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Men Shape a Downward Trend in Car Use among Young Adults—Evidence from Six Industrialized Countries

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ABSTRACT This paper investigates trends in the travel behaviour of young adults in Germany, France, Great Britain, Japan, Norway, and the USA over the past few decades with a focus on car availability and car travel. The trend analysis relies on micro-data from over 20 National Travel Surveys from the study countries dating back to the mid-1970s. The analysis of the survey data is supplemented by official statistics on licence holding. On this basis, this paper compiles a body of evidence for changes in mobility patterns among young adults in industrialized countries over the past few decades. The findings indicate that since the turn of the millennium, access to cars, measured in terms of drivers' licences and household car ownership, has decreased in most study countries—especially for men. Moreover, average daily car travel distance has decreased in most study countries, again especially for men. In France, Japan, and most significantly in the USA, the decrease in car travel has led to a reduction in total everyday travel by young travellers. In Great Britain, the decline in car travel was partly, and in Germany fully, compensated by an increased use of alternative modes of transport.

1. Introduction

For decades, young people's mobility development in industrialized countries has been in line with the growth of *per capita* travel associated with increasing motorization and car use in these countries (Progtrans, 2010; The World Bank, 2010). More recently, there has been a strong indication of profound changes in the travel behaviour among young adults in industrialized countries with signs of decreasing car orientation and reduced overall travel (Kuhnimhof, Bühler, & Dargay, 2011; Kuhnimhof, Bühler, Wirtz, & Kalinowska, 2012; Noble, 2005; Ruud & Nordbakke, 2005).

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In industrialized countries, young adults, between 20 and 30 years old, have traditionally been more mobile than any other age group (Institut für Angewandte Sozialwissenschaft, 2012; US Department of Transportation, Federal Highway Administration, 2012). Moreover, young adults' travel behaviour shapes future travel demand, because young travellers maintain at least some of their travel habits as they age. Since young people's travel habits are not yet as strongly ingrained and are more malleable than later in life, young adults are also more likely to change their travel behaviour in response to changing economic, social, and transport-related conditions.

This paper presents a review of travel behaviour of young adults in six industrialized countries, namely Germany, Great Britain, France, Japan, Norway, and the USA. Our review covers four decades, starting in the 1970s, but focuses on trend changes during the last decade. For this international comparative analysis, this paper gathers various sources of information, beginning with a brief literature review by country. A harmonized analysis of young adults' travel behaviour based on individual-level data on travel from over 20 National Travel Surveys (NTSs) represents the backbone of our study.

Our study covers many facets of mobility behaviour ranging from fundamental long-term choices such as driving licence holding to mode choice. We focus on daily travel because this segment of travel behaviour is captured more accurately by travel diary surveys than holiday travel. We illustrate that many travel indicators have seen relevant changes in trend since the turn of the millennium. Because survey data in general have their methodological limitations, the significance of single developments identified on the basis of NTS data should not be overstated. However, by combining various data sources, this paper compiles a body of evidence for considerable changes in the mobility behaviour of young adults in recent years. This study identifies important common denominators of this development across the study countries as well as highlights differences. This paper discusses these findings in the context of developments in relevant factors such as economy, demography, education, and transport supply. The paper concludes with implications for future research on this issue.

2. Literature Review

After decades of strong growth in aggregate travel demand fuelled mainly by increasing car use, there is a strong indication that the growth of everyday travel at the aggregate level is slowing down or even stagnating (Litman, 2006; Newmann & Kenworthy, 2011; Zumkeller, Chlond, & Manz, 2004). Particularly, automobile travel demand seems to be decreasing, stagnating, or growing only slowly in Western Europe and North America (Le Vine, Jones, & Polak, 2009; Newmann & Kenworthy, 2011; Puentes & Tomer, 2008). The term 'Peak Travel' has been coined for this development (Millard-Ball & Schipper, 2011). This change in trend is occurring in many countries even though—specifically in Europe—*per capita* automobile use of elderly travellers is still on the rise as the first highly motorized generation born after World War II is reaching retirement age (Buehler & Nobis, 2010; Forschungsgesellschaft für Straßen- und Verkehrswesen, 2006; Ottmann, 2010). Hence, for stagnation to occur, there must be developments which compensate for this travel demand growth in the elderly segment of the population (Dejoux, Bussi re, Madre, & Armoogum, 2010).

The research on 'Peak Travel' has so far paid little attention to diverging travel trends of different age groups. However, among young people, there is indeed a development that partly compensates for travel growth in other parts of the population. In recent years, there has been more and more indication that travel trends among young people in industrialized countries around the world are changing. Even before the year 2000, there was an early indication for this phenomenon: licensing statistics showed decreasing shares of licensed drivers among young adults in the USA, Great Britain, and Norway (Department for Transport, 2010; Federal Highway Administration, 2011; Nordbakke & Ruud, 2005); vehicle registrations *per capita* started to decline for young Germans in the early 1990s (Deutsche Shell, 2001).

After the turn of the millennium, more and more data that shed light on different aspects of this development in a number of industrialized countries have become available.

In the USA, the continued decline in the share of licensed drivers among young people was accompanied by a decreasing travel demand of young adults. The American 2008 National Household Travel Survey reported fewer trips *per capita* and fewer miles travelled for all age classes—a decline that has to be interpreted in the context of the high fuel prices and the start of the economic crisis during the survey period. However, the decrease in car mileage in the USA was most pronounced for young adults (Federal Highway Administration, 2012). This finding is in line with the results from regional travel surveys for the metropolitan area of Washington, DC, showing decreasing trip rates for young adults between 1994 and 2008. This survey also indicated a shift in mode choice from the car to alternative modes for young people in the DC area (Metropolitan Washington Council of Governments, 2010).

For the Nordic European countries Norway and Sweden, Ruud and Nordbakke (2005) discuss the decline in licence holding among young people, specifically in urban areas. They allude to socio-economics and increasing urbanization as important explanations of this development. Frändberg and Vilhelmson (2011) confirm this trend with their long-term analysis of the Swedish NTS and additionally point to decreasing car availability and travel demand by young Swedes.

