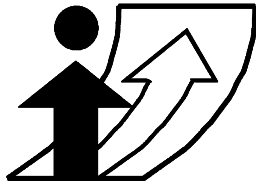


# **DEMOTORISATION SEEN THROUGH PANEL SURVEYS: A Comparison of France, Britain and Germany**

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## Demotorisation seen through Panel Surveys: A Comparison of France, Britain and Germany

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## Abstract

This paper examines the issue of demotorisation, i.e. the reduction in the number of cars owned by individual households. From a single survey conducted at one point in time, it is possible to get some information about demotorisation by asking retrospectively about past car ownership and when and why the number of cars in the household was reduced. However, a panel survey can provide much more information on the circumstances behind demotorisation since more information is available concerning other background factors, at various points in time, which may be of relevance to household car ownership decisions. This study uses panel data to examine the phenomenon of demotorisation in three European countries, France, Germany and Britain. The data sources are the French Parc Auto Survey (SOFRES-INRETS-ADEME), the German Mobility Panel (MOP) and the British Household Panel Survey (BHPS).

We define two main types of demotorisation: partial demotorisation, which is defined as reducing the number of cars but still remaining a car household and full demotorisation, which means giving up car ownership entirely.

In addition to comparing reductions in car ownership in the three countries, the study investigates the factors behind these differences. Factors considered are the age of the head-of-household, employment status, changes in household structure, changes in residential and work location, unemployment and retirement. The dynamics of demotorisation and the response to changes in circumstances are examined as well as the relationship between demotorisation and mobility.

Keywords: Motorisation, demotorisation, car ownership, panel survey

### Preferred citation

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## Introduction

Car ownership and the number of households and individuals with access to a car have been increasing more-or-less continually over the past decades in most countries. From year to year the changes are generally relatively small. The net changes that are observable on the aggregate level, however, conceal much more substantial changes on the individual household level. The net increase in car availability<sup>1</sup> is composed of some households increasing their number of cars and some, although fewer, households reducing their number of cars. The objective of this paper is to examine these reductions in car availability, a phenomenon we term “demotorisation”. Demotorisation is defined as any reduction in the number of cars available to an individual household, so that dispensing with second or third cars as well as giving up cars totally are included.

To observe such changes, it is necessary to have observations of the number of cars available to individual households over time. From a single survey conducted at one point in time, it is possible to get some information about total demotorisation by asking retrospectively about past car ownership and when and why the number of cars in the household was reduced. However, a panel survey can provide much more information on the circumstances behind various kinds of reduction in car ownership since more information is available concerning changes in other background factors, at various points in time, which may be of relevance to household car ownership decisions. This study uses panel data to examine demotorisation in three European countries, Britain, France, and Germany. The data are from the British Household Panel Survey (BHPS), the French Parc Auto Survey (SOFRES-INRETS-ADEME), and the German Mobility Panel (MOP).

We can define two main types of demotorisation:

- full demotorisation: a household which becomes a non-car household i.e. a reduction in car availability from 1 or more cars to 0 cars
- partial demotorisation: a multi-car household which reduces the number of cars, but remains a car household e.g. goes from 2 to 1 car or from 3 to 2 or 1 car.

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<sup>1</sup> The correct term is “availability” since we include both cars actually owned by the household and company cars to which they have access for personal use. Reference to “car ownership” in the paper refers to availability unless otherwise stated.

Demotorisation can be either a temporary or a long-term phenomenon. The former implies a reduction in the number of cars for one or more years followed by an increase. An example of this could be a period of unemployment of a household member – a car is sold when the person becomes unemployed and another car is purchased when the person begins work again. Long-term demotorisation is longer-lasting and can be thought of as permanent. Examples are when a car driver leaves the household and takes their car with them, when people give up driving for reasons of age or health, or because they no longer need a car for travel. Unless we have information about why the number of cars has been reduced, the conclusions that we can draw about the permanence of demotorisation are limited by the number of years over which the same household is observed.

We can also distinguish between relative and absolute demotorisation. In relative demotorisation the number of cars in a household is reduced because a car owner leaves the household and takes their car with them. In this case, both the number of cars and the number of drivers (or persons of driving age) are reduced at the micro level, but there is probably no reduction at the macro level, since the decrease in cars in one household is compensated for by an increase in cars in another household. In absolute demotorisation the number of cars is reduced, but the number of adults of driving age (or drivers) in the household remains the same: there is a reduction in the total number of vehicles at both the micro and macro level.

In addition to comparing reductions in car availability in the three countries, we examine the factors behind these reductions. Differences between groups of households, the effects of changes in employment, changing household structure and changes in residential and work location are considered. For France and Germany, we will also examine the effects of demotorisation on mobility and travel patterns (this cannot be done for Britain since the BHPS does not have data on car use).

The outline of the paper is as follows. After a description of the data sources (Section 2) and some background information for the three countries (Section 3), Section 4 presents the year-to-year changes in car availability and examines the reductions in car availability, while Section 5 highlights differences in demotorisation for various groups of households. Section 6 attempts to address the factors behind demotorisation. The dynamics of demotorisation are illustrated in Section 7, and the impact on mobility is examined in Section 8. The main conclusions of the study are summarised in Section 9.

## Data sources

### 1.1 France

« Parc-Auto » SOFRES is an annual panel survey of households based originally on households whose head is of French nationality, but extended in 2002 to all residents. Designed by INRETS and SOFRES, conducted by SOFRES (French polling institute) as part of the “Metascope” panel sample, this survey follows the evolutions of car ownership and car use. This ongoing survey is one of the most important continuous observation tools of French household behaviour (and behavioural changes). It is financed by ADEME, the French Agency for Environment and Energy Management, CCFA, the French Car Manufacturers Committee, and DSCR, the Department of Road Safety of the Ministry of Transport.

At the end of each year, 10 000 panellists (renewed at the rate of approximately 1/3 per year) complete a self-administered questionnaire, describing all private cars and light trucks available in their household. The essence of the questionnaire remains the same for each annual wave. It contains:

- a socio-economic and demographic description of the household and of one random individual, driver or not;
- car ownership;
- description of (max) 3 cars in the household with their technical characteristics (age, type of vehicle and type of fuel) and car use (total and annual mileage, for commuting and other main purposes of use, estimated fuel consumption per 100 km, etc.).

The annual files are available at INRETS as of 1984. The sample size varies from about 6500 to 7000 households each year, depending on response rate. These answers are weighted with five criteria to make them representative of the whole of France.

The database « *Parc* », organized, maintained and exploited at INRETS from 1984 to 2000, gathers all the annual waves of this survey together. It allows us to follow the dynamic evolution of car ownership and car use by both instantaneous global indicators (such as total fleet size, averages of mileage and consumption) and longitudinal analyses, using disaggregated pairing of the observations present in consecutive annual waves of the panel data.

Each household is supposed to stay in the panel for 3 or 4 years, so the « year n/year n+1 » pairing produces annual sub-sample of about 4 to 5 000 households, but we have identified 1750 households who have responded almost continuously for at least 10 years. Since the questionnaire is more time-consuming for households with cars, households without cars, or those which demotorised a long time ago, are easier to recruit and retain and are thus over-represented in the panel. For example, 22% of households are non-motorised according to the 1994 wave, but this increases to almost 25% in the sample of the households who gave full interviews from 1994 to 1998.

## 1.2 Germany

After German reunification in 1990 and massive growth rates of travel demand in the 80s, the German Ministry of Transport established the German mobility panel (MOP) to monitor transport demand to better understand the underlying processes. It was designed as a multi-purpose instrument and as a consequence a balance had to be struck between the depth of the survey and the burden imposed on respondents. Characteristics of the households and individuals are collected and respondents also complete a one-week travel diary. Each year about 350 new households are recruited, and it is envisaged that they will remain for 3 years thus producing a rotating panel. Within these household cohorts there is an average attrition rate of about 30 % (as the demands made on survey respondents are high). This annual refreshment results in about 450 households which are “repeaters” in any pair of consecutive years. The sample size each year as a cross-section comprises about 750 households. Altogether 2794 transitions from one year to the next can be observed, some of which are for the same households between different years.

