NTS was confirmed with time series data from HMRC's Survey of Personal Incomes (SPI), which shows that real incomes of British young adults (aged 20–29) fell year-on-year from 2000/1 to the onset of the 2007 recession (see Figure 5.2 in Le Vine & Jones, 2012). It is not possible, however, to use the published SPI data to confirm the trend in incomes for young Scottish adults.

Table 2.12: Various sociodemographic characteristics of Scottish men aged 20–29, and associated average car-driving mileage

Period	Characteristic	Percentage of young men (aged 20–29)	Average car-driving mileage of young men having relevant characteristic
1995/9	Working full-time	74% (3%)	6,718 (733)
2000/4		69% (2%)	5,649 (562)
2005/7		67% (2%)	4,870 (461)
2008/10		62% (3%)	4,905 (649)
1995/9	Single (not married)	62% (4%)	4,032 (597)
2000/4		67% (2%)	3,076 (378)
2005/7		71% (2%)	3,541 (371)
2008/10		N/A	N/A
1995/9	Living with at least one adult over the age of 34 in household (typically a parent)	48% (4%)	4,051 (582)
2000/4		43% (3%)	3,512 (501)
2005/7		47% (3%)	4,525 (511)
2008/10		48% (3%)	3,396 (506)
1995/9	Living in the 'Glasgow/ Edinburgh' NTS spatial classes	24% (3%)	3,491 (1,456)
2000/4		21% (2%)	3,848 (882)
2005/7		32% (2%)	2,461 (466)
2008/10		40% (3%)	2,293 (592)
1995/9	Student	4% (2%)	2,213 (1,198)
2000/4		10% (2%)	2,041 (785)
2005/7		11% (2%)	1,528 (623)
2008/10		10% (2%)	3,578 (2,032)
1995/9	Residence is owned (and no adult over the age of 34 lives in household)	23% (3%)	10,273 (1,683)
2000/4		29% (2%)	6,876 (866)
2005/7		19% (2%)	7,036 (1,050)
2008/10		17% (2%)	8,163 (1,423)
1995/9	Average for all men aged 20–29	N/A	5,634 (592)
2000/4		N/A	4,381 (411)
2005/7		N/A	3,922 (341)
2008/10		N/A	3,828 (478)

Source: NTS (standard error in brackets)

So, whilst one must be cautious about drawing firm conclusions from the small sample of Scottish men in their 20s in the NTS dataset, several relationships seen in both Scotland and all of Britain are worth noting. First, the fall in numbers holding a full driving licence has been partly, but far from fully, compensated for by an increase in the provisional-licence-holding. Second, young men's falling driving mileage has not been compensated for by increased mileage travelled by other modes. Third, there has been a general shift away from sociodemographic circumstances associated with high levels of driving (e.g. full-time employment) and towards those associated with less driving (e.g. being single, living in Glasgow or Edinburgh).

As already mentioned, the fall in driving mileage has been less in Scotland than in Britain (32% vs 41% between 1995/9 and 2008/10); this may be due in part to the average personal income of young men having risen faster in Scotland than Britain (prior to the recession), but establishing this with any certainty will require multivariate economic modelling.

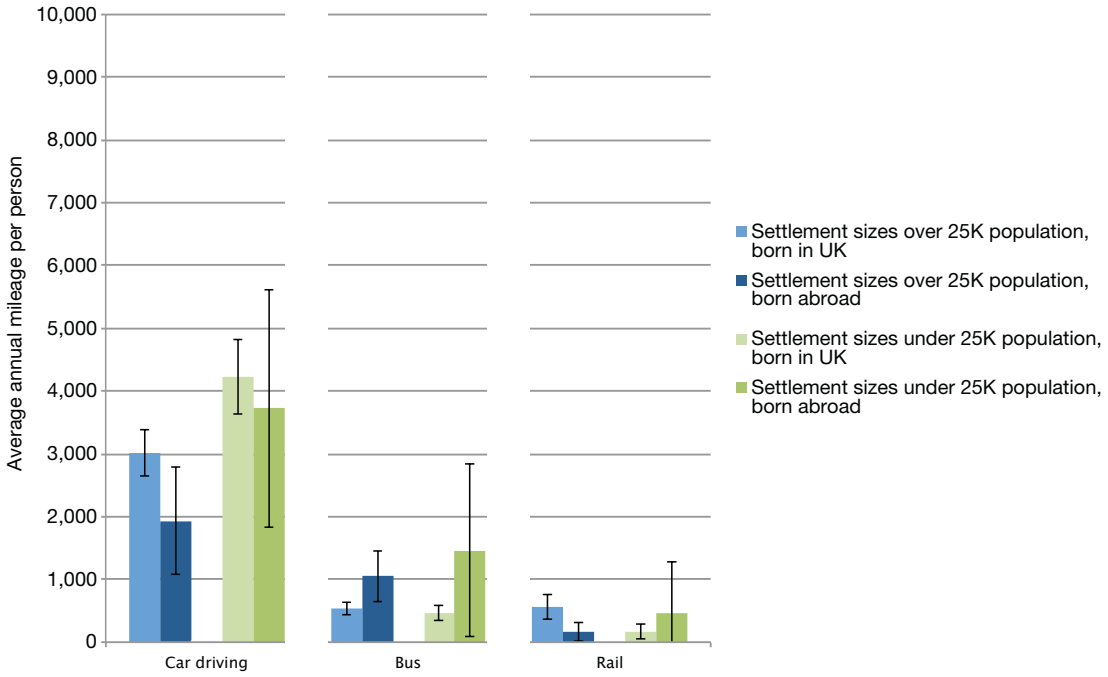
2.8 Migrants' travel patterns

Next we investigate differences in travel between two classes of adults living in Scotland: those born in the United Kingdom and those born abroad. The question as to birthplace was asked for the first time in the NTS in 2009. Owing to the small sample size of people born abroad (95 people in Scotland in combined years 2009 and 2010), the analyses below – looking at settlement size and personal income level – use very simplified classes.

The first of these analyses is shown in Figure 2.22, where the influence of migrant status on car driving, bus use and rail use is examined by whether or not the respondent lives in a settlement of greater than 25,000 population.

Even using this simple binary settlement classification, once confidence intervals are added, most of the differences between people born in the UK and abroad can be seen not to be statistically significant. People born within the UK drive on average more than people born abroad. This effect is nearly, but not quite, statistically significant in settlement sizes over 25,000 ($p=0.07$), and not close to significant in smaller settlements. While migrants exhibit a higher annual bus mileage in both areas, the differences are not statistically significant. And for rail the results are mixed, with migrants living in settlements of over 25,000 people having significantly lower rail mileage than non-migrants living in the same areas.

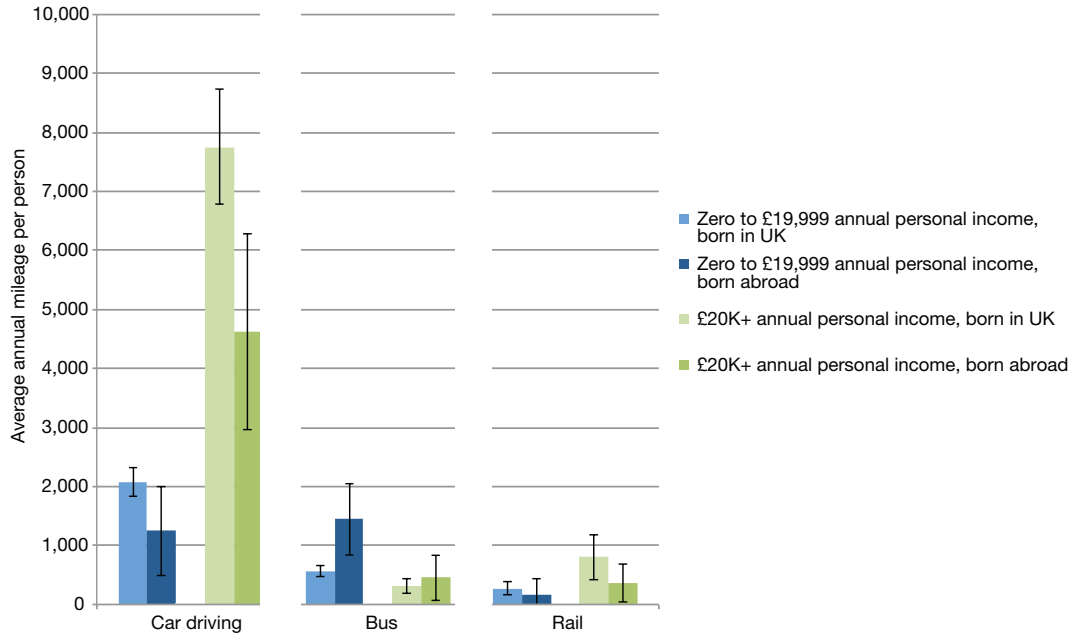
Figure 2.22: Average annual mileage (car driving, bus, rail) by settlement size and migration status



Source: NTS (error bars: 95% confidence interval)

Figure 2.23 shows that for car driving, the UK-born population displays a higher average mileage than migrants, and this is statistically significant for the above £20K/year income class, and nearly so (p=0.08) for the below £20K/year group.

Figure 2.23: Average annual mileage (car driving, bus, rail) by personal income level and migration status



Source: NTS (error bars: 95% confidence interval)

Figure 2.23 shows that for car driving, the UK-born population displays a higher average mileage than migrants, and this is statistically significant in both income classes (below £20K/year and above £20K/year). The higher average bus mileage of migrants is statistically significant in the lower income class, but not the higher one. The higher rail use among UK-born residents in both income classes is not statistically significant.

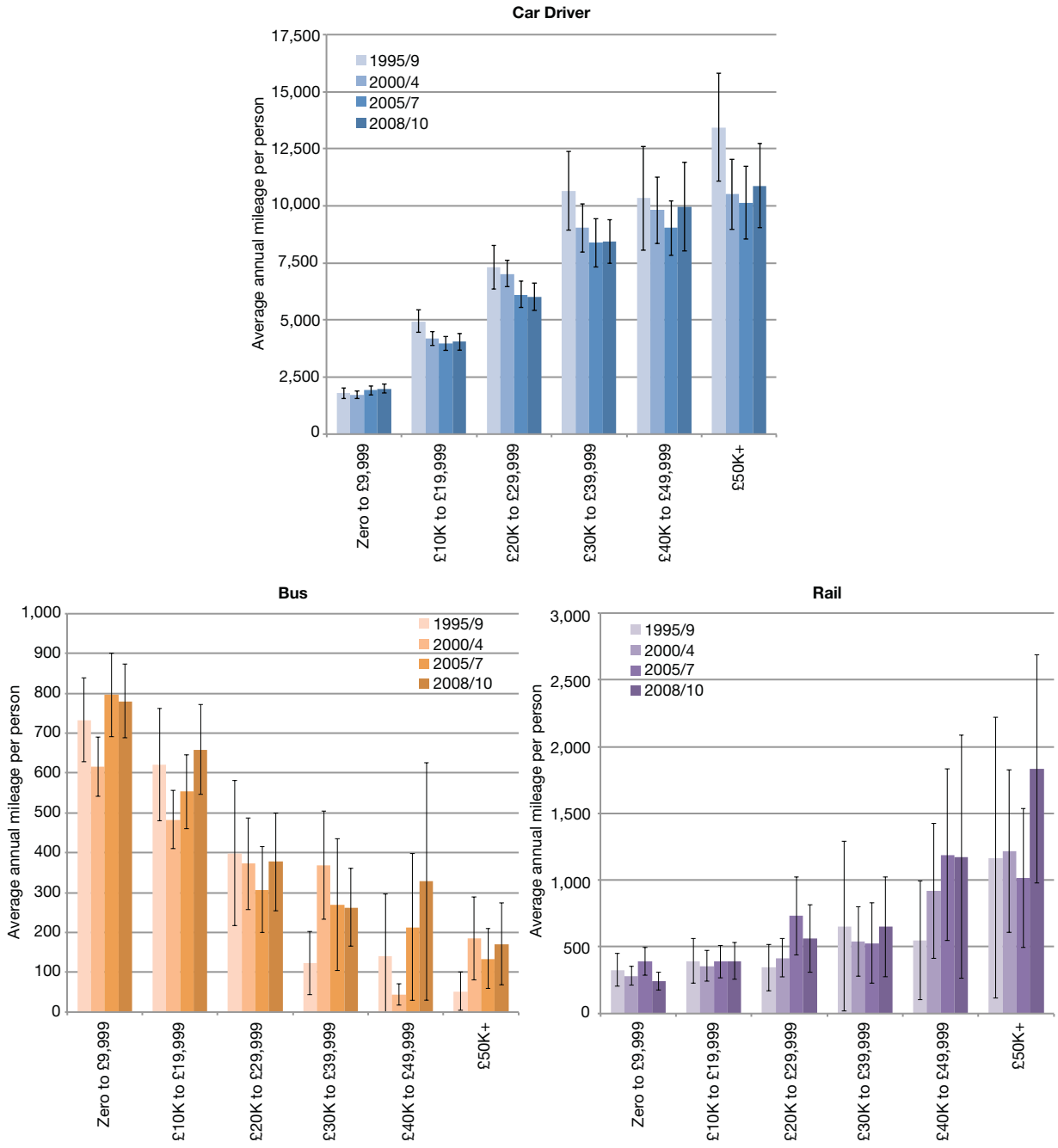
As with the national results in *On the Move*, these results must be treated with caution, pending a more in-depth understanding of the various hypothesised mechanisms which could cause people born abroad to have distinctive travel patterns.

2.9 Influences of income and occupation on travel patterns

2.9.1 Income effects

This section looks at how travel relates to income, and Figure 2.24 shows that both car driver and rail passenger mileages increase as personal incomes increase, but that the opposite is true for bus usage. But when we look at the trend of car driving distance over time within an income band, we then observe that the distance driven by all those earning over £10,000 per year seems to have fallen over time. Thus, were it not for rising incomes, we would be seeing a downward trend in driving. As previously noted in section 2.4, real income per Scottish person in the NTS sample rose by 25% in real terms between 1995/9 (£11,157) and 2008/10 (£14,000).

Figure 2.24: Average annual mileage, car driving, bus and rail, by personal income class (2010 price levels)



Source: NTS (error bars: 95% confidence interval)

Table 2.13 shows the correlations between income (at the personal and household level) and mileage for car drivers, bus passengers and rail passengers. The highest of the correlations is between personal income and car driving, and what is interesting is that it is about twice that of the correlation between *household* income and car mileage. Consistent with the results shown in Figure 2.24, income (whether personal or household) is correlated negatively

with bus use and positively with rail mileage, with the latter effect being a stronger correlation in all four time periods.

Table 2.13: Correlations between income (at personal and household level) and average annual mileage per person, car driving, bus and rail

Factors correlated	1995/9	2000/4	2005/7	2008/10
Personal income and car-driving mileage	0.47	0.43	0.40	0.43
Household income and car-driving mileage	0.20	0.20	0.23	0.22
Personal income and bus mileage	–0.07	–0.05	–0.07	–0.07
Household income and bus mileage	–0.06	–0.03	–0.08	–0.10
Personal income and rail mileage	0.07	0.10	0.08	0.13
Household income and rail mileage	0.08	0.07	0.05	0.12

Source: NTS (all correlations shown are statistically significant at the 5% level)

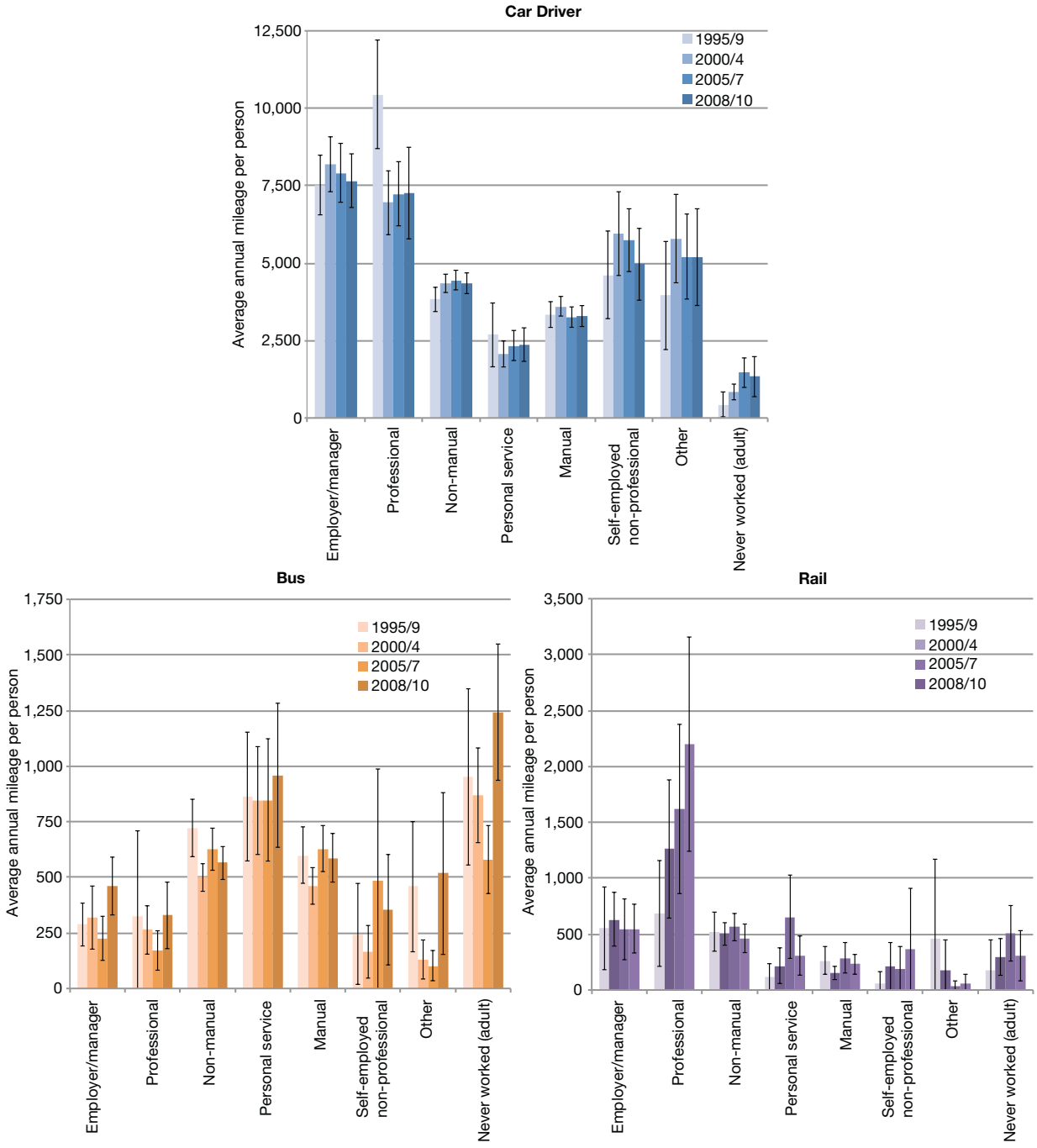
2.9.2 Influence of type of occupation

Figure 2.25 shows how car, bus and rail mileage varies among adults by current employment type (or, for those not presently working but who have at some time worked, the most recent type).

Car-driving mileage is seen to be highest amongst the highest-status groups – 'Employer/manager' and 'Professional' – and lowest among the 'Personal service' class and adults who have never worked. It is, moreover, precisely the latter two groups which have the highest level of bus usage.

Rail usage has grown rapidly amongst 'Professionals' – more than tripling between 1995/9 and 2008/10 – whilst their driving mileage seems to have fallen sharply between 1995/9 and 2000/4 and remained at a relatively stable level since.

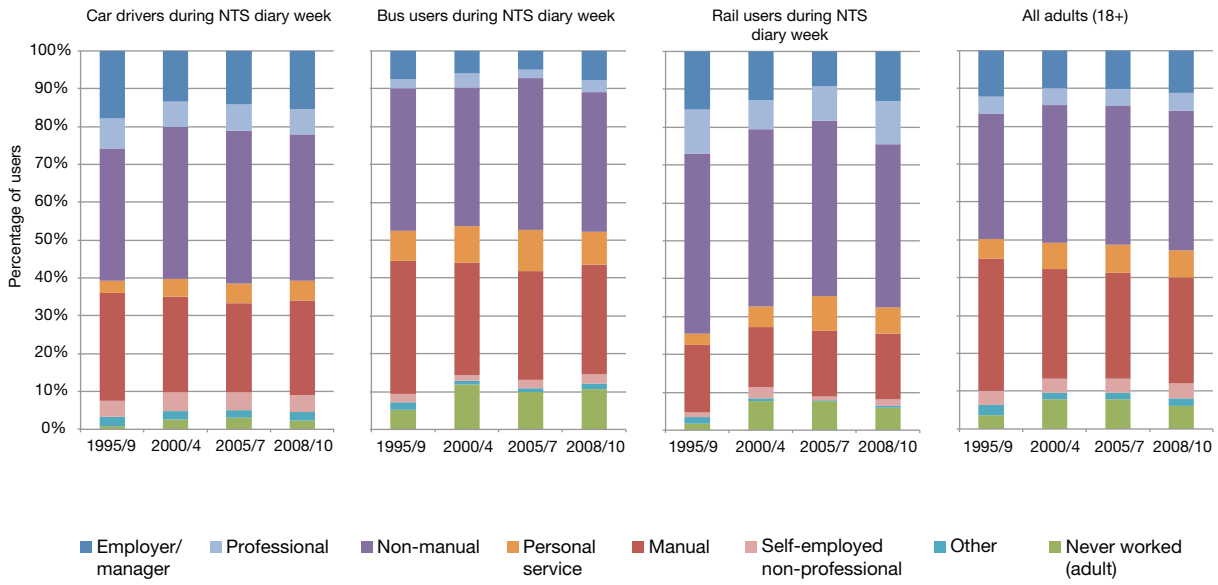
Figure 2.25 : Average annual mileage, car driving, bus and rail, by Socio-Economic Grouping



Source: NTS (error bars: 95% confidence interval)

Figure 2.26 illustrates the relationship between type of work and mode use from a different perspective, in terms of the occupational status of people who report driving a car, being a bus user, and/or being a rail user, during their NTS diary week. For comparison, the occupational distribution for all adults is also shown.

Figure 2.26: Distribution of Socio-Economic Grouping amongst car drivers, bus users and rail users



Source: NTS

As compared to 'all adults', a higher proportion of car drivers fall into both the 'Manual' and 'Non-manual' worker categories, and 'Personal service' workers are over-represented amongst bus users. 'Employer/manager', 'Professional' and 'Non-manual' workers are all over-represented amongst rail users.

2.10 Trends in travel by journey purpose

This section examines how travel by journey purpose has changed over time.

The NTS classifies journeys into up to 23 purpose categories; for this study, the NTS's less complex 15-purpose classification was used, which were then further combined into more-aggregate classes of journey purposes using the following criteria (which are also used in *On the Move*, to facilitate comparison):

- **Escort** – this consists of the NTS categories Escort-to-education and Escort-to-all-other
- **Other social/leisure** – Visit friends/relatives (not at private homes), Entertainment/public activity, Participate in sport, Holiday base, Day trip, Other including just walk
- **Shopping** – Food shopping, Non-food-shopping
- **Education** – the same as the NTS category
- **Commuting** – same
- **Business** – same
- **Personal business** – same
- **Visit friends/relatives at private homes** – same

Section 3.5 of this report compares the NTS and SHS estimates of travel by journey purpose.

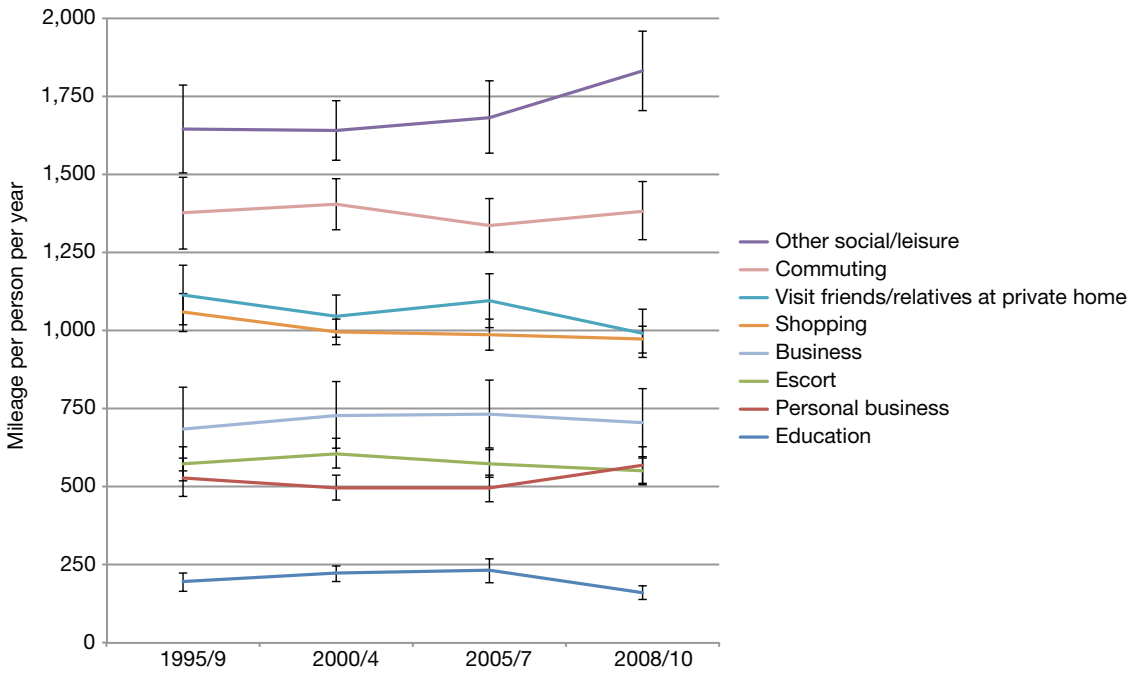
2.10.1 Overall travel

Trends in overall mileage by journey purpose are illustrated in Figure 2.27. The largest distance travelled (more than 1,800 miles per person per year in 2008/10) is accounted for by the combined 'Other social/leisure' category (note that 'Visiting friends/relatives at private homes' is treated as a separate journey purpose). Travel in this category has trended upwards since the early 2000s; much of the growth in this category is accounted for by travel to/from holiday locations.

'Commuting' accounts for the second-highest amount of distance travelled (about 1,400 miles a year), and shows no clear directional trend over time. 'Visiting friends/relatives at private homes' and 'Shopping' are both responsible for an average of about 1,000 miles per year of travel, with all other purposes accounting for less than 750 miles per year.

The only journey purpose to have trended monotonically up or down in all time periods was shopping, which has fallen over time (by about 8% in total between 1995/9 and 2008/10). It is not clear why this has been the case; two hypotheses are the consolidation of shopping into fewer, bigger shopping activities, and the possibility of online shopping substituting for shopping trips. The results do not allow us to distinguish between these and other hypotheses, although further research could shed light on this issue.

Figure 2.27: Average annual mileage by journey purpose, Scottish residents

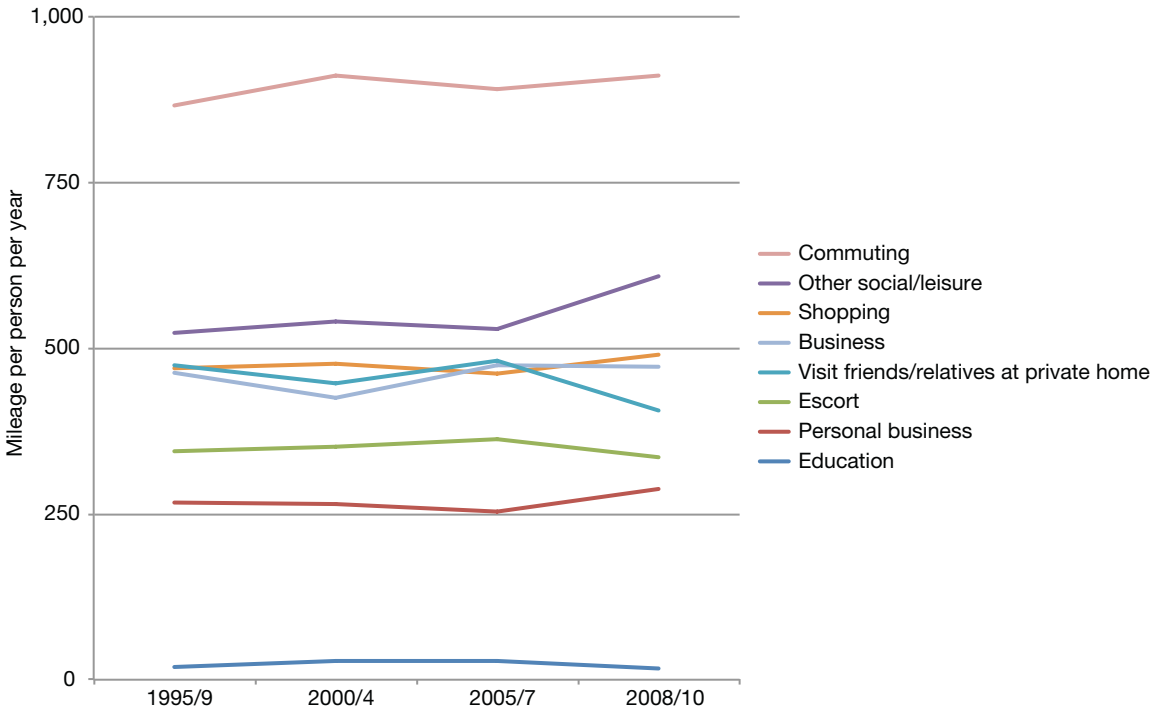


Source: NTS (error bars: 95% confidence interval)

2.10.2 Journey purpose, car drivers

Figure 2.28 shows the same purpose categories of travel as in Figure 2.27, but for car driver mileage only. Of the journey purposes shown, the highest-mileage class is commuting to work, at about 900 miles per person annually. Next is the 'Other social/leisure' class at around 600 miles per year, followed by the 'Shopping' and 'Business' travel categories at just under 500 miles per year each.

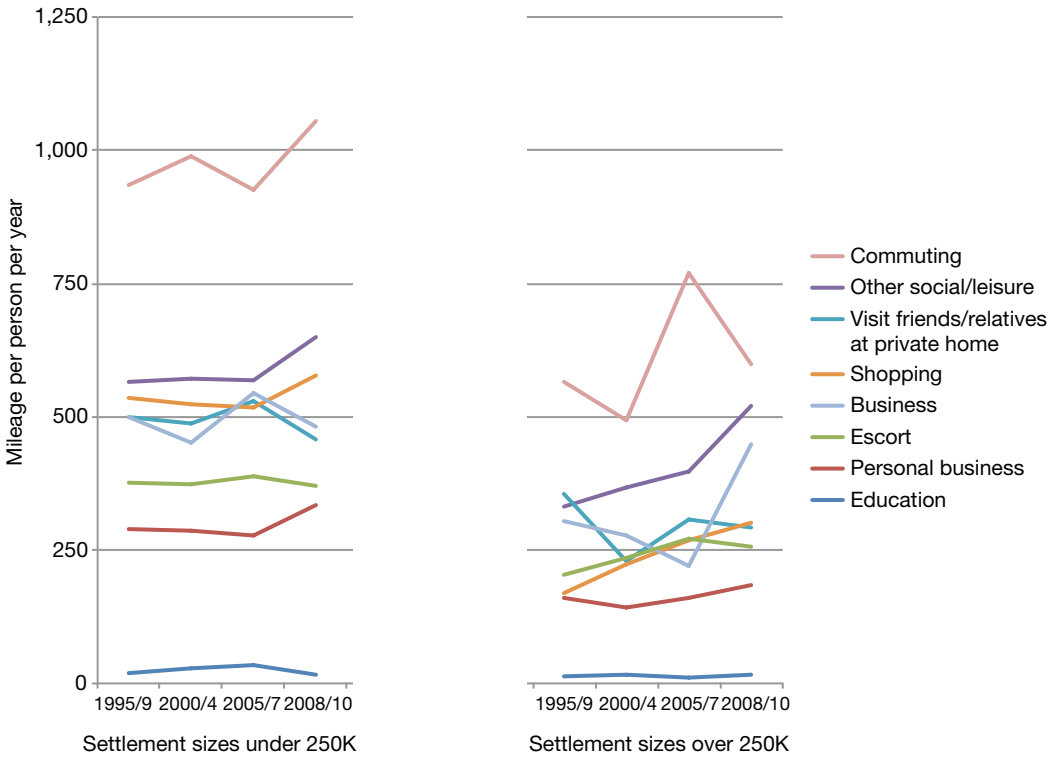
Figure 2.28: Average annual car-driving mileage by journey purpose



Source: NTS (standard errors are provided in Table A1 of the Appendix)

Figure 2.29 breaks down car-driving mileage for the various journey purposes into two spatial classes: settlements with over 250,000 people (representing mainly Glasgow and Edinburgh) and the rest of Scotland. For all of the major car-driving journey purposes, mileage is higher in the smaller settlement size category, as would be expected.

Figure 2.29: Average annual car-driving mileage by journey purpose, by settlement size

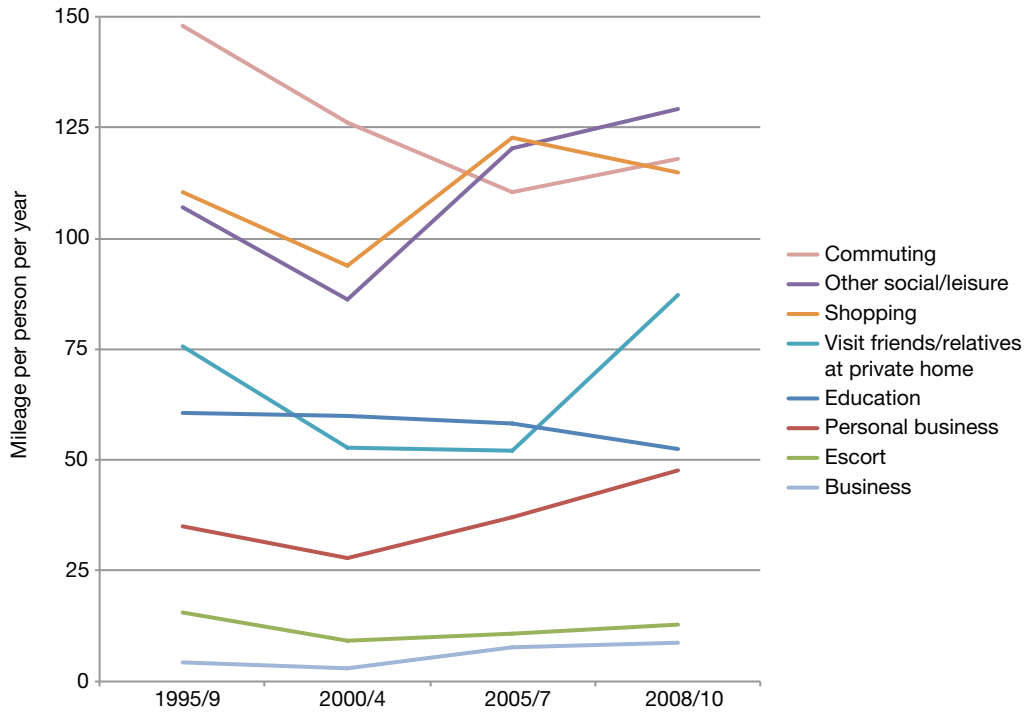


Source: NTS (standard errors are provided in Table A2 of the Appendix)

2.10.3 Journey purpose, bus passengers

Figure 2.30 shows bus mileage by type of journey purpose. 'Commuting', 'Shopping', and the 'Other social/leisure' purposes are each responsible for between 100 and 150 bus miles per person per year. 'Business' travel makes up a much smaller proportion than it does for car. Educational travel to school or college (by the respondent him/herself – not to be confused with 'Escort-to-education') accounts for a larger share of bus travel. The other major purpose is to 'Visit friends/relatives at private homes'; the remaining journey purposes each account for less than 50 miles of bus travel per person per year.

Figure 2.30: Average annual bus mileage by journey purpose

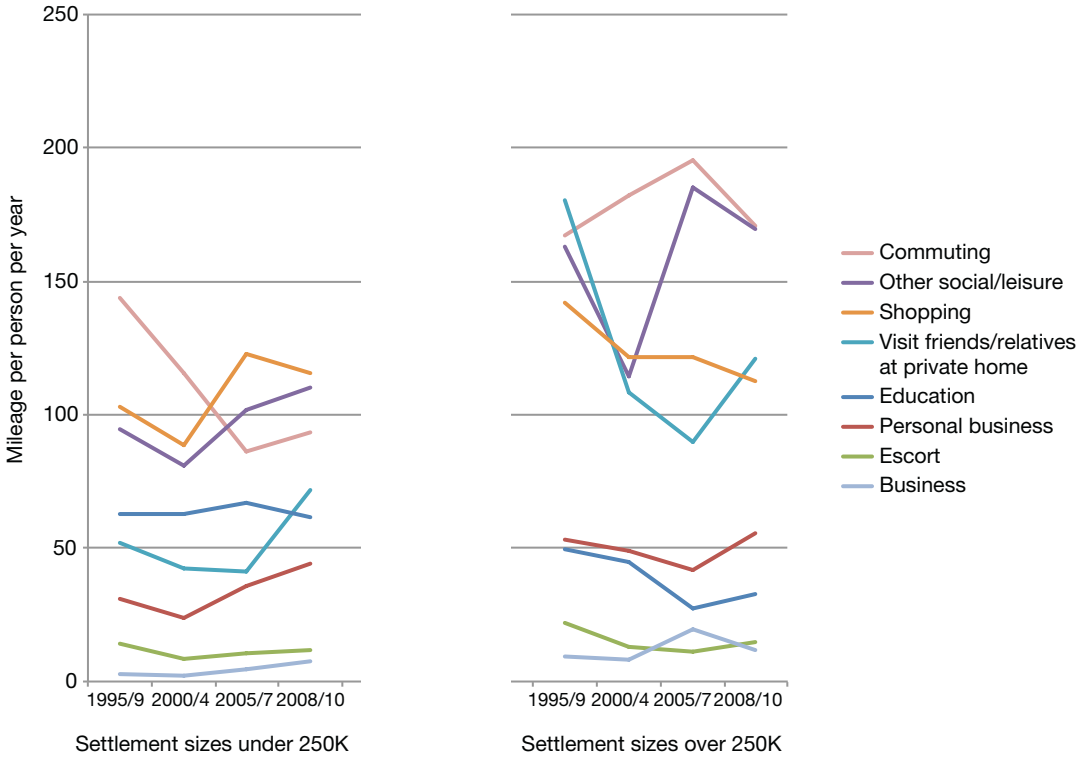


Source: NTS (standard errors are provided in Table A3 of the Appendix)

Figure 2.31 shows how bus mileage varies, for the various purposes, between 'Glasgow/Edinburgh' (settlements of over 250,000 population) and elsewhere in Scotland.