For Great Britain, Noble (2005) analysed the trend towards lower licence holding among young people in greater detail. She found that increased difficulty of driving tests and a rising share of unlicensed drivers might have contributed to this phenomenon. Above all, Noble speculates that increasing urbanization, more students, lower available incomes among young adults, and increasing costs for motoring help to explain this trend.

For Germany, the decrease in vehicle registrations for young drivers continued after the turn of the millennium (Kraftfahrtbundesamt, 2010a). Vehicle registrations might not reflect car ownership adequately, for example, because young Germans register their vehicles in their parents' name to avoid high insurance rates for novice drivers. However, other German statistics confirm the trend to a reduction in car ownership among young adults: while in 1993 53% of German students reported expenditures for a car, this figure had declined to 34% in 2009 (Bundesministerium für Bildung und Forschung, 2010). Between 2003 and 2008, the share of households with cars among all young German households, where the head of household is under 35, had decreased from 76% to 72% (Statistisches Bundesamt, 2003, 2008). Additionally, German NTSs

indicated an increase in young adults without car, modal shifts to alternative means of transport, and fewer young people with daily usage of the car (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2010; Kuhnimhof et al., 2012; Zumkeller et al., 2009). The German public and academic discourse about decreasing car ownership for young people is dominated by speculations about the impact of information and communication technology (ICT) on travel behaviour and psychological reasons such as new status symbols (Kruse, 2009; Tully, 2011). However, Kuhnimhof, Wirtz, and Manz (2012) show that socio-economic developments explain the majority of the decrease in young Germans' car ownership.

Kuhnimhof et al. (2011) compared the trend towards reduced car travel by young Germans and Britons and identified important similarities, namely increasing multimodality and stronger decreases in car travel for young men than for young women. Diverging trends by gender have also been found for other countries, namely Sweden (Frändberg & Vilhelmson, 2011) and the USA (Federal Highway Administration, 2011). There is a body of research on differences in mobility by gender, specifically looking at the traditionally much higher car ownership and usage by men (Rosenbloom, 2004) which prevailed for a long time even though in many domains of life the gender gap had been closing (Hjorthol, 2008). The recent divergence of mobility trends for young adults by gender has so far drawn little research attention.

In summary, the existing literature indicates a decrease in car orientation of young adults in various industrialized countries since the 1990s. Up to now, the statistics, figures, and sources of information used in this research have been quite heterogeneous. This inhibits a sensible comparison of the trends in different countries. The current study provides for such comparability and enables the identification of common denominators for the observed developments as can be found in diverging trends for men and women.

3. Data and Methodology

3.1 National Travel Surveys

Except for some figures on licence holding, this study is based on a descriptive statistical analysis of NTSs. Differences in definitions often inhibit comparisons of NTS results published in reports. Therefore, we conducted a harmonized descriptive analysis of micro-data from over 20 NTSs from four decades (Appendix 1 (available online) presents the list of used NTS data sources and sample sizes).

NTSs analysed for this study are all composed of a travel diary and additional questionnaires to capture household and individual information. Most of the utilized NTSs cover travel of the resident population of the entire territory of the respective country. The Japanese surveys which cover travel in selected cities represent an exception. To be comparable within Japan over time, our analysis through 2005 includes data from the 41 Japanese cities which formed the 1987, 1992, and 1999 samples even though the 2005 survey included 62 cities.

The usual reporting period in the utilized NTSs is one travel day (one week day and the weekend for France in 1994 and 2008). The British NTS, the German Mobility Panel (MOP) (from 1994 onwards), and the French NTS in 1982 are exceptions and cover an entire week. Surveys also differ with respect to many other characteristics such as sampling, recruitment, or mode of the interview. Differences exist

between countries but often also within national NTS series over time. In the following section, labelled 'Approaches for Harmonized Analysis', we describe our methodological approach to minimize the distorting effects of dissimilarities in survey methodology.

Among the utilized surveys, the British NTS and the German MOP feature the highest degree of continuity as they have been conducted continuously (Britain) or annually (Germany) since the mid-1990s with little change in methodology. Some surveys (e.g. Germany 1989 and Japan 1999) were excluded from certain analyses because the surveys exhibited extraordinarily high shares of missing values for specific variables. Because in the German MOP (1995–2009), age group-specific sample sizes for single years were quite small, MOP data were pooled into 1997 (1995–99), 2002 (2000–04), and 2007 (2005–09). Likewise, the British NTS data were pooled into 1996 (1995–97), 1999 (1998–2000), 2002 (2001–03), and 2005 (2004–06) (see Table A1 in the Appendix).

For ease of presentation, we have selected three representative years for most NTS-based graphs in this paper: (a) a first year dating back as far as possible in the analysed time series (1970s/1980s); (b) a second year in the 1990s which appears to represent the peak of many of the analysed trends; and (c) a third year representing the time around or shortly after 2005 which in most cases was the period when the most recent data were available at the time the study was conducted. The results for all the analysed years are given in Appendix 3.

3.2 Approaches for Harmonized Descriptive Analysis

Our analysis aimed at obtaining key mobility figures as harmonized and comparable as possible, not only internationally but also over time within countries. In principle, NTS data allow for the same type of analysis of data from different temporal or national contexts using common denominators. Nevertheless, comparisons of travel data across different surveys are often hampered by differences in survey methods that distort survey results (Hubert, Armoogum, Axhausen, & Madre, 2008). Hence, the challenge for our analysis was to harmonize NTS data *ex post* as well as possible and thus mitigate the impact of survey design differences. Even though such *ex post* harmonization is paramount for making results from different travel surveys comparable, we did not find systematic research on this issue. Following other pragmatic approaches to this challenge (Hubert & Toint, 2006; Timmermanns et al., 2003), we decided to use indicators as robust as possible to overcome differences in definitions, mitigate heterogeneous impacts of survey methodology on survey outcomes, and thus ensure best possible comparability of the presented results:

Car availability was defined as the coincidence of a driving licence on the person level and car ownership on the household level. Car availability includes passenger cars, sport utility vehicle (SUVs), and light trucks. This is particularly important for the USA, where SUVs and light trucks have accounted for an increasing share of the vehicle fleet.