In the beginning (1994 – 1999) the survey was undertaken only in the former Federal Republic of Germany (the former West Germany). In 1999 the survey was extended to include the “new” states of the former German Democratic Republic. This later enlargement has no consequences for demotorisation since in East Germany car ownership rose very rapidly in the first half of the nineties as a part of the catching-up-process with the west. By the end of 2001 the number of cars in private households had reached 479 per 1000 inhabitants in the eastern part and 514 per 1000 inhabitants in the western part.

The multi-stage recruitment and the repetition process introduce a selectivity-bias. Households without cars are more difficult to recruit than households with cars as the non-car-owners are less interested in mobility questions. Therefore the merged transitions are weighted to make them representative of the population as a whole. Overall the results can be interpreted as a snapshot of the change in socio-economic conditions and absolute

motorisation level in the whole of Germany in the period in 2000/2001. Nevertheless certain selectivity phenomena remain and may cause some biases in the results.

The trend of a slowly rising level of car-ownership within the population (cars per 1000 inhabitants) is roughly represented by this weighting approach. In Germany since the end of the catching-up process (in about 1997) the annual average increase in the number of passenger cars is about 1.2 %.

### 1.3 Britain

In contrast to France and Germany, there is no national transport panel survey for Britain. The data employed in this study are from the British Household Panel Survey (BHPS), which was established by the ESRC Research Centre on Micro-Social Change at the University of Essex in 1991 and was primarily designed to further understanding of social and economic change at the individual and household level in Great Britain. Although it is not a transport survey *per se*, the BHPS contains some information relating to transport: household car ownership and access to company cars, as well as a wealth of information on a large number of socio-economic and demographic characteristics.

Because the BHPS is designed to be statistically representative of all households in Britain, it is a stratified sample rather than a random sample. So far, ten years or “waves” of data have been released, from 1991 to 2000. The initial sample contained over 5000 households, and it has not been refreshed over the years. The BHPS was augmented by the addition of the UKECHP households in 1997 and increased Scottish and Welsh samples in 1999. These are excluded in the present study because they change the geographic mix so that the resulting sample is less representative of the population than is the original sample.

As with all panel surveys, however, there is a problem of attrition. This occurs because of non-response, unusable response or because the household or individual cannot be contacted. As far as panel surveys go, the attrition rate is lower than most. In the year 2000, 60% of the households initially interviewed in 1991 still remained in the survey, and 55% of the original households gave full interviews for all 10 years. As shown in Dargay and Hanly (2001), households who remain in the survey have on average a higher car ownership than those who drop out, so that the sample becomes less representative over time. A comparison of households with regular use of (access to) cars based on the National Travel Survey (NTS) and the BHPS shows that even for the first year (1991), the BHPS overestimates car ownership, presumably because of a higher response rate for higher car-owning (and presumably higher income) households. The overestimation becomes greater over time as

non-car households drop out to a greater degree than car-owning households, contrary to what is observed in France. By the year 2000, only 21% of BHPS households do not have cars, while for the country as a whole, 27% do not have cars. Despite this problem, the main advantage of the BHPS is that it is based on a relatively large sample and provides a longer panel on a substantial number of households than those available for most other countries (about 3000 households respond for ten years, compared to 1750 in Parc-Auto for France).

For this study, only the data for the years 1993 to 2000 are used, because the 1992 survey does not contain comparable information on car ownership. This results in 24509 observations of changes in individual households between any two consecutive years.

## **Background data**

The analysis is based on all cars regularly available to the household, i.e. both those privately owned by the household and those used by the household which are formally owned by the companies of the self employed or employed. Company cars represent different proportions of household car availability in the three countries. In Britain, company cars make up around 10% of the car fleet (body-type cars), and 10% of households have access to a company car. In France, company cars are far less common than in Britain: only about 2% of households have access to a company car and company-owned cars make up less than 5% of the total car fleet. For Germany company cars make up about 10 % of the total car fleet, and company cars used by households, both as cars of self-employed persons and company owned cars made available by the employer, are about 5 % of the fleet. The remaining 5 % are cars which are company cars for business purpose only. About 6-7% of German households have access to a company car for personal use. As the definition is the "availability of cars in households" the figures given for the three countries under review include both the strict private as well as the company cars used by private households.

It is useful to look at some background data for the three countries. Some figures for the year 2000 are shown in Table 1. France and Britain have a similar population, number of cars, car kilometres and per capita income (in purchasing power parity), while those for Germany are slightly higher. The number of cars per capita varies from 0.42 in Britain to 0.52 in Germany. Single-car households are most prevalent in all countries: 50% of all households in France and 54% in Germany, but only 45% in Britain. The difference is due to the fact that Britain has far more households without cars (27%) than either France (19%) or Germany (20%). However, the proportion of multi-car households is similar in Britain (28%) and Germany (27%), and higher in France (31%). Licence holding is also rather



different in the three countries: 83% of French and 80% of Germans 18 years and over hold licences compared to 73% in Britain (although the driving age is 17 in Britain compared to 18 in France and Germany). The differences are largely due to differences in licence holding among women. In all three countries a greater proportion of men than women hold driving licences, but the difference is smallest in France and greatest in Britain.

Table 1. Car ownership and background data in Britain, France and Germany, 2000. Source: Transport Statistics Great Britain 2002, National Travel Survey (GB), Panel "Parc Auto" SOFRES France 2002, The German Mobility Panel 2000, Verkehr in Zahlen (DIW, 2002).

|                                | Britain | France | Germany |
|--------------------------------|---------|--------|---------|
| cars* (millions)               | 24.4    | 28.1   | 42.8    |
| cars*/capita                   | .42     | .46    | .52     |
| car* km (billion)              | 378.7   | 394.0  | 517.0   |
| car* km per capita (1000)      | 6.5     | 6.5    | 6.5     |
| % of households with           |         |        |         |
| 0 cars                         | 27      | 19     | 20      |
| 1 car                          | 45      | 50     | 53      |
| 2 cars                         | 23      | 26     | 23      |
| 3+ cars                        | 5       | 5      | 4       |
| % licence holders              |         |        |         |
| of all adults age 18+**        | 73      | 83     | 80      |
| of males age 18+**             | 87      | 89     | 89      |
| of females age 18+**           | 61      | 78     | 73      |
| GDP per capita (1000 US\$ ppp) | 24.5    | 24.2   | 25.9    |
| population (million)           | 58.1    | 60.6   | 82.2    |
| area                           | 230     | 544    | 357     |
| population/sq kms              | 253     | 111    | 230     |

\* cars and taxis \*\*minimum age for driving is 17 in Britain, 18 in Germany and France

Car ownership has increased in the three countries in the past ten years: in 1990 the number of cars per capita was 0.38 in Britain, 0.41 in France and 0.43 in Germany. The growth rate was highest in Germany, about 20% compared to 10-12% in Britain and France. The rapid

growth in Germany follows reunification, and the rapid growth in car ownership in East Germany, which in 1990 had only 0.25 cars per capita compared with 0.48 in West Germany.

In all three countries, the percentage of households without access to a car has fallen over the past 10 years: from 33% to 27% in Britain and from 23% to 20% in France. In West Germany, the share of non-motorized households has declined from about 24 % to about 19.5 % since the mid-90s. In East Germany the share of non-motorized households is still larger, about 26%, the difference is mainly caused by households of elderly, who never owned a car and have no driving license. At the same time, multi-car ownership has increased from 23% to 28% in Britain and from 26% to 31% in France. In Germany the share of multi-car households increased from 20% (only West Germany, results of the KONTIV survey in 1989) to 27% (total of Germany, KONTIV 2002).