Nearly all journey purposes account for fewer miles of bus travel per person in the smaller settlements. Education travel is the exception – there is more bus mileage per-person to/from education activities in smaller cities and rural areas than in the 'Glasgow/Edinburgh' spatial class.

Figure 2.31: Average annual bus mileage by journey purpose, by settlement size



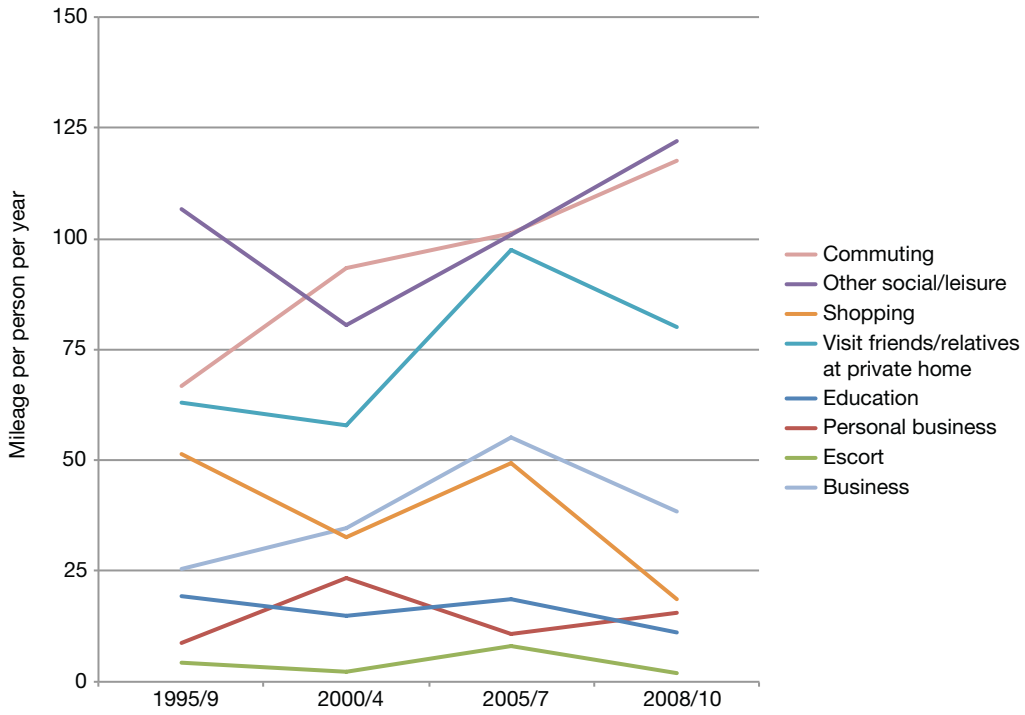
Source: NTS (standard errors are provided in Table A4 of the Appendix)

2.10.4 Journey purpose, rail passengers

Turning to rail travel, Figure 2.32 shows that 'Commuting' mileage by this mode has been growing systematically over time. 'Business' travel constitutes a much larger proportion of rail mileage than of bus travel. As with bus usage, however, 'Escort' travel is much lower proportionally than it is for car driving.

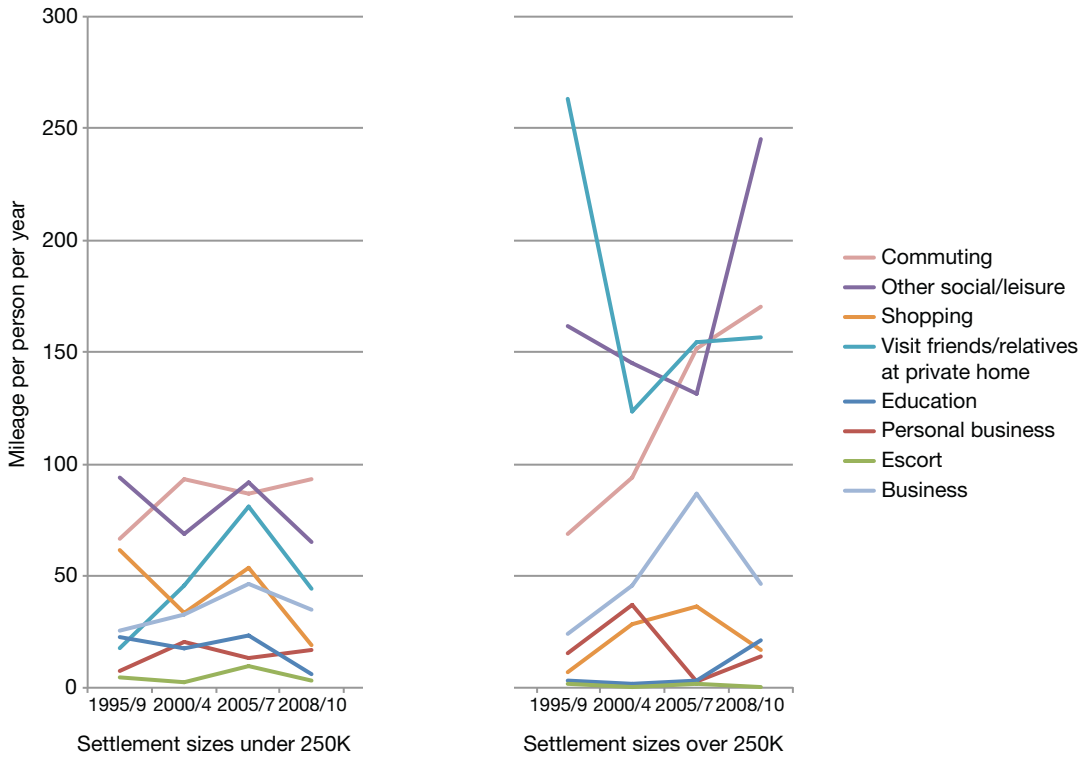
Figure 2.33 shows the breakdown of rail mileage by purpose and settlement size. The data is noisy, given the small sample size, but it seems clear nevertheless that 'Commuting' by rail has grown faster in the 'Glasgow/ Edinburgh' settlement size category than it has elsewhere. As with bus travel, rail mileage per person is higher for most journey purposes in the larger cities, but again the major exception to this is travel to/from education activities, which in all time periods except 2008/10 is much higher in the smaller settlement size category.

Figure 2.32: Average annual rail mileage by journey purpose



Source: NTS (standard errors are provided in Table A5 of the Appendix)

Figure 2.33: Average annual rail mileage by journey purpose, by settlement size



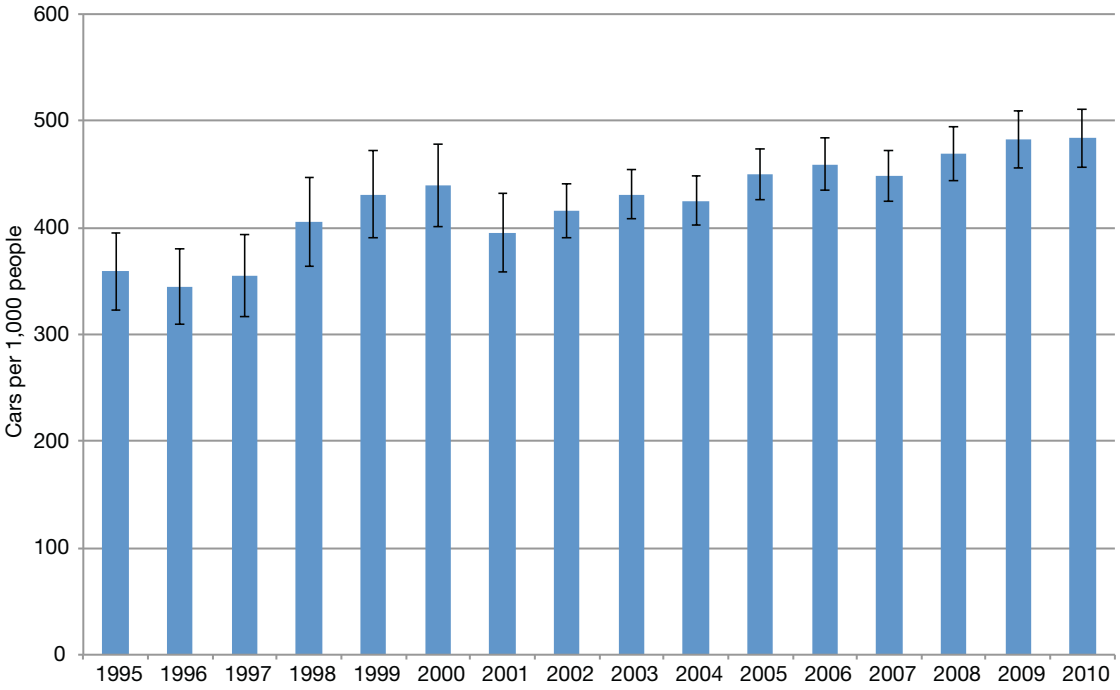
Source: NTS (standard errors are provided in Table A6 of the Appendix)

2.11 Trends in car ownership

2.11.1 Overall car ownership

Figure 2.34 shows how the rate of car ownership per person in Scotland has trended over time. Despite year-on-year fluctuations, car ownership has generally increased with time, from about 350 cars per 1,000 people in the mid-1990s to nearly 500 cars per 1,000 people (484 in 2010). This historical trend seems to have continued even during the current economic recession, albeit at a slow rate.

Figure 2.34: Car ownership per 1,000 people, Scottish residents



Source: NTS (error bars: 95% confidence interval)

These overall figures include two different forms of car ownership: privately owned cars and company cars; the latter are examined further in the next section.

In addition, drivers may drive a third category of car: a 'non-household car'. This refers to any car that is not a company car (as defined below) and is also not a personal car owned by a household member. If a person uses an employer's pool car, they are classified in the NTS as using a 'non-household car.' Driving by a person who borrows a car that is owned by someone that does not live in their household is also categorised as driving a 'non-household car', as is use of a rental car.

2.11.2 Company car ownership

A 'company car' is defined as one that an employee receives from their employer for continuous personal use, and for which they pay income tax for receiving the car as a benefit-in-kind. This definition excludes pool cars and other types of cars that are registered in a company's name but not made available to a single employee for continuous usage. Cars that self-employed people use for their business are not classified as company cars.

Table 2.14 shows how car ownership has changed over time, broken down by personal and company cars. What can be seen from the table is that it is personal cars that are responsible for the growth in car ownership that is seen in Figure 2.34. Unlike the full British sample, the data for Scotland do not show a continuous downward trend in company car ownership, which is probably a result of the smaller sample size (see section 3.6).

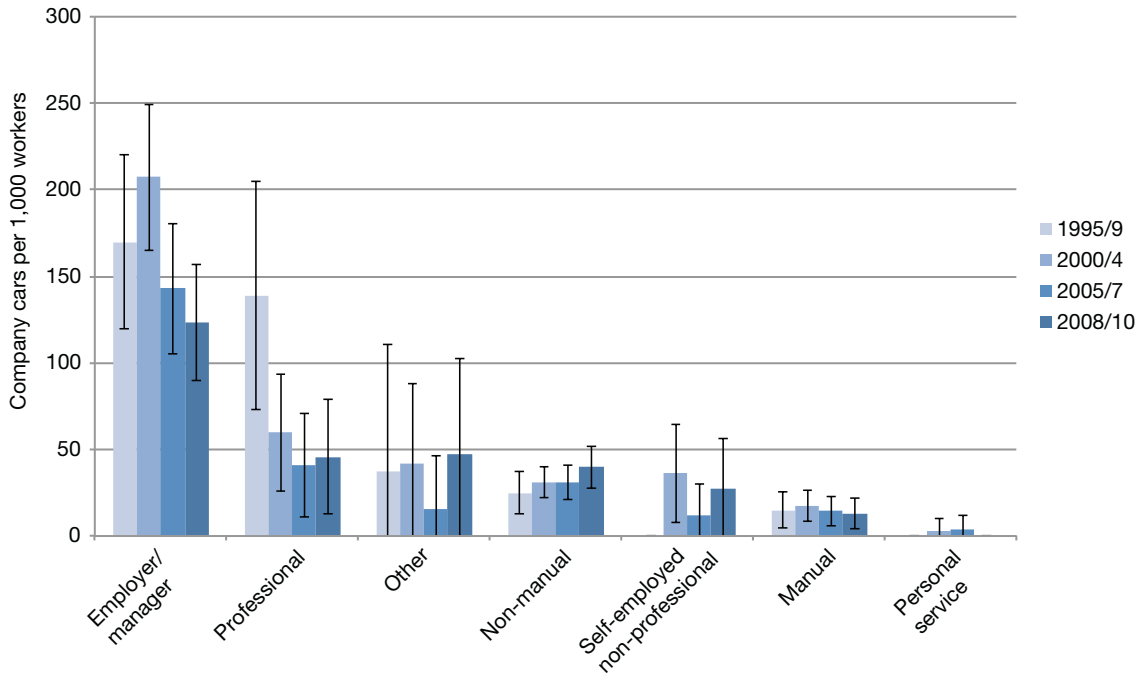
Table 2.14: Personal and company car ownership per 1,000 population (standard errors in brackets)

Period	Scotland		Britain	
	Personal cars	Company cars	Personal cars	Company cars
1995/9	378 (9)	21 (2)	397 (<0.5)	30 (1)
2000/4	423 (6)	24 (2)	432 (<0.5)	27 (1)
2005/7	453 (7)	19 (2)	458 (<0.5)	23 (1)
2008/10	479 (8)	20 (2)	462 (<0.5)	20 (1)

Source: NTS (standard errors in brackets)

Figure 2.35 shows how company car ownership has changed over time by type of occupation. As has been seen when the entirety of GB is examined, in Scotland the prevalence of company car ownership fell most markedly amongst 'Professionals' and the 'Employer/manager' class of worker, for whom company cars were most prevalent in earlier years.

Figure 2.35: Company cars per 1,000 workers by socioeconomic group



Source: NTS (error bars: 95% confidence interval)

2.12 Trends in car mileage by type of car ownership

2.12.1 Overall patterns

An important set of findings in the *On the Move* report highlighted the contribution made by company cars to overall trends in car driving across Britain. Company car mileage per person was found to have fallen so sharply that, after discounting it, there was no clear break in the growth of personal car use up to the 2008 recession, whereas there was a downward trend in overall driving mileage since about 2000. The reduction in company car use in GB for business purposes was mirrored by growth in rail travel for business purposes of about one quarter the magnitude. This section investigates how car usage has trended in Scotland, according to type of car ownership.

Table 2.15 summarises the changes in average mileage over time, in personal cars, company cars and non-household cars, again providing GB figures for comparison with Scotland. Personal car use rose by 9% on a per-person basis amongst Scottish residents between 1995/9 and 2005/7; it also rose by close to the same percentage across Great Britain as a whole. Personal car driving fell 2% in Scotland during the recession-impacted years, as compared with a 5% drop across all of Britain.

Company car usage fell by a somewhat smaller amount in Scotland (by 27% in Scotland against a drop of 36% in the GB level between 1995/9 and 2005/7), then rose by 8% in Scotland in contrast to a change of –20% at the GB level

between 2005/7 and 2008/10 – although it should be borne in mind that the confidence intervals are much larger in the Scottish results owing to the smaller sample size.[7] These two effects – the increase in use of personal and decrease in use of company cars – balanced each other out, resulting in just a 3% increase in car use in Scotland between the late 1990s and late 2000s, which is not statistically significant.

Whilst caution must be exercised owing to the large standard errors (arising from the small Scottish sample size), it does appear that as across Britain, there was an upward trend in driving mileage prior to the recession. There has subsequently been a decrease in driving mileage per person in the 2008/10 period across Britain. The Scottish NTS data is not showing a concurrent decrease in car mileage, but the traffic count data in Scotland show a roughly 3% fall in aggregate car traffic levels (see Figure 2.2).

Table 2.15: Average annual car-driving mileage per person, by personal cars, company cars and non-household cars, Scotland and GB

Period	Scotland				Great Britain			
	Personal cars	Company cars	Non-household cars	All car driving	Personal cars	Company cars	Non-household cars	All car driving
1995/9	2,825 (95)	391 (56)	211 (31)	3,427	2,904 (29)	581 (21)	168 (9)	3,653
2000/4	2,912 (71)	403 (40)	126 (16)	3,441	3,062 (22)	465 (13)	146 (6)	3,673
2005/7	3,069 (81)	286 (38)	125 (18)	3,480	3,156 (23)	372 (12)	131 (6)	3,659
2008/10	2,995 (77)	310 (40)	219 (33)	3,525	2,991 (23)	299 (12)	123 (6)	3,413
% change, 1995/9 to 2005/7	+9%	–27%	–41%	+2%	+9%	–36%	–22%	+<1%
% change, 2005/7 to 2008/10	–2%	+8%	+75%	+1%	–5%	–20%	–6%	–7%

Source: NTS (standard errors in brackets)

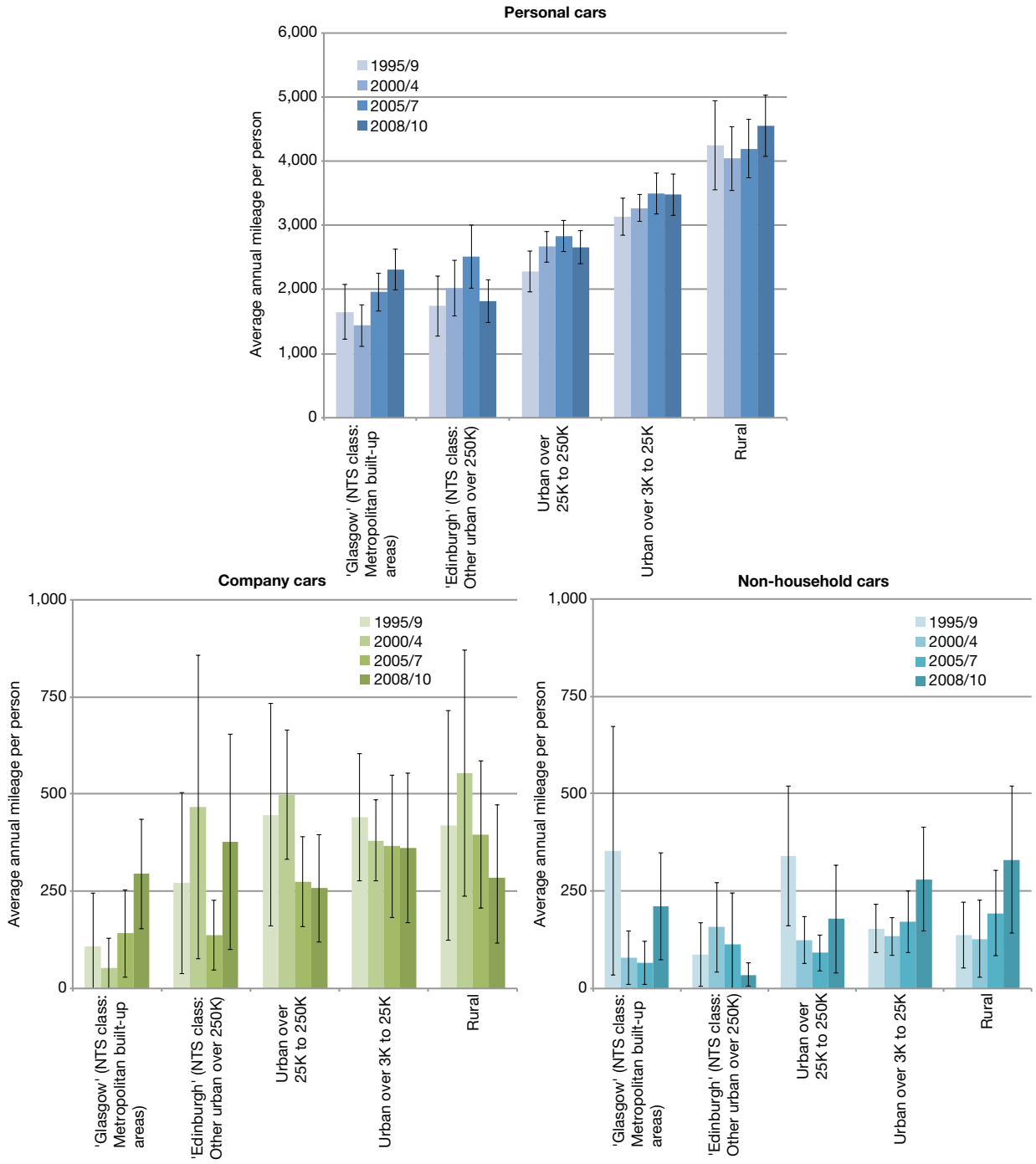
2.12.2 Influence of settlement size

Figure 2.36 illustrates patterns of car usage for the three types of ownership, by settlement size. Whilst there is a clear inverse relationship between

7 Even the fall in company car mileage between 1995/9 and 2005/7 is not statistically significant.

settlement size and personal car mileage, there are no strong and statistically significant comparable trends for the much smaller average per-person mileage in company cars or non-household cars.

Figure 2.36: Average annual car-driving mileage per person, personal cars, company cars and non-household cars by settlement size



Source: NTS (error bars: 95% confidence interval)

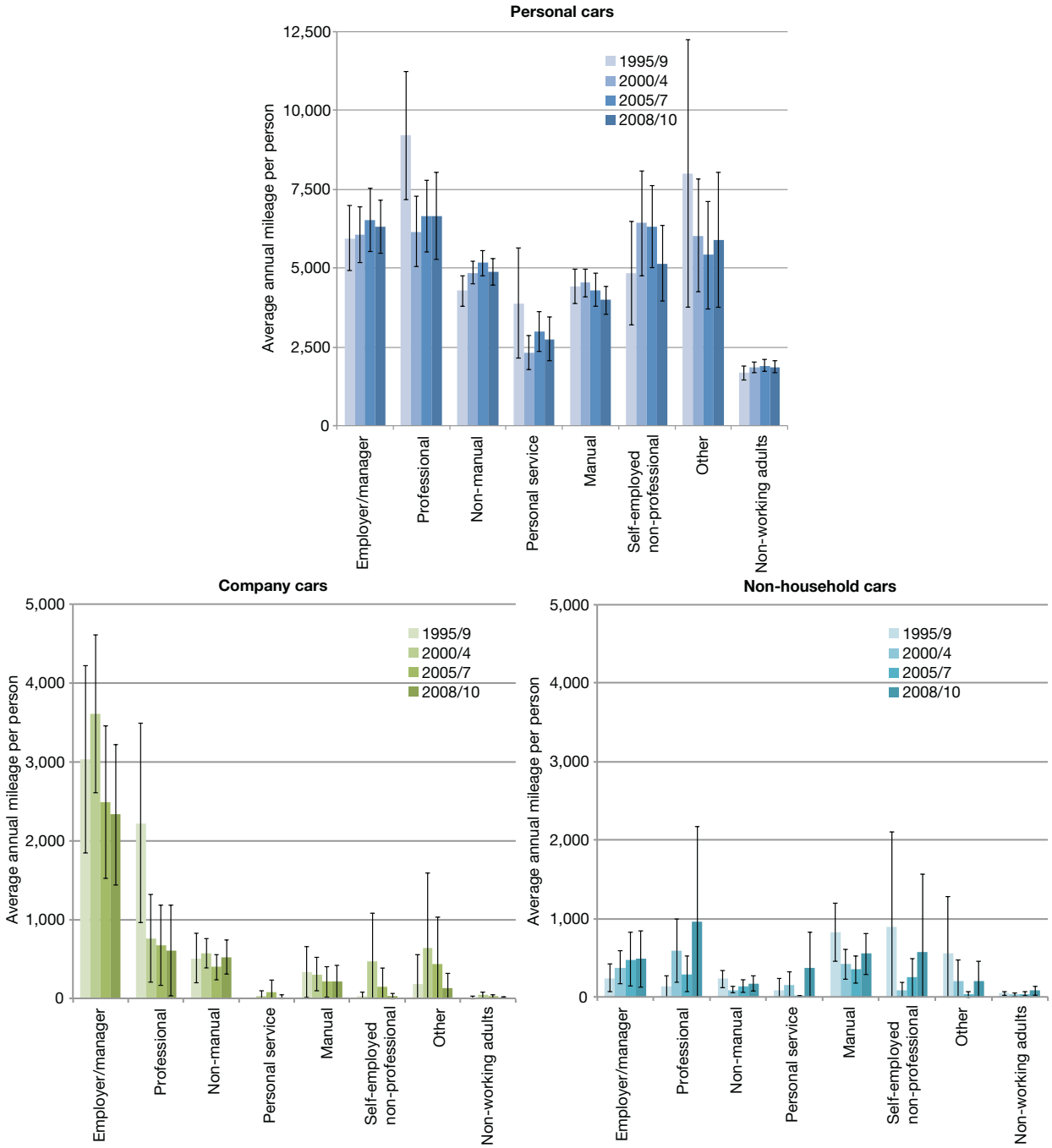
2.12.3 Influence of occupation and personal income

Figure 2.37 shows that, when car usage is broken down by type of ownership and occupation type, company car usage amongst Scottish residents is concentrated in the 'Employer/manager' class of workers. 'Professionals' had a high level of company car mileage in 1995/9, but in subsequent periods this became much lower and remained relatively stable; a similar trend is observable in their personal car use. As was seen in section 2.9.2 (Figure 2.25), rail usage by 'Professionals' underwent sustained period-on-period growth from 1995/9 to 2000/4, continuing on into 2005/7 and 2008/10. In Great Britain as a whole these three relationships – growing rail use, with falling levels of personal car and company car travel – were also found amongst professionals (see sections 3.2.2 and 3.4.2 of *On the Move*).

The NTS sample of 'Professionals' in Scotland is small,[8] and these results are therefore not broken down further. It would, however, be worth examining these trends using the SHS to see the extent to which these findings regarding the use of various forms of travel are interrelated.

8 The NTS's sample of professionals in Scotland numbers 131, 264, 217, and 206 people in 1995/9, 2000/4, 2005/7 and 2008/10 respectively.

Figure 2.37: Average annual car-driving mileage per person, personal cars, company cars and non-household cars, by socioeconomic group



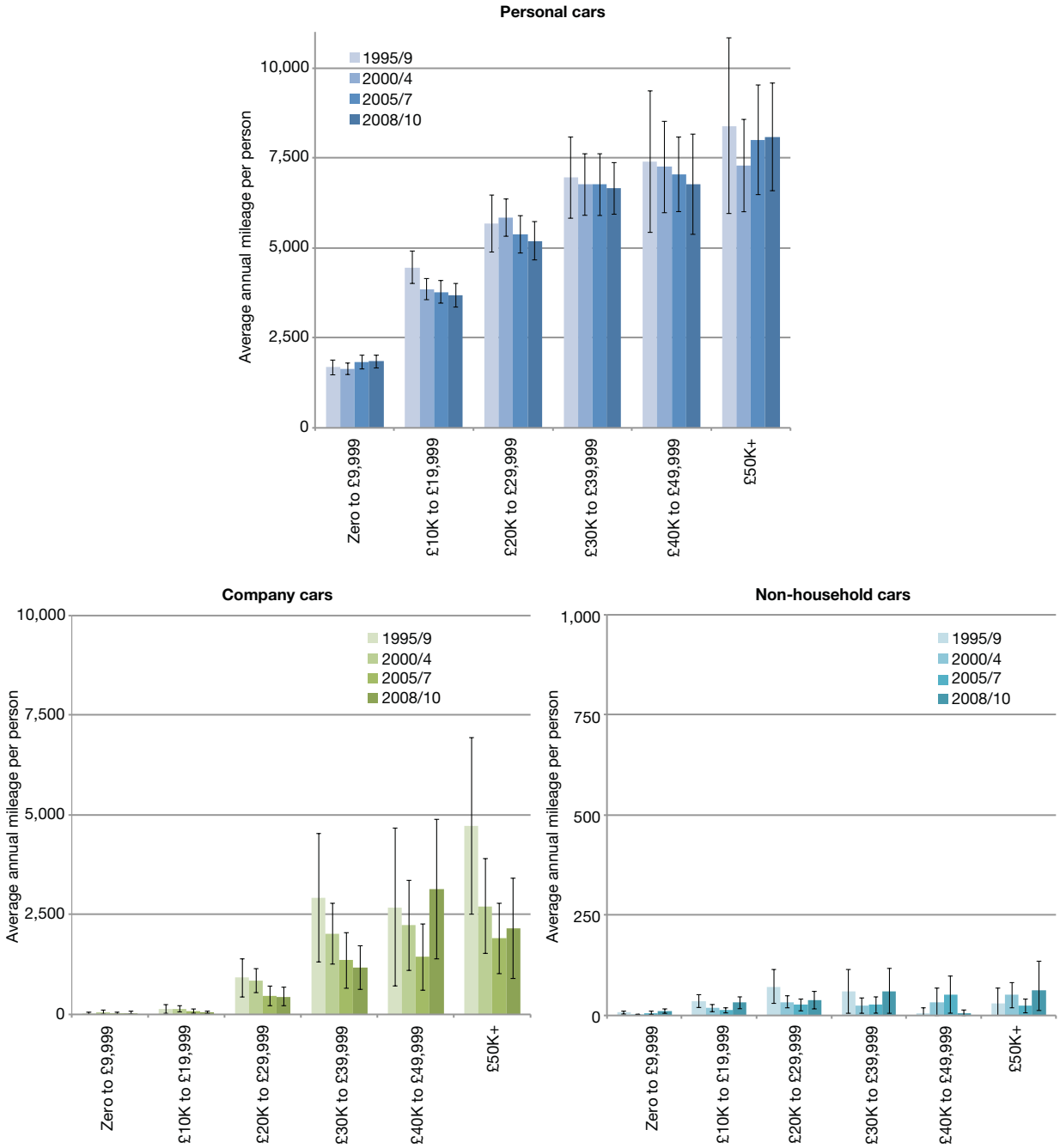
Source: NTS (error bars: 95% confidence interval)

Finally, 2.38 shows how the trend over time in car mileage breaks down when disaggregated by type of ownership. (This can be compared with Figure 2.24, which shows overall car mileage by personal income level.)

Very little company car mileage is driven (or has ever been driven) by people earning less than £20,000 per year (in 2010 prices). Whilst there is some noise in the data trends, there have been period-on-period falls in company car mileage per person in nearly all of the time periods since 1995/9 for income groups above the £20,000 level.

After accounting for the drop in company car use, we see that there has still been a general downward trend in personal car use within income classes, although for nearly all income groups the trend is not statistically significant. (The one exception to this is amongst those earning more than £50,000; for these people the estimate of average personal-car-driving mileage seems to have increased in the two most recent periods, though not to a statistically significant degree). Thus, even after accounting for declining company car use, the upward trend in personal car mileage would not exist were it not for rising incomes, which have changed the percentage of people that fall within each of the personal income classes (by shifting the distribution upwards over time, reweighting towards higher-income categories).

Figure 2.38: Average annual car-driving mileage per person (personal cars, company cars and non-household cars) by personal income level



Source: NTS (error bars: 95% confidence interval)

3. Comparison of the National Travel Survey and Scottish Household Survey

This section presents a high-level comparison of the properties of the NTS and SHS datasets. From 1 January 2013 the NTS no longer takes place in Scotland, meaning that the SHS will be the only continuing Scotland-wide travel survey, and will thus have additional demands placed on it. The SHS has not hitherto typically been used by Transport Scotland and others to estimate average annual travel mileage; this will be a major new requirement placed on the SHS travel diary dataset, and this section looks at the implications of using the survey to meet this need.

The NTS and SHS travel diary data series are here compared on an annual basis, as the aim is to understand the statistical properties of each, rather than to look at changing travel patterns over time.

This section builds on work previously performed by Transport Scotland (published in March 2012) investigating differences between the SHS and the NTS in Scotland (Transport Scotland, 2013).

The SHS's raw travel diary data is subject to a weighting methodology, to account for a variety of sampling biases. Transport Scotland made available for this study an extension of the standard travel diary weighting dataset, to facilitate the preparation of annual averages of travel indicators. This additional data allowed the study team to take account of SHS respondents who in principle were eligible to complete a travel diary but did not travel on their diary day, and so do not show up in the travel diary dataset. When calculating average annual mileage it is important to differentiate between these non-travellers on the one hand, and people who refused to take part in the travel diary or were not selected to take part on the other.

3.1 Comparisons of the samples

As can be seen by comparing Tables 1.1 and 1.2 in Section 1, the SHS has a much larger annual sample size than the NTS in Scotland; approximately 15 to 20 times as many households take part in the SHS in a given year than in the NTS in Scotland.

Both the NTS and SHS sample the population living in households – in other words, student halls of residence, nursing homes and suchlike are excluded from both. The NTS and SHS sample the Scottish household population in very different ways, however. The NTS uses a cluster sampling technique where postcode sectors are sampled in a stratified manner to account for region, car ownership levels, and population density. The SHS uses a more fine-grained stratification, sampling at least 500 households in each Scottish unitary authority each year, as well as fulfilling further detailed requirements (e.g. ensuring an appropriate level of coverage of the most deprived areas). The SHS also covers the entirety of Scotland, whereas the NTS excludes Scottish islands for practical reasons.

In addition to differences in how households are selected to take part in each of the surveys, the main substantive difference between the two surveys is that in the NTS *all* household members complete a diary, whereas the SHS only requests that a single randomly selected adult in each participating household complete a travel diary. This means that the SHS does not permit investigation of within-household travel relationships. It also means that children's travel is not knowable in detail from the SHS, as children are not selected to participate in the SHS's travel diary component.

The NTS data is collected via a hard copy travel diary, whereas the SHS is collected via Computer-Assisted Personal Interviewing (CAPI) on laptop computers. These two types of instruments will each have different biases associated with them, although the nature and magnitude of these biases cannot be known for sure. One important methodological difference is that (network) journey distance is estimated by NTS respondents themselves, but in the SHS it is calculated using computer software as the straight-line distance between the journey origin and destination. Future versions of the SHS travel diary data will contain both straight-line distance (for backwards compatibility) and estimated network distance for each journey (Transport Scotland, n.d.).

The more significant difference between the SHS and NTS travel diaries is that the NTS collects a full week's worth of travel data, whereas the SHS collects a single day's data (the day prior to the SHS interview). Because an unequal proportion of interviews take place on each day of the week, it is known that fewer SHS diaries take place on Fridays and weekends, and the SHS's weighting procedures account for this. In principle there may also be differences in the likelihood of travel diaries recording behaviour on and around public holidays, although this is not accounted for in the SHS weighting methodology (see section 3.3).

Short walking journeys are also treated differently between the SHS and NTS. The NTS asks respondents to record walks under one mile in length only on the last (seventh) day of their travel diary. Respondents to the SHS, on the other hand, did not report walks less than five minutes prior to 2007, and since then have been reporting all walking journeys including short trips. However, the SHS does not capture short walks between other forms of transport (i.e. where the destination purpose is 'Change mode') either, whereas the NTS does include these stages.

Table 3.1 shows the properties of the journey-level weights[9] used in the SHS and NTS[10]. Looking at columns 2 and 5 (shaded light blue), it can be seen that the weighting in the SHS shows significantly more variation.

Table 3.1: Properties of statistical weights for journeys

Year	NTS, standard deviation in journey weighting	NTS, minimum journey weighting	NTS, maximum journey weighting	SHS, standard deviation in journey weighting	SHS, minimum journey weighting	SHS, maximum journey weighting
1995	0.18	0.63	1.86	–	–	–
1996	0.19	0.56	2.13	–	–	–
1997	0.25	0.68	2.37	–	–	–
1998	0.20	0.74	2.13	–	–	–
1999	0.21	0.64	1.87	0.67	0.05	7.54
2000	0.21	0.57	1.92	0.67	0.04	7.16
2001	0.21	0.74	1.94	0.62	0.07	7.10
2002	0.22	0.64	2.46	0.66	0.05	6.16
2003	0.17	0.57	2.11	0.66	0.05	7.54
2004	0.19	0.55	1.99	0.64	0.06	7.12
2005	0.16	0.52	1.64	0.84	0.04	14.63
2006	0.17	0.63	2.21	0.80	0.04	16.76
2007	0.20	0.63	2.65	0.87	0.05	25.14
2008	0.22	0.64	2.69	0.85	0.05	10.53
2009	0.19	0.73	1.93	–	–	–
2010	0.25	0.62	4.52	–	–	–

Source: NTS and SHS, as noted

9 The NTS applies different weights to different journey purposes (to account for varying rates of drop-off during the diary week), whilst all journeys by an SHS respondent are weighted equally.

10 The NTS results shown in Table 3.1 do not include the factor-of-seven weighting used to inflate short walks that are reported by NTS respondents only on the last day of their week-long diary.

3.2 Comparison of NTS and SHS: car, bus and rail use per adult

This section looks at how estimates of average annual mileage per adult for car driving, bus and rail vary between the NTS and SHS samples.

Figure 3.1 shows the estimates of car-driving mileage as calculated from each of the two datasets. The NTS consistently shows a higher estimated mileage, the gap in estimated mileage was 39% (of the NTS estimate) in 2008. It is likely that this results in large part from differences, outlined above, in how journey mileage is estimated for each of the datasets. The NTS asks respondents to self-report their actual travel distance for each journey (the sum of the network segments they travelled), whilst the SHS calculates journey distance as straight-line distance between the origin and destination. Research undertaken for Transport Scotland shows that, for car-driving journeys in the SHS dataset, the straight-line distance is around one quarter shorter on average than the distance of the road route that would take the minimum amount of travel time (Transport Scotland, n.d.).

We found that 42% of adult NTS respondents were observed to drive a car during any one of their seven diary days, as compared to the 39% of SHS respondents who drove on their diary day (both averaged 1999–2008). There were also differences in car-driving stages (the term 'stage' is defined in section 1.2) per car driver. Of people observed to drive at all on a given day, they made an average of either 2.9 or 3.1 car-driving stages per day, according to the SHS and NTS respectively (again both calculations are from 1999–2008 data). The combination of these two effects would result in calculated average annual car-driving mileage that is 18% higher in the NTS than the SHS, even if the stage-lengths were the same. So differences in reporting of journeys seem to also account for some of the difference in annual car-driving mileage between the SHS and NTS. Table 3.2 breaks down the average annual per-adult mileage for car-driving, bus and rail systematically into three components:

- of all person-days (of adults age 16+) in the NTS and SHS, the proportion on which each mode of travel was used. In the case of the SHS, with its one-day travel diary, this is simply the percentage of adults that used each mode. In the case of the NTS, the analysis is somewhat more complex as seven days of travel are observed for each respondent;
- on days when NTS or SHS (adult) respondents use a given mode of transport, the average number of stages that they perform using that mode of travel; and
- the average observed distance per journey stage.