Travel modes were categorized into foot, bicycle, motorcycle, public transport (including long-distance rail, coach, and air travel), and car (including driver and passenger as some of the analysed NTSs do not differentiate the two categories). The category car comprises all light-duty vehicles for private passenger use, such as passenger cars, SUVs, and light trucks.

Travelled distances were cut off at 500 km in order to take account of the fact that the British NTS includes only journeys within Great Britain (i.e. if a trip was longer than this distance, it was counted only as 500 km).

Kilometres per trip-maker per day were chosen as the measure for *per capita* travel demand, first, because biases in the share of trip-makers which affect key mobility indicators per person and day do not matter if only mobile persons are considered and, second, because omission of short trips which are more likely to be underreported in surveys due to recall error leaves reported total daily travel distances largely unaffected (Kuhnimhof, Collet, Armoogum, & Madre, 2009). *Travellers aged 20–29* were selected as the study group for our NTS analyses. This is because for data privacy reasons the age is only available in age groups in the British NTS. Under this limitation, the common age group definition 20–29 proved to show the most significant changes in the travel behaviour trends. Therefore, all the presented mobility figures refer to this age group, except the statistics on licence holding which partly use other data sources with a different age breakdown.

We acknowledge that for an in-depth analysis of changes in travel behaviour, indicators with a greater degree of detail would provide additional insights. For example, our decision to subsume both ‘driver’ and ‘passenger’ under ‘car’ possibly hides shifts in car use or occupancy rates. Moreover, kilometres per trip-maker and day as a measure of mobility demand emphasize distances travelled and possibly disguise changes in activity participation—as would be captured by analysing the number of trips. Finally, the limitation on distances up to 500 km has implications for the scope of our study: journeys over 500 km account for roughly about one-fifth of total travel distance (Kuhnimhof & Last, 2009). In contrast to the observed trends in daily travel, the number and the distance of trips over 500 km still seem to increase in industrialized countries (Statistisches Bundesamt, 2012a). Hence, the 500-km limit emphasizes our study’s focus on everyday travel. Despite these limitations, we believe that we have chosen indicators which are both robust and meaningful for establishing internationally comparable time series and uncovering common denominators of young adults’ travel trends.

4. Trends of Key Mobility Indicators

4.1 *Driving Licences*

Driving licences represent basic prerequisites for driving and the share of licensed drivers is an important indicator for the travel options available to young people. Figure 1 shows the licence-holding rates since the 1990s (2002 for Germany) for young men and women in the six study countries. For Germany, France, Great Britain, and Norway, these figures are based on the NTS; for the USA and Japan, they refer to official statistics on licence holding based on licensing registers. For Germany (since 2006) and Norway, such licensing register statistics are also available. The trends of licensing register statistics in Germany and Norway are in line with NTS trends in licence holding depicted in Figure 1.

Between about two-thirds and almost 90% of young adults in their 20s hold a licence in these countries. Conditions for obtaining a driving licence—age limit, costs, tests, provisional licences, etc.—differ widely between countries. This

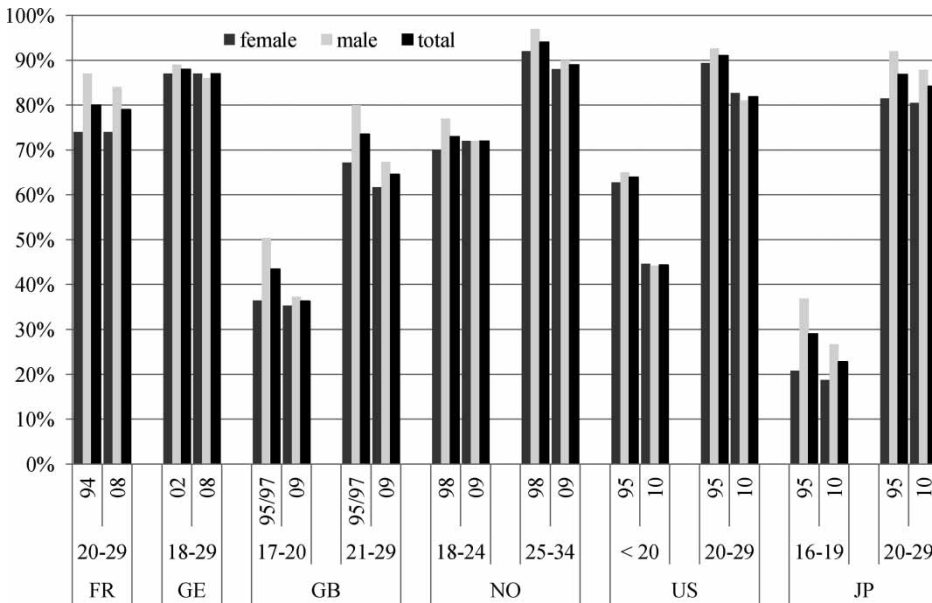


Figure 1. Share of licensed drivers among young adults by age group and gender (authors' representation; for data sources, see Appendix 2).

may help explain the heterogeneous levels of licence holding. Also the different methods for generating the licensing statistics have to be considered when comparing countries. Within each country, statistics on licence holding shown in Figure 1 are consistent over time and therefore intra-country changes over time should be reliable.

Conditions for getting a licence change over time with likely impacts on licence holding. Noble (2005) noted that passing the test for a licence has probably become more difficult in Great Britain over time. In France, the abolition of national military service in 1997—during which young men could get their driving licence for free—corresponded with a decrease in licence holding among low-income young adults (Avrillier, Hivert, & Kramarz, 2010). This reflects the manifold reasons which influence licence holding by young adults.