Differences in car ownership between countries are often explained in terms of differences in income and in the costs of car ownership and use. From the above table, income may explain some of the difference in car ownership between Germany and the other two countries, but the difference in car ownership between France and Britain appears to depend on other factors.

The following table gives an overview of fuel prices and the relevant taxes and charges for the operation of a private car. The basic fuel prices (without taxes) are about the same in the three countries; differences are the result of taxation.

Buying a car should be cheaper in Germany because of the lower rate of VAT. The annual vehicle tax is negligible for gasoline powered cars whereas the lower fuel prices compensate for the higher tax on diesel cars if the yearly mileage is sufficiently high. In France, operation of both diesel and petrol cars is relatively cheap as the annual tax was abandoned in 2000 and the fuel prices are the lowest of the three countries. However, this is compensated for by a high taxation charge on insurance. In Britain, both annual taxation and higher fuel prices make car use the most expensive of the three countries, even though the tax on insurance is much lower. Overall, car-operating costs are higher in Britain than in France and Germany, and although new car taxation (VAT) lies in between, new car prices have been comparatively high in Britain. The high cost of motoring in Britain is also reflected in its share of expenditures: nearly 15%, compared with about 11 – 12 % in Germany and 13 % in France. The low car ownership in Britain compared to France and Germany is consistent with Britain's higher motoring costs. From these differences it can also be hypothesized that the pressure to reduce car ownership will be stronger in Britain

than in France and Germany, since keeping an existing car is in comparison relatively cheap in terms of vehicle tax and fuel costs in the latter two countries.

Table 2 Fuel prices, taxation on car purchase and operation and motoring costs in % of total expenditures. Based on Kunert, Kuhfeld: "Große Unterschiede in der Abgabenbelastung von Personenkraftwagen in Europa", DIW-Wochenbericht 47/2002) and national statistical sources (Les transports en 2001, 39e rapport de la Commission des comptes des transports de la Nation, Ministère des transports et INSEE)

|         | Gasoline<br>[EUR] | Diesel<br>[EUR] | VAT<br>[%] on<br>purchase | Taxes on<br>the<br>insurance<br>[%] | annual motor tax for a<br>typical car (VW Golf) |        | motoring<br>costs in %<br>of total<br>expen-<br>ditures |
|---------|-------------------|-----------------|---------------------------|-------------------------------------|---|--------|---|
|         |                   |                 |                           |                                     | Gasoline  | Diesel |   |
| Britain | 1.224             | 1.257           | 17.5                      | 5                                   | 195   | 179    | 14.6  |
| France  | 1.041             | 0.785           | 19.6                      | 33.1                                | 0   | 0      | 13.2 *  |
| Germany | 1.10              | 0.875           | 16                        | 16                                  | 71  | 262    | 11.3  |

Over the past few years, real motoring costs have increased in all three countries, while for decades previously real prices had generally been falling. In Germany, for instance, fuel prices and fuel taxation have risen while available incomes have stagnated as a result of the financial burden of reunification. At the same time, operation of a car has become more expensive as a result of more severe environmental legislation (unleaded fuel, catalytic converters). In Britain, both fuel prices and insurance costs have increased over the past few years, and although car purchase prices have fallen, overall motoring costs have risen in relation to income. In France, even though there has been an increase in fuel prices since 1998, and of insurance costs, the share of car costs in % of total expenditure has been quite stable since the seventies (around 13%). Its year-to-year evolution is mainly due to the cyclical variations of the new car market.

## Changes in household car ownership

Using the data from the three surveys, we first consider car ownership in two consecutive years for individual households. The start year, 1994, is the same for all three countries, but the end years are different so that the numbers of pairs of years differs: 6 for Britain, 4 for France and 7 for Germany. Although the period of coverage is longest for Germany, the number of changes or transitions observed is smallest because of the relatively small sample

size: 2794 transitions compared to 24509 for Britain and 37059 for France, where the sample size is largest.

The transitions between two consecutive years for each country are shown in Table 3. The main diagonals of the matrices, indicating no change in car ownership from one year to the next, contain by far the majority of households. The cases above the diagonal indicate those households with an increase in cars between the two years, whereas those below the diagonal indicate a reduction in the number of cars, or demotorisation.

Table 3 Changes in car ownership in two consecutive years, number of cases. Britain, France and Germany

|                | Britain*        |       |      |      |       | France**        |       |      |      |       | Germany***      |      |     |     |       |
|----------------|-----------------|-------|------|------|-------|-----------------|-------|------|------|-------|-----------------|------|-----|-----|-------|
|                | cars year n + 1 |       |      |      |       | cars year n + 1 |       |      |      |       | cars year n + 1 |      |     |     |       |
| Cars<br>year n | 0               | 1     | 2    | 3+   | total | 0               | 1     | 2    | 3+   | total | 0               | 1    | 2   | 3+  | total |
| 0              | 5550            | 422   | 31   | 6    | 6009  | 7419            | 510   | 33   | 4    | 7966  | 294             | 22   | 1   | 0   | 317   |
| 1              | 390             | 9759  | 1019 | 101  | 11269 | 351             | 17936 | 1109 | 29   | 19426 | 9               | 1590 | 93  | 7   | 1699  |
| 2              | 18              | 835   | 4661 | 446  | 5960  | 30              | 1125  | 6988 | 318  | 8461  | 0               | 79   | 569 | 24  | 672   |
| 3+             | 5               | 92    | 373  | 801  | 1271  | 1               | 58    | 352  | 795  | 1207  | 0               | 5    | 25  | 76  | 106   |
| Total          | 5963            | 11108 | 6084 | 1354 | 24509 | 7801            | 19630 | 8483 | 1146 | 37059 | 303             | 1696 | 688 | 107 | 2794  |

\*between 1994 and 2000 \*\* between 1994 and 1998, weighted results \*\*\* between 1994 and 2001, unweighted results; the transitions 3+/3+ include demotorisations, motorisations and households where the number of cars remains stable. In the more detailed analyses of demotorisation these few cases will be dealt with.

A comparison of these changes in car ownership on the individual household level with the net changes that would be observed if panel data were not available (Table 4) shows that a very small net effect (an average annual increase of from 0.2% in France to 1.2% in Britain) corresponds to quite substantial increases and decreases.

Table 4 Average gross and net changes\* in cars between two consecutive years in % of cars in first year. Britain, France and Germany

|                        | Britain | France | Germany |
|------------------------|---------|--------|---------|
| gross changes in cars: |         |        |         |
| increase in cars       | 8.0     | 5.2    | 4.6     |
| decrease in cars       | 6.8     | 5.0    | 3.7     |
| net change             | 1.2     | 0.2    | 1.0     |

\*these are an underestimation since 3+ cars is assumed equal to 3 cars

The changes in car ownership in percent of households in each of the samples are shown in Table 5<sup>2</sup>. The general pattern is the same in the three countries. The majority of households have the same number of cars in any two consecutive years. The greatest proportion of households, nearly 40% in Britain and just less than 50% in France and Germany, have one car for both years, while about 20% have no car or 2 cars during the two years. Similarly, the most common changes in all countries are increases from 1 to 2 cars and reductions from 2 to 1 car.