Multiplying these three components results in the calculation of average mileage per adult per day for each of the three forms of travel, which can then be factored up to the annual estimate.

Table 3.2: Breakdown of per-person mileage by components

	Percentage of SHS diary person-days during which mode of travel is used at least once (car driving / bus / rail)	On SHS diary person-days when mode of travel is used, average number of journey stages per person-day (car driving / bus / rail)	Average length of SHS journey stages, in miles (car driving / bus / rail)
1995	39% / 15% / 2%	3.2 / 1.8 / 1.6	8.6 / 6.0 / 25.7
1996	39% / 16% / 1%	3.2 / 1.9 / 1.7	8.1 / 5.6 / 32.1
1997	41% / 11% / 1%	3.4 / 1.8 / 1.8	8.7 / 5.7 / 19.6
1998	42% / 14% / 2%	3.3 / 1.9 / 1.4	8.0 / 5.7 / 64.0
1999	42% / 15% / 3%	3.2 / 1.8 / 1.7	8.7 / 6.8 / 26.1
2000	46% / 10% / 4%	3.2 / 1.8 / 1.8	9.0 / 6.9 / 23.9
2001	40% / 13% / 3%	3.3 / 1.7 / 1.6	9.1 / 6.4 / 18.1
2002	41% / 12% / 2%	3.1 / 1.8 / 1.6	8.3 / 4.5 / 26.3
2003	42% / 13% / 2%	3.1 / 1.9 / 1.7	8.3 / 5.6 / 23.2
2004	42% / 13% / 3%	3.1 / 1.8 / 1.7	8.4 / 6.0 / 25.8
2005	43% / 12% / 3%	3.2 / 1.9 / 1.7	8.9 / 5.4 / 24.8
2006	43% / 12% / 2%	3.0 / 1.9 / 1.7	8.6 / 6.0 / 26.7
2007	41% / 14% / 3%	3.0 / 1.8 / 1.7	8.3 / 7.2 / 28.6
2008	45% / 12% / 3%	2.9 / 1.8 / 1.7	8.8 / 7.3 / 30.1
2009	44% / 13% / 2%	2.9 / 1.8 / 1.6	8.8 / 6.6 / 25.8
2010	41% / 14% / 3%	3.0 / 1.9 / 1.7	8.5 / 6.0 / 23.3
Average (1999 to 2008 only)	42% / 13% / 3%	3.1 / 1.8 / 1.7	8.6 / 6.2 / 25.3

(Continued on next page)

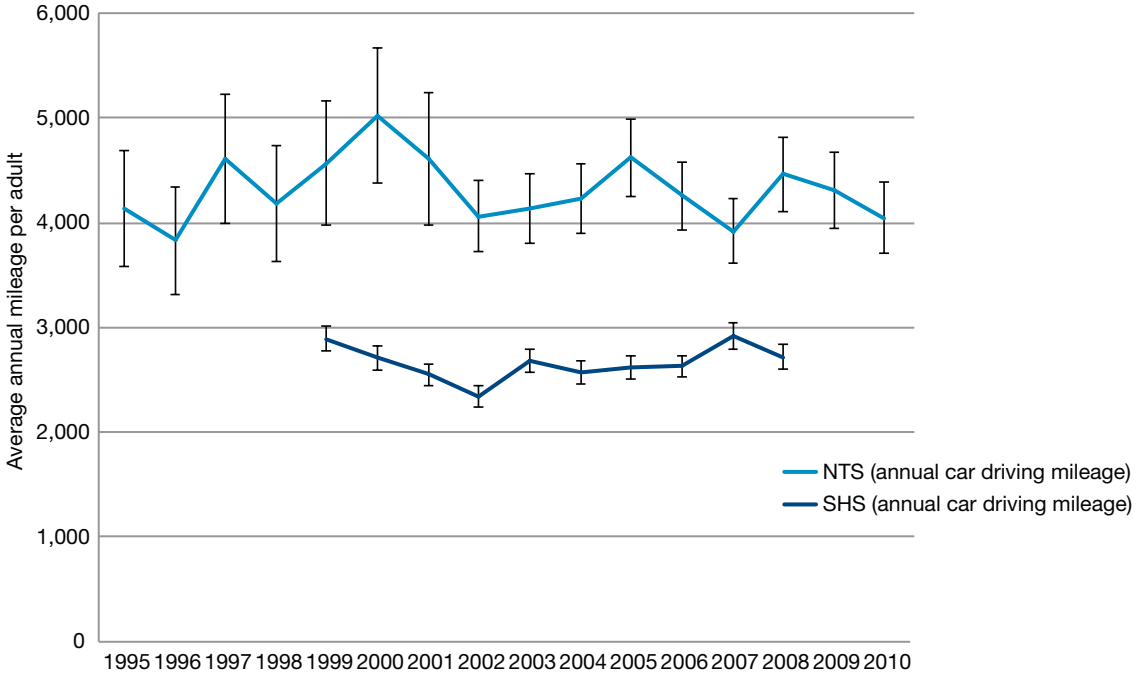
Table 3.2: Breakdown of per-person mileage by components (continued)

	Percentage of NTS diary person-days (adults only) during which mode of travel is used at least once (car driving / bus / rail)	On NTS diary person-days (adults only) when mode of travel is used, average number of journey stages per person-day (car driving / bus / rail)	Average length of NTS journey stages, in miles (car driving / bus / rail)
1999	40% / 11% / 2%	2.9 / 1.9 / 1.8	6.8 / 3.7 / 16.6
2000	38% / 11% / 2%	2.9 / 1.9 / 1.8	6.5 / 4.2 / 16.6
2001	37% / 10% / 2%	2.9 / 1.9 / 1.8	6.5 / 3.8 / 16.2
2002	38% / 11% / 1%	2.9 / 1.9 / 1.9	5.8 / 3.7 / 13.4
2003	39% / 10% / 2%	3.0 / 1.9 / 1.9	6.4 / 4.0 / 15.6
2004	38% / 11% / 2%	2.9 / 1.9 / 1.8	6.5 / 4.3 / 16.2
2005	38% / 10% / 2%	2.8 / 1.9 / 1.8	6.6 / 4.2 / 15.5
2006	39% / 11% / 2%	2.8 / 1.9 / 1.9	6.5 / 3.9 / 16.6
2007	43% / 11% / 2%	2.9 / 2.1 / 1.9	6.4 / 4.2 / 21.6
2008	41% / 10% / 2%	2.9 / 2.1 / 1.9	6.3 / 4.2 / 44.7
Average (1999 to 2008)	39% / 10% / 2%	2.9 / 2.0 / 1.9	6.4 / 4.0 / 19.3* * 19.3 mi./ stage becomes 16.5 mi./stage if 2008 data is excluded

Source: NTS

Aside from the differences between the magnitude of the average annual mileage calculations from the two datasets, what can be seen from Figure 3.1 is that the NTS estimate of average annual mileage exhibits more year-on-year variability – noise – than the SHS. Neither dataset shows a strong trend over time of increasing or decreasing car travel per adult.

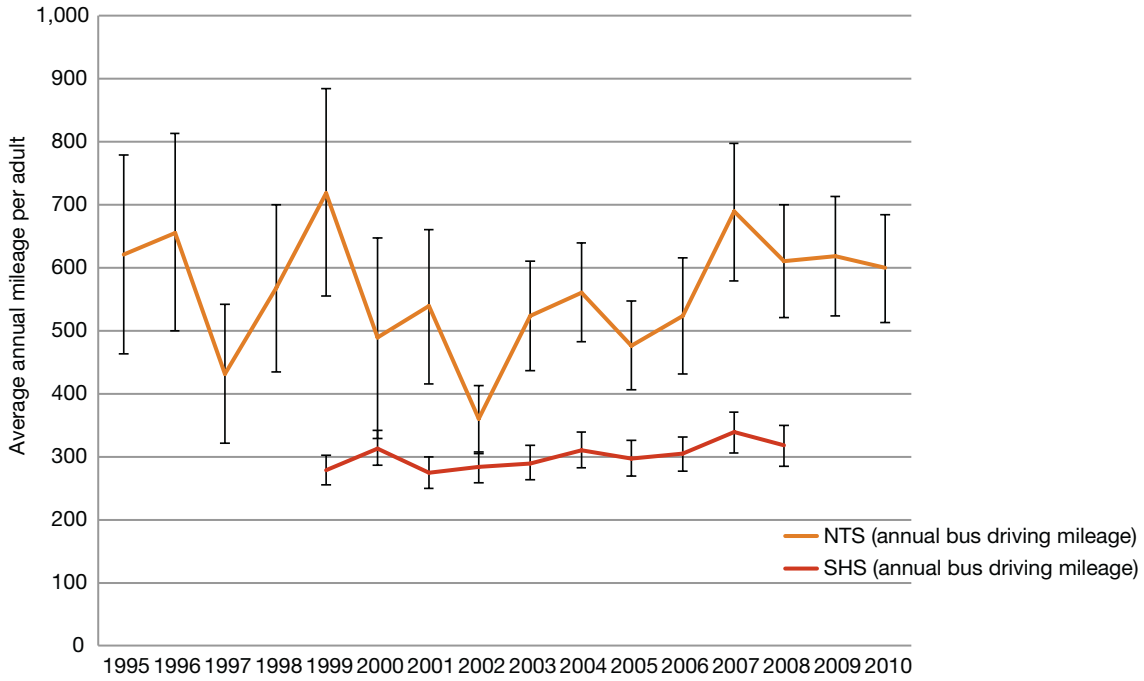
Figure 3.1: Average annual estimated car-driving mileage per adult



Source: NTS and SHS (error bars: 95% confidence interval)

Figure 3.2 compares NTS and SHS estimates of annual bus mileage per adult. As with car driving, the NTS data consistently provides an estimate that is higher by an average of about 40%, and shows a larger year-on-year variability (owing to its smaller sample size). Both datasets seem to show an increasing trend in bus usage per adult dating from the early 2000s.

Figure 3.2: Average annual estimated bus mileage per adult

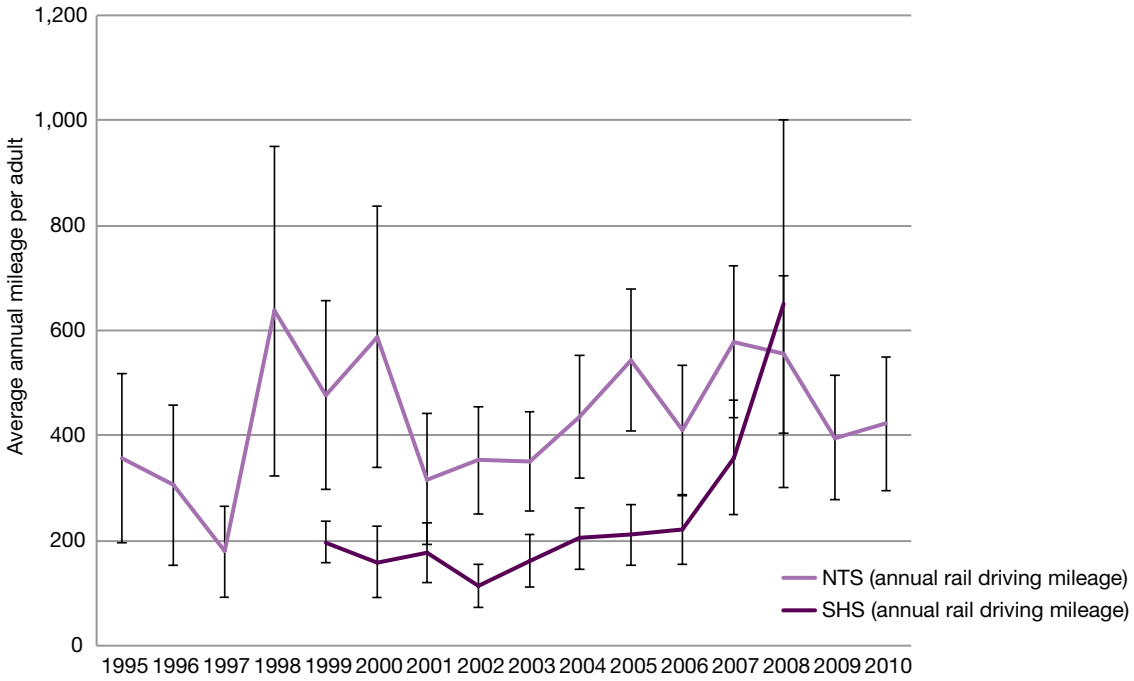


Source: NTS and SHS (error bars: 95% confidence interval)

Figure 3.3 shows the same comparison of annual mileage between NTS and SHS, this time for rail travel. Both the NTS and SHS are showing year-on-year increases in rail travel since the early 2000s, and as with the other two modes of transport, the NTS data varies more on a year-on-year basis.

There is also a large jump in the SHS time series of rail mileage in 2008. It is implausible that rail usage per adult grew 78% in the space of a year, from 362 to 645 miles per year. Instead, what has happened is that a small number of very long-distance rail journeys that have large journey-weighting values have had a major, disproportionate impact on the overall estimate of rail usage. The estimated standard error, which assumes the microdata on people's use of rail has a standard normal distribution, is shown to be larger in 2008 than earlier years, but it appears that this is an underestimate of the actual variance.

Figure 3.3: Average annual estimated rail mileage per adult



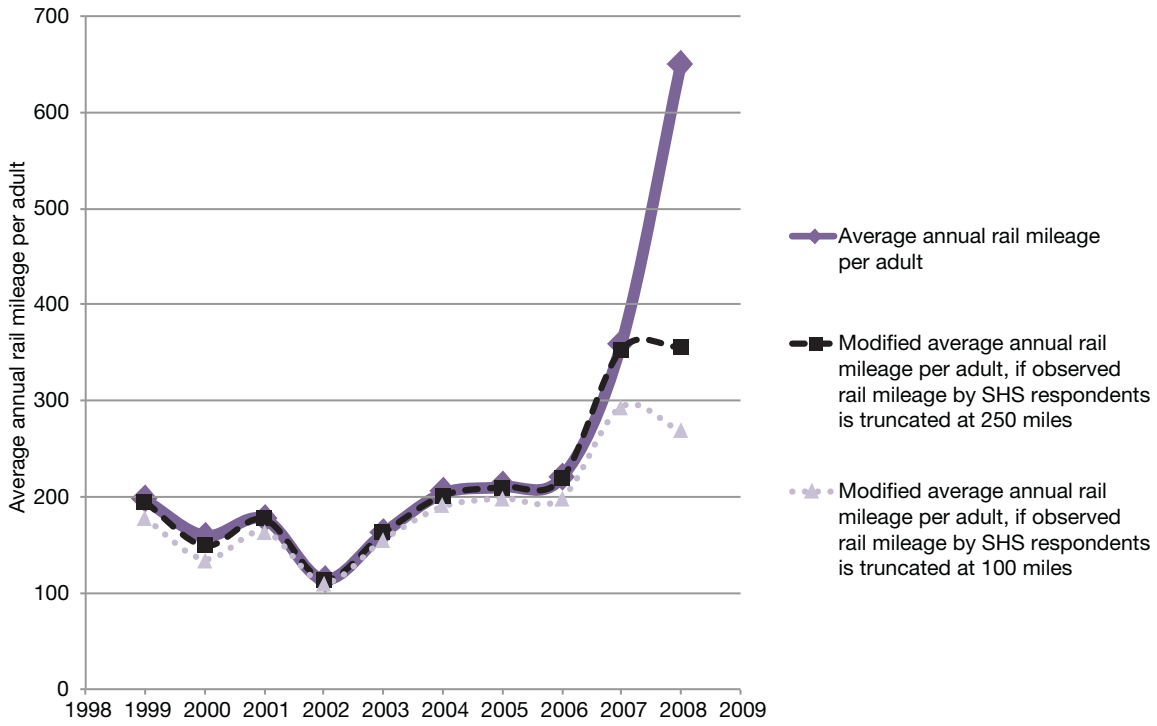
Source: NTS and SHS (error bars: 95% confidence interval)

In order to illustrate the effects due to a small number of SHS respondents travelling very long distances by rail on their diary day, Figure 3.4 shows how the calculation of annual rail mileage per adult would change if the distribution were to be truncated, using two alternative threshold values. The rail mileage of any SHS respondent travelling by rail more than 100 (or 250) miles on their diary day is recoded as precisely 100 (or 250) miles. Thus, the tan-coloured line (the lowest of the three on the chart) shows the effect of recoding the daily rail mileage of all people that travelled more than 100 miles by rail on their diary day as exactly 100 miles. The green line shows the same for a 250-rail-miles-per-day threshold.[11]

What can be seen in Figure 3.4 is that this results in a much smaller estimate of rail mileage per adult in 2008, and to some degree in 2007 as well (when the 100-mile-per-day threshold is applied). The direction of the trend over time is still upwards since the early 2000s, however. Interestingly, the effect of truncating at 100-rail-miles-per-day seems to have grown in recent years, which could indicate that Scottish residents are in fact making an increasing number of long-distance journeys by rail. Rail ticket sales data corroborate this point, as between 2000/1 and 2010/1 rail journeys entirely within Scotland grew by 26% (from 62.3 million to 78.3 million per year) whilst cross-border journeys grew at a faster rate (48%) but from a much smaller base (from 2.5 million to 3.7 million).

11 The 250-miles-per-day threshold affects 38 SHS respondents out of 131,997 diary respondents over the 1999–2008 period. The 100-miles-per-day threshold affects 247 SHS respondents.

Figure 3.4: Illustration of average annual estimated rail mileage per adult if distribution is truncated



Source: SHS

Note that in Figures 3.1 to 3.3, the error bars show the standard error, which has been calculated as the standard deviation divided by the square root of the unweighted sample size, and therefore:

(1) is based on simplifying distributional assumptions;

(2) does not take account of the fact that the NTS diary data is hierarchical, as there are seven observations of travel days per person and (except in single-person households) multiple people observed per household, whereas the SHS is a single-day-per-respondent (and per household) survey; and

(3) is dependent on sample size.

It is not surprising that the estimates of standard error are smaller for the SHS travel diary dataset, owing to its larger sample size.

Table 3.3 shows how the standard deviation values of estimated average annual mileage (for car driving, bus and rail, separately) vary between the NTS

and SHS, by dividing one by the other. This removes the issue of differences in sample sizes, and ideally we would find similar standard deviation values between the two datasets (i.e. ratios of 1.0) and no trends over time. What we see is that, broadly speaking, the degree of variance in the two datasets agree with each other, despite the methodological differences in how the two surveys measure the same behaviour.

Table 3.3: Ratio of calculated standard deviation values in annual mileage (for car driving, bus and rail) between the SHS and NTS

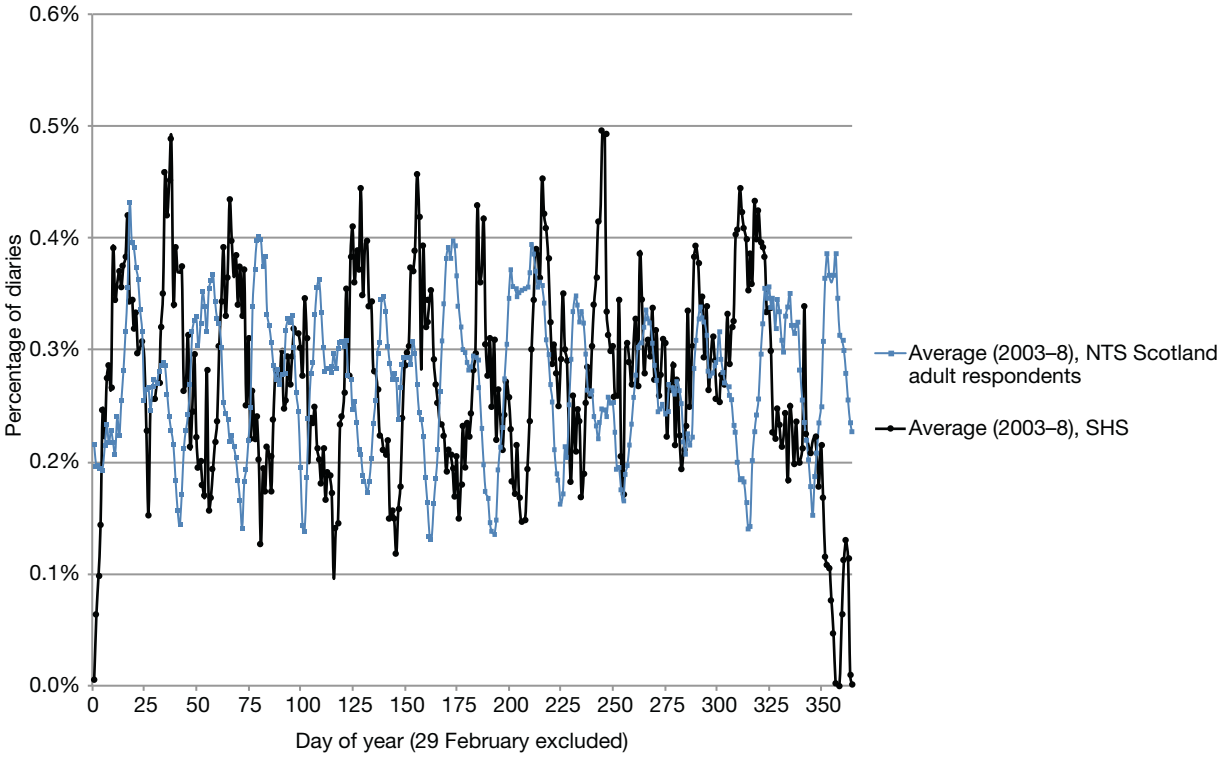
Year	Ratio between SHS and NTS standard deviation (annual estimate of adult respondents' car-driving mileage)	Ratio between SHS and NTS standard deviation (annual estimate of adult respondents' bus mileage)	Ratio between SHS and NTS standard deviation (annual estimate of adult respondents' rail mileage)
1999	0.96	0.71	1.09
2000	0.87	0.86	0.84
2001	0.82	0.98	1.36
2002	0.90	1.40	0.75
2003	0.99	0.92	0.99
2004	0.99	1.09	0.94
2005	0.84	1.15	0.77
2006	0.93	0.86	0.98
2007	1.14	0.80	1.28
2008	0.97	1.06	4.17
Average	0.94	0.98	1.31 (1.00 if 2008 datapoint is excluded)

Source: NTS and SHS, as noted

3.3 Comparison of NTS and SHS: distribution of travel diaries by day of year

Neither the NTS nor SHS diaries are distributed evenly across the days of the year, as can be seen in Figure 3.5. Data is shown for 2003–8, which is the period when day-of-year information is available in the SHS travel diary dataset.

Figure 3.5: Percentage of SHS and NTS diaries by day of year, 2003–8



Source: NTS and SHS, as noted

The NTS diaries follow a distinct pattern on a monthly basis, with the highest number of diaries in the field around days 18–20 of each month, and the fewest around days 12–13.

A recurring month-to-month distribution is also seen for SHS diaries, with the peak in number of diaries around days 5–9 of the month, and the trough near days 26–28.

The SHS's diary day is always the day before the respondent's interview, whereas the NTS's week-long diary is distributed according to a monthly sampling plan, and hence depends less strongly on the date of the placement interview. There is no strong seasonal variation in the distribution of NTS diaries, but between 2003 and 2008 there were no SHS diaries on Christmas Eve or Christmas Day, only three on New Year's Day, and relatively few on other days around the holiday season.

Figure 3.6 shows average car-driving mileage per adult by day of year for both datasets, and Figures 3.7 and 3.8 show the same for bus and rail respectively.

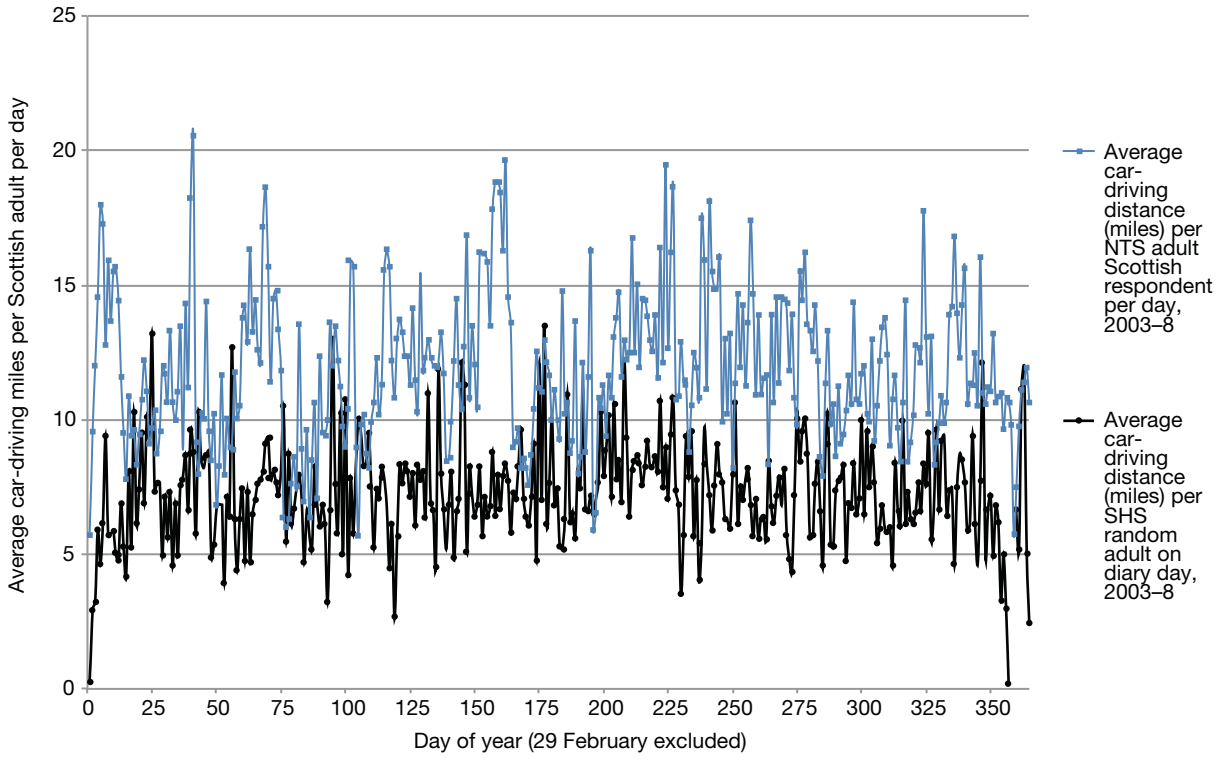
The NTS records a low level of driving mileage on Christmas Day, when no SHS diaries take place, and the same on New Year's Day, when very few SHS diaries are recorded.

There is greater day-to-day variability in the recorded bus and rail mileage than for car driving, because of the smaller number of public transport journeys. The spikes in bus mileage are probably due to a small number of long-distance coach (rather than local bus) journeys. With the NTS it is possible to analyse the two types of bus use separately, but the SHS software does not record this distinction.

A single long-distance rail journey in the SHS travel diary dataset causes the spike in rail mileage on a day in early January.

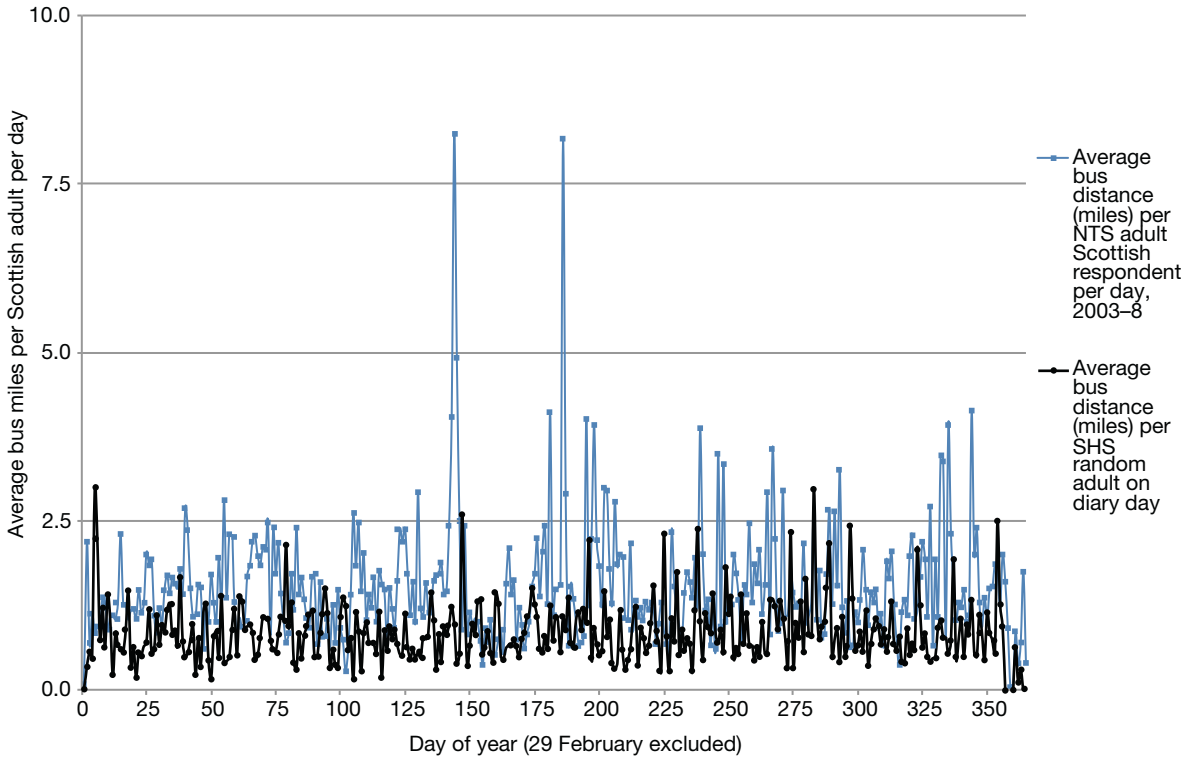
The effect on annual mileage estimates of the SHS undersampling that took place in the December/January holiday period is small, however: removing diaries the last 15 days of December and first 5 days of January from the calculation of annual mileage results in a shift of less than 1% in the ratio of car-driving, bus, or rail mileage recorded by the SHS relative to the NTS.

Figure 3.6: Average car-driving mileage per day by day of year



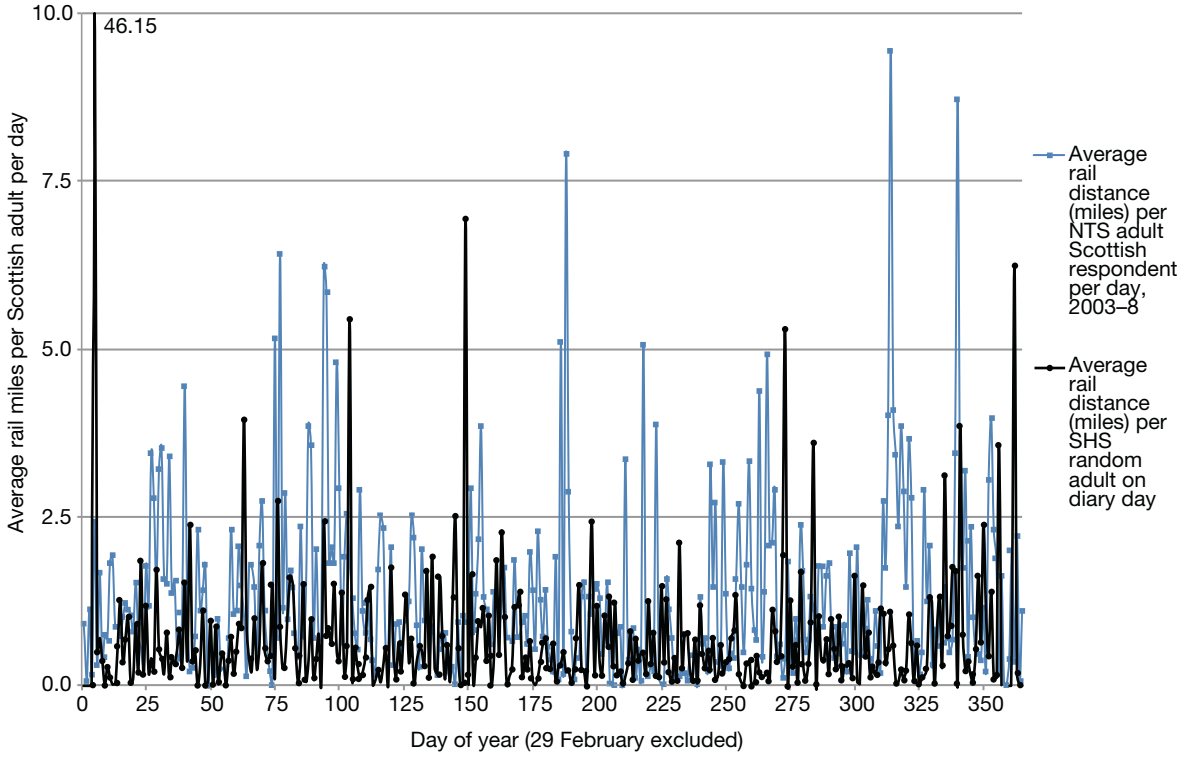
Source: NTS and SHS, as noted

Figure 3.7: Average bus mileage per day by day of year



Source: NTS and SHS, as noted

Figure 3.8: Average rail mileage per day by day of year



Source: NTS and SHS, as noted

We would expect there to be no correlation between mileage per adult per day and how many diaries take place on each day of the year. Table 3.4 shows that no significant correlation is found in either dataset for bus mileage or rail mileage. However there are significant correlations between the number of diaries per day and driving mileage per day. The correlation is positive (+0.13) for the SHS, and larger and negative (–0.25) for the NTS.

It is not clear why these correlations occur; in the case of the SHS it is probably due in part to a small number of diaries being collected on (and on days adjacent to) public holidays, when car use is relatively low. Although the SHS's weighting methodology corrects for the different probability of randomly selected adults being interviewed on each day of the week, based on their economic status, it is designed to be a simple and straightforward weighting scheme. It is thus possible that there could be some residual bias due to the non-random day-of-the-week distribution of SHS diaries.

The negative correlation between the number of NTS diaries active on any given day of the year and the average car driving mileage appears to be due to the NTS's sampling protocol. Each month's quota of NTS fieldwork begins on or about the 12th of the month. Those interviews that take place later in the quota-month lead to diaries that also take place later in the quota month, and it appears that there is an association between how much one drives and tendency to complete a diary later in the quota-month. The causes of these relationships could be established by statistically modelling the average travel distance and the number of diaries observed by day of year in the SHS and NTS datasets.

Table 3.4: Correlation between number of diaries and average mileage per adult

Period	SHS, car driving	SHS, bus	SHS, rail	NTS, car driving	NTS, bus	NTS, rail
2003–8 (averaged)	0.13 (0.01)	0.004 (0.94)	–0.04 (0.43)	–0.25 (0.00)	0.07 (0.18)	–0.06 (0.24)

Source: NTS and SHS; units are days of year (significance levels in brackets)

3.4 Comparison of NTS and SHS: car, bus and rail use by age and gender

The next 12 figures (Figures 3.9 to 3.20) show the same information as the previous three figures, but these charts are paired, showing SHS results followed by NTS results, for males and then females by seven age groups, for each of the three modes in turn.

We do not comment on each of them individually, but note some general results.

First, the NTS estimates show more year-on-year variation, as expected because of the smaller sample sizes.

Second, particularly for bus and rail travel, both of the datasets (but especially the NTS) show evidence of a small number of observations having major impacts on the overall average mileage values. The notable exception to this is the extreme SHS estimate of rail use by men in the 16–19 age class in 2008 (see Figure 3.17), as previously noted: a single SHS respondent in this category was identified as having a major impact on the average level. As shown in Figures 3.3 and 3.4, the effect of this single respondent can be seen on the overall per-adult estimated rail mileage. The NTS shows a similar effect due to a single respondent in 2000 (a man aged 60–69), but here the effect is not nearly as large.