Overall, the share of licensed drivers among young adults has decreased noticeably in four of the six study countries. In France and Germany, there is no significant change. As mentioned above, for Germany, a new official statistic based on the licence register has become available recently (Kraftfahrtbundesamt, 2010b). It is only available from 2006 onwards and confirms the stagnation of licence holding among young adults in the recent years. Also in Great Britain and in the USA, this downward trend in licensing has turned into stagnation since about 2005.

Figure 1 also shows that in most countries the share of licensed drivers has fallen much more strongly for young men than for young women. In some cases (Germany, Japan, and teenagers in Britain), licence holding has only declined for men and has been stable for women. In the 1990s, young men were more likely to have a licence than young women in all the study countries. This has reversed in Germany and the USA and has almost levelled out in most other countries.

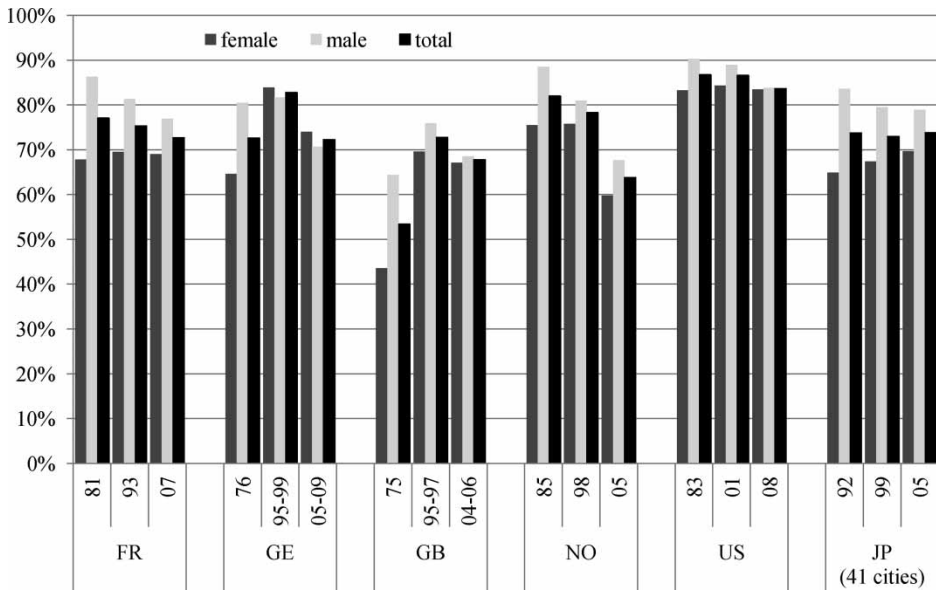


Figure 2. Car availability (personal driving licence and the existence of a car or a light-duty vehicle in the residential household) by young adults (age 20–29) by gender (authors' analysis; for data sources, see Appendix 1).

4.2 Car Availability

Another prerequisite for driving is access to a car—usually a personal car or a vehicle shared within the residential household. As a common denominator for car availability across the broad range of surveys in our analysis, we used the joint occurrence of licence holding on the person level and vehicle ownership on the household level. Figure 2 shows the evolution of car availability for the age group 20–29 by gender in the six countries under observation since the 1970s/1980s. With the exception of Japan, there was no country in which car availability for young adults in total was higher after 2005 than before the turn of the millennium. In Norway and France, a noticeable decline in car availability even occurred throughout the 1980s and 1990s. The decrease after 2000 is specifically pronounced in Germany, Norway, and Great Britain.

As Figure 2 shows, in most countries car availability has declined much more strongly for men than for women. Compared with women, men were much more likely to have a car available in the 1970s/1980s. This gender gap has diminished considerably, not only because women have caught up but also because car availability for men has decreased. The increase in overall car availability among young Japanese is due to the continued rise of car availability for young women there.

4.3 Modal Split

While car ownership in many cases is a joint decision of several household members, mode choice is mostly an individual decision, albeit influenced by car availability. Figure 3 shows mode shares for trips of young adults in the study countries and the corresponding trends over time. Conforming to expectation,

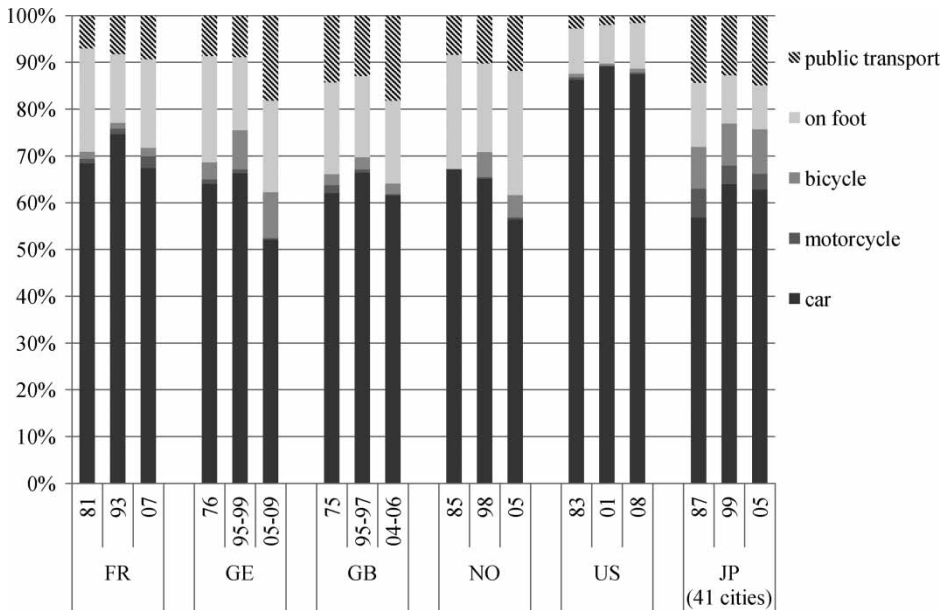


Figure 3. Evolution of trip-based mode share of travellers aged 20–29 (authors' analysis; for data sources, see Appendix 1).

the car is by far more dominant in the USA than in the other countries. On the contrary, public transport is almost negligible in the USA (<2%), while it achieves 10–20% market share in the other countries. Germany, Japan, and Norway are the only countries where a significant share of travel is covered by bicycle. In most countries, except in Japan, motorized two-wheelers are only a niche.