Table 5 Changes in car ownership in two consecutive years, in % of all households in sample. Britain, France and Germany.

|             | Britain*        |      |      |     |       | France**        |      |      |     |       | Germany***      |      |      |     |       |
|-------------|-----------------|------|------|-----|-------|-----------------|------|------|-----|-------|-----------------|------|------|-----|-------|
|             | cars year n + 1 |      |      |     |       | cars year n + 1 |      |      |     |       | cars year n + 1 |      |      |     |       |
| cars year n | 0               | 1    | 2    | 3+  | total | 0               | 1    | 2    | 3+  | total | 0               | 1    | 2    | 3+  | total |
| 0           | 22.6            | 1.7  | 0.1  | 0.0 | 24.5  | 20.0            | 1.4  | 0.1  | 0.0 | 21.5  | 19.8            | 1.4  | 0.1  | 0   | 21.3  |
| 1           | 1.6             | 39.8 | 4.2  | 0.4 | 46.0  | 0.9             | 48.4 | 3.0  | 0.1 | 52.4  | 0.2             | 48.8 | 2.5  | 0.2 | 51.7  |
| 2           | 0.1             | 3.4  | 19.0 | 1.8 | 24.3  | 0.1             | 3.0  | 18.9 | 0.9 | 22.8  | 0               | 2.7  | 19.7 | 0.7 | 23.1  |
| 3+          | 0.0             | 0.4  | 1.5  | 3.3 | 5.2   | 0.0             | 0.2  | 1.0  | 2.1 | 3.3   | 0               | 0.2  | 0.9  | 2.8 | 3.9   |
| Total       | 24.3            | 45.3 | 24.8 | 5.5 | 100   | 21.1            | 53.0 | 22.9 | 3.1 | 100   | 20.0            | 53.1 | 23.2 | 3.3 | 100   |

\*between 1993 and 2000 \*\* between 1994 and 1998, weighted results \*\*\* between 1994 and 2001 weighted results; the transitions 3+/3+ include demotorisations, motorisations and households where the number of cars remains stable

The most important results of the above table are summarised in Table 6. The first row gives the percentage of households who reduce car ownership, or demotorise between two

<sup>2</sup> The under-representation of households without cars can be noted for Britain: the BHPS gives an average of 24% over the sample period compared with an actual average of around 29%.

consecutive years: 7% of British, 5.2% of French and about 4% of German households. The overwhelming majority of demotorisations are partial, i.e. the household reduces the number of cars but remains a car household.<sup>3</sup> Full demotorisation, or giving up the car totally, is much less common, particularly in Germany, but is experienced by 1% and 1.7% of households each year in France and Britain, respectively. Changes in car ownership – both reductions and increases - are far more common in Britain: only about 85% of households do not change their number of cars between any two years, compared with around 90% in France and Germany. In all three countries, slightly more households increase the number of cars each year than reduce it, so that overall car ownership continues to grow. Thus although British households are most likely to reduce their number of cars, they are also most likely to increase car ownership: volatility is far greater than in the other two countries.

Table 6 Changes in car ownership between two consecutive years, in percent of households. Britain, France and Germany.

|                  | Britain | France | Germany |
|------------------|---------|--------|---------|
| reduction        | 7.0     | 5.2    | 4.0     |
| of which: full   | 1.7     | 1.0    | 0.2     |
| partial          | 5.3     | 4.2    | 3.8     |
| remains the same | 84.7    | 89.4   | 91.1    |
| increase         | 8.3     | 5.4    | 4.9     |
| total            | 100     | 100    | 100     |

As the primary concern of this paper is demotorisation, we shall limit our discussion and the analysis that follows to reductions in car ownership. The various types of demotorisation are categorised in Table 7. As noted earlier, the majority of reductions in cars are accounted for by households going from 2 cars to 1 car. This makes up between 48.7% (Britain) and

<sup>3</sup> This supports the study by Goodwin (1988) of car ownership using panel data from Manchester, South Yorkshire and the Netherlands. He also concludes that about 10% of the population is likely to reduce its car ownership over periods of 1 to 5 years. There is also variation between countries/areas: between 2 consecutive years, 10% of households in the Manchester sample reduced car ownership, compared to only 4.5% of the Netherlands sample.

66.9% (Germany). In all three countries, a similar share of demotorisations, around 20%, are made up of reductions from 3+ to 2 cars. The major difference lies in 1-car households who give up their cars. This makes up about 20% of demotorisations in France and Britain, but less than 8% in Germany. Although reducing car ownership is less common in France and Germany than it is in Britain (see Table 6), of those households who do demotorise, nearly equal proportions give up their cars totally in Britain and France, while the proportion in Germany is less than half this. Finally, we see that a reduction of more than one car over the period of a year is very rare.

Table 7 Demotorisation: reductions in car ownership between two consecutive years by number of cars years n and n+1, number of cases and % of all reductions. Britain, France and Germany.

| cars year n to n+1 | Britain |      | France |      | Germany* |       |
|--------------------|---------|------|--------|------|----------|-------|
|                    | cases   | %    | cases  | %    | cases    | %     |
| 3+ to 2            | 373     | 21.8 | 352    | 18.4 | 25       | 21.2  |
| 3+ to 1            | 92      | 5.4  | 58     | 3.0  | 5        | 4.2   |
| 3+ to 0            | 5       | 0.3  | 1      | 0.1  | 0        | 0.0   |
| 2 to 1             | 835     | 48.7 | 1125   | 58.7 | 79       | 66.9  |
| 2 to 0             | 18      | 1.1  | 30     | 1.6  | 0        | 0.0   |
| 1 to 0             | 390     | 22.8 | 351    | 18.3 | 9        | 7.6   |
| all                | 1713    | 100  | 1917   | 100  | 122*     | 100.0 |

\* 122 instead of 118: including transitions from 5 to 4 and 4 to 3 cars

Looking at the share of households reducing car ownership by the number of cars in the first year (Table 8), we see that the probability of reducing car ownership increases with the number of cars owned, which is to be expected. For all levels of car ownership, demotorisation is most common in Britain and least common in Germany, with France about halfway between.

Table 8 Share of households with 1, 2 and 3+ cars in initial year reducing car ownership between two consecutive years, in %. Britain, France and Germany

|                           | Britain | France | Germany |
|---------------------------|---------|--------|---------|
| households owning 3+ cars | 37.0    | 34.1   | *28.3   |
| households owning 2 cars  | 14.3    | 13.6   | 11.8    |
| households owning 1 car   | 3.5     | 1.8    | 0.5     |
| all households            | 7.0     | 5.2    | 4.2*    |

\* including transitions from 5 to 4 and 4 to 3 cars

## Reductions in car ownership for different groups

In this section, we look at how demotorisation varies in different household groups in order to determine which households are most likely to reduce their car ownership. Since we are concerned with households who reduce their number of cars, we only consider households who have cars to begin with, i.e. the figures refer to demotorisations in percent of car households in the initial year. In this way, differences in car ownership between the different groups are taken into account. The percentages can thus be interpreted as the likelihood of a car household in the particular group reducing their number of cars. The likelihood of *any* household in the group reducing car ownership will, of course, be smaller, the difference decreasing as the proportion of households with cars in the group increases. For this reason, the percentages are higher than those shown in the previous tables.

Table 9 looks at the age of the head of household in the initial year. Demotorisations are most common amongst car owners in the youngest age group and least common in the oldest age group. This is true for all three countries, and for partial and both types of demotorisation together. Full demotorisation is also most likely in the youngest age group, but is higher in the eldest group than in the middle age groups. An explanation for the relatively low partial demotorisation in the eldest group is that multiple car ownership is less common in this group than in the middle-age groups. The age distribution of the British car owners is different from the other two countries (only 12% of over 65s compared to 20% for France and Germany), which reflects a lower car ownership amongst the over 65s in Britain. Only about 40% of this age group have cars in Britain (compared to an average of 75% for all households). In Germany the share of car-owning households of pensioners has in 2002 (KONTIV 2002) already reached a level of nearly 70 % while in France (2001), 68% of this age group (over 65) have cars, compared to an average of 81% for all households. However,



this difference in age distribution only explains a very small part of the higher average demotorisation (all groups) in Britain: with few exceptions demotorisation is greatest in Britain and lowest in Germany for all age groups.