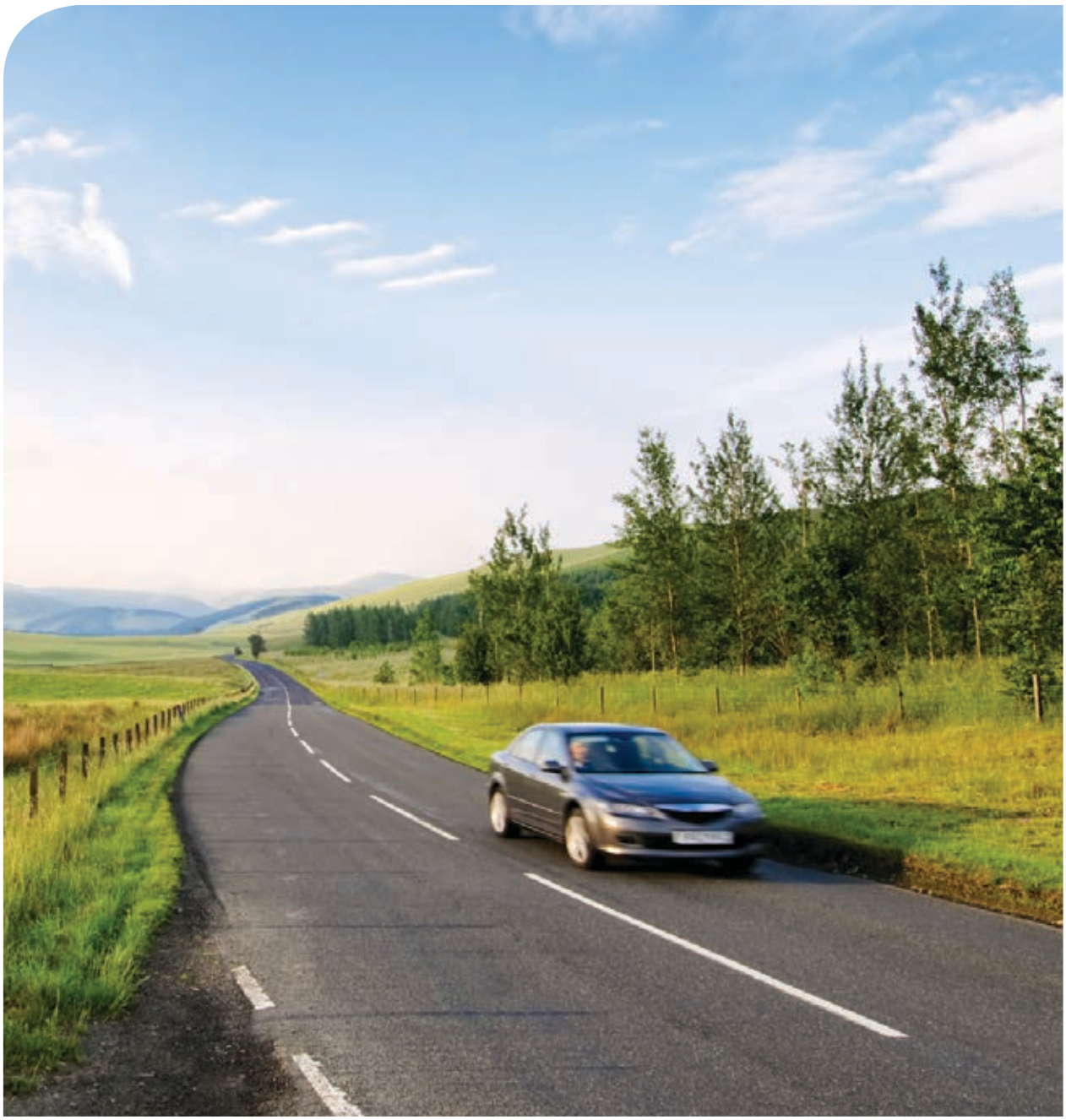
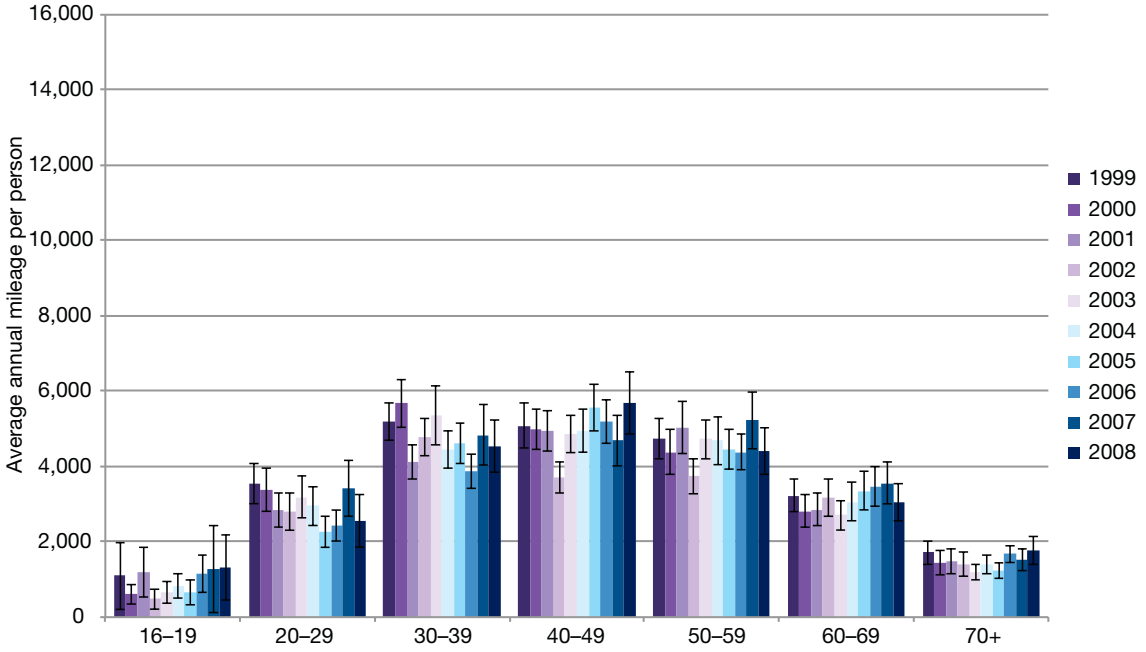
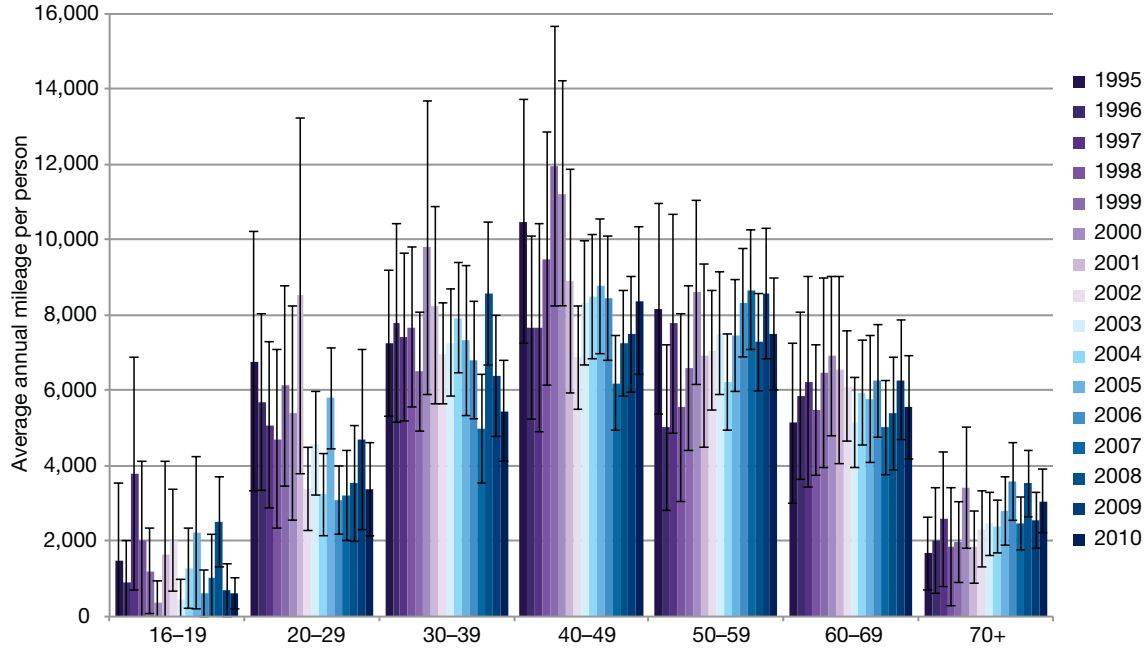


Figure 3.9: Average annual car-driving mileage (men) estimated by the SHS, by age group



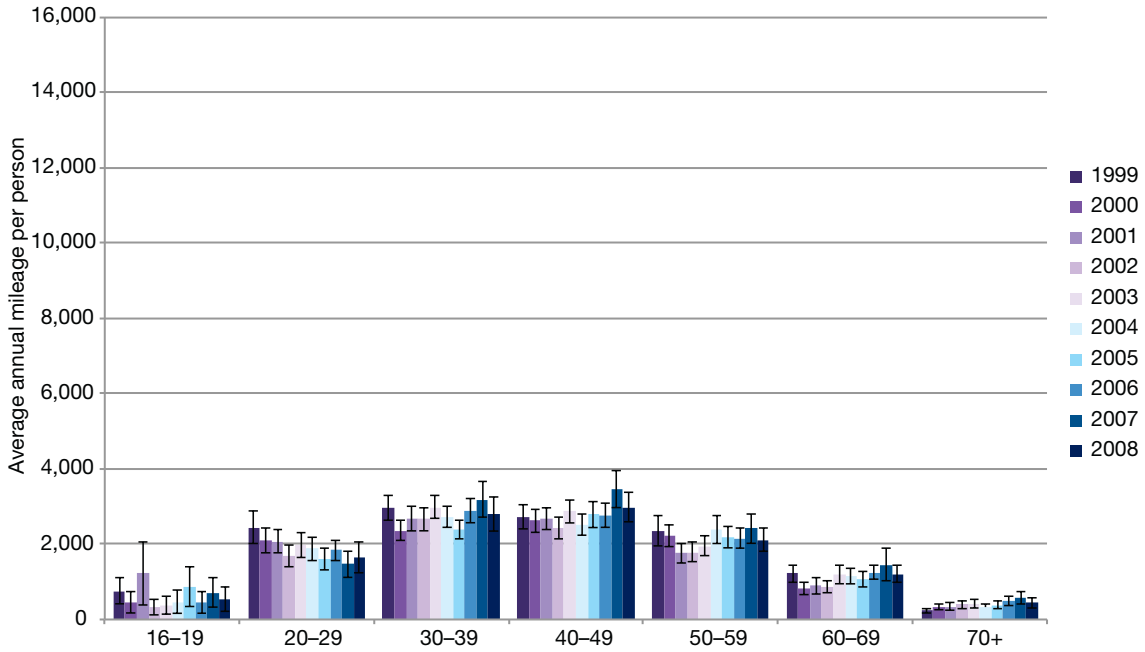
Source: SHS (error bars: 95% confidence interval)

Figure 3.10: Average annual car-driving mileage (men) estimated by the NTS, by age group



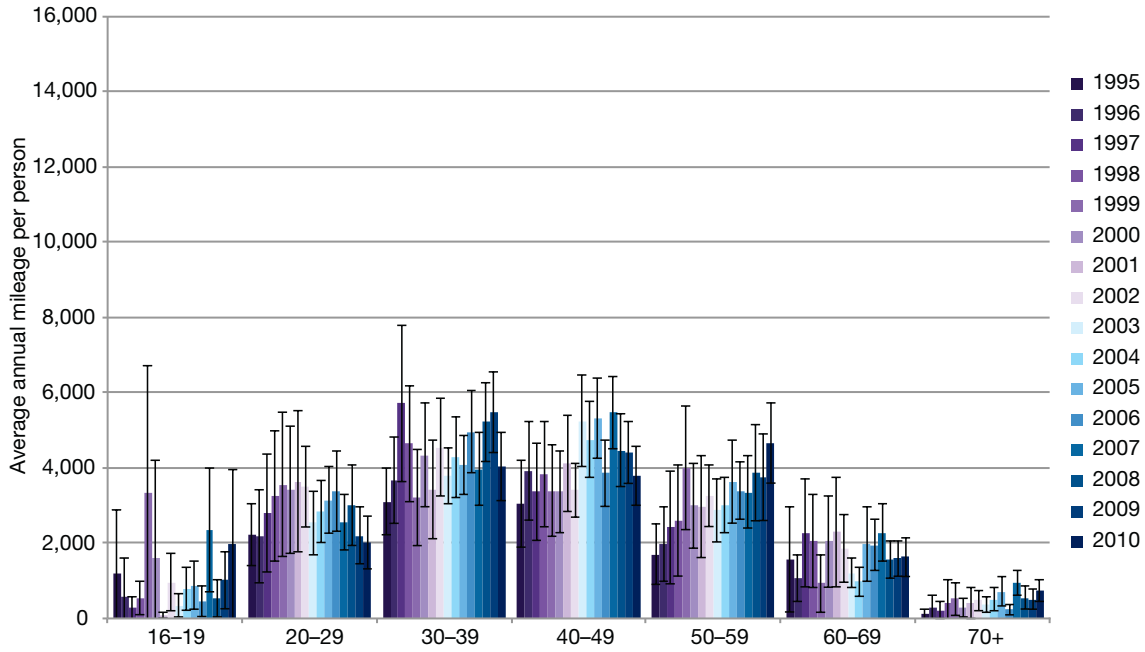
Source: NTS (error bars: 95% confidence interval)

Figure 3.11: Average annual car-driving mileage (women) estimated by the SHS, by age group



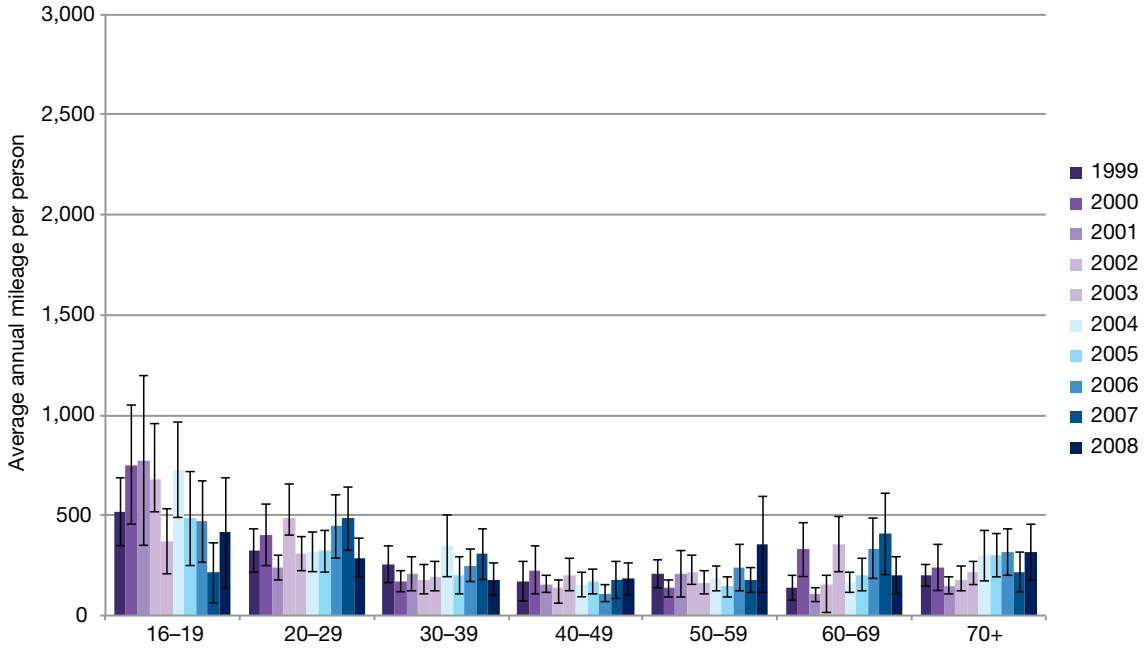
Source: SHS (error bars: 95% confidence interval)

Figure 3.12: Average annual car-driving mileage (women) estimated by the NTS, by age group



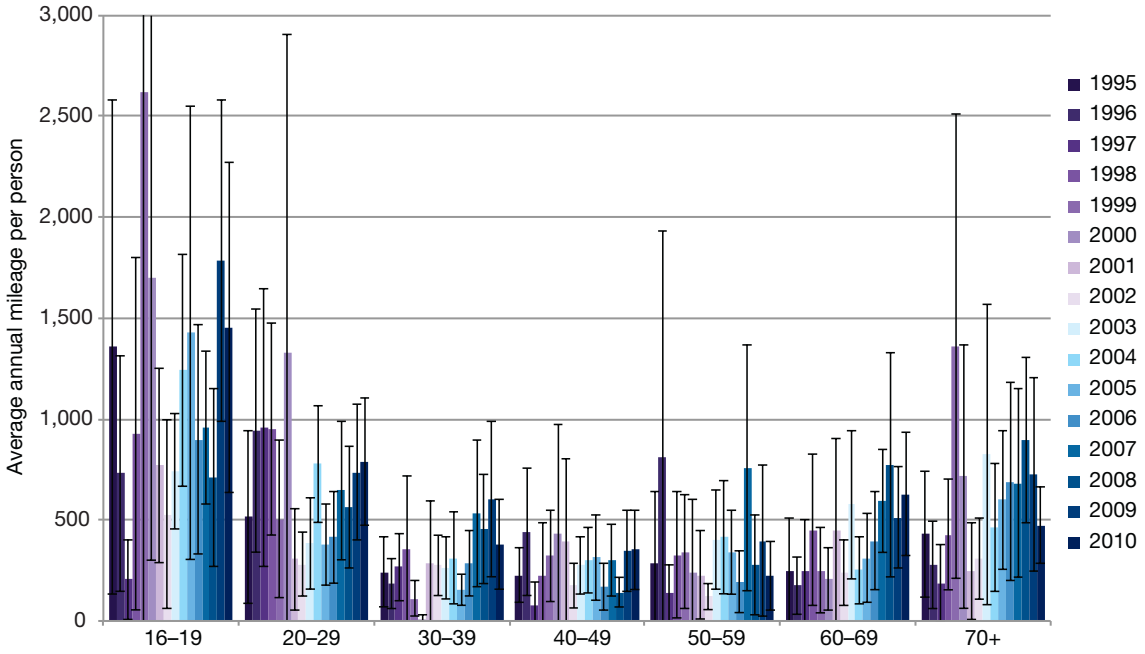
Source: NTS (error bars: 95% confidence interval)

Figure 3.13: Average annual bus mileage (men) estimated by the SHS, by age group



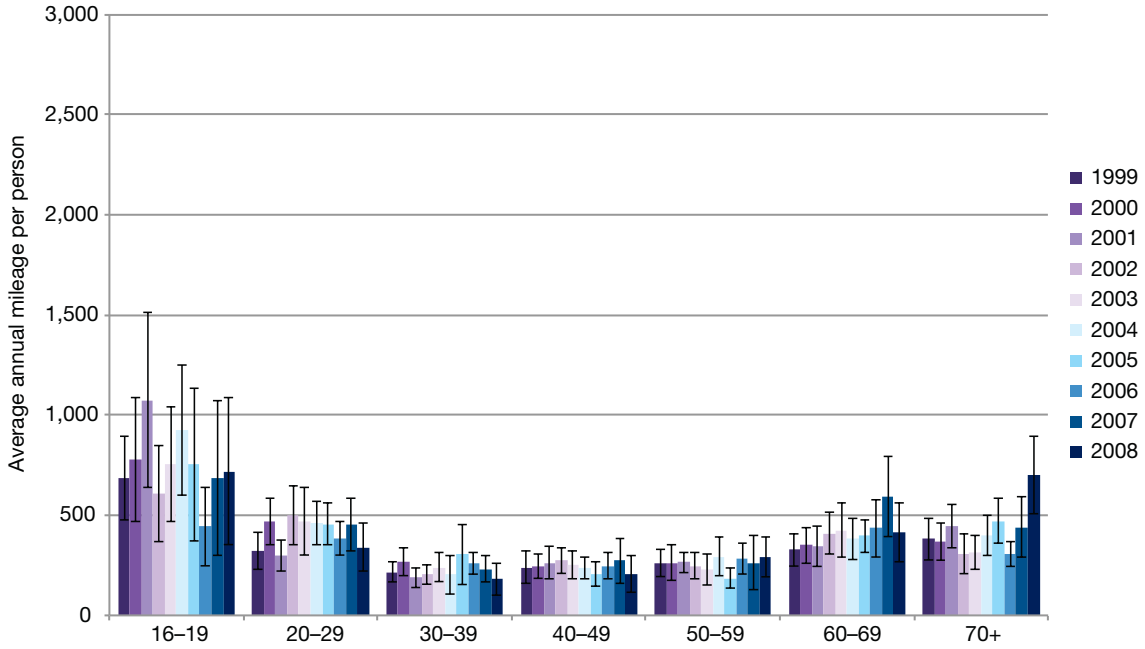
Source: SHS (error bars: 95% confidence interval)

Figure 3.14: Average annual bus mileage (men) estimated by the NTS, by age group



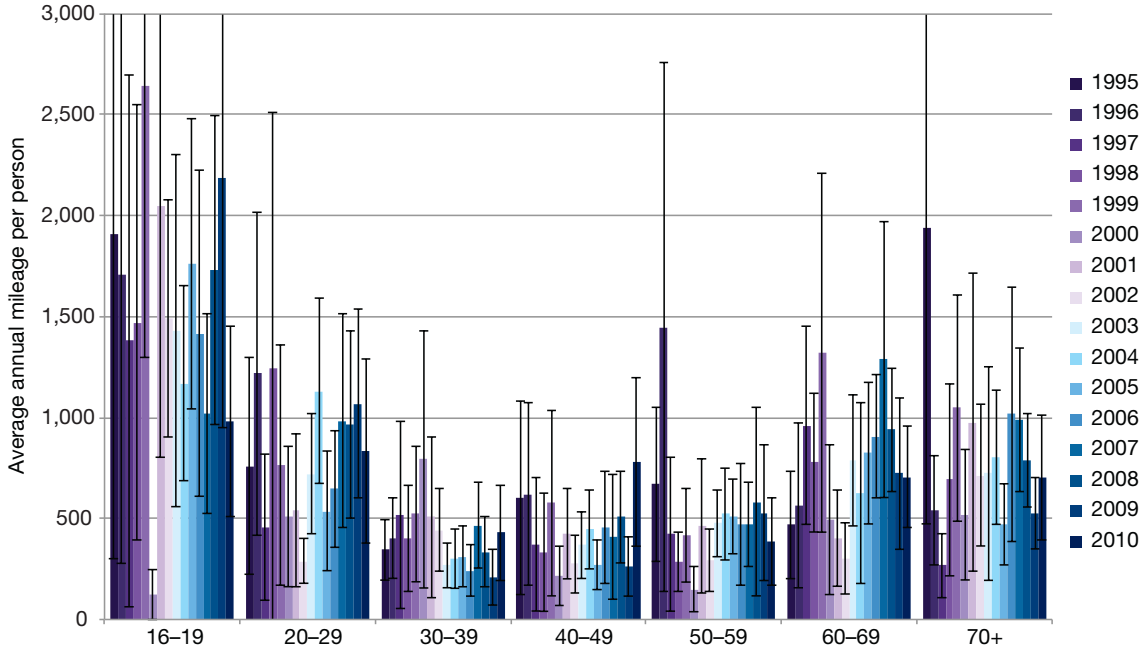
Source: NTS (error bars: 95% confidence interval)

Figure 3.15: Average annual bus mileage (women) estimated by the SHS, by age group



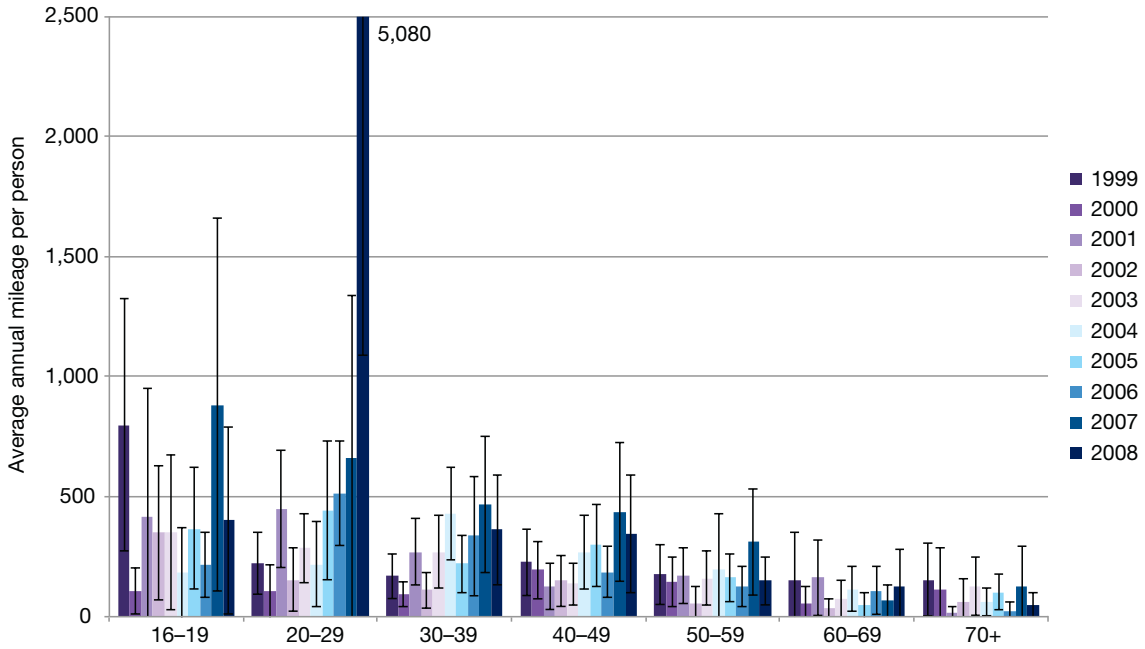
Source: SHS (error bars: 95% confidence interval)

Figure 3.16: Average annual bus mileage (women) estimated by the NTS, by age group



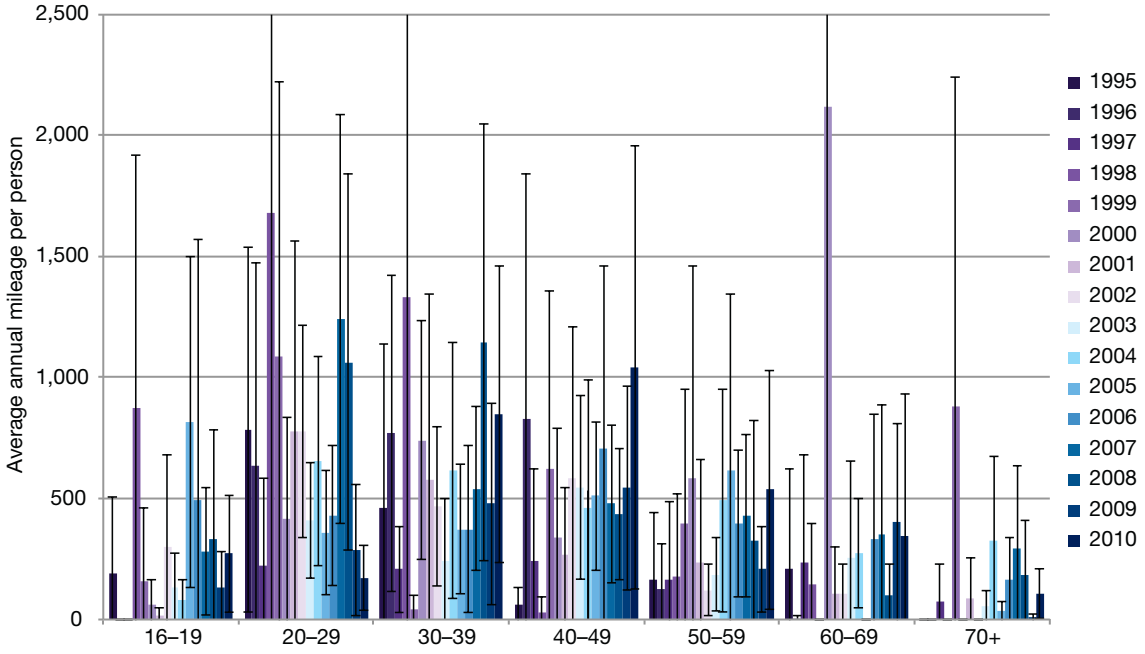
Source: NTS (error bars: 95% confidence interval)

Figure 3.17: Average annual rail mileage (men) estimated by the SHS, by age group



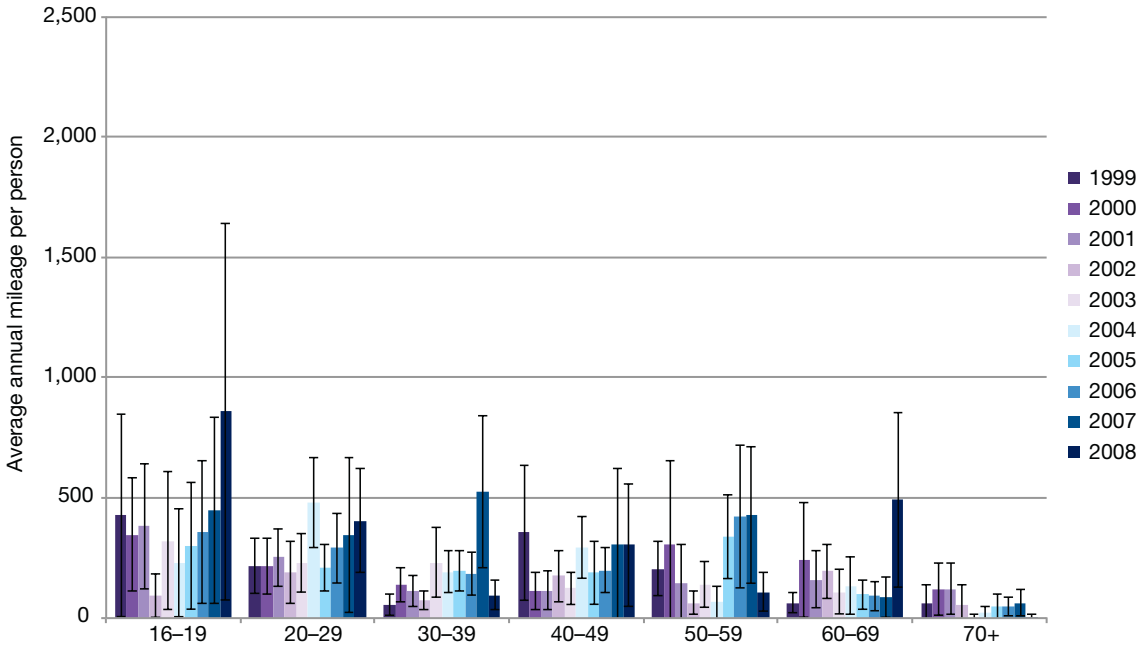
Source: SHS (error bars: 95% confidence interval)

Figure 3.18: Average annual rail mileage (men) estimated by the NTS, by age group



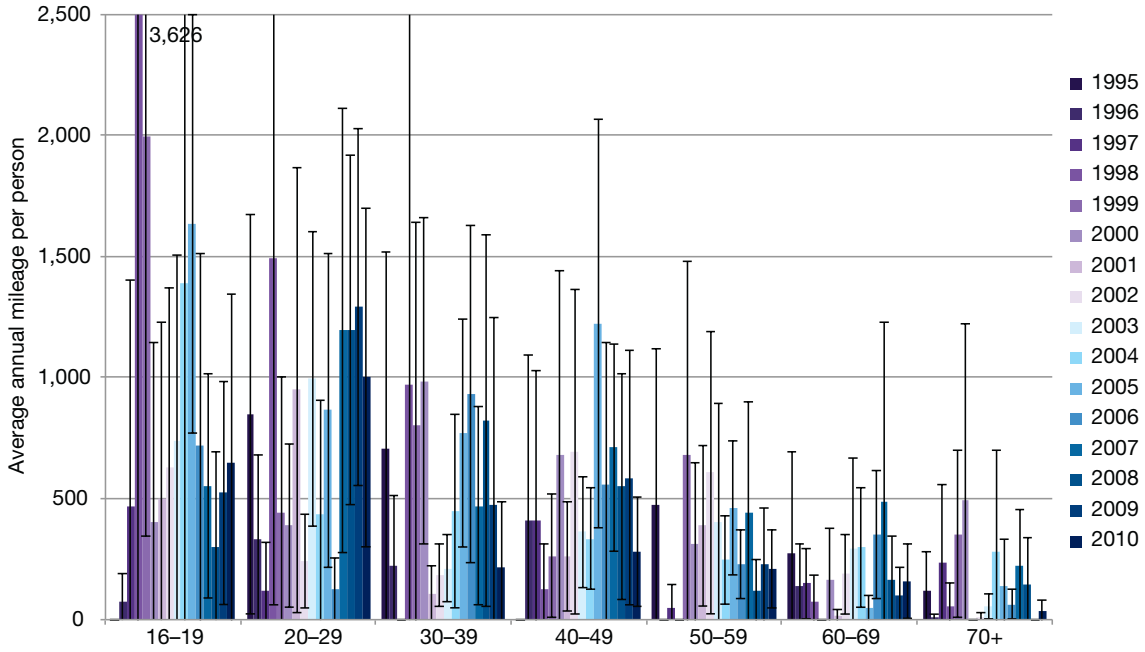
Source: NTS (error bars: 95% confidence interval)

Figure 3.19: Average annual rail mileage (women) estimated by the SHS, by age group



Source: SHS (error bars: 95% confidence interval)

Figure 3.20: Average annual rail mileage (women) estimated by the NTS, by age group



Source: NTS (error bars: 95% confidence interval)

3.5 Comparison of NTS and SHS: travel by purpose

In this section we compare the breakdown of journey purpose between the NTS and SHS travel diary datasets, for car, bus and rail travel.

There is an important difference in how journey purposes are captured in the two surveys. NTS respondents write onto their paper travel diary the purpose of each of their journeys in their own words, and these are subsequently processed into standard journey purposes. When an NTS interviewer picks up a respondent's travel diary at the end of their diary week, they take the opportunity to quickly check it over and have the opportunity to ask the respondent to clarify any ambiguous journey purpose information at that point. SHS respondents, by contrast, select the purposes of their journeys from a list on the screen of their interviewer's laptop computer.

Many different journey purposes are found in each of the two datasets – 29 in the SHS and up to 23 in the NTS (as noted previously, the NTS's less complex 15-purpose classification was used for this study). Results are presented here in more aggregate classes of journey purposes, using the following combinations (cf. section 2.10):

For the NTS:

- **Escort** – this consists of the NTS categories Escort-to-education and Escort-to-all-other
- **Other social/leisure** – Visit friends/relatives (not at private homes), Entertainment/public activity, Participate in sport, Holiday base, Day trip, Other including just walk
- **Shopping** – Food shopping, Non-food-shopping
- **Education** – the same as the NTS category
- **Commuting** – same
- **Business** – same
- **Personal business** – same
- **Visit friends/relatives at private homes** – same

For the SHS:

- **Commuting** – same
- **Other social/leisure** – Eating/drinking (not alone or at work), Entertainment/other public activities, Participating in sport, Coming/going on holiday, Day trip, Other not coded
- **Shopping** – same
- **Visit friends/relatives** – same[12]
- **Education** – same

12 It should be noted that the 'visit friends/relatives' purpose in the SHS does not explicitly exclude visiting friends/relatives at out-of-home places. If a person made a journey, for instance, to a pub where they saw friends/relatives, it would be up to their interpretation to decide whether it was a 'visit friends/relatives' journey or an 'eating/drinking (not alone or at work)' journey.
A cursory review of the types of places visited for SHS 'visit friends/relatives' journeys found that nearly all were made to/from private homes. Therefore, this purpose was treated as analogous to the NTS purpose 'visit friends/relatives at private homes' in the analysis in this section.

- **Personal business** – Visit hospital or health, Eating/drinking alone or at work, Other personal business
- **Escort** – Escort-to-home, Escort-to-work, Escort-in-course-of-work, Escort-to-education, Escort-to-shops, Escort-to-personal-business, Escort-to-other
- **Business** – same
- **Return home** – same

Table 3.5 shows the breakdown by purpose of average annual car-driving mileage per adult, for the SHS and NTS respectively. Data from all years from 1999 to 2008 is averaged in order to minimise noise. The closest correspondence between the SHS and NTS (for a major purpose) is for 'Commuting', where the SHS estimate is 73% of the NTS estimate. At the other end of the spectrum, only 44% as much driving mileage is recorded for 'Escort' purposes, and 51% for 'Business' and 'Visit friends/relatives' purposes.

Table 3.5: Car-driving mileage per adult per year by journey purpose, averaged across all years 1999 to 2008, estimated from SHS and NTS, showing ratios between the two surveys

	Commuting	Other social/ leisure	Shopping	Visit friends / relatives	Education	Personal business	Escort	Business (in course of work)	Return home (only 2007/8)
SHS	828 (9)	396 (8)	362 (5)	286 (6)	27 (1)	227 (5)	191 (4)	288 (8)	180 (7)
NTS	1,127 (27)	701 (23)	596 (12)	563 (18)	39 (5)	340 (12)	439 (15)	580 (30)	–
Ratio (SHS/ NTS)	73%	56%	61%	51%	69%	67%	44%	50%	–

Source: NTS and SHS, as noted (standard errors in brackets)

Table 3.6 shows the same information, but for bus mileage rather than car driving. Here there is a larger discrepancy (67% for bus, as compared with 44% for car driving) between what the NTS and SHS are estimating for the 'Other social/leisure' category, and the gap for 'Commuting' is larger as well. The SHS estimate for 'Education' mileage is just over half (53%) of the NTS estimate.

Table 3.6: Bus mileage per adult per year by journey purpose, averaged across all years 1999 to 2008, estimated from SHS and NTS, showing ratios between the two surveys

	Commuting	Other social/ leisure	Shopping	Visit friends / relatives	Education	Personal business	Escort	Business (in course of work)	Return home (only 2007/8)
SHS	85 (2)	40 (2)	72 (2)	34 (2)	20 (1)	27 (1)	9 (1)	4 (1)	16 (1)
NTS	153 (9)	123 (10)	122 (5)	61 (5)	38 (4)	40 (4)	6 (1)	5 (1)	–
Ratio (SHS/ NTS)	56%	33%	59%	55%	53%	68%	140%	83%	–

Source: NTS and SHS, as noted (standard errors in brackets)

Table 3.7 presents the results of the SHS/NTS comparison for rail mileage, and we see that for 'Commuting', the difference between the SHS and NTS estimated annual mileage is larger still, at 54%. The SHS estimate of travel to 'Visit friends and relatives' is only 26% of the NTS estimate. The NTS defines this journey purpose as visiting only at private homes, whereas the SHS definition does not specify where the visit could take place. However, this difference in definition cannot in itself explain why the SHS estimate is so much lower than the NTS estimate.

Table 3.7: Rail mileage per adult per year by journey purpose, averaged across all years 1999 to 2008, estimated from SHS and NTS, showing ratios between the two surveys

	Commuting	Other social/ leisure	Shopping	Visit friends / relatives	Education	Personal business	Escort	Business (in course of work)	Return home (only 2007/8)
SHS	61 (3)	34 (3)	22 (2)	20 (2)	16 (1)	18 (2)	9 (2)	18 (3)	247 (24)
NTS	132 (11)	103 (11)	50 (7)	79 (10)	22 (4)	24 (5)	(2)	48 (7)	–
Ratio (SHS/ NTS)	46%	33%	46%	26%	72%	76%	297%	37%	–

Source: NTS and SHS, as noted (standard errors in brackets)

3.6 Comparison of NTS and SHS: company car ownership

A key feature of the NTS travel diary is that it records which car is used for each car journey that people report. It distinguishes between whether a person uses their 'own' car (one that they drive more than anyone else), another household car, a company car, or a non-household car (see section 2.11.1 for definition) for each of their car journeys. It was this rather unique design feature of the NTS that made it possible in the *On the Move* study to identify the important contribution of company car usage to overall changes in car-driving levels.

The SHS diary does not record car use in this level of detail; it records whether a traveller is a car driver or a car passenger, but not the specific car in which they undertook their journey.