As we briefly mentioned in the data section, the surveying of short trips and walk trips is likely to be specifically affected by survey methodology. The example of the US NHTS survey series exemplifies this: since 2001, the US NHTS has included additional survey questions reminding respondents not to forget short trips (Federal Highway Administration, 2012). For this reason, changes in mode shares have to be interpreted with caution.

As regards the development over time, the car share has declined in the most recent period in all countries. In most cases, this represents a change in trend compared with the previous periods. Japan is the only country where the car mode share of young adults is notably higher today than that in the 1980s. On the other hand, public transport has gained ground in this age group in recent years in all European study countries. The shift from the car to public transport and non-motorized modes is specifically pronounced in Germany where a strong decrease in young adults' car ownership is combined with declining car use by young car owners, indicating increasing multimodality (Kuhnimhof et al., 2012).

4.4 Multimodality

For planners and policy-makers, it is important to understand if the decline in the car mode share is mainly caused (a) by an increased share of travellers with few alternatives (i.e. carless households or 'transit captives') or (b) by travellers with

multiple options who increasingly choose not to use the car. The latter (b) would indicate that the alternatives, specifically public transport, are increasingly competitive in a multi-optional market.

For Germany and Great Britain, Kuhnimhof et al. (2012) identified increasing multimodality as an important development among young travellers. 'Multimodality' is defined as the behavioural phenomenon of using multiple modes of transport during a certain period of time such as a travel day or week (Kuhnimhof, Chlond, & von der Ruhren, 2006; Nobis, 2007). Based on the German and British multiday NTS data, Kuhnimhof et al. (2011) were able to show that the share of everyday drivers among young persons with car availability decreased considerably in recent years. At the same time, the share of young car owners with occasional use of public transport increased in these countries.

In order to study the impact of multimodality on young adults' car mileage, we analysed the share of young car owners' total mileage by mode (Figure 4). Multi-day travel diary data are preferable to quantify multimodality because they allow for the assessment of individual mode use over longer periods of time (Kuhnimhof, 2009). If only single-day travel data are available as in many surveys of our study, the share of mileage that young car owners travel with other modes can serve as a proxy.

Figure 4 illustrates that young American drivers hardly use modes of travel other than the automobile and this has not changed in the last three decades. Young Japanese, on the other hand, exhibit the highest level of multimodality among the study countries, possibly with recent increases. The high level of multimodality among young Japanese may partly also be explained by the focus of the Japanese surveys on urban areas where multimodality is likely to be higher.

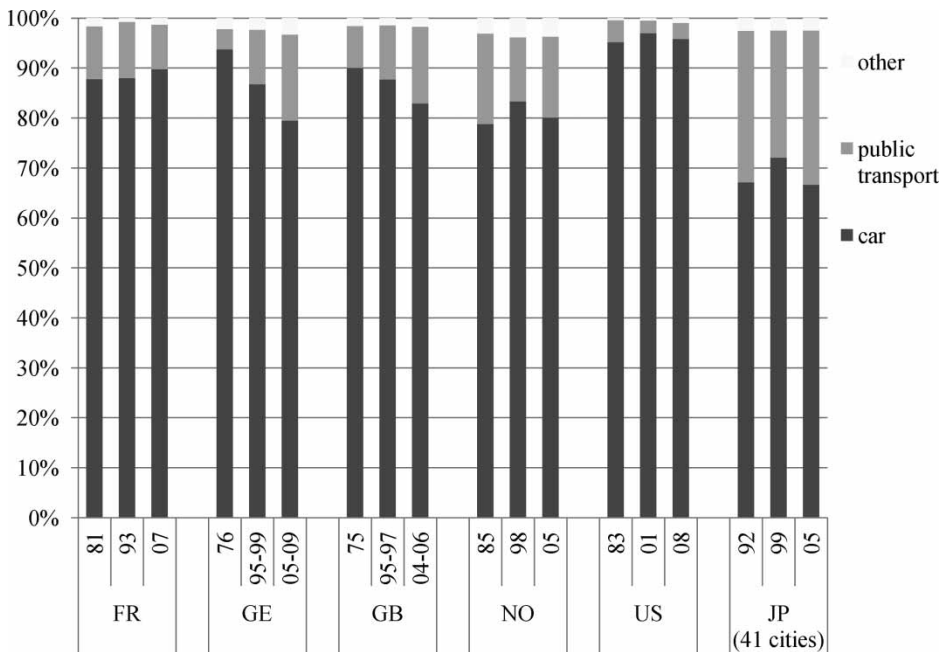


Figure 4. Share of mileage by young adults (age 20–29) with car availability by mode (authors' analysis; for data sources, see Appendix 1).

The current level of multimodality in the European countries is more or less comparable.

Increasing multimodality of car owners as a long-term trend is only evident for Germany and Great Britain. For Germany, Kuhnimhof et al. (2012) were able to show that the shift in travel demand by car owners to other modes explains almost 40% of the decrease in young adults' car mileage between 1998 and 2008. Figure 4 indicates that increasing multimodality might also be important for the development in Great Britain but is unlikely to be relevant for decreased car use in the other study countries.

4.5 Car Mileage

Total *per capita* car mileage represents the result of many individual decisions from obtaining a licence to everyday mode choice—as discussed above. Figure 5 shows the evolution of *per capita* car travel by young adults in the six study countries since the 1970s based on all the analysed NTS data (except Germany in 1989 and Japan in 1999).

Car mileages of young Japanese adults are the lowest, probably partly because the Japanese surveys only cover cities where mileage is lower. Car mileage of young adults in Japan has stagnated between 1987 and 2005. Compared with their Japanese counterparts, young Europeans exhibit almost twice the *per capita* car mileage. Figure 5 illustrates that car mileages of young travellers in Germany and Great Britain peaked in the late 1990s. Thereafter, their car mileages have been decreasing. In the case of France—which overall exhibits the level and development quite similar to those of Germany—it is possible that car travel has also peaked around 2000 without an NTS capturing this climax. The development in Norway differs somewhat from that in the other European countries as there has been an almost continuous slight decrease in car travel by young adults throughout the study period.