It also must be stressed that one cannot draw the conclusion that car ownership is declining in groups with high demotorisation. In most cases, the number of households in the group increasing car ownership is greater than the number reducing car ownership, so the proportion of households with cars is continuing to rise. For Britain, the percentage of households (with or without cars) reducing car ownership is higher than the percentage increasing it only for the 50-65 and over 65 age groups, so car ownership is declining as the head ages within these groups. This supports the life cycle effect noted in Dargay, Madre and Berri (2000) for Britain and France: car ownership increases with the age of the household head up until about the age of 50, and thereafter declines.

Table 9 Households reducing car ownership by age of head of household in initial year, in % of car households within group and number of cases (car households) in each group

|            |         | Britain | France | Germany |
|------------|---------|---------|--------|---------|
| 18 to 24   | full    | 6.9     | 2.9    | 5.0     |
|            | partial | 9.8     | 10.5   | 10.0    |
|            | both    | 16.7    | 13.4   | 15.0    |
|            | cases   | 407     | 366    | 20      |
| 25 to 34   | full    | 2.0     | 1.1    | 0.8     |
|            | partial | 7.0     | 4.9    | 5.3     |
|            | both    | 9.0     | 6.0    | 6.1     |
|            | cases   | 4065    | 5151   | 359     |
| 35 to 49   | full    | 1.7     | 1.2    | 0.0     |
|            | partial | 8.1     | 5.9    | 4.5     |
|            | both    | 9.8     | 7.1    | 4.5     |
|            | cases   | 6935    | 9192   | 838     |
| 50 to 65   | full    | 1.8     | 1.1    | 0.3     |
|            | Partial | 7.6     | 6.8    | 6.5     |
|            | Both    | 9.4     | 7.9    | 6.7     |
|            | cases   | 4793    | 8162   | 756     |
| Over 65    | full    | 4.3     | 1.7    | 0.6     |
|            | partial | 2.1     | 2.3    | 1.0     |
|            | both    | 6.4     | 4.0    | 1.6     |
|            | cases   | 2300    | 6223   | 504     |
| All groups | full    | 2.2     | 1.3    | 0.4     |
|            | partial | 7.0     | 5.3    | 4.4     |
|            | both    | 9.3     | 6.6    | 4.8     |
|            | cases   | 18500   | 29093  | 2477    |

Employment status, whether a person is employed, unemployed, retired or otherwise, can be relevant for demotorisation. In the next section, we investigate the effect on car ownership of changing employment status, i.e. when an employed person becomes unemployed or retires. Here we are concerned with those who do not change employment status in two consecutive years. In Table 10 the relationship between demotorisation and the employment

status of the head of household is shown. Car households where the head is unemployed for two consecutive years are most likely to reduce car ownership, which is as one would expect. More surprising is that households where the head is retired are less likely to reduce car ownership than are households where the head is employed. This is largely due to the higher partial demotorisations (and multi-car ownership) amongst the employed; full demotorisation, is, as expected, more prevalent in retired households than those where the head is employed.

Table 10 Households reducing car ownership by employment status of the head of household, in % of car households not changing employment status\* and number of cases (car households) in each group

|            |         | Britain | France | Germany |
|------------|---------|---------|--------|---------|
| Employed   | full    | 1.2     | 0.9    | 0.2     |
|            | partial | 7.9     | 6.0    | 5.3     |
|            | both    | 9.1     | 6.9    | 5.5     |
|            | cases   | 12237   | 13335  | 1524    |
| Unemployed | full    | 5.1     | 3.2    |         |
|            | partial | 6.0     | 7.0    |         |
|            | both    | 11.1    | 10.2   |         |
|            | cases   | 217     | 1025   | **      |
| Retired    | full    | 3.3     | 1.4    | 0.7     |
|            | partial | 3.2     | 3.6    | 0.8     |
|            | both    | 6.5     | 5.0    | 1.5     |
|            | cases   | 3476    | 9921   | 602     |

\* Other cases are omitted as definitions and characteristics differ between countries

\*\* too few cases to be representative

## Factors influencing demotorisation

Demotorisation can be related to various changes in household circumstances: change in household composition, moving house, changing employer or place of employment, becoming unemployed or retiring. In the following, we explore reductions in car ownership occurring in the same period as the change in circumstances i.e. we look at demotorisations between years  $n$  and  $n+1$  for households who change a given circumstance between years  $n$  and  $n+1$ .

Firstly, we distinguish between relative and absolute demotorisation. Absolute demotorisation occurs when the number of cars declines but the number of drivers remains the same. In contrast, in relative demotorisation the number of cars in a household is reduced because a car owner leaves the household and takes their car with them, so the number of cars in relation to drivers for the members of the original household remains unchanged. Unfortunately, not all of the surveys provide information about car users and their associated cars, nor even about licence holding. Instead, we are limited to the consideration of persons of driving age. As seen in Table 11, demotorisation occurs in around 1/3 of households where an individual of driving age moves out. Demotorisation is far less likely in households where no members of driving age move out, and even less likely where persons of driving age move into the household. The general pattern is similar to that noted earlier: in most cases, demotorisation (both full, partial and both) is highest in Britain and lowest in Germany. However, for those households with a reduction of individuals of driving age, partial and both types of demotorisation are lowest in France.

Table 11 Change in number of car drivers or individuals of driving age (17+ in Britain, 18+ in France and Germany). Full and partial demotorisation in % of car households within group and number of cases (car households) in each group

|  |         | Britain      | France       | Germany     |
|--|---------|--------------|--------------|-------------|
| decrease in individuals<br>of driving age            | full    | 8.5          | 4.7          | 1.6         |
|  | partial | 29.9         | 24.6         | 31.3        |
|  | both    | 38.4         | 29.3         | 32.8        |
|  | cases   | <i>1187</i>  | <i>1341</i>  | <i>128</i>  |
| no change in number of<br>individuals of driving age | full    | 1.8          | 1.2          | 0.3         |
|  | partial | 5.5          | 4.3          | 3.1         |
|  | both    | 7.3          | 5.5          | 3.4         |
|  | cases   | <i>16122</i> | <i>26609</i> | <i>2216</i> |
| increase in individuals<br>of driving age            | full    | 1.3          | 0.7          | 0.0         |
|  | partial | 5.2          | 4.7          | 2.9         |
|  | both    | 6.5          | 5.4          | 2.9         |
|  | cases   | <i>1191</i>  | <i>1144</i>  | <i>136</i>  |

Next we consider the effect of moving house on demotorisation (Table 12). A problem here is that it is difficult to keep track of households who move house, so that they are often lost from the panel. For this reason the proportion of households in the survey who move house

between any two years is underestimated, so that the sample size for movers will be relatively low. A possible consequence of this may be a selectivity bias, so we must be cautious in our interpretation of the results. As we have no reason to expect the rate of moving house to differ between the countries, it appears that the dropout rate for households who move house is greatest in Germany: only 2% of the sample of households with cars move house between two consecutive years compared to about over 6% in Britain and France.

From the table, the general trend seems to be that moving house nearly doubles the likelihood of demotorisation. The most obvious exception is full demotorisations in Germany, which occur in 0.4% of car households who do not move house, but not at all in car households who move. This, however, may be due to the small sample size or the selectivity bias mentioned earlier. As before, Britain shows the greatest propensity towards demotorisation. Again, it should be pointed out that for all three countries, the number of mover/non-mover households that increase car ownership is greater than the number who reduce it, so car ownership continues to rise for both groups, but the volatility is much higher amongst households that move house.

In France, the demotorisations for those who “move house” are comprised of:

- full : 2.0, partial : 6.4 for 692 cases moving in the same municipality
- full : 2.7, partial : 9.3 for 1141 cases changing municipality

Those who move to a different area are far more likely to demotorise than those who remain in the same area.