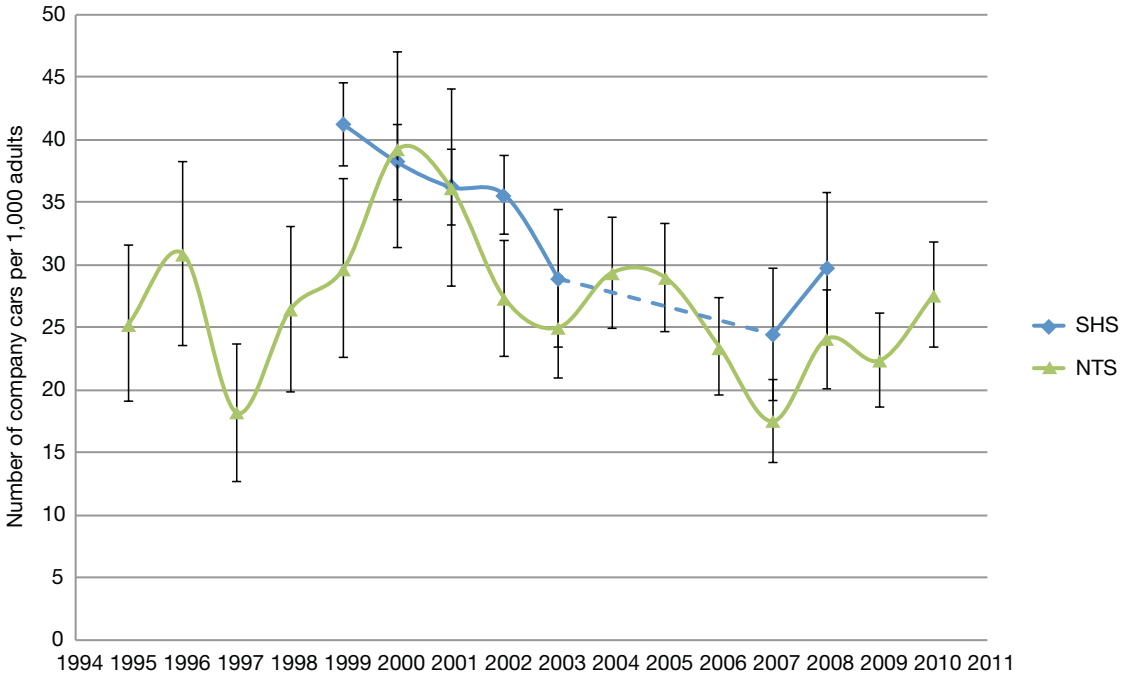
Changing the SHS to identify car use by vehicle, in the way in which the NTS does, would require substantially more of the respondents' time, which may make it impractical, given that the SHS is a general-purpose social survey, with personal travel only one of several topics covered.

However, even if it does not prove feasible to revise the SHS diary instrument to track car usage at the level of the individual vehicle as the NTS does, it would be useful for the SHS to ask car-owning respondents whether they own a company car or not. This can be done by means of a low-burden interview question; one has been included in the SHS in most years since it was first collected in 1999, but not all. As of 2012 it is asked on a biennial basis.

Figure 3.21 shows the trend over time in company car ownership as estimated from the SHS data, with the NTS data plotted alongside it. In 1999 to 2003, households responding to the SHS were asked, regarding each car they own, whether it is owned (or leased) privately or is a company car. In 2007 and 2008, randomly selected adults in part of the SHS sample are asked about company car ownership. What is more, only adults selected at random who are in employment *and* who report that they usually drive to work are asked about company car ownership. Therefore it is not known whether a person has a company car if they say they do not usually drive to work. Thus the data from 2007 and 2008 is not directly comparable to that from earlier years. The current SHS (2012) enquires about company car ownership in the same way.

What can be seen from Figure 3.21 is that the SHS broadly concurs with the NTS in showing that a sustained fall in company car ownership took place in Scotland in the early 2000s.

Figure 3.21: Company cars per 1,000 adults (Scottish residents)



Source: NTS and SHS (error bars: 95% confidence interval)

According to the NTS data, approximately 95% of the car-driving mileage of Scottish company car drivers is covered in a company car (as opposed to a personal car or a non-household car). Conversely, less than 1% of driving mileage by people who do not have their own company car is carried out in other household members' company cars. So knowing whether an SHS respondent is a company car driver, and how much they drive, should provide a reasonable estimate of company car usage, although this relationship may not continue to be stable over time.

It would be desirable to ask whether any of the vehicles kept by households responding to the SHS are company cars, which would mean a marginally higher level of respondent burden than the current practice of asking about company car ownership at the random-adult level. It would be useful to know the degree to which having a company car in a household affects the travel patterns not only of its main driver, but also in terms of its impact on the mobility of other household members.

It also seems desirable to remove the routing that restricts the company car question to only those adults who report that they usually drive to work. There will be a small number of respondents who have a company car but report that they do not usually drive to work, and their characteristics would be worth knowing.

Finally, attention should be paid to the distinction between a company car that is registered to one's employer but available for private use (sometimes with free fuel provided as well), and other company-owned vehicles that are only to be used for business purposes, such as work vans.

3.7 Suggestions for modifying the SHS design

This section discusses possible updates to the SHS instrument, to account for changing demands on the SHS data.

3.7.1 A simplified weighting scheme

As was seen in section 3.1, the weighting methods applied to the SHS travel diary data result in a wider distribution of weights than is used for the NTS. The practical implication of this is that, particularly for minor modes such as rail, a small number of journeys with high weights can have a very large impact on overall average mileage estimates. To avoid this distorting effect, it would be useful to review the SHS's weighting protocol to see whether it would be possible to prepare, in addition to the standard weights as currently prepared, a simplified weighting scheme. Such a simplified weighting scheme would correct for fewer types of sampling bias, and trade this loss off against the gain of yielding fewer weights that are very large, thus rendering it less sensitive to outlier datapoints and thus more stable.

3.7.2 A longer-duration diary for long-distance journeys

A second way of addressing this issue would be to focus, rather than on the weighting, on the recording of long-distance journeys, by recording these generally infrequent events over a longer time period. Respondents could be asked about any long-distance journeys (e.g. those above, say, 100 miles in length) that they have made within (for instance) the previous week. As only a small proportion of respondents will have undertaken long-distance journeys, the level of additional respondent burden will be modest. A hybrid methodology could then be developed for calculating average annual mileage that makes use of the one-day standard diary and the seven-day long-distance diary.

3.7.3 Improved tracking of childrens' travel patterns

An increasingly relevant issue, one that spans both transport and public health, is in which ways and how much children travel – particularly their usage of active forms of transport. Only adults complete SHS travel diaries at present, so children's travel is not comprehensively recorded. The SHS asks only about the methods of transport used for journeys to and from school for one randomly selected schoolchild in each respondent household. This amounts to an important gap in the SHS.

3.7.4 Questions on frequency of use of transport modes

The SHS's single-day travel diary means that day-to-day variability in people's travel is not covered. Transport analysts are increasingly sensitive to this issue, which can be particularly important when policies are under consideration that would encourage people to occasionally use modes of transport other than personal car. The ideal way to track such behaviour is through a multi-day diary, though another option (subject to different kinds of biases) is to make use of questions (some of which are already asked in the SHS) which ask people about the frequency of their use of various forms of travel. An advantage of the latter option is that it would be possible to better track usage levels of modes for which even a multi-day diary is insufficient, such as aviation.

3.7.5 Increased tracking of travel data of all household members

As the SHS diary is completed only by a single adult respondent per household, it does not allow study of within-household dynamics in travel patterns. The optimal way to do so would be to collect two (or more) travel diaries from multi-adult households, but this would involve substantially more response-burden-per-household and could lead to a lower response rate. A second-best option would be to ensure that certain structural questions about mobility (e.g. licence-holding, whether each person has access to their own personal car, whether they own public transport season tickets, their frequency of modal use) are asked of all adults, rather than the randomly selected adult only.

3.7.6 Questions regarding reasons for not driving

As driving by young people seems to have fallen over time, the Scottish government may wish to monitor this trend more closely. A simple option for achieving this would be to add several interview questions (implying some additional response burden) that ask the reasons for which non-drivers have not acquired a driving licence, as the NTS recently began doing (see Figure 2.11). The SHS included questions along these lines in years past, but since 2001 has not done so. Questions about the learning-to-drive process, such as whether one has taken the theory or practical tests and failed (and when), would be very useful in understanding this transition process more fully than can now be done with the NTS or SHS. An additional set of questions could also be considered, enquiring, for instance, about young people's expectations for their lifestyle and travel in the future.

3.7.7 Shared mobility

'Shared mobility' (in the form of car hire, car clubs, lift sharing, bike sharing, and the like) is becoming increasingly important, both in terms of sustainable travel patterns and in the allocation of resources by Transport Scotland, which is a major sponsor of the development of car clubs in Scotland. It thus makes sense to consider questions in the SHS about subscription to and usage of shared-mobility services, to better understand how these schemes are developing and being used. Users tend to only use these services on an occasional basis, however, making it more valuable to have a multi-day travel diary, or a question about frequency of use.

3.7.8 Additional considerations

As the SHS travel diary dataset has different properties from the NTS, it will be necessary for certain applications (e.g. carbon accounting) to better understand how well the SHS captures different types of travel, and to distinguish between trends in travel patterns and trend breaks that arise from switching from the NTS to the SHS – and from one SHS contractor to another. The 14-year overlap (1999 to 2012) between the two datasets will be helpful in this regard, as will be comparing future trends in the SHS against other data sources, such as road traffic counts and public transport ticket sales, as well as trends observed in the NTS in English regions with similar spatial and population characteristics.

It is important to keep in mind that the British NTS is not the only feasible alternative to the SHS; other design options include GPS-based tracking, telephone interviews, two-day travel diaries, and so forth. The NTS itself is also not an error-free time series: a redesign of the diary instrument in 2007 seemed to lead to a higher level of under-reporting of short trips that year, for instance. The SHS will inevitably not be perfect either, but the NTS is not necessarily the standard to judge it against. What the SHS needs to do is provide data to answer the questions that it is required – and resourced – to answer.

4. Assessment of Links Between Internet Usage and Travel Trends

One of the strengths of the SHS (Scottish Household Survey) is that in addition to travel diary data it also collects fairly detailed information on other aspects of people's activities and lifestyles, well beyond what is gathered in the NTS (National Travel Survey). An area of particular interest in recent years is the relationship between physical travel and online (or virtual) activity.

The SHS's unique design allows us to investigate the issue of physical and online activity in depth, as respondents complete a one-day travel diary and also provide detailed information about their online activities. As described below, the data used in this analysis is from 2005 and 2006, which means that much has since changed in how people make use of the Internet.

4.1 Overview of SHS data on virtual activities

The analysis reported in this section uses data from the 2005/6 edition of the SHS, for several reasons. It is the most recent set of available SHS data that is not recession-affected. Moreover, the 2007/8 edition of the SHS, the most recent available, did not ask how much time people spend online per week, which was found to be an important piece of information. But, as the 2005/6 data is several years old, it does not include some recent trends in online activity. It asks about use of chat rooms, for instance, rather than online social networking such as Facebook.

It is possible in principle to prepare a time series of telecommunications usage as recorded in the SHS. However, the questions have varied over time since 1999 as the Internet has evolved, so for the purposes of this study it was decided to perform a cross-sectional analysis using the 2005/6 data. A logical next step would be to undertake a more in-depth time-series analysis with the complexities that that implies.

The SHS's detailed questions about Internet use are asked of adults only (and only of one adult per household – the same adult who is selected to complete

a travel diary). It must also be noted that the line of questioning in the 2005/6 SHS about participation in online activities asks explicitly about *personal* Internet usage, to the exclusion of *business activity*.[13] Further, the questions about online-activity participation ask respondents to indicate whether they have "ever participated" in each one of the list of online activities, which is a rather broad question and does not necessarily imply that they continue to take part in those activities, nor that they ever carried them out on a regular basis.

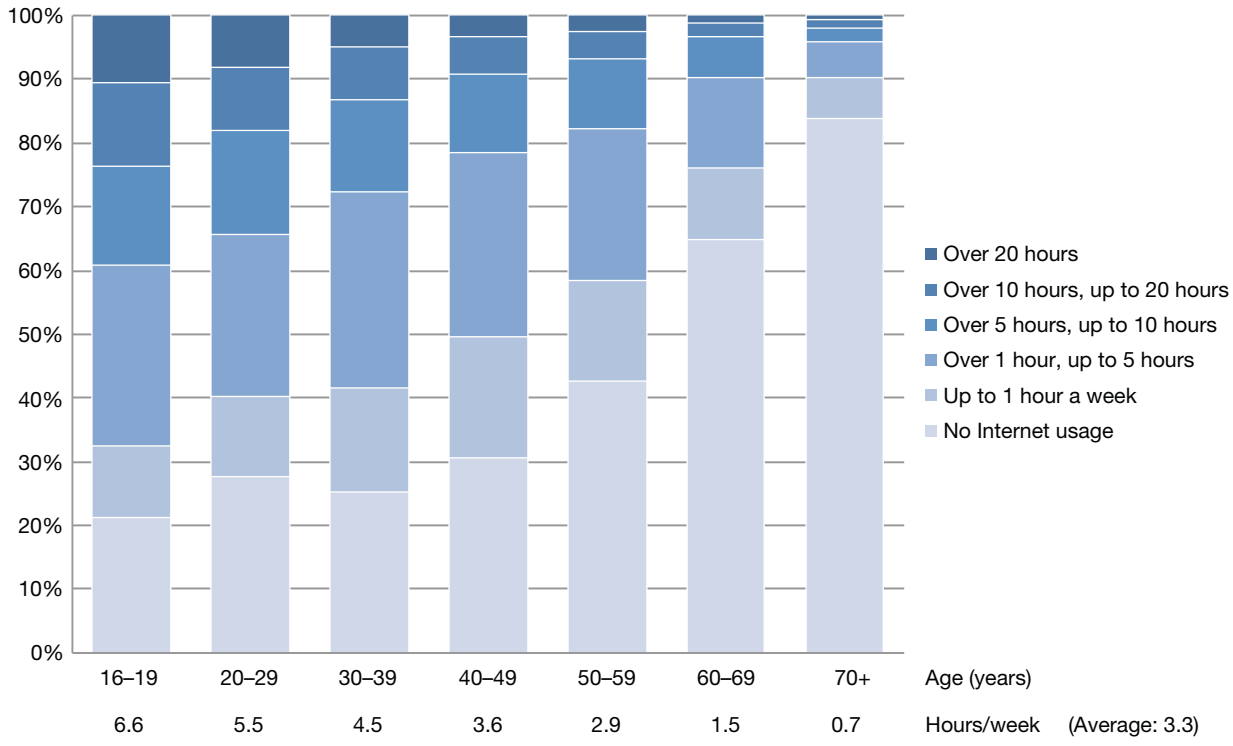
4.2 Time spent on the Internet

Figures 4.1 and 4.2 show the breakdown of time spent on the Internet per week for men and women respectively.

For both sexes, time spent online is highest amongst teenagers, and decreases with age.

Men report spending more time online; the average for men across all age groups is 3.3 hours per week, as against 2.2 hours for women. The percentage of men who do not use the Internet at all is also lower: 44% vs 50%.

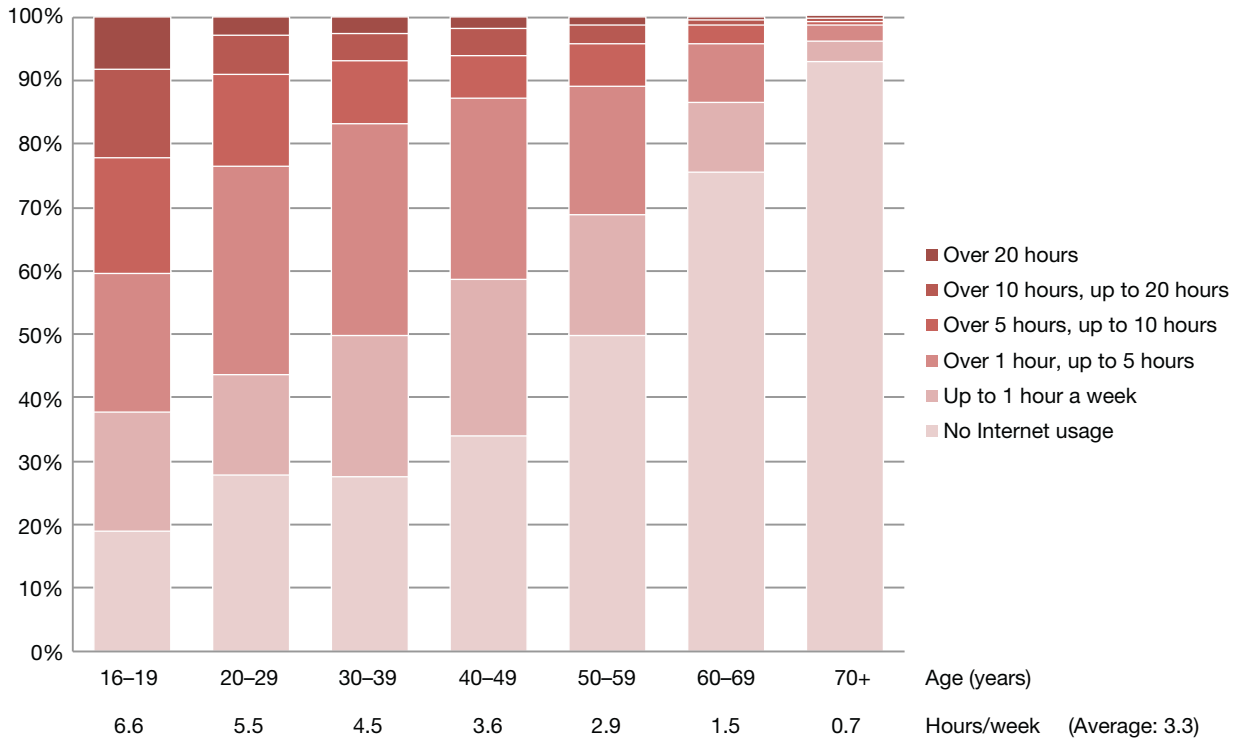
Figure 4.1: Time spent online per week by men, by age group



Source: SHS

13 The current practice (as per the 2012 SHS questionnaire) is to ask respondents to indicate separately whether they use the Internet for personal purposes and for work, but they are not asked to provide any breakdown of the work activities which they carry out online.

Figure 4.2: Time spent online per week by women, by age group



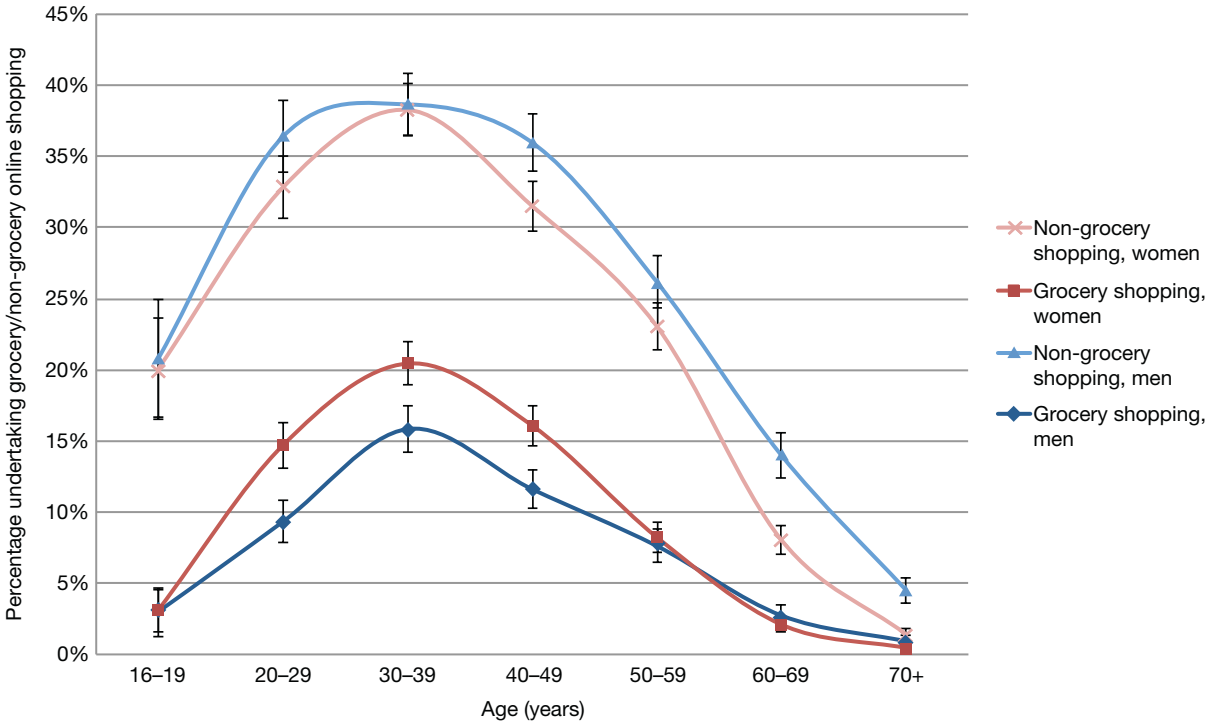
Source: SHS

4.3 Demographic patterns of online shopping activity

This section looks at how usage of online shopping varies by a set of sociodemographic variables.

Figure 4.3 shows online shopping patterns for men and women, by age grouping. In all groups, more people (in most cases at least twice as many) take part in online shopping for non-grocery items than for food. For both sexes, the highest level of participation in online shopping is not amongst teenagers – as with time spent online – but rather amongst people in their 30s. Men generally take part in online shopping for items other than food at a higher rate than women, but the opposite is true when it comes to shopping for food online.

Figure 4.3: Percentage of men and women who shop online for food and other items, by age group

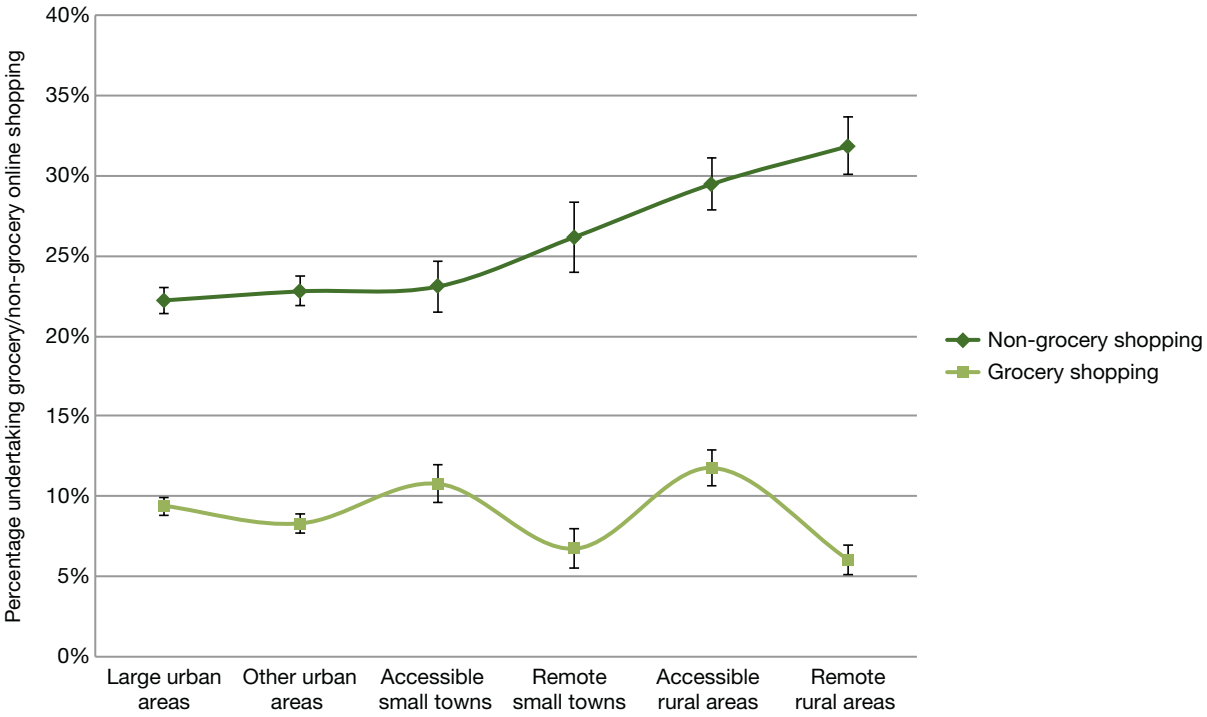


Source: SHS (error bars: 95% confidence interval)

Figure 4.4 shows how participation in online shopping varies with city size, and reveals some interesting relationships. Shopping for non-food items is most common in rural areas and least common in the largest cities. But for food shopping, on the other hand, the relationship is different. The rate for food shopping seems to either be stable across the area types, or perhaps to decrease slightly as one moves from the large cities towards rural areas. A point worth noting is that in areas of Scotland away from the Central Belt[14] there can be additional delivery charges beyond the standard rates, which would serve to discourage use of online ordering in remote areas.

14 The Central Belt is the part of Scotland that stretches from Glasgow in the west to Edinburgh in the east, and contains the majority of the population. The region varies greatly, from the cities of Glasgow and Edinburgh to the rural areas of the South Region.

Figure 4.4: Percentage of adults who shop online for food and other items, by settlement size

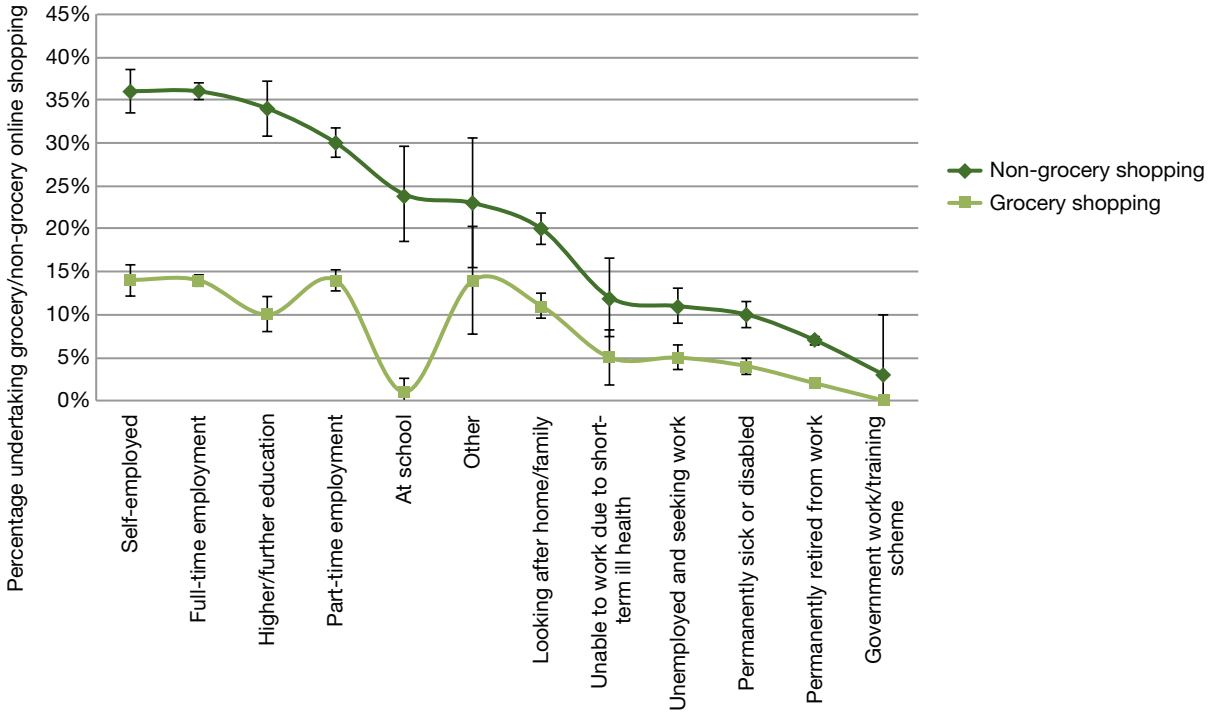


Source: SHS (error bars: 95% confidence interval)

Figure 4.5 shows how online shopping varies by economic status. The highest participation rates for both types of online shopping are amongst self-employed and other full-time-employed people. Amongst those working part-time, the percentage who take part in non-food shopping is lower by about five percentage points, but about the same as full-time workers for buying food online.

Amongst young adults in school (nearly all of whom are aged 16 and 17, as opposed to those in higher education that tend to be somewhat older) the pattern is different to that observed for most other groups. For young people in school their rate of online food shopping is low (below 2%) but the rate of shopping for items other than food is fairly high. It is likely that they live in households where another (older) person, a parent perhaps, does most of the food shopping.

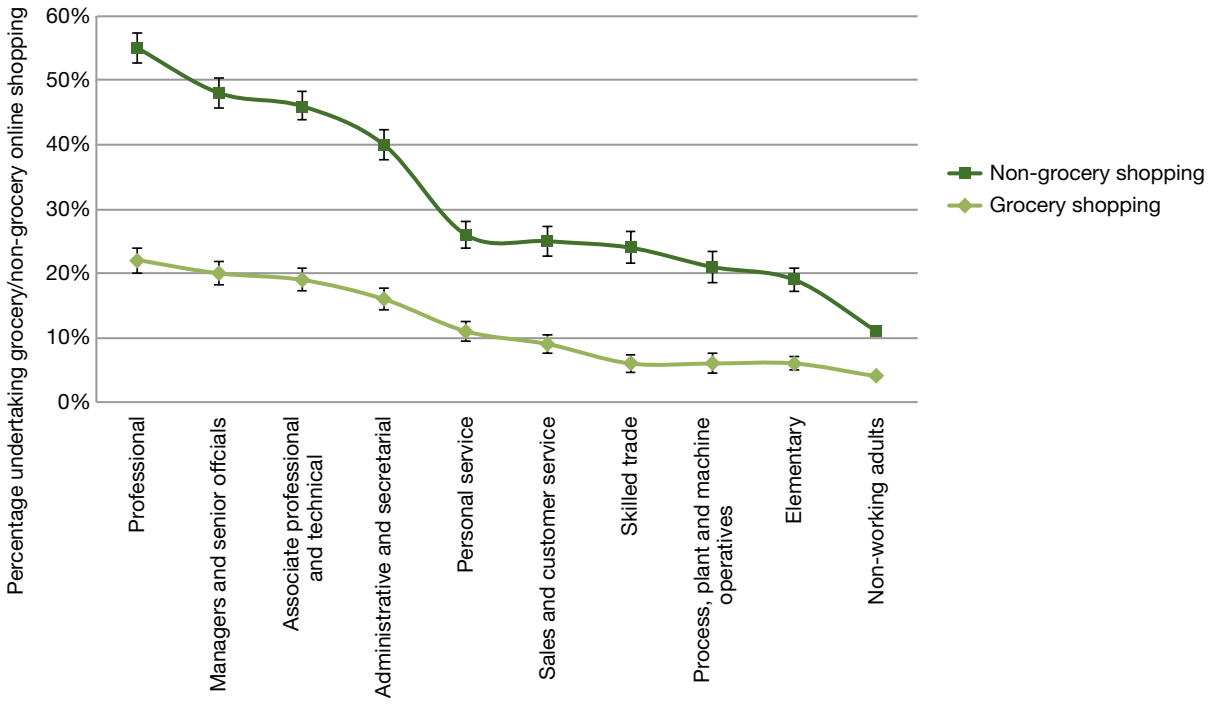
Figure 4.5: Percentage of adults who shop online for food and other items, by socioeconomic status



Source: SHS (error bars: 95% confidence interval)

Figure 4.6 shows how online shopping varies by the type of industry in which one works. Here we see similar trends for food and non-food shopping. Both are highest for workers in 'Professional occupations' and lowest for adults who do not work.

Figure 4.6: Percentage of adults who shop online for food and other items, by type of employment (Standard Occupational Classification)



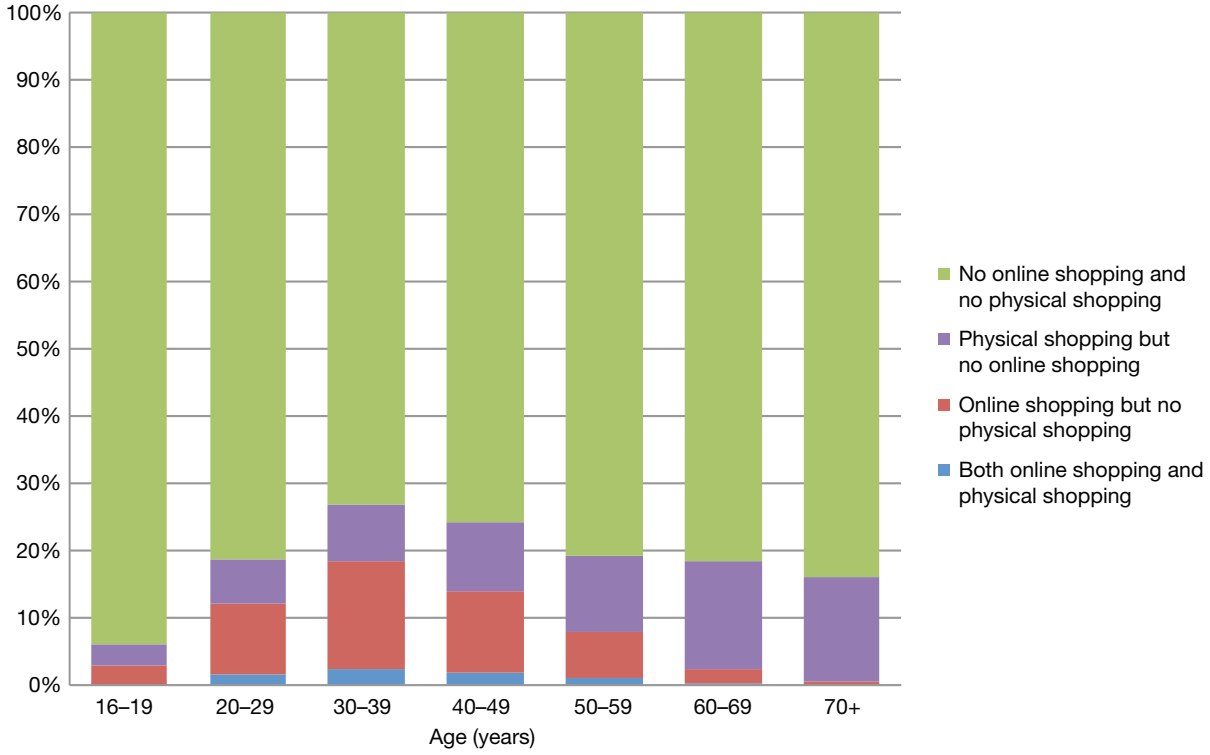
Source: SHS (error bars: 95% confidence interval)

4.4 Participation in physical and online shopping activity

In this section we look at the interrelationships between online and physical shopping. The first point to note is a data issue; physical shopping activities are observed in SHS respondents' one-day travel diaries, whilst the data regarding participation in online shopping comes from the answers to the SHS question about whether respondents *ever participated* in online shopping. What this means is that the absolute percentages in Figures 4.7 and 4.8 are not meaningful; only the differences between the age groups and between the two Figures are.

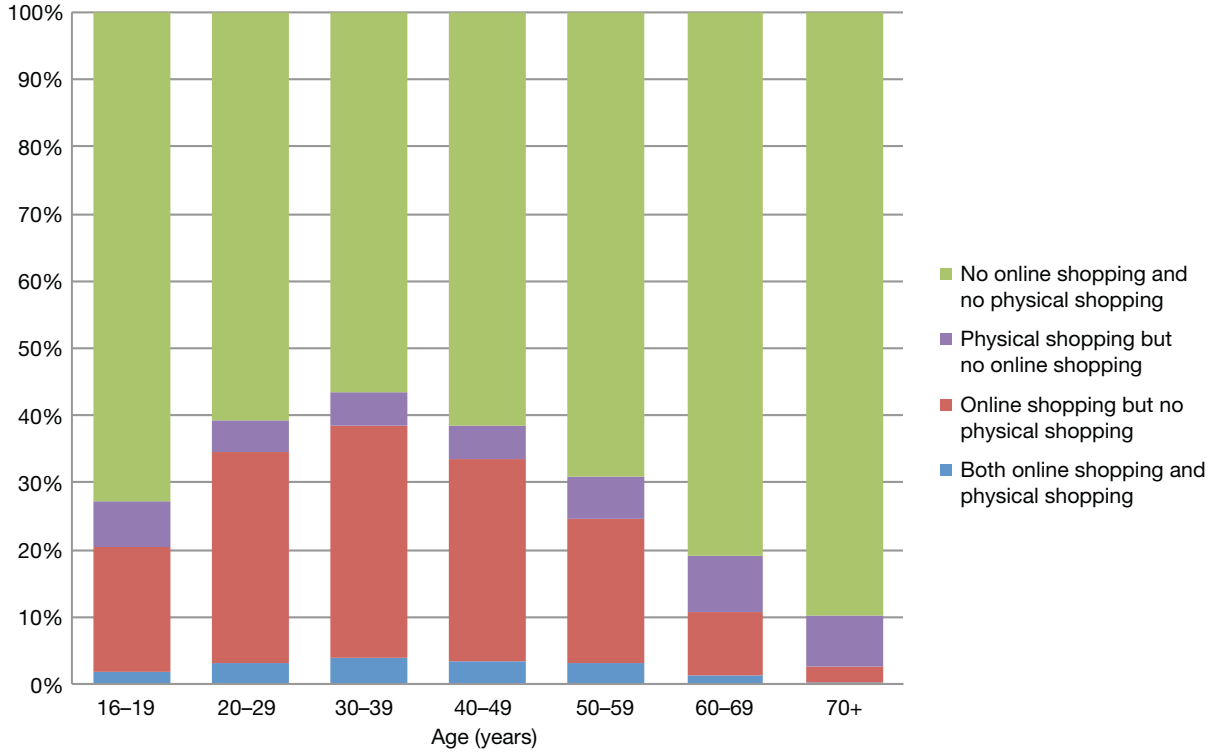
In Figure 4.7 it can be seen that older adults are the most likely among all ages to shop for their groceries only physically, whilst people in their 30s are the most likely to do so only online, or both online and physically. Figure 4.8 reveals similar patterns across age groups for non-grocery shopping, the largest difference (as compared to grocery shopping) being that it highlights that people (of all ages) are more likely to say they have shopped online for non-food items than for food. It can also be seen that the proportion of people who travel to shop for food on their SHS diary day (the 'physical shopping but no online shopping' category shown in purple) increases with age. This effect is also seen for non-food-shopping travel, but it is much weaker.