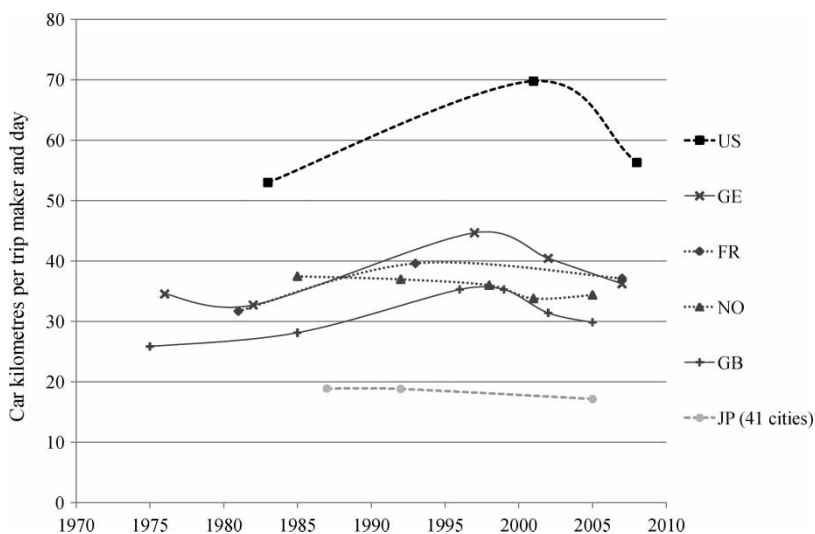


Figure 5. Evolution of car kilometres per trip-maker and day (driver and passenger) by travellers aged 20–29 (authors' analysis; for data sources, see Appendix 1).

The car mileage of young Americans is the highest among the analysed countries. The 2001 US NTS measured the highest value of *per capita* car travel of all data points in our analysis. The measure of car travel for young Americans taken in 2008 is much lower again, implying a peak of *per capita* car travel around the turn of the millennium like in some other study countries. These measurements have to be interpreted with care: an all-time high of US fuel prices (Bureau of Infrastructure, Transport and Regional Economics [BITRE], 2012) and the start of the economic crisis during the US NTS observation period in 2008/2009 are confounding factors which have to be taken into account.

While *per capita* passenger kilometres travelled by all modes and for all age classes in the other study countries largely stagnated since the turn of the millennium, all age groups in the USA reduced their observed travel in 2008 compared with that in 2001—on average, by 10%. There is an indication that vehicle miles travelled *per capita* started to decline in the USA before 2008 (Bureau of Transportation Statistics, 2012). Against this background, it seems possible that the events of 2008 have exacerbated a trend which existed before. In any case, our analyses showed that young Americans reduced their *per capita* car and total mileage more than any other age group in the USA. This indicates that young adults were spearheading the observed trend towards less car travel in the USA.

We also analysed the development of car mileage by economic activity. Car mileage *per capita* was generally higher for employed young adults, but it declined for both employed and other young adults.

Despite the heterogeneous definitions of rural and urban areas in the NTSs, we also analysed car travel for these two spatial categories (as the Japanese data did not include rural areas, this differentiation was not possible). Conforming to expectation, car travel *per capita* was lower in urban areas in all the study countries and trends towards less car travel were more pronounced in cities. Only France and Norway show a slight increase in car mileage in rural areas. Overall, significantly diverging trends of young adults' travel for rural and urban areas were not a common denominator across the study countries. However, again we found such diverging trends by gender as described in the next section.

4.6 Car Mileage and Total Mileage by Gender

In line with the findings on licence holding and car availability, trends in car mileage differed by gender: young men reduced their car mileage noticeably more strongly than women in most study countries (Figures 6 and 7). In France and Japan, car mileages of young women even continued to grow. Norway is the only study country where the gender gap in terms of car mileage increased in recent years because male car mileage increased slightly, while women reduced their driving. In the other countries, the car mileage gender gap has narrowed significantly. It disappeared in Germany and the USA as a result of the young men's trend to reduce their driving.

In the countries where young men reduced their car mileage, their overall mileage for all everyday trips declined. Only in Germany, there was a considerable shift in young men's travel to alternative modes, which is in line with the findings on multimodality described above. In conjunction with an increase in non-car travel by women, this resulted in a stagnation of total mileage in everyday travel by young German adults. In France, Great Britain, the USA, and Japan,

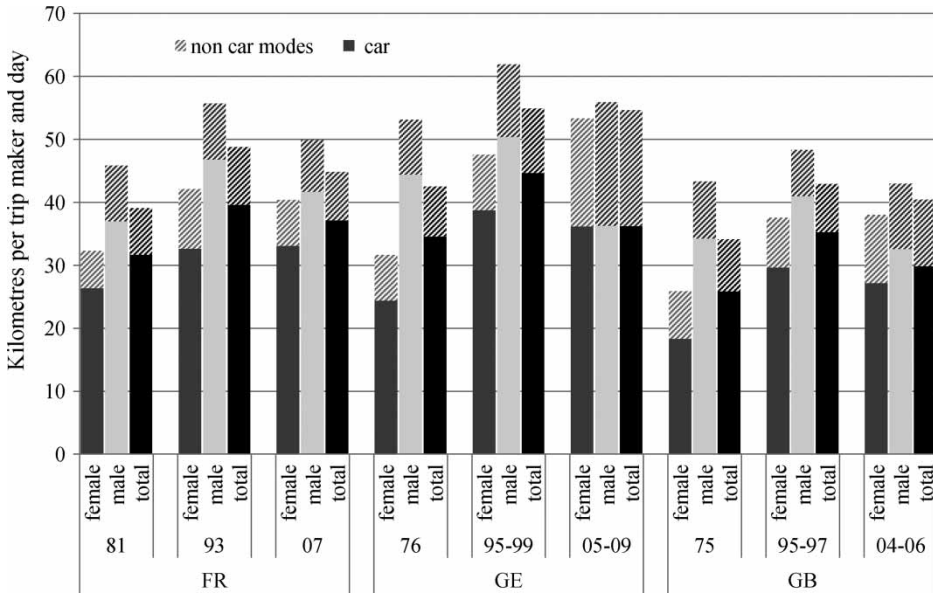


Figure 6. Evolution of kilometres travelled by car (driver and passenger) and other modes per trip-maker and day for young adults (age 20–29) by gender for France, Germany, and Great Britain (authors’ analysis; for data sources, see Appendix 1).