Of course, there are various reasons for moving house, some of which will be more relevant for car ownership decisions. In France, for example, if a household with 2 people employed moves house, they often try to minimise the wife’s home-to-work trip (even if the husband’s increases). The result is not so clear cut in terms of (de)motorisation or total mobility (sum of km). On the other hand, some households move (often within the same area) because of a change in household structure (children leaving home, for example). In this case it will be difficult to separate out the effects moving house from the change in household structure. But some other moves correspond to an important change in professional situation and regional location: in these cases, the new situation may require a new decision on car ownership. The effect of moving house on car ownership may also have a different time profiles if the move is within the same area or to a different area. If the move is within the same general area, alternative modes will already be well known so adjustment will be

relatively rapid. On the other hand, if the move is to a different, less-known area, a longer time of adaptation will probably be required.

Table 12 Moving House. Full and partial demotorisation in % of car households within group and number of cases (car households) in each group\*

|                   |         | Britain | France | Germany |
|-------------------|---------|---------|--------|---------|
| move house        | full    | 4.4     | 2.4    | 0.0     |
|                   | partial | 11.0    | 8.2    | 9.6     |
|                   | both    | 15.4    | 10.6   | 9.6     |
|                   | cases   | 1252    | 1833   | 52      |
| do not move house | full    | 2.1     | 1.2    | 0.4     |
|                   | partial | 6.7     | 5.1    | 4.4     |
|                   | both    | 8.8     | 6.3    | 4.8     |
|                   | cases   | 17247   | 26985  | 2425    |

\*German results biased as a result of selectivity phenomena

Table 13 shows the effects of changing employer on car ownership. We can assume that individuals who change employer also change work place and that it is this locational factor that will have the primary effect on car ownership. However, changing employer may also affect access to a company car. We see that households where at least one person changes employer have a higher probability of reducing car ownership than households where no members change employer. Changing employer is associated primarily with partial demotorisation, as the likelihood of full demotorisation is nearly the same for both those who change employer and those who do not.

For Germany, households where an individual changes employer are twice as likely to demotorise (8.5% of car households) as those where there is no change in employer. Changing employer has a smaller impact in Britain: although just over 11% of those who change employer demotorise, 9% of those with the same employer also demotorise. This is rather surprising given the higher proportion of company cars in Britain, and suggests that it is not a main reason for the comparatively large changes in car ownership from year to year.

For both Britain and Germany the effect of changing employer is smaller than of moving house, but the difference is much greater in Britain.

Table 13 Changing Employer. At least one person in household changes employer. Full and partial demotorisation in % of car households within group and number of cases (car households) in each group\*\*

|                        |         | Britain | France | Germany |
|------------------------|---------|---------|--------|---------|
| change in employer     | full    | 2.1     | *      | 0.4     |
|                        | partial | 9.1     | *      | 8.1     |
|                        | both    | 11.2    | *      | 8.5     |
|                        | cases   | 2299    |        | 260     |
| no change in employer* | full    | 2.3     | *      | 0.4     |
|                        | partial | 6.7     | *      | 3.9     |
|                        | both    | 9.0     | *      | 4.3     |
|                        | cases   | 16201   |        | 2089    |

\* the information of “change in employer” is not available for each person in the French panel

\*\* for Britain includes households without working persons, for Germany only households with working persons

A change of employer/workplace often has consequences for accessibility. A new workplace might be less accessible by car (e.g. more difficult or expensive parking) than the previous one or vice versa. Additionally, an improvement in the accessibility by other modes (non-motorized modes, public transport) can encourage a switch from car for commuting leading to the redundancy of an existing car and thus to a demotorisation. Similarly, if the new workplace is further away from home and less accessible by public transport than the old workplace, the purchase of a first or second car may result.

Each year the German MOP asks

- if a person has changed place of work / place of education since the previous year,
- how accessible the workplace / place of education is by public transport (PT) and non-motorized modes (NM) in qualitative terms,
- how the parking conditions are (also in qualitative terms).

Using this information we can investigate whether or not improved access to public transport or a degradation in car parking conditions is associated with demotorisation.

Table 14 Demotorisations associated with a change in workplace and its accessibility. Analysis limited to people who are working or in education in two consecutive years and changed the work-/education place

|   |                            | Germany            |
|---|----------------------------|--------------------|
| Households with persons changing the work or education-place                            |                            |                    |
| without improvement in access (PT/NM) or without a degradation in car-parking situation | Demotorisations %<br>cases | 11.8<br><i>119</i> |
| with improvement in the access (PT/NM) or with a degradation in car-parking situation   | Demotorisations %<br>cases | 13.2<br><i>91</i>  |
| with persons changing work- or education place with accessibility-information missing   | Demotorisations %<br>cases | 0.0<br><i>12</i>   |

A change of employer/workplace will influence the demand for travel and thus the possibility of giving up car-ownership. The influence of changed accessibility (Table 14) is plausible: relatively more households decrease car-ownership when accessibility to public transport/NM is improved and the parking situation deteriorates (13.2%) compared with those where no change in accessibility can be observed (11.7%). However, the influence is rather weak, as the number of cases is very small. Although it is not shown here, it can be mentioned that the relative proportions of households increasing car ownership are opposite those of the demotorisations: relatively fewer households increase car ownership when accessibility by PT/MT improves or when the parking situation deteriorates than when these improve.

The effects of changing employment status of head-of-household are shown in Table 15. For Britain and Germany, becoming unemployed has a greater impact than retirement on demotorisation, while the opposite true for France, which is due to the relatively small percentage of partial demotorisations among those who become unemployed in France. Becoming unemployed is the only case where demotorisations are higher in Germany than in France. An explanation for this may be differences in unemployment characteristics (age of people concerned, duration or recurrence, unemployment benefits) between the countries. However, a more detailed study is required to investigate this issue.

It should also be noted (although not shown in the tables) that for all three countries, when the head-of-household either becomes unemployed or retires the number of households



reducing car ownership is greater than the number increasing it, so that car ownership actually falls. As expected, this is reversed when the unemployed head becomes employed again.

Table 15 Changing employment status of head of household. Full and partial demotorisation in % of car households within group and number of cases (car households) in each group

|                        |         | Britain | France | Germany |
|------------------------|---------|---------|--------|---------|
| Employed to unemployed | full    | 7.8     | 4.4    | 0.0     |
|                        | partial | 14.1    | 4.4    | 14.7    |
|                        | both    | 21.9    | 8.8    | 14.7    |
|                        | cases   | 192     | 384    | 34      |
| Employed to retired    | full    | 1.5     | 1.1    | 0.0     |
|                        | partial | 11.0    | 9.8    | 7.3     |
|                        | both    | 12.5    | 10.9   | 7.3     |
|                        | cases   | 263     | 391    | 55      |
| Remains employed       | full    | 1.2     | 0.8    | 0.0     |
|                        | partial | 7.9     | 5.3    | 5.7     |
|                        | both    | 9.1     | 6.1    | 5.7     |
|                        | cases   | 12237   | 18591  | 35      |

The factors discussed above may, of course, be correlated, and combined. For example, a change in employer or employment status can be associated (and even more highly correlated) with the decision to move house. The simple analysis used in this paper does not permit us to determine the relative importance of the various factors or to distinguish between causality and correlation, but, needless to say, it seems particularly difficult, due to the partly small sample sizes, to analyse joint (or nested) effects or to find the most important factors. Perhaps one possibility consists of finding particularly significant and hierarchical categories (a priori or with classification or factorial methods) in order to distinguish change in household structure (with or without change in residential location) and change in professional situations (change status, job, or time, with or without change in residential location).



## 1.4 Summing up the various factors behind demotorisation

Adding up all potential reasons and causes for demotorisation it is obvious that for one demotorisation there are generally several causes responsible at the same time.