Figure 4.7: Participation in online and physical GROCERY shopping activities



Source: SHS

Figure 4.8: Participation in online and physical NON-GROCERY shopping activities



Source: SHS

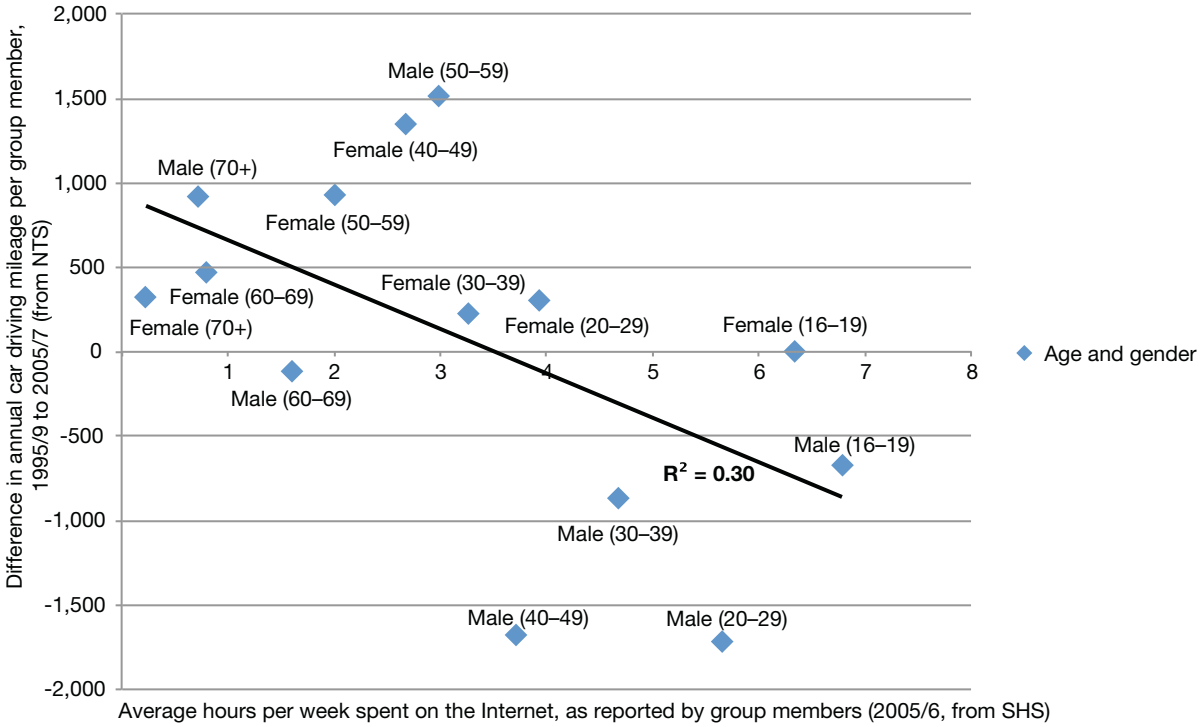
4.5 Relationship between online activity and licence-holding/car use

This section takes a more detailed look at the linkages between online activity and physical mobility.

The first analysis (Figure 4.9) investigates the relationship between how much time SHS respondents reported spending online in 2005/6 and the changes in car-driving mileage that occurred amongst people in the same age-sex group between 1995/9 and 2005/7, using the NTS. The NTS was used in Figure 4.9 to estimate the time-change in driving mileage, as data is available in a consistent time series from 1995, whereas the SHS began only in 1999.

What we see is a fairly strong (R^2=0.30) negative relationship between time spent online and growth in car use. The demographic groups whose driving increased tend to use the Internet less than the groups whose driving fell. The groups whose car use increased also tend to be older, however. Whilst it would appear that there is a relationship between car usage and time spent online from Figure 4.9, we cannot be sure of this because of potential confounding variables that are not taken account of here (e.g. income, type-of-employment, household-structure, etc). In the rest of this section we look at this relationship with a set of analyses that are more sensitive to such possibly confounding effects.

Figure 4.9: Relationship between time spent online (2005/6) and changes in car use (between 1995/9 and 2005/7), by age-sex group



Source: SHS and NTS

4.5.1 Segmentation of Internet use by type of online activity

The SHS asks adults whether they perform each of 17 types of online activities, which are listed in Table 4.1. In order to characterise patterns in the types of activities that people perform online, we defined four distinct segments of Internet users (using a k-means cluster analysis):

- people who are '**narrow**'[15] Internet users – on average they report that they have performed 3.2 of the online activities;
- people who are '**moderate**' Internet users (average of 4.8 online activities);
- people who are '**broad (with low levels of online leisure activities)**' Internet users, labelled henceforth as the '**broad (without leisure)**' segment (average of 8.3 online activities); and
- people who are '**broad (with high levels of online leisure activities)**' Internet users, labelled henceforth as the '**broad (with leisure)**' segment (average of 10.1 online activities).

15 The terms 'narrow', 'moderate' and (two variants of) 'broad' to describe breadth of online activity are used to avoid confusion with time spent online which might result from using words such as 'small', 'large', 'light' or 'heavy'.

Table 4.1 presents the details of how people in each of these four segments make use of the Internet, as well as their demographic profiles and mobility indicators, for these four segments and also for people who do not use the Internet.

Table 4.1: Segments of adults by level and type of online activity

Online activity	Non-users	Narrow Internet users	Moderate Internet users	Broad (without leisure) Internet users	Broad (with leisure) Internet users	Weighted average of Internet users
Using e-mail	–	71%	87%	99%	99%	87%
General browsing or surfing	–	62%	69%	91%	96%	77%
Finding information about goods/services	–	42%	65%	94%	92%	69%
Buying or ordering tickets and services	–	0%	100%	91%	85%	64%
Non-grocery shopping	–	17%	24%	87%	73%	45%
Finding information related to education	–	22%	27%	69%	79%	44%
Personal banking / financial / investment activities	–	13%	27%	76%	59%	40%
Using or accessing government/official sites	–	10%	14%	80%	59%	36%
Playing or downloading music	–	20%	20%	27%	96%	34%
Looking for work	–	15%	17%	39%	63%	29%
Playing or downloading games	–	14%	9%	6%	83%	22%
Online learning	–	10%	8%	30%	46%	20%
Grocery shopping	–	6%	10%	32%	29%	17%
Using chat rooms or sites	–	9%	5%	5%	43%	12%
Paying rent	–	0%	0%	1%	3%	1%
Voting	–	0%	0%	3%	3%	1%
None of these	–	4%	0%	0%	0%	1%

(Continued on next page)

Online activity	Non-users	Narrow Internet users	Moderate Internet users	Broad (without leisure) Internet users	Broad (with leisure) Internet users	Weighted average of Internet users
Average number of online-activity types performed	0	3.2	4.8	8.3	10.1	6.0
Average time spent online (hours per week)	0	3.8	3.8	5.5	9.2	5.1
Average age	58	42	43	43	33	41
Average annual driving mileage	1,689	3,296	4,479	5,032	3,448	4,081
Average annual bus mileage	335	329	243	206	374	282
Average annual rail mileage	97	195	326	471	388	332
Percentage with a full car driving licence	49%	70%	83%	90%	72%	79%
Cars per household	0.8	1.3	1.5	1.5	1.4	1.4
Percentage that are women[16]	59%	54%	56%	56%	40%	53%
Average annual household income	£15,795	£21,373	£26,775	£31,268	£27,017	£26,260
Percentage living in large urban areas	43%	34%	36%	39%	45%	38%
Percentage of full-time workers	21%	41%	51%	56%	55%	50%
Percentage of people in each cluster	56%	14%	12%	11%	7%	-

Source: SHS

Just over half (56%) of Scottish adults were not online in 2005/6, and they are the oldest on average of the segments shown in Table 4.1. They drive the lowest level of per-person mileage and also use rail the least, but are relatively heavy users of bus services. They have the lowest rates of licence-holding and household car ownership, the lowest household income levels, and the lowest rate (by far) of full-time employment; the membership of this segment also contains the highest proportion of females of any segment.

In the aggregate, 'narrow' Internet users perform the fewest online activities of any of the four segments, although there are several exceptions (e.g. 14%

16 The SHS sample of random adults was 56% female in 2005/6.

of them report downloading or playing games online, compared to only 9% of 'moderate' Internet users).

After people who do not use the Internet at all, those in the 'narrow' segment have the lowest average driving mileage and are licensed to drive at the lowest rate. People in the 'moderate' category have a higher rate of licence-holding and annual driving mileage and are about two years older on average than 'narrow' Internet users. Despite 'moderate' users performing more types of online activities, people in these two segments spend on average the same amount of time online (just under four hours per week).

The distinction between the 'moderate' and the two 'broad' classes of Internet use is more clear-cut. Compared with 'moderate' users, 'broad (without leisure)' Internet users spend nearly two more hours online per week, whilst 'broad (with leisure)' Internet users spend more than twice as much time online. The difference in terms of number of online activities is similarly sharp: four and five additional types of activities for the two 'broad' classes respectively.

The differences between the two types of 'broad' Internet users are most distinct for the three leisure types of online activities: playing games, listening to music, and chatting online.

Of the categories listed, the highest car-driving mileage is by the 'broad (without leisure)' segment. They also exhibit the highest rate of rail use, and lowest rate of bus use.

'Broad (with leisure)' Internet users have the youngest average age (33) of all five segments. They have lower rates of licence-holding (72%) and car mileage (3,448/year) than the 'moderate' and 'broad (without leisure)' classes, and have a greater tendency to live in cities and in households with lower car ownership levels than those of 'broad (without leisure)' and 'moderate' Internet users.

4.5.2 Segmentation of Internet use by time spent online

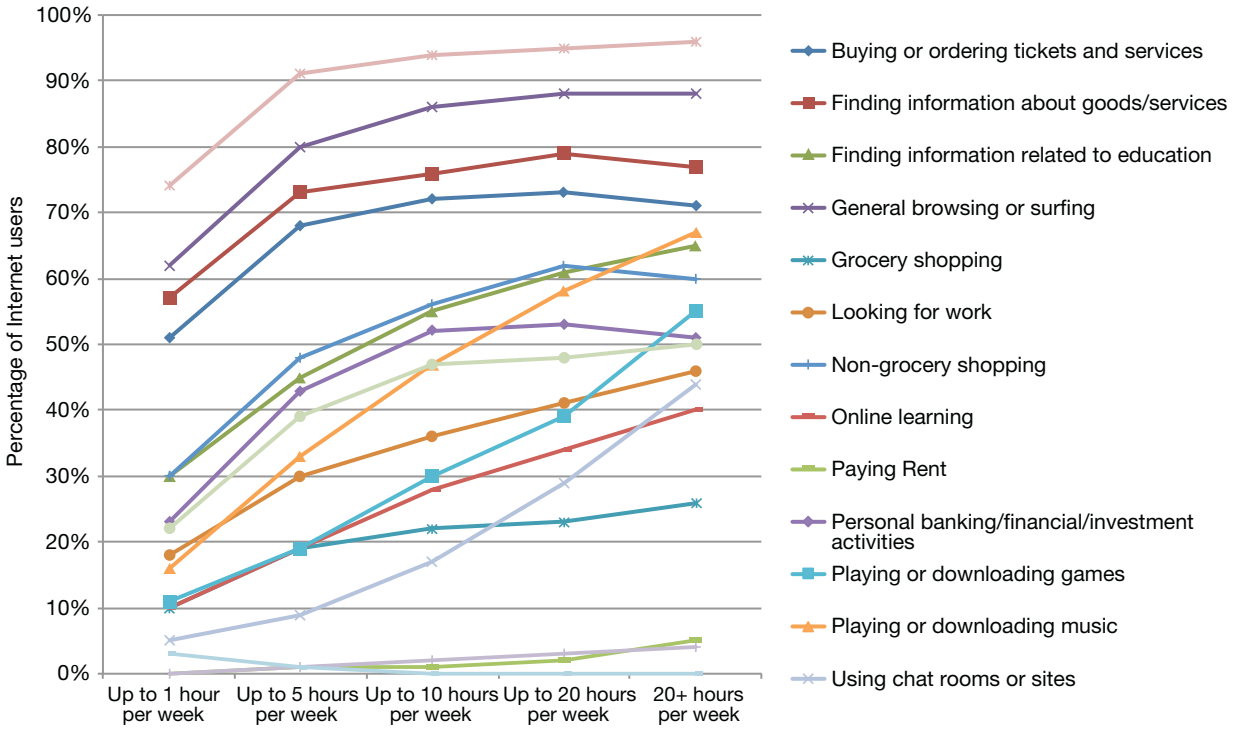
A second way of categorising Internet use is on the basis of how much time people report spending online per week. SHS respondents indicate which of the following bands best describes their online activity:

- No Internet use
- Up to 1 hour a week
- Over 1 hour, up to 5 hours
- Over 5 hours, up to 10 hours
- Over 10 hours, up to 20 hours
- Over 20 hours

Figure 4.10 shows the prevalence of the various online activities by the amount of time spent online per week. Table 4.2 shows the main characteristics of

these clusters, with Figure 4.10 showing graphically the same information as the top part of Table 4.2.

Figure 4.10: Percentage of Internet users within each segment (defined by time spent online) who perform each online activity



Source: SHS

Table 4.2: Segments of adults by time spent online

Online activity	Non-users	Up to 1 hour per week	Over 1 hour, up to 5 hours	Over 5 hours, up to 10 hours	Over 10 hours, up to 20 hours	Over 20 hours	Weighted average of Internet users
Using e-mail	–	74%	91%	94%	95%	96%	87%
General browsing or surfing	–	62%	80%	86%	88%	88%	77%
Finding information about goods/ services	–	57%	73%	76%	79%	77%	69%
Buying or ordering tickets and services	–	51%	68%	72%	73%	71%	64%
Non-grocery shopping	–	30%	48%	56%	62%	60%	46%
Finding information related to education	–	30%	45%	55%	61%	65%	45%
Personal banking / financial / investment activities	–	23%	43%	52%	53%	51%	40%
Using or accessing government/ official sites	–	22%	39%	47%	48%	50%	37%
Playing or downloading music	–	16%	33%	47%	58%	67%	34%
Looking for work	–	18%	30%	36%	41%	46%	29%
Playing or downloading games	–	11%	19%	30%	39%	55%	22%
Online learning	–	10%	19%	28%	34%	40%	20%
Grocery shopping	–	10%	19%	22%	23%	26%	18%
Using chat rooms or sites	–	5%	9%	17%	29%	44%	13%
Paying rent	–	0%	1%	1%	2%	5%	1%
Voting	–	0%	1%	2%	3%	4%	1%
None of these	–	3%	1%	0%	0%	0%	1%

(Continued on next page)

Online activity	Non-users	Up to 1 hour per week	Over 1 hour, up to 5 hours	Over 5 hours, up to 10 hours	Over 10 hours, up to 20 hours	Over 20 hours	Weighted average of Internet users
Statistic							
Average number of online-activity types performed	0	4.2	6.2	7.2	7.9	8.4	6.0
Average age	58	44	41	39	37	35	41
Average annual driving mileage	1,689	4,223	4,406	4,041	3,350	1,881	4,083
Average annual bus mileage	335	240	320	286	286	233	284
Average annual rail mileage	97	304	363	213	426	476	332
Percentage with a full car driving licence	49%	81%	82%	77%	73%	61%	79%
Cars per household	0.8	1.3	1.3	1.2	1.2	1.0	1.3
Percentage of women	57%	60%	54%	45%	44%	36%	53%
Average annual household income	£15,795	£25,151	£27,404	£26,444	£26,149	£22,599	£26,257
Percentage living in large urban areas	43%	34%	37%	41%	40%	46%	37%
Percentage of full-time workers	21%	49%	53%	50%	48%	36%	50%
Percentage of people in each cluster	56%	13%	18%	7%	4%	2%	–

Source: SHS

People who do not use the Internet are on average the oldest of these six groups. They have the lowest rates of licence-holding and household car ownership, and the lowest incomes. They drive and use rail the least, and use bus services the most.

Leaving non-users aside, amongst Internet users it is the heaviest users (i.e. those who spend 20 or more hours per week online) who have the lowest rate of household car ownership, full-time employment, and income. The proportions of these heavy users who live in urban areas and who are men are the highest among all segments, including non-users. They drive and use bus services the least (although non-users drive even less), but use rail the

most. Most of these effects trend more or less smoothly from the ‘up to 1 hour’ through to the ‘over 20 hours’ categories of time spent online per week.

Figures 4.11 and 4.12 show how licence-holding and driving mileage, respectively, relate to online activity. They show that ‘Broad (without leisure) Internet users’ tend to have the highest access to cars and have the highest rate of licence-holding, with ‘Narrow Internet users’ at the other end of the spectrum. Furthermore, both figures show a negative relationship between licence-holding/car-driving and time spent online.

The analysis up to this point of the relationship between mobility and online activity has not corrected for any of the sociodemographic differences between the various Internet user segments. The next section begins to do this, by taking account of these differences one at a time.

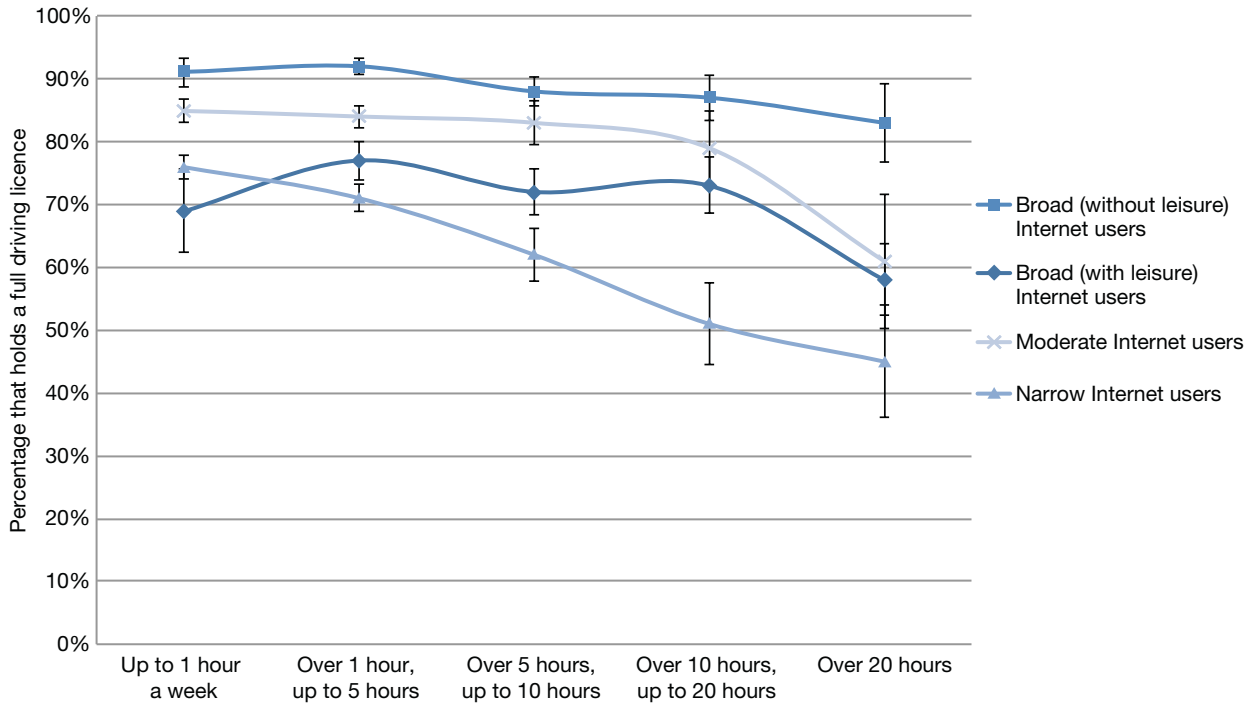
4.5.3 Cross-tabulation of two dimensions of Internet use (type of activity and time spent online)

Figures 4.11 and 4.12 break down Internet users by both of the two dimensions just described (types of activities performed online and time spent online), and look at the differences in driving licence holding and average car-driving mileage respectively.

What we find is that the ‘broad (without leisure)’ group is the most mobile of the segments defined by type of online use, a finding which holds across all classes of time spent online, and for both licence-holding and driving mileage. The least mobile of these segments at most levels of time spent online is the ‘narrow’ use category.

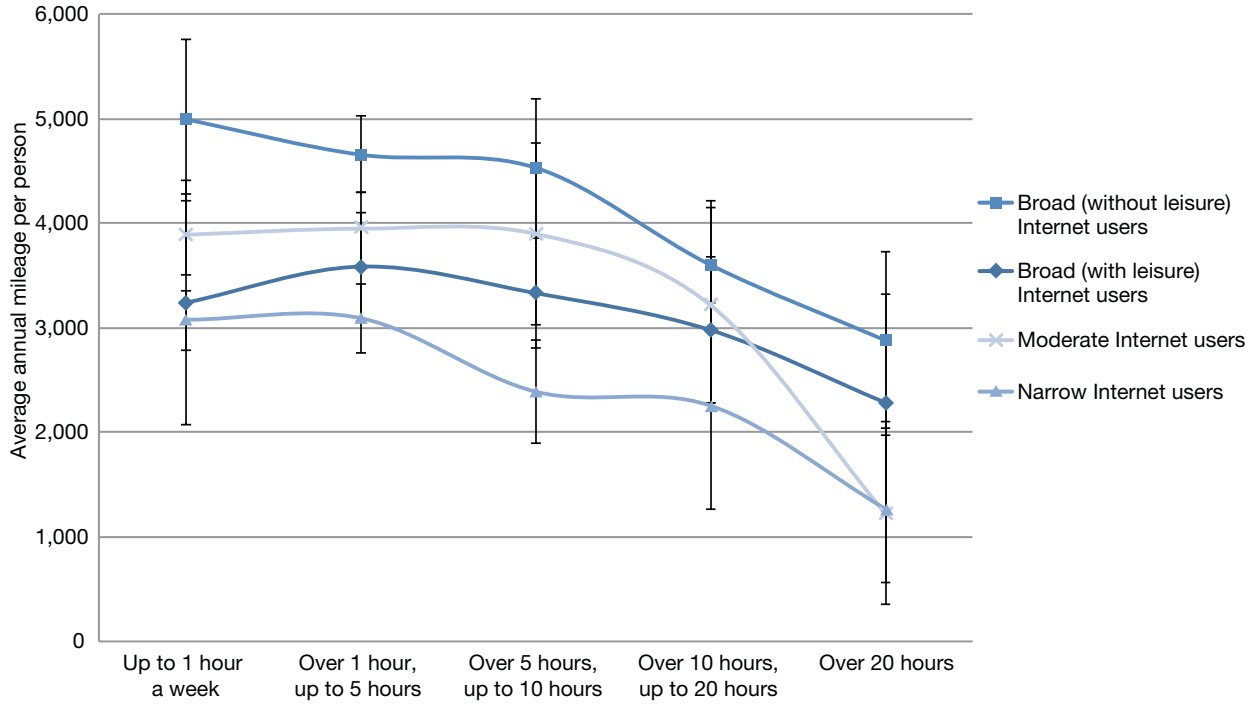
The tendency to exhibit lower rates of both licence-holding and driving mileage as one spends more time online can also be seen, a relationship which is particularly pronounced as one moves towards the right on the charts (i.e. at high levels of time spent online).

Figure 4.11: Percentage of people with a full driving licence, by Internet-usage segment and time spent online



Source: SHS (error bars: 95% confidence interval)

Figure 4.12: Average annual car-driving mileage, by Internet-usage segment and time spent online



Source: SHS (error bars: 95% confidence interval)

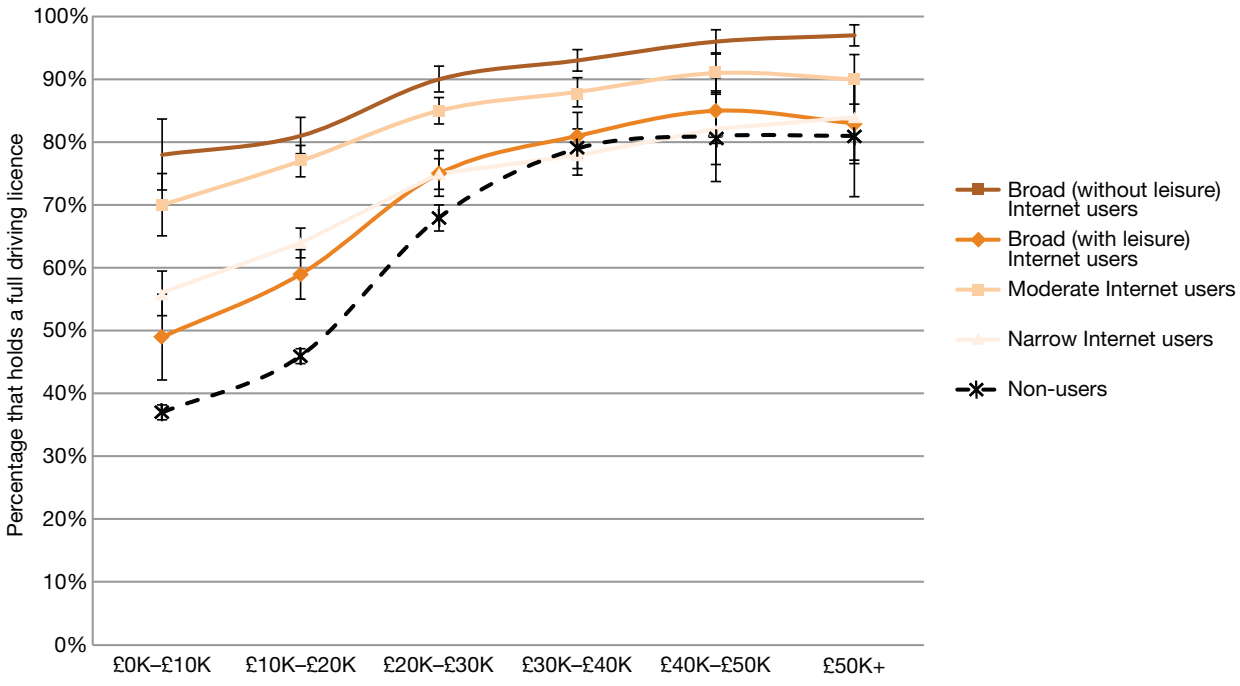
4.5.4 Distinguishing between demographic differences and effects linked to online activity

Owing to the large differences in the demographic profiles of the various segments of online activity, a question that needs to be addressed is whether the differences in the mobility indicators of the various segments are caused simply by those demographic differences, or whether they are somehow related to the use of the Internet itself.

Although the techniques employed in this study cannot provide a definitive answer as to whether, and if so how, the advent of the Internet is *causing* travel patterns to change, it is possible to take account of the sociodemographic differences and then see whether there remain effects that are apparently independent of them.

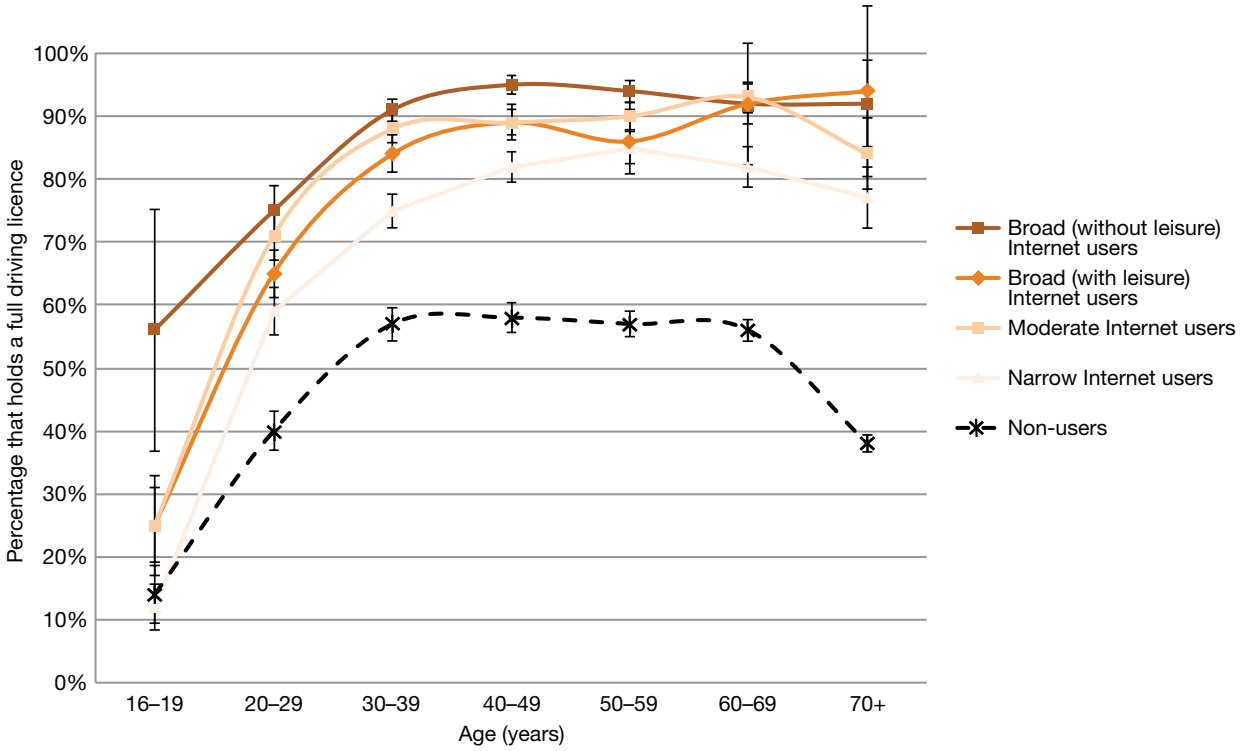
Figures 4.13 and 4.14 show how rates of licence-holding vary with the online-activity indicators, after separating out household income and age respectively. It can be seen that, in general, the high rate of licence-holding amongst the 'broad (without leisure)' segment holds after accounting, separately, for differences in licence-holding rates explicable by income and age.

Figure 4.13: Percentage of people with a full driving licence, by Internet-usage segment and household income level (2010 prices)



Source: SHS (error bars: 95% confidence interval)

Figure 4.14: Percentage of people with a full driving licence, by Internet-usage segment and age group



Source: SHS (error bars: 95% confidence interval)

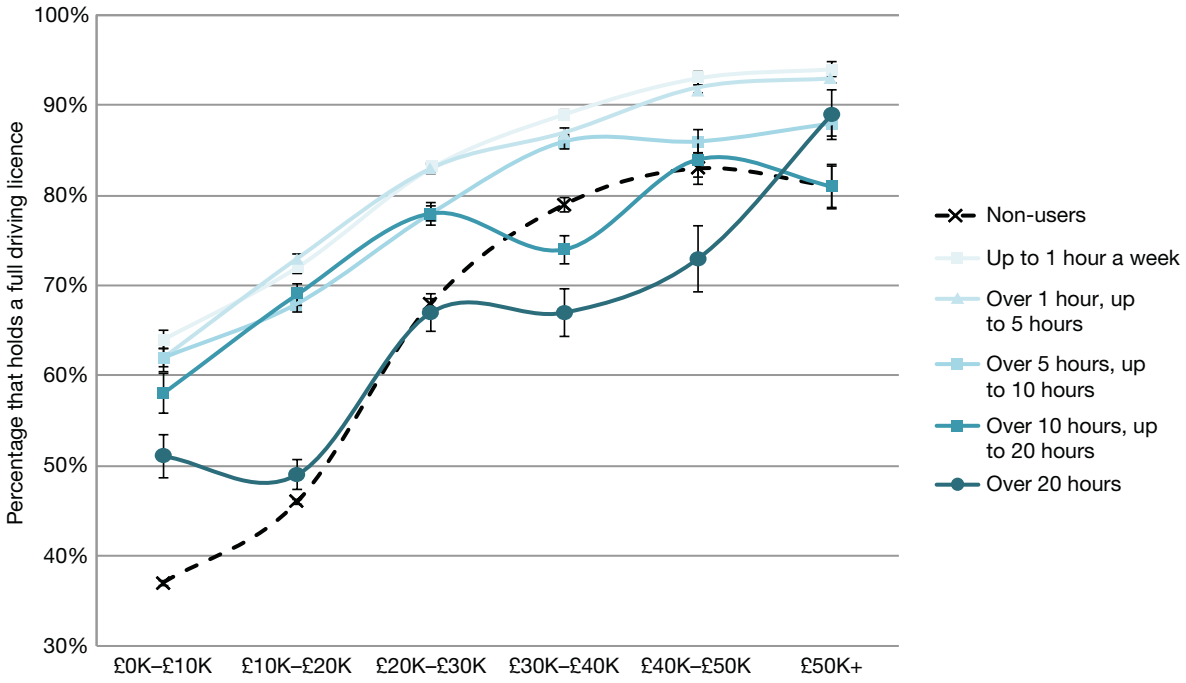
Figures 4.15 and 4.16 also show rates of licence-holding, but where Internet usage is characterised by time spent online rather than types of online activities performed. We see that the general trend is that spending large amounts of time online is associated with lower rates of licence-holding than spending small amounts of time online, even after accounting for people's income level or age. But, not being an Internet user at all is an even stronger predictor of not having a driving licence, after correcting for age (but not as clear when income is corrected for).

A similar set of analyses to those shown in Figures 4.13 to 4.16 were performed for car-driving mileage rather than licence-holding. The results (which are not included here in the interests of brevity) were broadly consistent, although noisier owing to car mileage having a higher degree of variability from person to person than whether they have a driving licence or not.

The findings in this section provide some evidence that the effects on mobility indicators apparently due to Internet usage may be more than a mere reflection of the fact that demographically different types of people use the Internet in different ways (if at all).

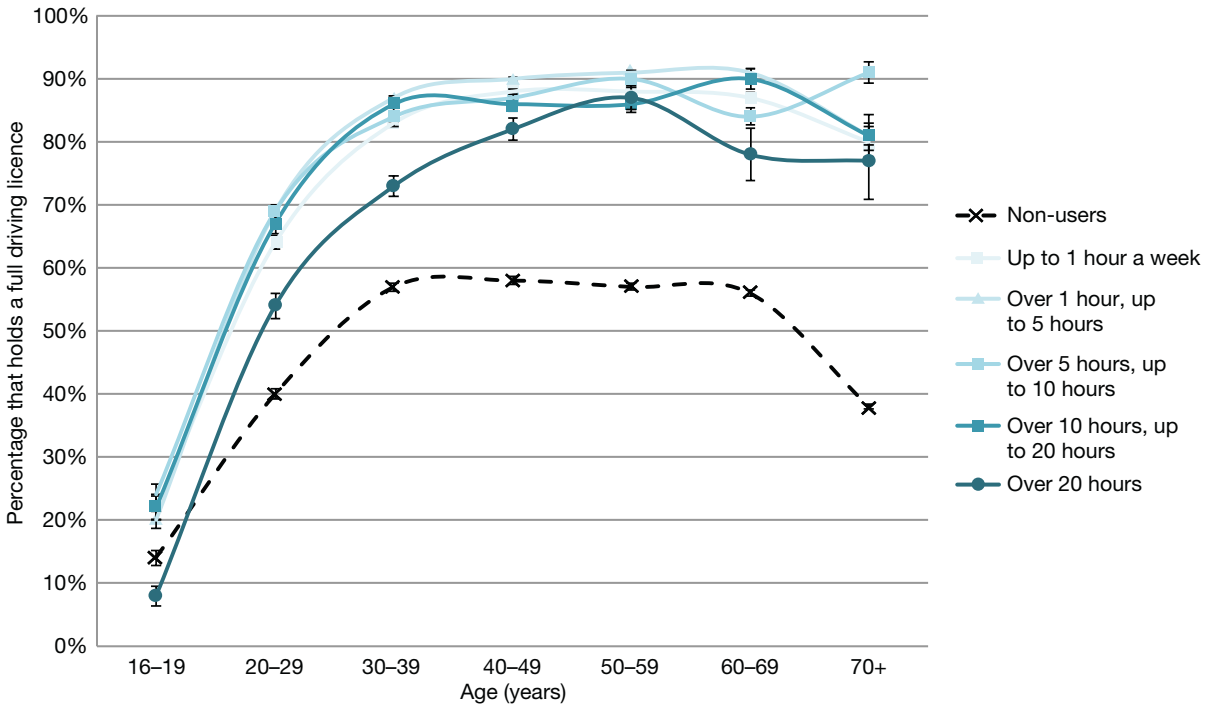
To further investigate this issue, the next section presents a set of multivariate regression analyses, wherein a wide set of sociodemographic differences are all accounted for simultaneously, rather than correcting for a single dimension (income, age, type of work one does, and so on) at a time.

Figure 4.15: Percentage of people with a full driving licence, by time spent online and household income level (2010 prices)



Source: SHS (error bars: 95% confidence interval)

Figure 4.16: Percentage of people with a full driving licence, by time spent online class and age group



Source: SHS (error bars: 95% confidence interval)

4.6 Multivariate analysis of the effect of online activity on licence-holding and car usage

This section presents the set of multivariate regressions that were performed to isolate the effects of Internet usage on mobility indicators, after having taken into account sociodemographic effects.

Before turning to the details of the analyses, it must be pointed out that these regression analyses can only identify that association between Internet usage and the mobility indicators which is independent of the sociodemographic differences between Internet users and non-users. This is different from saying that the Internet has *caused* changes in how people travel. It is possible, for instance, that there are certain personality characteristics that correlate with both Internet usage and physical travel (i.e. some types of people are predisposed to spend much time online, and also to – for example – travel less), which would mean that interpreting the effects in this section as *causal* would be misleading. More sophisticated analysis could in principle account for this, but the methods required would rely on panel data (multiple observations of an individual over a time period), whereas the SHS is a repeated cross-sectional dataset.

The regression models were specified to make use of the richness of the SHS dataset. Explanatory variables included:

- Gender
- Age (as well as age squared, to account for possible non-linearities)
- Household income
- Place of residence (dummy variables for remote rural areas through to large urban areas, using the six-class spatial code in the SHS)
- Economic status (full-time employment, part-time employment, student, and other)
- Type of work one does (Standard Occupational Classification 2000) [17]
- State of health (self-reported by respondent as "good health", "fairly good health", or "not good health")
- Illness status (self-reported by respondent as whether they have a disability, a "long-standing illness", both, or neither)
- Characterisation of Internet activity: Cross-tabulation of segments of people defined by type of online activities performed and time spent online per week

A series of three regression models is presented below. The first of these is a binary regression model of whether a person has a driving licence or not, and includes all of the SHS's 'random adults' (the respondents who completed a travel diary and the detailed questionnaire covering their Internet usage). The second is identical, with the exception that the sample used is restricted to

17 See www.ons.gov.uk/ons/guide-method/classifications/archived-standard-classifications/standard-occupational-classification-2000/about-soc-2000/index.html

people under the age of 25. The third of these is a linear regression model of annual car-driving mileage, where once again all of the SHS's 'random adults' are included in the sample.