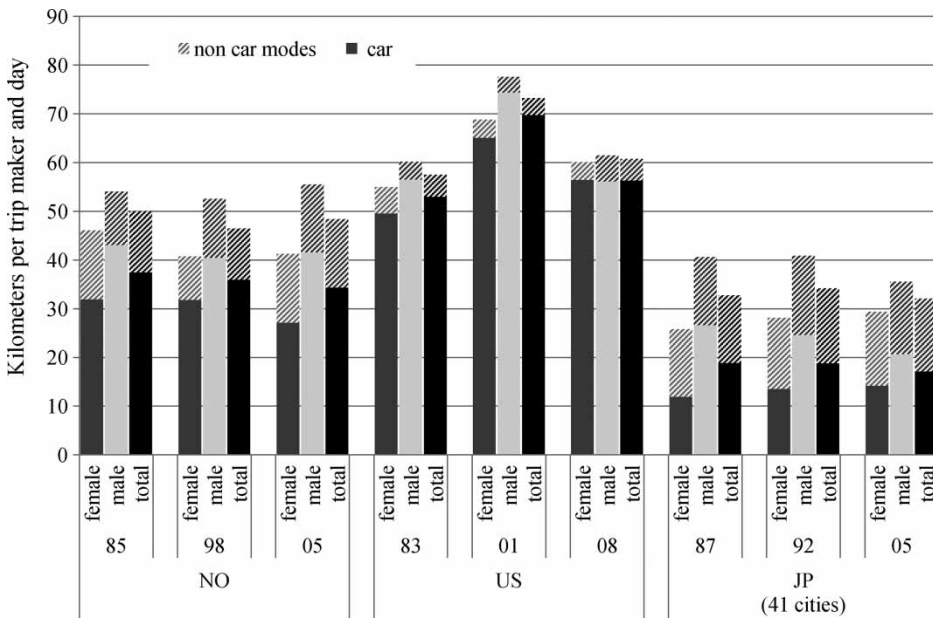


Figure 7. Evolution of kilometres travelled by car (driver and passenger) and other modes per trip-maker and day for young adults (age 20–29) by gender for Norway, the USA, and Japan (authors’ analysis; for data sources, see Appendix 1).

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total everyday travel by young adults was lower after the turn of the millennium than before.

5. Discussion

The bottom line is that the study countries have seen declines in the dominance of the car for young adults' mobility in the decade since the turn of the millennium. In the case of some indicators or countries, such developments have been going on for two decades or even longer. The decrease in automobile ownership and use is predominantly—and in some countries exclusively—a male phenomenon. Moreover, in some countries, the mode choice behaviour of young adults is shifting to alternative modes and in most countries their overall travel demand has declined.

A sound interpretation of the presented figures and developments needs to consider the possible impacts of survey selectivity on the quality of survey results. Documentation of survey fieldwork indicates that specifically young adults are among the segments of society that have become increasingly difficult to recruit for travel surveys (Zumkeller, Vortisch, Kagerbauer, Chlond, & Wirtz, 2011). The NTSs in our analyses generally use weights to correct for potential socio-demographic biases. Nevertheless, there is the possibility of a self-selection bias of individuals with specific mobility styles which possibly magnifies the presented trends if it increases over time. However, our NTS-based results are not only harmonized across countries and over time but also consistent with other sources of information, such as licensing statistics. Therefore, it is unlikely that the observed changes in trend can be entirely attributed to survey selectivity. We are confident that our findings about a decrease in young adults'—and specifically young men's—car orientation reflect a real development.

There are numerous possible explanations for the observed changes in mobility patterns by young travellers, which we briefly discuss in the following. To start with, all of the study countries are undergoing relevant socio-economic changes that need to be taken into account.

5.1 Socio-economic Changes Leading to Altered Living Situations for Young Adults

Overall, the share of young people receiving tertiary education is still increasing (UNESCO, 2011). Corresponding with this development are decreasing workforce participation among young adults (The World Bank, 2010) and an increasing age for starting a family (INSEE, 2009; Office for National Statistics, 2012; Statistisches Bundesamt, 2010; US Census Bureau, 2010). Moreover, in many countries, the share of urban population—specifically among the young—is still increasing (Statistisches Bundesamt, 2012b; The World Bank, 2010).

All of these socio-economic developments contribute to a larger share of young people being in a life situation in which they are less prone to car ownership or use. Moreover, these developments are fundamental long-term societal trends. Their influence on young adults' mobility could also help explain why in some cases—licence holding in Great Britain, vehicle registrations in Germany, and car availability in Norway—the dominance of the car for young adults' mobility started to decline as early as about 1990. Kuhnimhof et al. (2012) have shown that these socio-economic factors in conjunction with a decrease in real incomes of young adults explain about two-thirds of the decline in car ownership among young German adults in the last decade.

A high relevance of these socio-economic developments for the mobility trends of young adults seems likely in all study countries. Nevertheless, the German results cannot simply be transferred to other countries as the details of these socio-economic developments differ from country to country. Diverging trends for youth unemployment indicate the heterogeneous developments of young adults' income situation in the study countries even though all countries experienced overall gross domestic product growth between 1995 and 2008 (The World Bank, 2010). Also other influential factors have developed differently in the various countries, for example, the age of leaving the parents' home: while it has risen only a little bit in Germany in the last 30 years (Weinmann, 2010), it has increased significantly in Japan (Japan Ministry of Internal Affairs and Communications, 2010), potentially giving more young Japanese the option to use their parents' car. This may help to explain why car availability among young Japanese has still been increasing, even though licence holding has decreased. Overall, the heterogeneity of the socio-economic conditions renders necessary a country-by-country analysis to assess the relevance of socio-economics as a driving force for the changing mobility patterns of young people.