Since the surveys (PARC-AUTO, BHPS, MOP) used in this paper do not have the same approach for data collection or the same variables and definitions, they all do not allow the same interpretation. Consequently for each of the surveys different approaches are used for summing up the results on the factors relating to demotorisation.

### FRANCE

In the French survey, those households who had cars in the past but had given them up are asked directly about reasons for doing so. This question, asked to the head-of-household, permits multiple answers from a number of choices (Table 16). The results are very similar for all the recent annual waves including 1999 to 2001. About one half of respondents mention changes in the household's structure, regardless of whether the demotorisation occurred a long time ago or more recently. Change in household structure includes grown children moving from the parental home, widowhood (more frequent for women, 85%), etc.

Only the younger households (head 18-24 years old) mention economic reasons as being most important (car purchase and running costs, insufficient income). However, these economic reasons are given as the second most frequent cause of demotorisation for all households, regardless of the household's income level. The reasons linked to traffic and parking difficulties are mentioned less frequently, but far more in the centres and the inner suburbs of the biggest urban areas than in other areas. Interestingly, a preference for public transport is chosen by 14 to 18% of respondents, but less than 3% say they are concerned with pollution. About equal numbers (around 10%) mention a change in professional situation or residential location.

Table 16 Main reasons mentioned for total demotorisation for households who had car(s) in the past, % mentioned for the panel waves of 1999/2000/2001. France

|                                  | 1999 | 2000 | 2001 |
|----------------------------------|------|------|------|
| change in household structure    | 47.8 | 48.7 | 48.5 |
| health reasons                   | 7.5  | 16.7 | 17.6 |
| maintenance too expensive        | 25.8 | 15.7 | 22.0 |
| preference for public transport  | 17.5 | 13.7 | 18.2 |
| difficult to drive and park      | 16.0 | 12.5 | 14.1 |
| change in professional situation | 9.8  | 8.9  | 10.0 |
| change in residential location   | 11.8 | 8.6  | 10.4 |
| car out of order                 | 0.8  | 3.6  | -    |
| preference for 2 wheels          | 2.9  | 3.2  | 3.8  |
| concern with pollution           | 2.0  | 3.2  | 2.0  |
| too old to have a car            | -    | 2.4  | -    |
| preference for car renting       | -    | 1.1  | -    |
| other                            | 4.9  | 7.4  | 10.1 |

## BRITAIN

For Britain we can only infer the causes of demotorisation from the data. From Table 17 we see that about 27% of all demotorisations are contemporaneous with an adult leaving the household, i.e. are relative demotorisations. Slightly more partial demotorisations are relative than full demotorisations. More full demotorisations appear to be associated with moving house than with changing employer, but more partial demotorisations are associated with changing employer than with moving house. However, both changing employer and moving house seem to have less of an impact than when an adult leaves the household (about half the effect). A change in work status, becoming unemployed or retiring, is far less relevant to car ownership, either one being associated with less than 3% of demotorisations. A slightly larger proportion of full demotorisations happen at the same time as the head becomes unemployed than when the head retires, while the opposite is the case for partial demotorisations. Finally, we consider transitory demotorisations. These are defined as cases where the reduction in the number of cars in the household lasts for only one year, i.e. a reduction in the number of cars between year  $t$  and year  $t+1$  is followed by an increase in the number of cars in year  $t+2$ . We see from the table that about 1/3 of all demotorisations are

transitory by this definition: about 37% of full demotorisations and 32% of partial demotorisations.

Table 17 Assignment of causes to demotorisation, % of full, partial and all demotorisations where household experienced the given changes in circumstance between the same two consecutive years. Britain.

|         | relative<br>adult<br>leaves<br>household | moves<br>house | changes<br>employer | becomes<br>unemployed | retires | transitory | none of<br>these |
|---------|--|----------------|---------------------|-----------------------|---------|------------|------------------|
| full    | 24.5                                     | 13.3           | 11.6                | 3.6                   | 1.0     | 37.0       | 35.0             |
| partial | 27.3                                     | 10.6           | 16.2                | 2.1                   | 2.2     | 32.0       | 35.0             |
| both    | 26.6                                     | 11.3           | 15.1                | 2.5                   | 1.9     | 33.2       | 35.0             |

## GERMANY

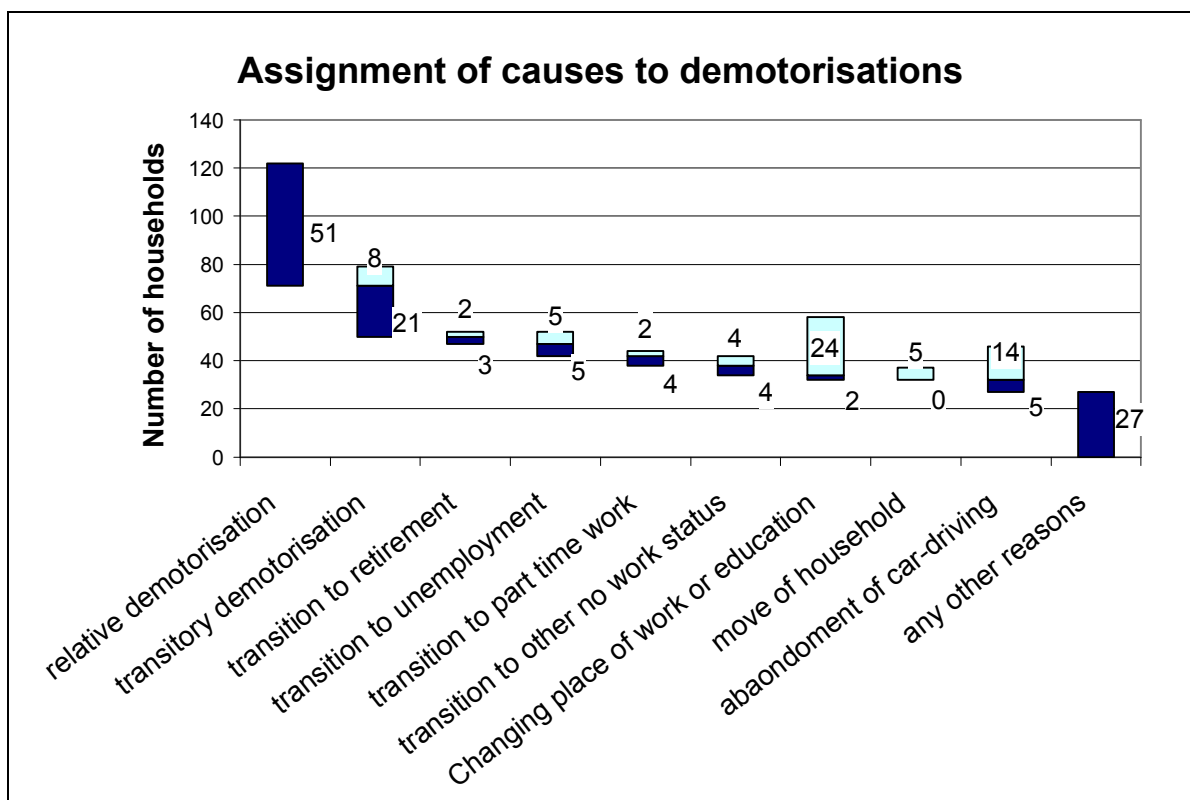
The assignment of causes to demotorisations for Germany is presented in Figure 1. The numbers of cases are given where demotorisation could be connected to each of the reasons. Those shown in a dark colour are those where the explanation is unique (only one cause). The other cases (in the light colour) are already in previous categories i.e are also associated with one or more of the other stated categories.