4.6.1 Models of driving licence-holding

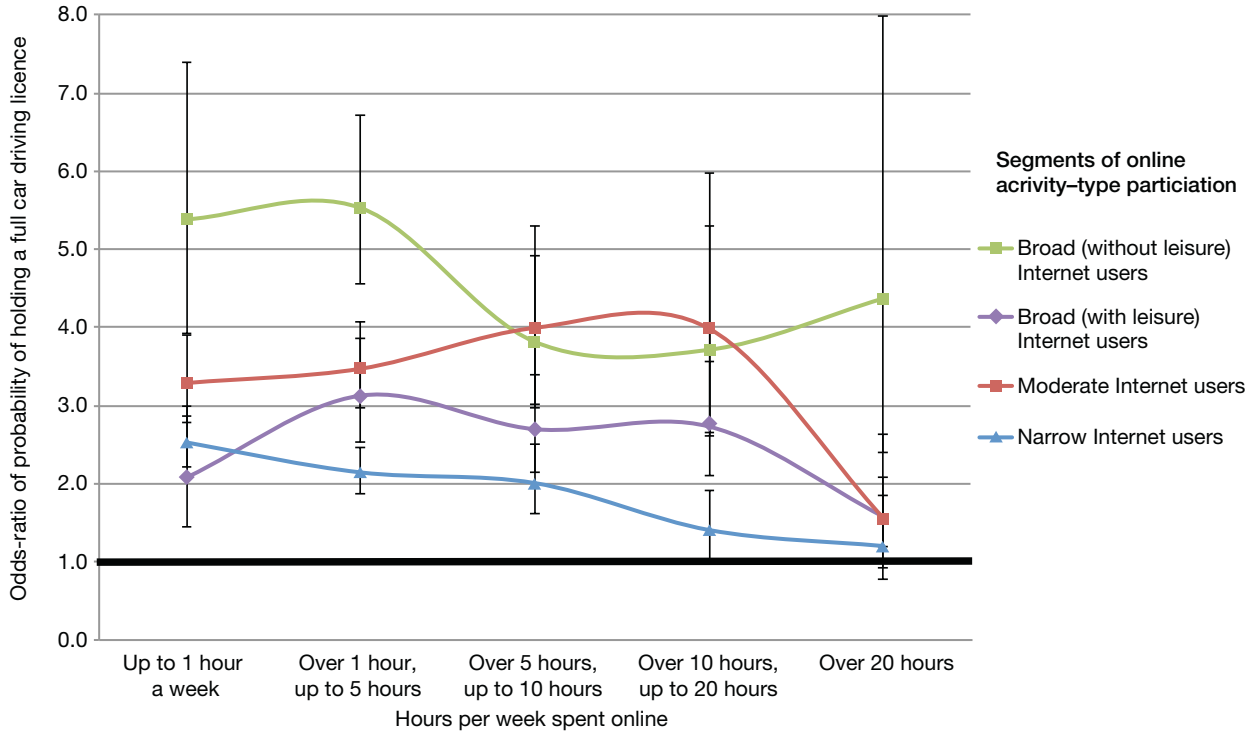
Results from the first of the models, of whether a person holds a full car driving licence, are shown in Table A7 in the Appendix.

The estimated 'baseline' effects due to sociodemographic characteristics are broadly intuitive, which is reassuring. The effects which are of interest – those relating to Internet usage – are highlighted in bold in Table A7 and appear at the bottom of the table. Note that the effects are all estimated relative to the effect attributable to not using the Internet, which is fixed at zero for identification. What can be seen is that the effects of online activity are, without exception, positively signed, and in nearly all cases are statistically significant.

Figure 4.17 shows these effects graphically, where the estimated parameters have been converted into the implied effect on the log-odds (a measure linked to probability) of a person having a driving licence. For instance, the odds of a person having a driving licence who is a 'broad (without leisure)' Internet user and spends less than an hour per week online are estimated to be just over five times as large as the odds of an otherwise-identical person who does not use the Internet.

What this means is that ***all 20*** of these categories of Internet use are each independently positively linked to licence-holding, relative to not using the Internet at all. The weighted-average effect of Internet use is to increase the odds of licence-holding by a multiple of just over three (3.4) times those that apply to an identical person who does not go online. Figure 4.17 shows that the large effects are associated with the 'broad (without leisure)' and 'moderate' segments of online-activity participation. Particularly for the 'narrow' class, the effect – whilst still being positive for all five categories of amount of time spent online per week relative to no Internet usage – decreases with the amount of time spent online.

Figure 4.17: Marginal effects of Internet use on the probability of holding a full car driving licence (with non-Internet-users as a reference point), from model with all adults in sample



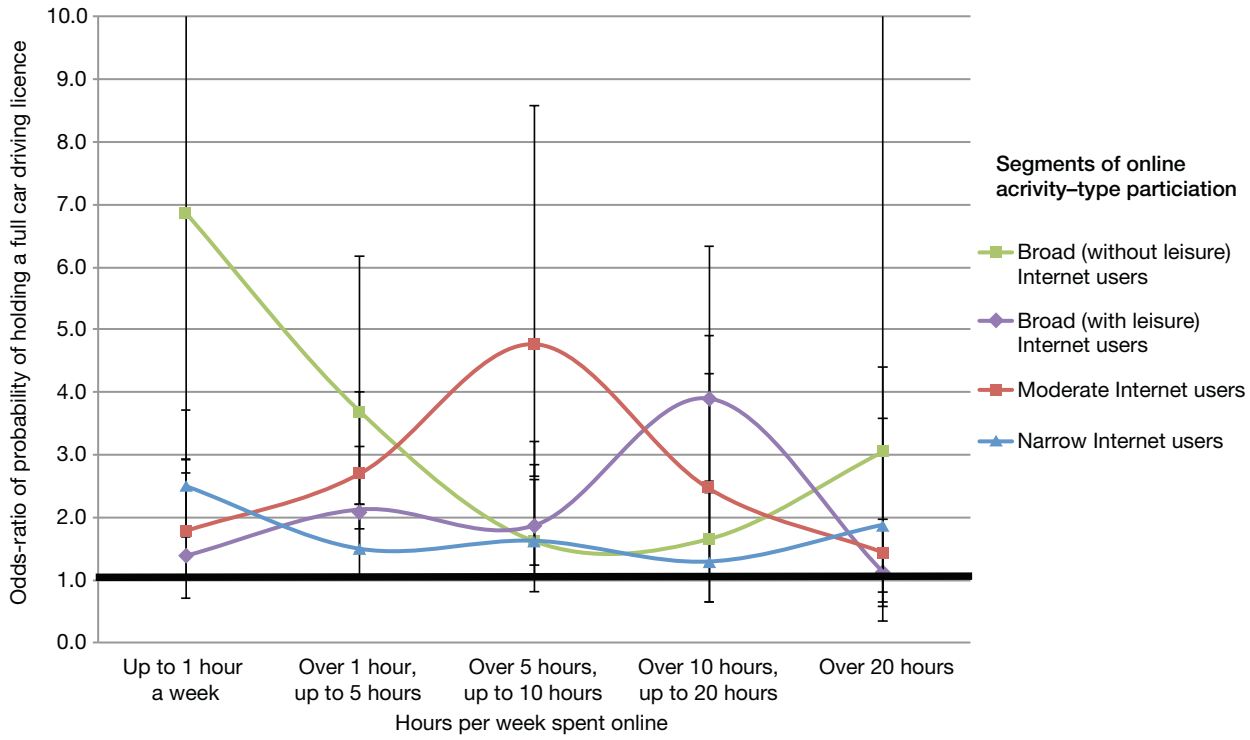
Source: SHS (error bars: 95% confidence interval)

There is a difficulty in modelling driving licence-holding, in that whether a middle-aged or older person has a licence is likely to be an artefact of an earlier period in their life – their early adulthood. This is a problem because we observe the explanatory variables in the present day; there is a temporal mismatch between them and the dependent variable (whether one has a licence today that may have been acquired many years ago).

In an effort to account for this issue in an approximate manner, so as not to introduce statistical complexity, a second regression model was created, identical to the first except that it had a restricted sample limited to Scottish adults under the age of 25.

The results are shown in Table A8 in the Appendix, with the effects attributable to Internet usage shown graphically in Figure 4.18. Whilst the confidence intervals of the estimated effects are wider than in Table A7 (owing in part to the much smaller sample size), once again we see that ***all 20*** of the categories of Internet usage have a positive effect on licence-holding. The differences amongst the various segments of online-activity participation are not very distinct, though the weighted-average effect of Internet usage is to increase one's odds of having a licence by just more than a doubling (2.4).

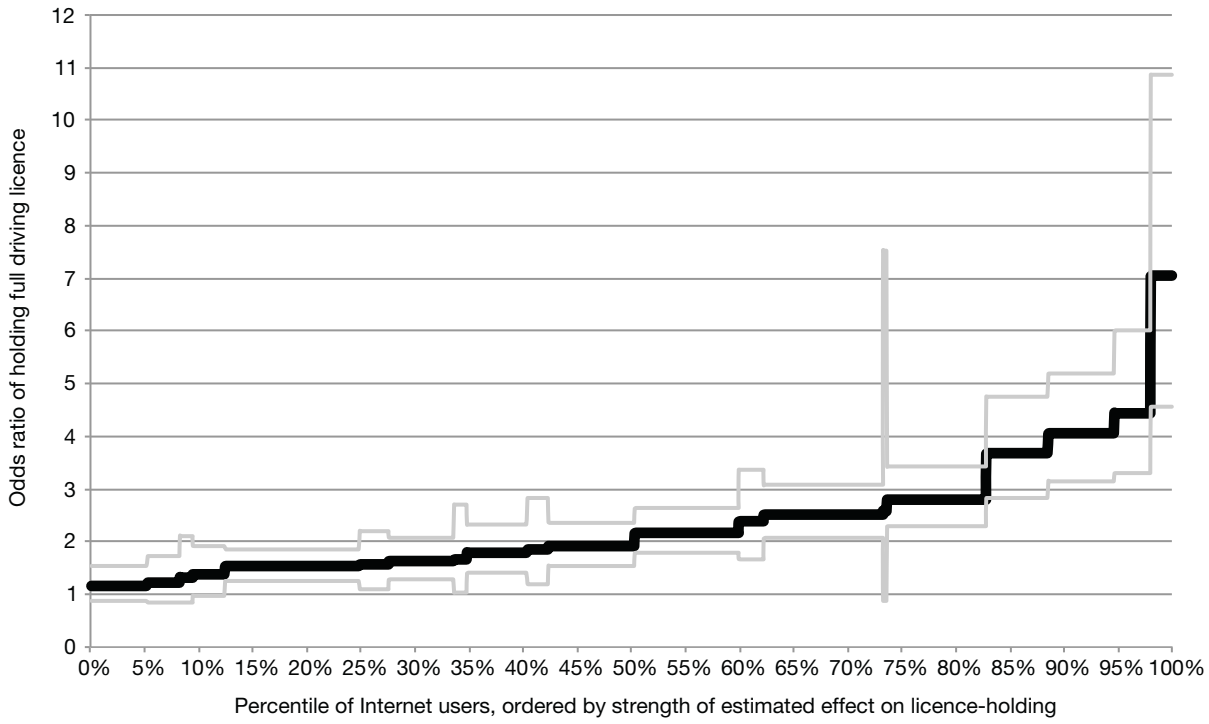
Figure 4.18: Marginal effects of Internet use on the probability of holding a full car driving licence for 17- to 24-year-old young adults (with non-Internet-users as a reference point)



Source: SHS (error bars: 95% confidence interval)

By using the parameter estimates and the known Internet-usage profile of each adult under the age of 25 in the SHS sample, the estimated effect on licensing due to Internet usage for each adult under the age of 25 in the sample can be estimated. Figure 4.19 shows how the estimated effect is distributed amongst young adult (under age 25) Internet-users in the SHS sample. Consistent with the positively signed parameters shown in Figure 4.18, it can be seen in Figure 4.19 that all Internet users are predicted to be more likely to hold a driving licence than otherwise identical non-internet users. The median effect is an odds ratio of roughly 2.0 – meaning that the odds of licence-holding are approximately doubled.

Figure 4.19: Net effect of Internet use on the probability of holding a full car driving licence for 17- to 24-years-old young adults



Source: SHS (thin grey lines represent 95% confidence interval)

4.6.2 Model of car-driving mileage

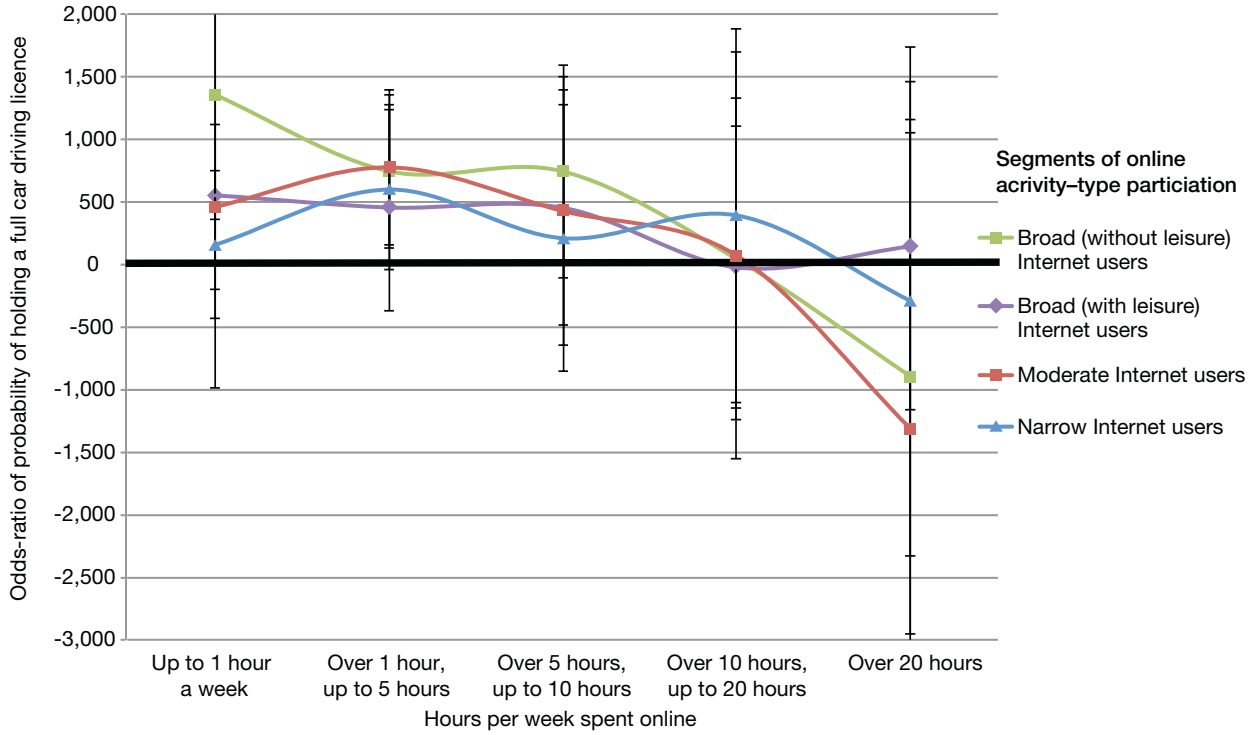
Table A9 in the Appendix shows a regression analysis which has, with two exceptions, the same set of explanatory variables as in the licence-holding analyses, but where the method is linear regression and the dependent variable is each person's annual car-driving mileage. Included as an explanatory variable here is whether a person has a driving licence, and the only other difference is that, since annual car-driving mileage is estimated by grossing up the mileage observed on each person's diary day, we have included dummy variables for the day of the week of people's diary days. This is because the SHS diary day is always the day before the interview, and so is not randomly distributed across the days of the week. Adults of all ages are included in the sample used in this model.

As with the analyses of licence-holding, the results for the control effects (shown in the upper part of Table A9) are generally intuitive.

The effects relating to Internet usage are shown graphically in Figure 4.20. The confidence intervals are wider than the corresponding set for the licence-holding analysis (see Figure 4.17). This is not surprising, as driving mileage is a much more variable quantity to analyse than driving-licence-holding (which can only take values of yes or no).

Nevertheless, there are clear trends that can be seen in Figure 4.20. First, for all levels of time spent online per week under 20 hours, being in any of the four online-activity participation segments is associated with a higher driving mileage than not using the Internet. The weighted average (using all 20 of the estimated effects) of the effect of being an Internet user is to drive nearly 500 miles (505) more per year relative to not being online. Second, beyond five hours online per week, there is a clear negative relationship between time spent online and car-driving mileage. Spending a lot of time online is associated with lower driving mileage than being online for less time.

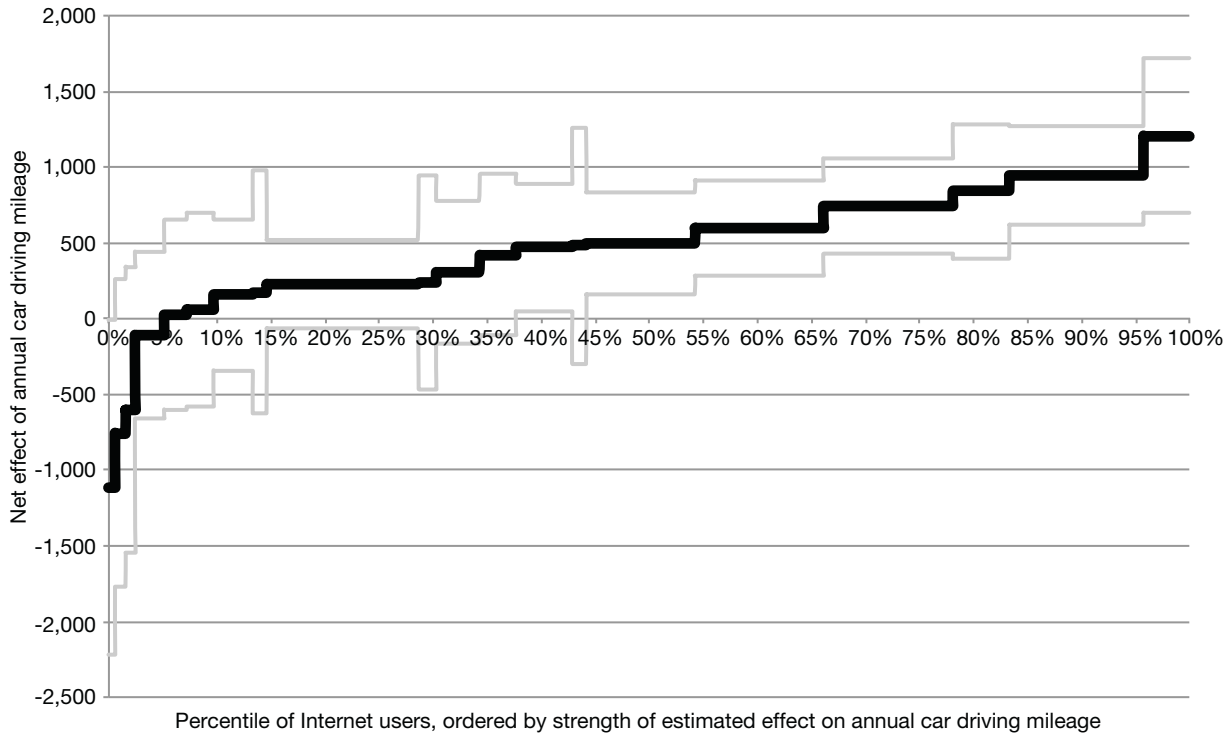
Figure 4.20: Marginal effect of Internet use segments on annual car-driving mileage (with non-Internet-users as a reference point)



Source: SHS (error bars: 95% confidence interval)

The estimated net effect of Internet use on annual car driving mileage is shown in Figure 4.21 (this figure is analogous to Figure 4.19 above, but the set of people analysed is all adults rather than only young adults). The driving-mileage regression suggests that for about 5% of people their Internet-usage pattern is associated negatively with how much they drive, with the opposite effect for the rest of the adult population (the remaining 95%). The median effect (the 50th percentile) is just under +500 miles/year relative to otherwise identical people who do not use the Internet at all.

Figure 4.21: Net effect of Internet use on annual car driving mileage for all adults



Source: SHS (thin grey lines represent 95% confidence interval)

4.7 Suggestions for modifying the online-activity portion of the SHS questionnaire

On the basis of the findings reported in this section, several points are worth noting regarding the part of the SHS interview that enquires about online activity. These suggestions are based on the 2012 version of the SHS questionnaire, to avoid making recommendations on the basis of the 2005/6 design that have already been addressed in more recent iterations of the SHS.

While the SHS in 2005/6 asked only about personal Internet use, the 2012 SHS also enquired as to whether people make use of the Internet for work purposes. However, the questions about the type of online activities that people perform do not appear in the 2012 questionnaire. This report shows that the ability to distinguish between different regimes of Internet use is valuable for gaining an understanding of how Internet usage is linked with how people travel. Thus it may be desirable to include an updated version of such questions (for example enquiring about "online social networking" rather than "chat rooms", and adding in "video-calling") in future versions of the SHS, and to gather some detail on the broad classes of work activities that people perform online (and whether they use the Internet for work purposes at a fixed workplace, at home, on-the-go, or in some combination of these). It would also

be valuable to be able to identify on which types of online activities people spend the most, and the least, time. A straightforward way to do this would be to ask the respondent a question such as *"Of these online activities that you do, which do you spend the most (least) time doing?"*

If a decision is taken to reintroduce questions about online-activity participation, it would be desirable to revise the question format. Rather than enquiring about which online activities people have "ever participated in", it would be desirable to enquire about regular activity participation, by means of a question such as: *"Which activities do you regularly participate in?"*

It is important to note that a significant weakness will be built into any question about time spent online, which will show up when attempting to establish the relationship between online activities and physical travel. This is because a person could be using their time online in any of a very large number of ways, some of which will be more time-efficient than others. Time is an *input* to using the Internet productively to achieve objectives, and it is the achievement of such objectives online that is likely to impact on physical travel to out-of-home activities that could otherwise achieve similar objectives. This is a point worth noting, but it is probably not worth modifying the SHS to take it into account; measuring goal achievement via people's activities is much less straightforward than measuring their time input to those activities, however, and the latter is likely to be an acceptable proxy for many of the uses of the SHS data.

The detailed questions about Internet use are part of the 'random adult' portion of the SHS interview. This means that only one adult (defined in the SHS as anyone aged 16 or over) from each household answers these questions, and therefore similar information is not collected on children's online activities, which would be of interest.

In order to help identify the extent to which online activities are affecting people's real-world activities and travel, it may be worth adding a question about how disruptive it would be to people's lives if the Internet were not available. A simple form of such a question could perhaps be worded (subject to refinement and piloting) as:

Thinking of the types of things you do online – if the Internet disappeared…

- *I would mostly do similar things anyway, but in different ways*
- *I would mostly not be able to do those things*

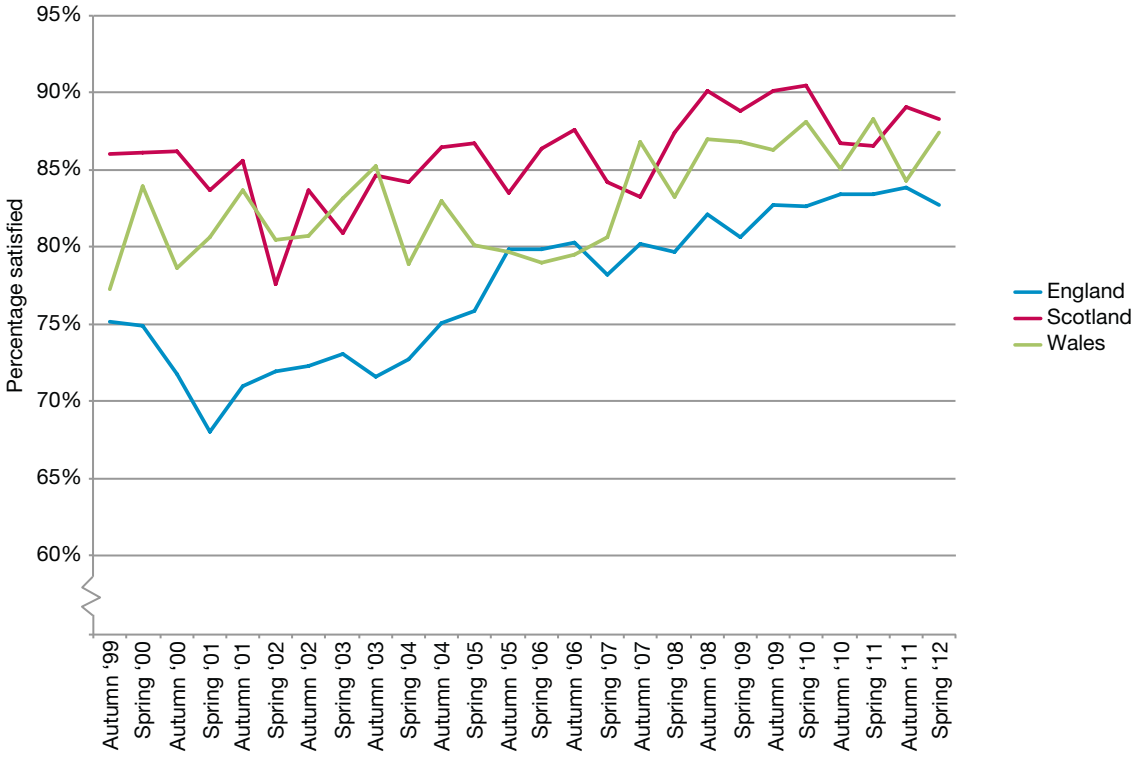
5. Rail Satisfaction Levels in Scotland

This section reports on an analysis of the NRPS (National Rail Passenger Survey) microdata from the years 1999 to 2012. Building on the GB-wide analysis carried out in a companion report (Preston & Jones, 2012) to this study, a brief investigation is made into how trends in customer satisfaction have varied between England, Scotland and Wales.

Methodological details regarding the NRPS can be found in the companion report. One important point to note is that the analyses of the NTS (and the SHS) data in this report are based on interviews with Scottish residents, whereas the NRPS analysis is based on interviews with rail passengers whose journey originated in Scotland, regardless of whether they were Scottish residents or not.

Figure 5.1 shows that in Scotland overall passenger satisfaction with their rail journey was more or less flat up to 2007, and since then has been on average several percentage points higher. The rate of satisfaction in England was much lower than in Scotland and Wales in the beginning of the time series (autumn 1999), but since 2001 the gap has narrowed. Scotland has generally had the highest rate of overall rail passenger satisfaction in Britain, with exceptions in a few time periods when satisfaction in Wales was marginally higher.

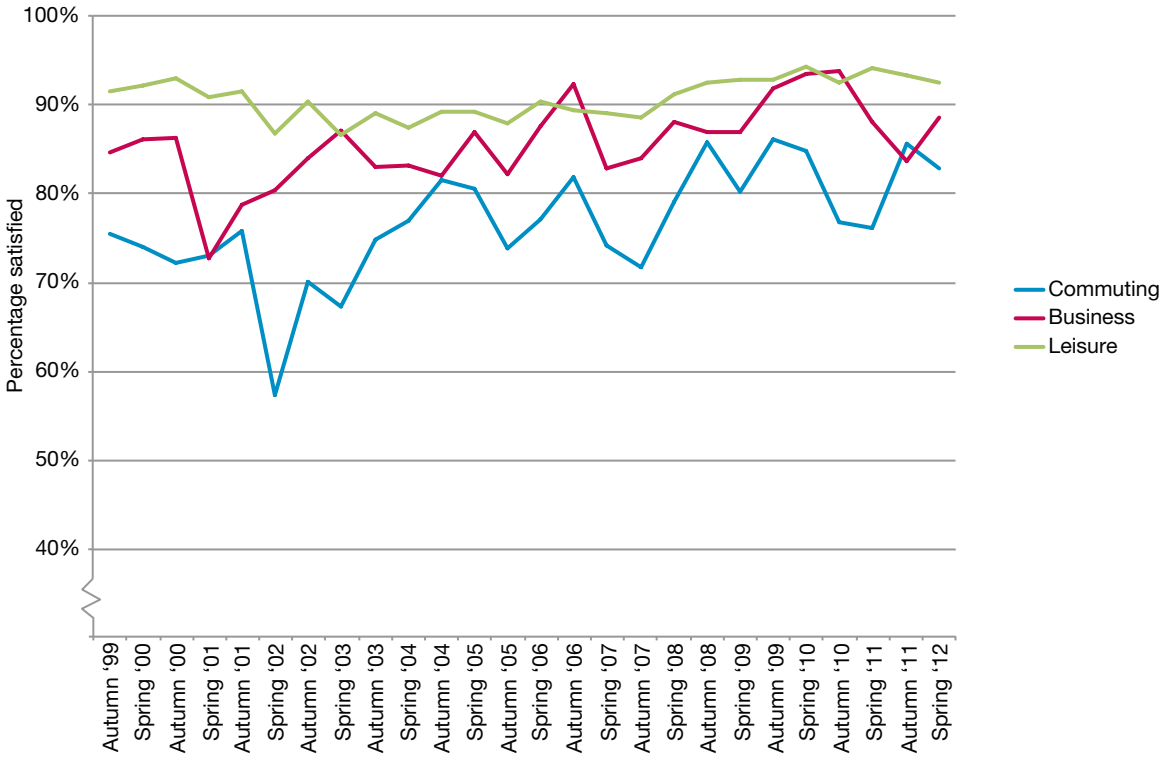
Figure 5.1: Rail passenger rate of satisfaction with their overall journey



Source: NRPS

Figure 5.2 shows how customer satisfaction varies by three journey purposes, for Scotland only. Commuters typically report the lowest rates of satisfaction, whilst leisure travellers report the highest. There seems to have been a slow upward trend in commuters' reported satisfaction, while the trend is more or less flat for leisure journeys.

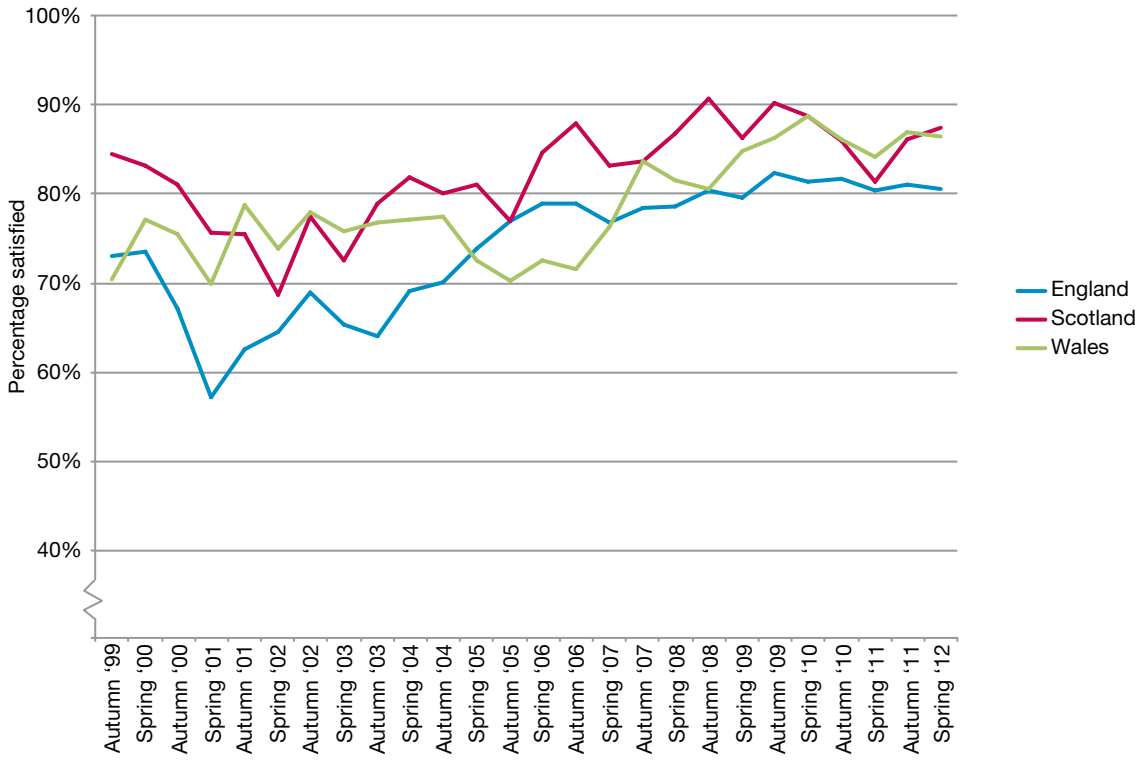
Figure 5.2: Rail passenger rate of satisfaction with their overall journey, by journey purpose



Source: NRPS

Figure 5.3 shows the rates of reported satisfaction with train service punctuality for England, Scotland and Wales. The trend was broadly upwards in all three countries until the late 2000s, since when it has been flatter. Scotland has had the highest rates of satisfaction with punctuality during most of the survey period, but in very recent periods it has dropped slightly to become level with Wales.

Figure 5.3: Rail passenger rate of satisfaction with the punctuality of trains

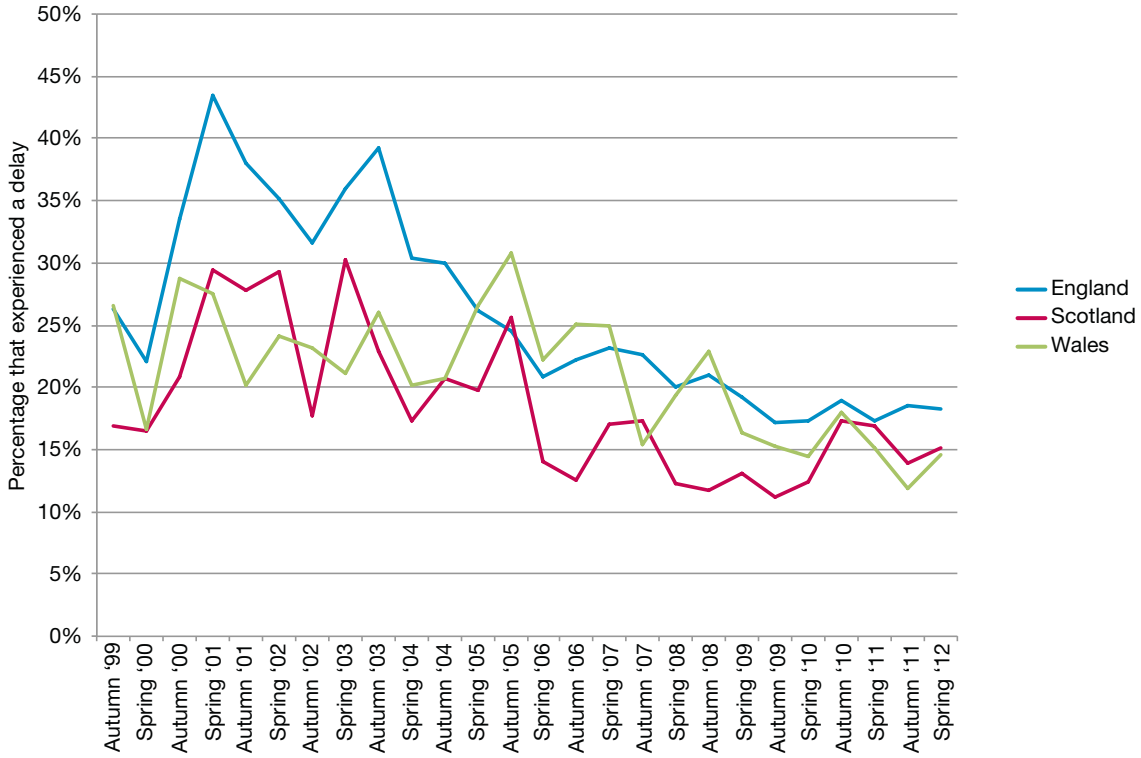


Source: NRPS

Whilst Figure 5.3 looked at satisfaction with rail service punctuality in general, Figure 5.4 is based on the NRPS question which asks respondents whether they experienced a delay on their surveyed journey.

The trend here is basically the converse of that shown in Figure 5.3: during the early 2000s, reported delays were much more prevalent in England than Wales or Scotland. Over time this has converged somewhat, as while delays have fallen in Scotland and Wales, they have done so at a faster rate in England. Scotland had the lowest frequency of reported delays for much of the time series, but the last three surveys have shown a lower rate in Wales than in either Scotland or England.

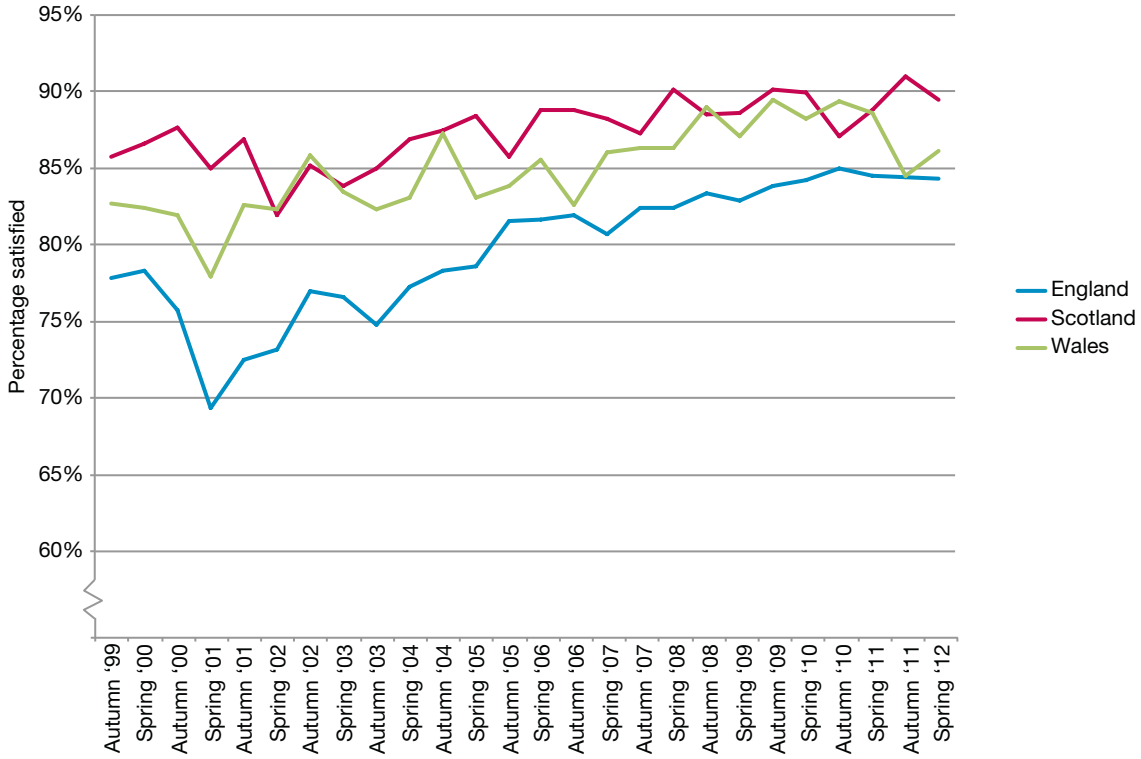
Figure 5.4: Percentage of rail passengers who report experiencing a delay during their journey



Source: NRPS

Figure 5.5 illustrates passengers' assessments of whether they are satisfied with the 'length' (i.e. the duration) of their journey. Here Scotland has been essentially level with Wales for the highest rate of satisfaction since about 2008, but in the most recent two rail surveys, passengers in Scotland have reported the higher satisfaction with journey length.