5.2 *Factors with Possible Impacts on Young Adults' Travel Behaviour*

The outlined socio-economic developments are not likely to explain the observed mobility trends entirely. Also with regard to other potential explanations for young adults' mobility trends, common denominators—albeit with some heterogeneity in detail—can be found for the study countries: all countries except Japan have seen significant fuel price increases between 1995 and 2007 (the year before the financial crisis) with real gasoline prices increasing between 13% in Norway and 85% in the USA (BITRE, 2012).

Regarding the transport system, in many countries, numerous policy measures aim at discouraging driving and fostering the use of other modes, at least in urban areas. The London congestion charging scheme, pedestrianizing Times Square in New York City, and the introduction of substantial student discounts for public transport in Germany ('Semesterticket') (Buehler & Pucher, 2012; Peistrup & Stingel, 2007) represent landmarks of this multifaceted development.

There have also been significant developments regarding supply and price in long-distance travel (e.g. emergence of low-cost air travel and extension of high-speed rail). Overall, these developments have likely stimulated continued growth of long-distance travel among young adults (Statistisches Bundesamt, 2012a). Nevertheless, these developments may have had unexpected impacts on everyday travel: if long-distance trips by car are replaced by air travel as observed in Germany (ifmo, 2011), this might motivate those who owned a car primarily for long-distance journeys to make do without a private car.

Psychological factors represent another important aspect to consider. They may range from environmental awareness to more pragmatism in everyday mobility choices.

Finally, the impact of ICT, which has developed dynamically in the recent years, on travel behaviour remains an open question (ifmo, 2003; Mokhtarian, Salomon, & Handy, 2006). Possibly, this issue should be revisited with a focus on those who grew up with ICT and developed their mobility habits in the presence of such technology. Specifically and more recently, the impact of the emergence of smart-phones and other mobile devices on young adults' mobility has been discussed

(a) because these devices enable online activity while travelling which might impact on mode choice and (b) because they possibly replace the car as new highly visible status symbols (Tully, 2011). We believe that with regard to the trends described in this paper, the impact of such devices is negligible: the presented trends have been going on during the last two decades. The i-phone, on the other hand, is currently only 5 years old, indicating that the impact of smart-phones on travel can only be very recent.

6. Conclusions and Outlook

The mobility of young adults in industrialized countries is still dominated by the car—but less so than that only a decade ago. Based on evidence from Germany, France, Great Britain, Norway, Japan, and the USA, this paper substantiates findings that mobility patterns in daily travel among young adults in industrialized countries have been changing in recent years: access to cars in terms of driving licences and car availability in households has decreased in most study countries, particularly for men. Moreover, car travel distance *per capita* has also decreased in most study countries, again particularly for men. In France and Japan and specifically the USA, the decrease in travel by car has led to lower overall mileages for everyday travel by young adults. In Great Britain, this was partly and in Germany fully compensated by an increased use of alternative modes.

The findings of this study are based on numerous secondary sources as well as descriptive statistical analysis of NTSs. In our analysis, we applied *ex post* survey harmonization in order to make sure that the results from the different NTSs are comparable even if the survey methodologies differed. For this, we chose pragmatic approaches because systematic research on such *ex post* survey harmonization is largely missing. We believe that in addition to the on-going efforts to improve and harmonize travel surveys, research should be dedicated to *ex post* harmonization of existing surveys. This would help to improve comparative statistics based on travel surveys. It would also enable making the most out of the existing data from different surveys.

Despite these constraints, we believe that the findings of our study are robust, reflect real developments, and help to identify common denominators for and differences in the changes in young adults' travel across countries. Moreover, given the wide range of countries covered in our study (North America, Japan, and Central and Northern Europe), it would be no surprise if the trend towards decreased car orientation among young adults also prevailed in other industrialized countries. In pointing out the importance of gender and mode choice in this context, this study gives important hints as to which issues have to be considered when conducting research on this phenomenon in additional countries.

The brief discussion of possible explanations for the observed changes in travel behaviour development also showed international similarities with regard to potential reasons for this development. Nevertheless, the details of relevant socio-economic developments differ from country to country. This suggests the necessity of a detailed investigation of the explanatory contribution of these factors on a country-by-country basis.

Socio-economics do not fully explain the observed changes in travel. For example, diverging trends by gender indicate that other factors also shaped changes in travel behaviour. Until recently, car ownership and driving have been lower for young women than for men. Moreover, both genders increased

their car ownership and driving until the 1990s. An underlying pattern of increasing car ownership and use may have continued for young women during the last decade as they were catching up with men. For women, this catching-up may have partially offset a trend towards decreased car orientation for both genders.

However, it seems likely that relevant factors influenced men more than women because the change in trend appears to be stronger for men. In this context, it might be worthwhile to investigate psychological factors with different impacts on men and women but also societal developments such as intra-household task-sharing.

In those countries where decreased car availability and car travel were not or were only partially compensated by increased travel by other modes, this has led to a decline in *per capita* daily travel by young adults. Against this background, understanding this decrease in car availability and car travel, that is, mainly the altered mobility choices by young men, might be a key to explaining why everyday travel demand in industrialized countries has been stagnating recently even though motorization still grows among the senior population.

Finally, our findings have important implications for modelling transport because they present unexpected changes in behavioural trends. If there is a break in trends, models based purely on past experience will result in inaccurate forecasts. Moreover, we do not know whether this new generation of travellers maintains their novel travel patterns as they age or whether they simply return to the more auto-orientated mobility styles of their predecessors later in life. This is an open question with significance for travel demand forecasting. These all suggest that exploring the future with different scenarios instead of point projections would be more adequate.

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