Figure 5.5: Rail passenger rate of satisfaction with the duration of their journey

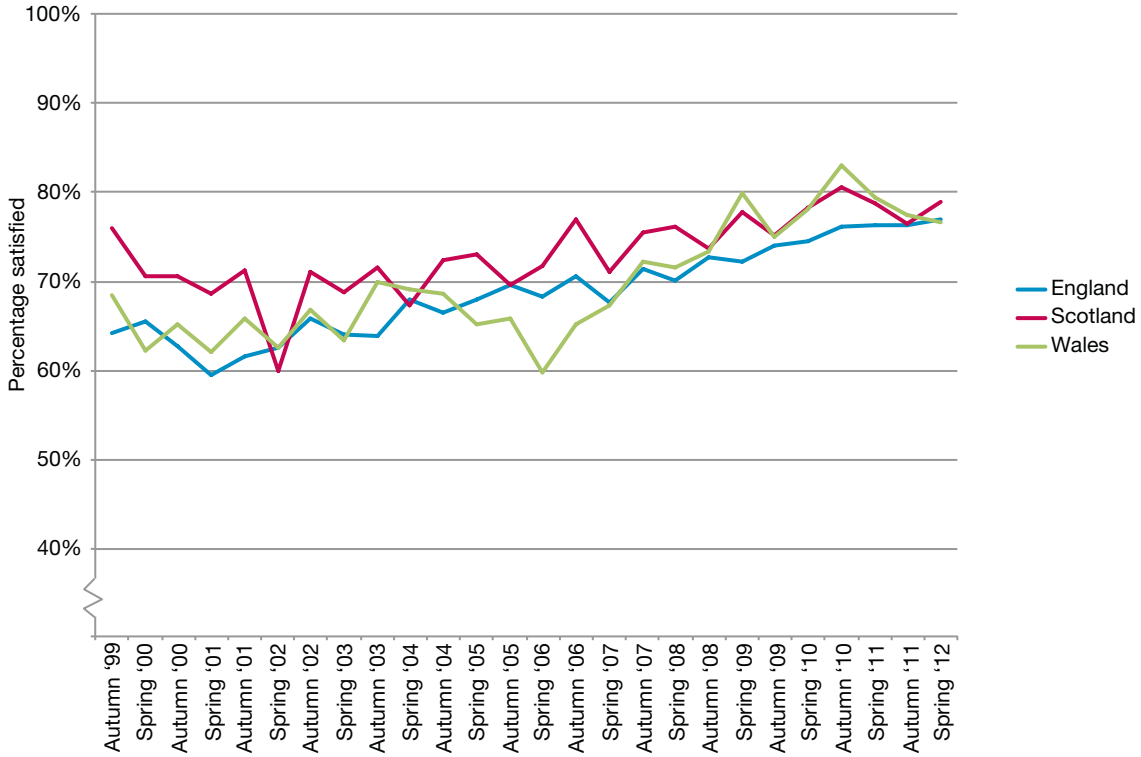


Source: NRPS

Figure 5.6 shows passenger satisfaction with rail connecting services. In all three countries the trend has been upwards; and in the most recent survey periods there has been little difference between them.

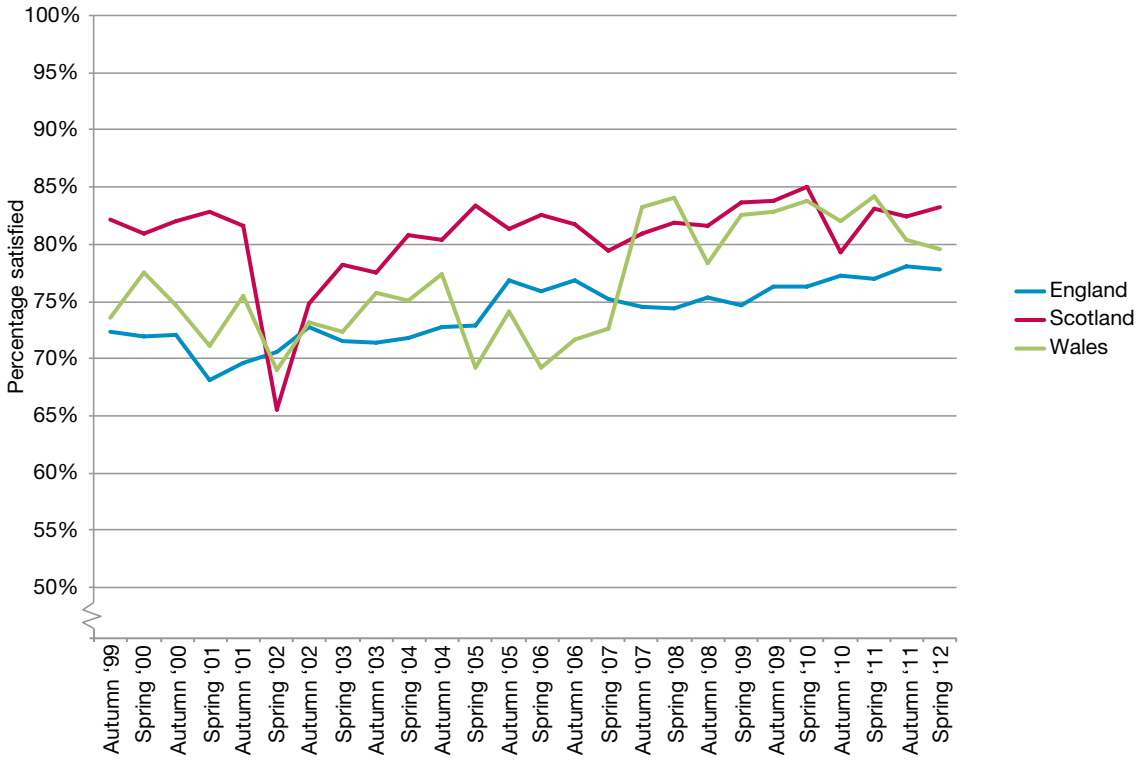
Interestingly, however, the trend in satisfaction with rail service frequency (shown in Figure 5.7) has been much flatter. Rail passengers are reporting rising satisfaction with punctuality, but more or less stable levels of satisfaction with the frequency of trains. Since around 2007 the rate of satisfaction with service frequency in Scotland has been about level with the rate in Wales (owing to a marked improvement in the latter), both of which are higher than the rate for England. A further notable point is that in the most recent surveys, satisfaction with punctuality has been several percentage points higher than satisfaction with service frequency.

Figure 5.6: Rail passenger rate of satisfaction with the connections on their journey



Source: NRPS

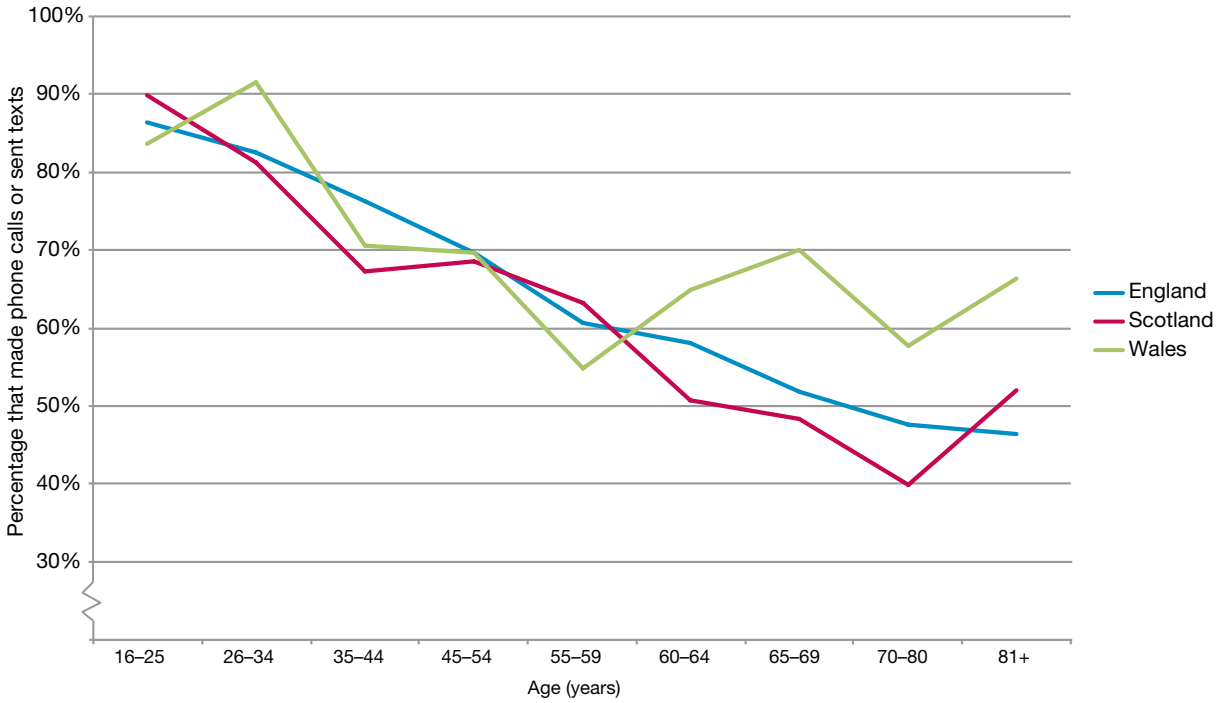
Figure 5.7: Rail passenger rate of satisfaction with the frequency of rail service



Source: NRPS

Figure 5.8 shows how the percentage of rail travellers who reported making phone calls or sending text messages during their journey varies by age (from autumn 2011). Not surprisingly, the percentage decreases with age (with the exception in Scotland of over-81s).[18] For ages 60 and over, the rate for rail passengers in Wales is somewhat higher than that in Scotland or in England.

Figure 5.8: Percentage of rail passengers who made phone calls or sent texts during their journey



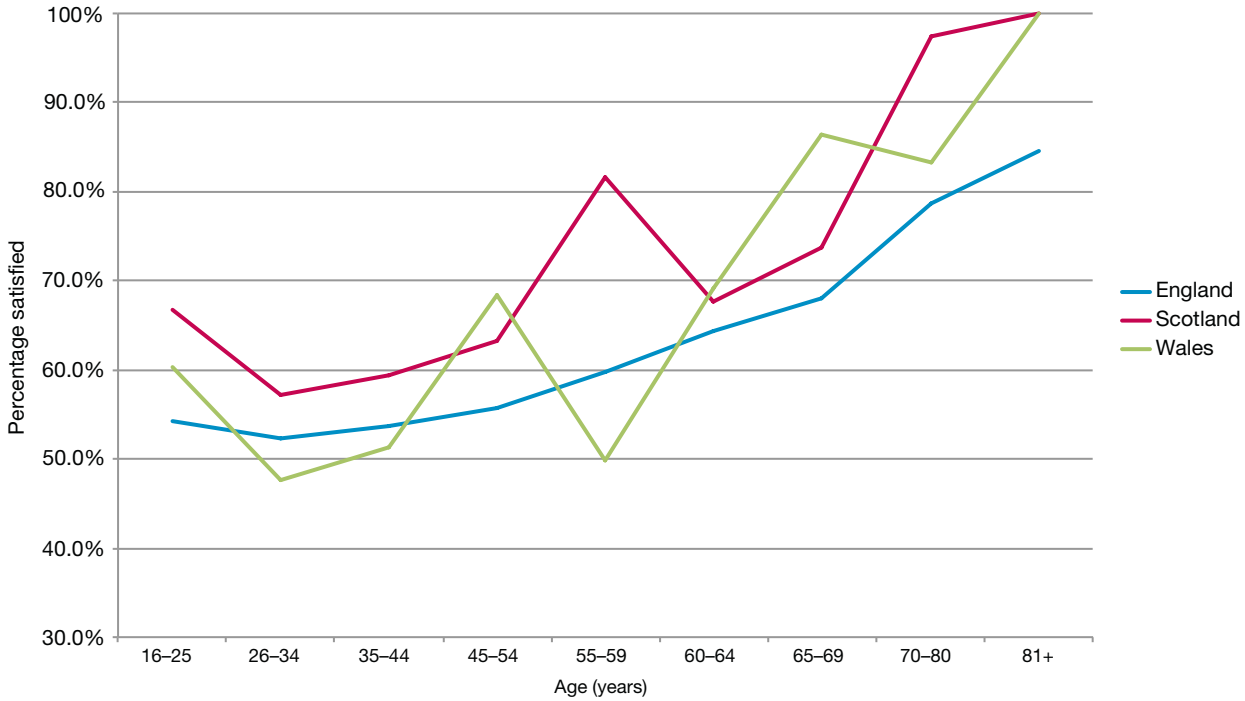
Source: NRPS

Figure 5.9 shows that there is an opposite relationship between age and satisfaction with mobile phone reception. It is lowest amongst young adults (at about 65% in Scotland for 16- to 25-year-olds, and lower for the other two countries). For all ages the rate of satisfaction was higher in Scotland than England.

Figure 5.10 shows the extent of use of mobile data services. As with the users of mobile phones for phone calls and text messages, the percentage of travellers using data services is higher amongst young adults. But the rate is lower: up to 90% of 16- to 25-year-olds reported making phone calls or sending text messages, but only 72% of that age group (in Scotland, and less elsewhere) said that they used mobile data services.

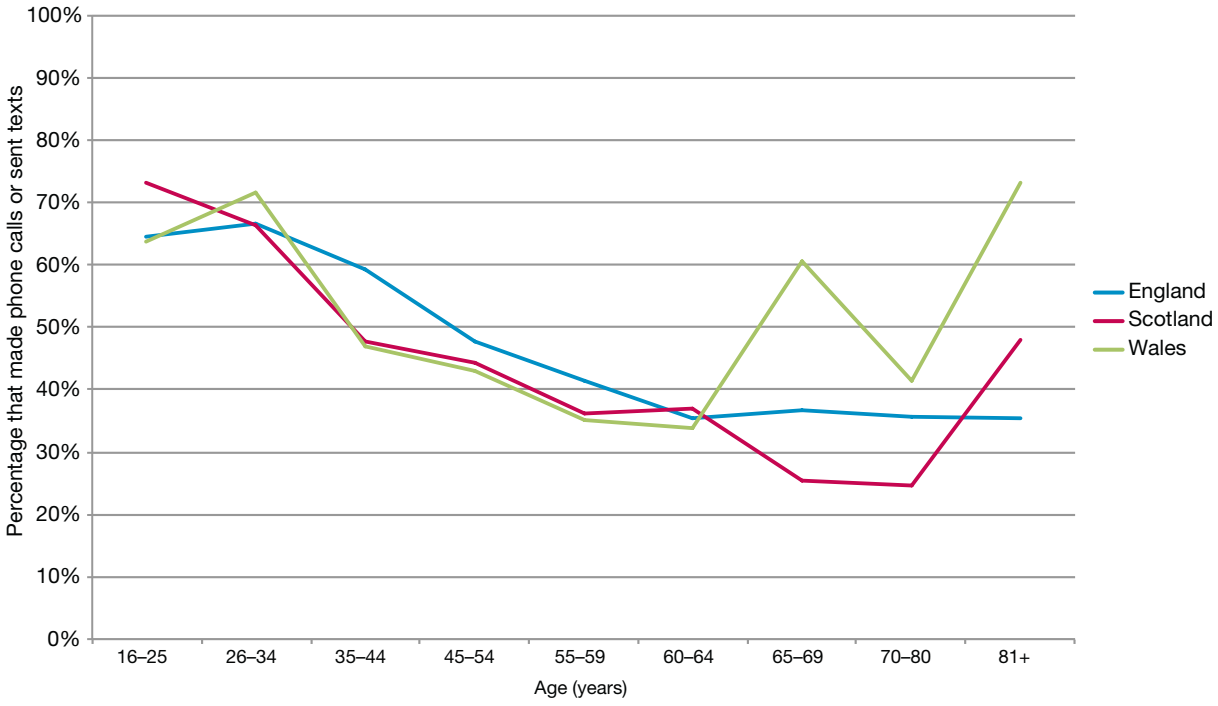
18 The sample size of over-81s answering this question was 6,288 in England, 188 in Wales and 653 in Scotland.

Figure 5.9: Rail passenger rate of satisfaction with mobile phone reception



Source: NRPS (error bars: 95% confidence interval)

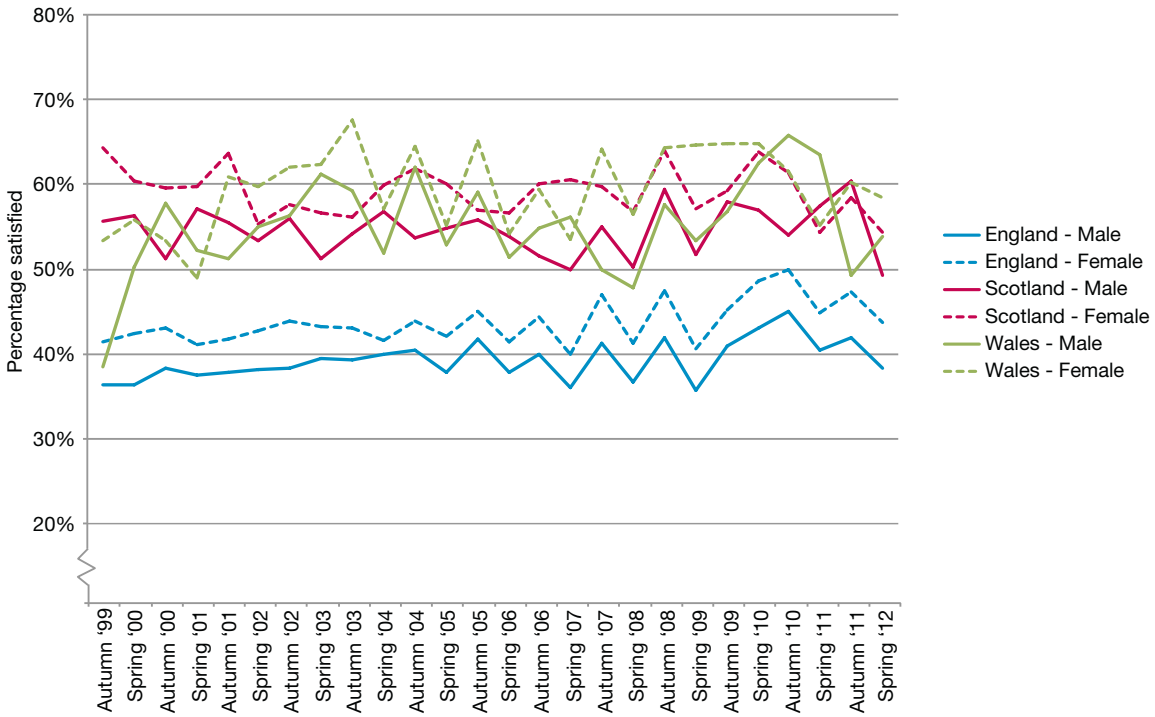
Figure 5.10: Percentage of rail passengers who report using mobile data services during their journey



Source: NRPS

Finally, this analysis of NRPS data looks at how satisfaction with rail ticket prices varies over time by gender in each country (see Figure 5.11). There has been relatively little change over time in the rates, but there are noteworthy differences across gender and country. Women tend to report higher rates of satisfaction with price than men, and a larger percentage of rail passengers in Scotland and Wales generally report they are satisfied with price than in England.

Figure 5.11: Rail passenger rate of satisfaction with the price of their journey, by gender



Source: NRPS

6. Conclusions

This report has examined the following issues relating to personal travel in Scotland:

1) trends in travel, as captured by the British NTS;
2) the properties of the SHS as compared to the NTS, which is important because from January 2013 the NTS no longer covers Scotland;
3) relationships between online-activity participation and personal travel, using the SHS;
4) trends in rail passenger satisfaction, as recorded by the NRPS.

The main results are summarised in the Executive Summary.

As with the study report that looked at travel trends across Britain as a whole (*On the Move*), the main contribution of this report is to highlight important relationships affecting personal travel that were not previously well understood.

Straightforward statistical techniques were used, although in this report some multivariate regression was performed in the assessment of the linkages between online activity and physical travel, to enable us to separate effects associated with Internet use from other well-established effects which are attributable to people's individual sociodemographic profiles. The findings suggest a number of ways in which physical travel and online activity relate, but it must be noted that they are not sufficient to assert direct causal effects of using the Internet on how people travel.

On the basis of the findings presented here, it may be desirable to consider revisions to the SHS design for several reasons. Some of the suggestions would result in more reliable estimates of average annual travel mileage from the SHS, which is likely to be a growing need consequent on the ending of the NTS in Scotland. Others would address gaps in the SHS (by, for example, collecting detailed information on children's travel through a children's diary), whilst a third set of suggestions pertain to ways in which the SHS could be used to gather information about people's online activities that is more detailed and more relevant than that which it currently provides.

It is hoped that the relationships which this study has brought to the fore will be helpful as inputs to ongoing work to refine Transport Scotland's travel forecasting methods.

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Appendix

Table A1: Average annual car-driving mileage by journey purpose

	Education	Personal business	Escort	Other social/ leisure	Visit friends/ relatives at private home	Shopping	Business	Commuting
1995/9	19 (45)	267 (49)	345 (5)	523 (22)	474 (21)	469 (20)	463 (35)	866 (30)
2000/4	27 (33)	264 (33)	352 (4)	539 (18)	446 (15)	477 (14)	425 (27)	910 (22)
2005/7	29 (35)	252 (39)	362 (9)	530 (18)	481 (16)	462 (14)	474 (29)	891 (27)
2008/10	17 (37)	287 (42)	336 (4)	609 (18)	406 (16)	489 (17)	472 (35)	910 (24)

Source: NTS (standard error in brackets)

Table A2: Average annual car-driving mileage by journey purpose, by settlement size

	Education	Personal business	Escort	Other social/ leisure	Visit friends/ relatives at private home	Shopping	Business	Commuting
Car driving mileage per person per year (settlement sizes under 250K population)								
1995/9	20 (6)	291 (23)	377 (26)	566 (40)	501 (34)	537 (25)	499 (58)	934 (50)
2000/4	30 (5)	287 (16)	374 (20)	572 (30)	487 (25)	524 (17)	453 (37)	988 (37)
2005/7	34 (11)	278 (18)	388 (21)	567 (33)	530 (33)	516 (19)	546 (49)	925 (39)
2008/10	17 (5)	335 (21)	372 (24)	649 (42)	458 (31)	577 (22)	483 (51)	1055 (48)
Car driving mileage per person per year (settlement sizes over 250K population)								
1995/9	15 (7)	162 (31)	204 (37)	332 (61)	357 (53)	169 (22)	304 (80)	566 (99)
2000/4	15 (7)	141 (21)	237 (47)	367 (47)	229 (34)	223 (21)	279 (64)	493 (61)
2005/7	11 (6)	161 (18)	271 (28)	398 (53)	308 (34)	270 (21)	220 (41)	769 (79)
2008/10	16 (7)	183 (27)	258 (23)	522 (65)	292 (32)	301 (21)	448 (72)	598 (51)

Source: NTS (standard error in brackets)

Table A3: Average annual bus mileage by journey purpose

	Education	Personal business	Escort	Other social/ leisure	Visit friends/ relatives at private home	Shopping	Business	Commuting
1995/9	61 (15)	35 (2)	16 (8)	107 (4)	76 (7)	110 (4)	4 (19)	148 (9)
2000/4	60 (10)	28 (1)	9 (6)	86 (1)	53 (5)	94 (2)	3 (10)	126 (5)
2005/7	58 (10)	37 (2)	11 (8)	120 (2)	52 (8)	123 (3)	8 (16)	110 (8)
2008/10	52 (10)	48 (3)	13 (6)	129 (2)	87 (7)	115 (5)	9 (13)	118 (10)

Source: NTS (standard error in brackets)

Table A4: Average annual bus mileage by journey purpose, by settlement size

	Education	Personal business	Escort	Other social/ leisure	Visit friends/ relatives at private home	Shopping	Business	Commuting
Bus mileage per person per year (Settlement sizes under 250K population)								
1995/9	63 (9)	31 (5)	14 (5)	94 (19)	52 (6)	103 (8)	3 (2)	144 (18)
2000/4	63 (7)	24 (2)	8 (1)	81 (11)	43 (5)	89 (5)	2 (1)	115 (11)
2005/7	67 (10)	36 (4)	11 (2)	102 (17)	41 (6)	123 (9)	4 (1)	86 (10)
2008/10	62 (9)	44 (5)	12 (2)	110 (16)	72 (11)	116 (9)	8 (5)	94 (12)
Bus mileage per person per year (Settlement sizes over 250K population)								
1995/9	50 (13)	53 (11)	22 (7)	163 (54)	180 (42)	142 (15)	10 (4)	167 (29)
2000/4	45 (9)	49 (7)	13 (3)	114 (24)	108 (20)	122 (12)	8 (4)	182 (23)
2005/7	27 (6)	42 (5)	11 (4)	185 (37)	90 (27)	121 (12)	19 (6)	195 (24)
2008/10	33 (6)	56 (12)	15 (4)	170 (25)	121 (21)	113 (10)	11 (3)	171 (19)

Source: NTS (standard error in brackets)

Table A5: Average annual rail mileage by journey purpose

	Education	Personal business	Escort	Other social/ leisure	Visit friends/ relatives at private home	Shopping	Business	Commuting
1995/9	19 (13)	9 (10)	4 (7)	107 (2)	63 (12)	51 (3)	25 (24)	67 (21)
2000/4	15 (11)	23 (8)	2 (4)	80 (1)	58 (5)	33 (6)	35 (13)	93 (10)
2005/7	19 (15)	11 (12)	8 (6)	101 (5)	97 (12)	49 (3)	55 (13)	101 (18)
2008/10	11 (17)	16 (11)	2 (4)	122 (1)	80 (3)	19 (4)	38 (19)	118 (15)

Source: NTS (standard error in brackets)

Table A6: Average annual rail mileage by journey purpose, by settlement size

	Education	Personal business	Escort	Other social/ leisure	Visit friends/ relatives at private home	Shopping	Business	Commuting
Rail mileage per person per year (settlement sizes under 250K population)								
1995/9	23 (8)	7 (3)	5 (2)	94 (25)	18 (6)	61 (14)	26 (12)	66 (14)
2000/4	18 (5)	21 (6)	3 (1)	68 (12)	45 (9)	33 (5)	33 (8)	93 (12)
2005/7	23 (7)	13 (3)	10 (6)	92 (14)	81 (18)	53 (16)	46 (12)	87 (13)
2008/10	6 (4)	17 (5)	3 (1)	65 (13)	44 (13)	19 (4)	35 (13)	93 (16)
Rail mileage per person per year (settlement sizes over 250K population)								
1995/9	3 (3)	16 (9)	2 (2)	162 (67)	263 (113)	7 (3)	24 (16)	69 (30)
2000/4	1 (1)	37 (24)	- (-)	145 (51)	124 (45)	28 (10)	46 (25)	94 (22)
2005/7	3 (2)	3 (1)	2 (1)	132 (36)	155 (49)	36 (11)	87 (35)	152 (50)
2008/10	21 (9)	14 (8)	- (-)	245 (53)	157 (40)	17 (5)	46 (21)	170 (43)

Source: NTS (standard error in brackets)

Table A7: Results from binary logistic regression analysis of whether adults hold full car driving licences

Parameter	ρ^2=0.35 n=27,229 Null log-likelihood = –19,590.1 Final log-likelihood = –12,688.6 Percent of sample observed to have a licence: 65%	
	Mean parameter estimate	Significance (p-value)
Constant	–5.35	<0.01
Dummy (Male)	0.972	<0.01
Age	0.174	<0.01
Age-squared	–0.00150	<0.01
Household income (£000s/year)	0.0278	<0.01
Dummy (Large Urban Areas)	–0.965	<0.01
Dummy (Other Urban Areas)	–0.692	<0.01
Dummy (Accessible Small Towns)	–0.497	<0.01
Dummy (Remote Small Towns)	–0.467	<0.01
Dummy (Accessible Rural Areas)	–0.113	0.18
Dummy (Remote Rural Areas)	Fixed at zero	–
Dummy (Self-employed)	0.964	<0.01
Dummy (Full-time worker)	0.203	0.06
Dummy (Part-time worker)	0.193	0.08
Dummy (Student)	–0.233	0.03
Dummy (Neither employed nor student)	Fixed at zero	–
Dummy (Managers and senior officials)	0.937	<0.01
Dummy (Professional occupations)	1.174	<0.01
Dummy (Associate professional and technical occupations)	1.050	<0.01
Dummy (Administrative and secretarial occupations)	0.809	<0.01
Dummy (Skilled trades occupations)	0.540	<0.01
Dummy (Personal service occupations)	0.381	<0.01
Dummy (Sales and customer service occupations)	0.273	0.03
Dummy (Process, plant and machine operatives)	0.701	<0.01
Dummy (Elementary occupations)	–0.244	0.02
Dummy (Non-working adults)	Fixed at zero	–

(Continued on next page)

Parameter	Mean parameter estimate	Significance (p-value)
Dummy (Good health)	0.698	<0.01
Dummy (Fairly good health)	0.325	<0.01
Dummy (Not good health)	Fixed at zero	–
Dummy – Narrow users (up to 1 hour)	**0.950**	**<0.01**
Dummy – Narrow users (over 1 hour, up to 5 hours)	**0.778**	**<0.01**
Dummy – Narrow users (over 5 hours, up to 10 hours)	**0.686**	**<0.01**
Dummy – Narrow users (over 10 hours, up to 20 hours)	**0.319**	**0.04**
Dummy – Narrow users (over 20 hours)	**0.177**	**0.43**
Dummy – Moderate users (up to 1 hour)	**1.215**	**<0.01**
Dummy – Moderate users (over 1 hour, up to 5 hours)	**1.266**	**<0.01**
Dummy – Moderate users (over 5 hours, up to 10 hours)	**1.381**	**<0.01**
Dummy – Moderate users (over 10 hours, up to 20 hours)	**1.390**	**<0.01**
Dummy – Moderate users (over 20 hours)	**0.423**	**0.12**
Dummy – Broad (without leisure) users (up to 1 hour)	**1.712**	**<0.01**
Dummy – Broad (without leisure) users (over 1 hour, up to 5 hours)	**1.734**	**<0.01**
Dummy – Broad (without leisure) users (over 5 hours, up to 10 hours)	**1.362**	**<0.01**
Dummy – Broad (without leisure) users (over 10 hours, up to 20 hours)	**1.316**	**<0.01**
Dummy – Broad (without leisure) users (over 20 hours)	**1.460**	**<0.01**
Dummy – Broad (with leisure) users (up to 1 hour)	**0.755**	**<0.01**
Dummy – Broad (with leisure) users (over 1 hour, up to 5 hours)	**1.165**	**<0.01**
Dummy – Broad (with leisure) users (over 5 hours, up to 10 hours)	**1.009**	**<0.01**
Dummy – Broad (with leisure) users (over 10 hours, up to 20 hours)	**1.020**	**<0.01**
Dummy – Broad (with leisure) users (over 20 hours)	**0.473**	**<0.01**
Dummy – Non-users of Internet	**Fixed at zero**	**–**

Source: SHS

Table A8: Results from binary logistic regression analysis of whether young adults between 17 and 24 years old hold full car driving licences

Parameter	ρ^2=0.27 n=1,921 Null log-likelihood = –1,823.89 Final log-likelihood = –1,334.62 Percentage of sample observed to have a licence: 42%	
	Mean parameter estimate	Significance (p-value)
Constant	–48.139	<0.01
Dummy (Male)	–0.110	0.32
Age	4.225	<0.01
Age-squared	–0.95881	<0.01
Household income (£000s/year)	0.0120	<0.01
Dummy (Large Urban Areas)	–0.777	<0.01
Dummy (Other Urban Areas)	–0.736	<0.01
Dummy (Accessible Small Towns)	–0.394	0.18
Dummy (Remote Small Towns)	–1.144	<0.01
Dummy (Accessible Rural Areas)	–0.224	0.44
Dummy (Remote Rural Areas)	Fixed at zero	–
Dummy (Self-employed)	1.797	<0.01
Dummy (Full-time worker)	1.161	<0.01
Dummy (Part-time worker)	0.788	<0.01
Dummy (Student)	1.206	<0.01
Dummy (Neither employed nor student)	Fixed at zero	–
Dummy (Managers and senior officials)	0.179	0.56
Dummy (Professional occupations)	1.251	<0.01
Dummy (Associate professional and technical occupations)	0.806	<0.01
Dummy (Administrative and secretarial occupations)	0.098	0.66
Dummy (Skilled trades occupations)	0.844	<0.01
Dummy (Personal service occupations)	–0.073	0.76
Dummy (Sales and customer service occupations)	0.136	0.47
Dummy (Process, plant and machine operatives)	0.553	0.06
Dummy (Elementary occupations)	0.033	0.86
Dummy (Non-working adults)	Fixed at zero	–

(Continued on next page)

Parameter	Mean parameter estimate	Significance (p-value)
Dummy (Good health)	0.759	<0.01
Dummy (Fairly good health)	0.426	0.10
Dummy (Not good health)	Fixed at zero	–
Dummy – Narrow users (up to 1 hour)	**0.921**	**<0.01**
Dummy – Narrow users (over 1 hour, up to 5 hours)	**0.425**	**0.03**
Dummy – Narrow users (over 5 hours, up to 10 hours)	**0.491**	**0.04**
Dummy – Narrow users (over 10 hours, up to 20 hours)	**0.197**	**0.57**
Dummy – Narrow users (over 20 hours)	**0.610**	**0.16**
Dummy – Moderate users (up to 1 hour)	**0.589**	**0.02**
Dummy – Moderate users (over 1 hour, up to 5 hours)	**1.029**	**<0.01**
Dummy – Moderate users (over 5 hours, up to 10 hours)	**1.493**	**<0.01**
Dummy – Moderate users (over 10 hours, up to 20 hours)	**0.865**	**0.01**
Dummy – Moderate users (over 20 hours)	**0.284**	**0.54**
Dummy – Broad (without leisure) users (up to 1 hour)	**1.952**	**<0.01**
Dummy – Broad (without leisure) users (over 1 hour, up to 5 hours)	**1.301**	**<0.01**
Dummy – Broad (without leisure) users (over 5 hours, up to 10 hours)	**0.444**	**0.20**
Dummy – Broad (without leisure) users (over 10 hours, up to 20 hours)	**0.511**	**0.29**
Dummy – Broad (without leisure) users (over 20 hours)	**0.952**	**0.37**
Dummy – Broad (with leisure) users (up to 1 hour)	**0.314**	**0.35**
Dummy – Broad (with leisure) users (over 1 hour, up to 5 hours)	**0.771**	**<0.01**
Dummy – Broad (with leisure) users (over 5 hours, up to 10 hours)	**0.650**	**<0.01**
Dummy – Broad (with leisure) users (over 10 hours, up to 20 hours)	**1.398**	**<0.01**
Dummy – Broad (with leisure) users (over 20 hours)	**0.150**	**0.60**
Dummy – Non-users of Internet	**Fixed at zero**	**–**

Source: SHS

Table A9: Results from linear regression analysis of car-driving distance (annual mileage, all adults)

Parameter	R^2=0.14 n=27,229 Mean car-driving distance (miles/year): 2,623 Standard deviation: 6,383	
	Mean parameter estimate	Significance (p-value)
Constant	–977	<0.01
Dummy (Holds a full car driving licence)	2,504	<0.01
Dummy (Male)	751	<0.01
Age	57.067	<0.01
Age-squared	–0.5333	<0.01
Household income (£000s/year)	18.20	<0.01
Dummy (Large Urban Areas)	–2,309	<0.01
Dummy (Other Urban Areas)	–1, 695	<0.01
Dummy (Accessible Small Towns)	–966	<0.01
Dummy (Remote Small Towns)	–1,098	<0.01
Dummy (Accessible Rural Areas)	–83.62	0.64
Dummy (Remote Rural Areas)	Fixed at zero	–
Dummy (Self-employed)	1,378	<0.01
Dummy (Full-time worker)	638	<0.01
Dummy (Part-time worker)	–266	0.29
Dummy (Student)	35.86	0.88
Dummy (Neither employed nor student)	Fixed at zero	–
Dummy (Monday)	397	<0.01
Dummy (Tuesday)	379	<0.01
Dummy (Wednesday)	550	<0.01
Dummy (Thursday)	561	<0.01
Dummy (Friday)	686	<0.01
Dummy (Saturday)	–133	0.32
Dummy (Sunday)	Fixed at zero	–
Dummy (Managers and senior officials)	1,474	<0.01
Dummy (Professional occupations)	720	<0.01
Dummy (Associate professional and technical occupations)	1,048	<0.01
Dummy (Administrative and secretarial occupations)	191	0.46

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Parameter	Mean parameter estimate	Significance (p-value)
Dummy (Skilled trades occupations)	891	<0.01
Dummy (Personal service occupations)	420	0.11
Dummy (Sales and customer service occupations)	304	0.24
Dummy (Process, plant and machine operatives)	967	<0.01
Dummy (Elementary occupations)	399	0.10
Dummy (Non-working adults)	Fixed at zero	–
Dummy (Good health)	105	0.38
Dummy (Fairly good health)	146	0.23
Dummy (Not good health)	Fixed at zero	–
Dummy – Narrow users (up to 1 hour)	**229**	**0.12**
Dummy – Narrow users (over 1 hour, up to 5 hours)	**600**	**<0.01**
Dummy – Narrow users (over 5 hours, up to 10 hours)	**158**	**0.53**
Dummy – Narrow users (over 10 hours, up to 20 hours)	**239**	**0.51**
Dummy – Narrow users (over 20 hours)	**–602**	**0.21**
Dummy – Moderate users (up to 1 hour)	**499**	**<0.01**
Dummy – Moderate users (over 1 hour, up to 5 hours)	**743**	**<0.01**
Dummy – Moderate users (over 5 hours, up to 10 hours)	**421**	**0.12**
Dummy – Moderate users (over 10 hours, up to 20 hours)	**176**	**0.67**
Dummy – Moderate users (over 20 hours)	**–1,115**	**0.05**
Dummy – Broad (without leisure) users (up to 1 hour)	**1,208**	**<0.01**
Dummy – Broad (without leisure) users (over 1 hour, up to 5 hours)	**944**	**<0.01**
Dummy – Broad (without leisure) users (over 5 hours, up to 10 hours)	**840**	**<0.01**
Dummy – Broad (without leisure) users (over 10 hours, up to 20 hours)	**62**	**0.85**
Dummy – Broad (without leisure) users (over 20 hours)	**–754**	**0.15**
Dummy – Broad (with leisure) users (up to 1 hour)	**482**	**0.22**
Dummy – Broad (with leisure) users (over 1 hour, up to 5 hours)	**472**	**0.03**
Dummy – Broad (with leisure) users (over 5 hours, up to 10 hours)	**307**	**0.20**

(Continued on next page)

Parameter	Mean parameter estimate	Significance (p-value)
Dummy – Broad (with leisure) users (over 10 hours, up to 20 hours)	**–107**	**0.70**
Dummy – Broad (with leisure) users (over 20 hours)	**26**	**0.94**
Dummy – Non-users of Internet	**Fixed at zero**	**–**

Source: SHS

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