- Of the 122 demotorisations, 51 were relative demotorisations, where a car driver left the household.
- Following the definition of transitory demotorisations as in the British case (the reduction in the number of cars in the household lasts for only one year and will be cancelled by a motorisation in the next year) of the remaining 71 demotorisations 29 were transitory, of which 21 had none of the other factors occurring at the same time.
- 5 demotorisations took place in combination with the retirement of a person, of which 2 took place at the same time as other factors.
- 10 demotorisations occurred in combination with a transition to unemployment. For half of these unemployment was the only identifiable cause, for the other half other reasons were also responsible.
- Demotorisations for the transitions to part time work and for transitions to other non-work status show similar patterns - each with 4 single-causalities; and 2 and 4 cases respectively where other reasons were identifiable at the same time.
- Altogether in 26 cases a change of work place was associated with the abandonment of a car, but only in two of these cases could an improved accessibility be identified as the single relevant cause for the demotorisation.

- Altogether in 19 cases (19 persons in households) ceasing driving a car occurs in combination with demotorisation, mainly as the result of reduced travel requirements. But in only 5 cases is this the single cause.
- Household moving residence only occurs in combination with other reasons for demotorisation. It alone is never the single reason for demotorisation.

For the remaining 27 cases no reasons or combinations of reasons mentioned above could be identified. This may mean that reasons other than those considered might be responsible. On the other hand these 27 cases could be the result of a lagged effect of the same factors identified above.

Figure 1: Germany: Assignment of demotorisations to causes



## The dynamics of demotorisation

In the previous section, we saw how demotorisation might be related to various changes which occur in the household. Because we were only concerned with reductions in car ownership occurring in the same year as the change in circumstances, only two consecutive observations were needed for each household. However, there is strong evidence which suggests that the response to changes in personal circumstances and other factors which affect car ownership may take a longer time to be completed and thus will not be totally captured from only 2 annual observations. To explore the effects over a longer period requires observations of the same household over a larger number of years. Both the British and French data sources follow households over relatively long periods of time and provide a reasonably large sample to examine dynamics over a longer time horizon. Unfortunately, the German data does not provide sufficient data for such an analysis. Because of differences in the British and French data, we look at the dynamics for each country separately.

### BRITAIN

In order to explore the dynamics of demotorisation we limit ourselves to households remaining in the survey (and for which we have relevant information) for at least 4 consecutive years. From Table 18, we see that in Britain 9% of these households reduce car ownership between 2 consecutive years, 11.5% after 2 years and 13.3% after 3 years.

Table 18 Britain: The dynamics of demotorisation (households in panel for 4 consecutive years), % of car households in year n who demotorise in the following 3 years\*

| from year n to year: | n+1 | n+2  | n+3  |
|----------------------|-----|------|------|
| full                 | 2.1 | 3.0  | 3.5  |
| partial              | 7.0 | 8.5  | 9.8  |
| both                 | 9.1 | 11.5 | 13.3 |

\* 12576 cases

For the reduction in car ownership when an adult leaves the household (Table 19), there are no delayed effects. This is as would be expected if the departing driver takes their car with

them. That demotorisation is slightly reduced over time may be explained by some households replacing the car of the departed driver (for example in the case of a parent sharing a car with an adult child, who leaves the household taking the car).

Table 19 Britain: the dynamics of demotorisation. Adult of driving age leaves household between year n and n+1, (households in panel for 4 consecutive years), % of car households in year n who demotorise in the following 3 years\*

| from year n to year: | n+1  | n+2  | n+3  |
|----------------------|------|------|------|
| full                 | 9.1  | 9.3  | 8.9  |
| partial              | 33.1 | 30.5 | 31.6 |
| both                 | 42.2 | 39.8 | 40.5 |

\* 526 cases

The effects of moving house and the head retiring (Table 20) appear to occur rather rapidly, generally, within 2 years. The effects of changing employer, however, appear to take a bit longer: at least 3 years. Although none of these tables can purport to prove causality, the percentage of demotorisations are higher than for the overall sample, so that an association is strongly suggested.

Table 20 Britain: the dynamics of demotorisation Moving house, retirement and change of employer between year n and n+1, (households in panel for 4 consecutive years), % of car households in year n who demotorise in the following 3 years\*

| from year n to year: | move house* |      |      | head retires** |      |      | at least one person changes employer*** |      |      |
|----------------------|-------------|------|------|----------------|------|------|---|------|------|
|                      | n+1         | n+2  | n+3  | n+1            | n+2  | n+3  | n+1                                     | n+2  | n+3  |
| full                 | 4.5         | 5.4  | 4.6  | 1.6            | 3.1  | 3.9  | 1.8                                     | 2.6  | 3.6  |
| partial              | 9.4         | 10.9 | 11.6 | 10.2           | 14.7 | 11.7 | 8.6                                     | 13.0 | 14.7 |
| both                 | 13.9        | 16.3 | 16.2 | 11.7           | 17.8 | 15.6 | 10.4                                    | 15.6 | 18.3 |

\* 680 cases \*\* 128 cases \*\*\* 851 cases

## FRANCE

An earlier French study (Rousseau, 2001) examined reductions in car ownership over a period of years following the occurrence of supposed “influencing factors” (age, activity



status, professional and family transitions). We discuss some of the results below. Excluding the youngest households (head between 18 and 24), which have the highest rate of demotorisation, full demotorisation is highest for the 65+ age group and partial demotorisation is highest for the 50-65 age category. In addition, the percentage of multi-car households who reduce car ownership is higher in the 50-65 (20%) and 65+ (16%) categories than in younger ones (14% for 25-49). This result is confirmed by the effects of changing professional status; in fact, entry to and exit from the active working life are closely related to changes in car ownership. However, their effects are not symmetric or comparable:

- there is an observable and immediate link between unemployment and demotorisation. This concerns especially young people (more than 20% of the unemployed 18-24 demotorise) and partial demotorisation
- retirement has almost no effect on full demotorisation. Its effect on partial demotorisation does not occur immediately. The share of retired people partially demotorising (from 2 to 1 car) was estimated to be 23%, but for 18%, this does not occur until 2 years after retirement.

A change of household structure also may have a lagged effect. Excluding relative demotorisation (i.e. a simultaneous reduction in the number of driving licence holders and of cars in the household), some demotorisations are observed three years after an adult departs from the household (4% of the full and 14% of the partial demotorisations).

Although the results of the British and French surveys are not strictly comparable, they both support the notion that the full effects of changes in household circumstances on car ownership do not necessarily occur immediately, but may take a number of years to be completed.

## **Demotorisation and mobility**

Only the French and German surveys have information on travel, and since the data are not comparable, different approaches are used to explore the relationship between demotorisation and mobility. The results for the two countries are thus presented separately.

### **FRANCE**

Since the interest and design of the French survey is based on the car (ownership and use) rather than on individuals, it does not have information on travel by individuals in the

household but only on kilometres per car. It is not possible, therefore, to examine household travel after a full demotorisation. Comparisons of annual household car mileage before and after a partial demotorisation, however, can be done. The results of the survey indicate that 20% of households kept the total number of car kilometres nearly the same after partial demotorisation (from 2 to 1 car). In this case, the car which was given up was only used minimally. In the other instances, the total number of kilometres declined sharply. In these cases, the car disposed of was used intensively, and even though the annual use of the remaining car increased, the increase did not fully make up for reduction due to the loss of the other car. However, as also noted in previous studies (Hivert, 1999), the bi-annual pairing (n/n+1) does not provide sufficient information to fully analyse behaviour before and after a change in car ownership, since the process of change takes a longer period of time.

Because there is no information on travel by other modes in the French survey, nothing can be said about overall changes in travel when car ownership is reduced. This requires a full travel survey which includes household travel by all modes. The German panel provides this information

## **GERMANY**

The German MOP contains a travel diary and thus allows the analysis of the extent to which the travel in demotorising households is affected. Daily travel distance, daily travel time, the daily number of trips and the modal split can be calculated from the survey data. For such an analysis only those demotorisations where a “real” change of mobility options takes place should be considered (i.e. both relative and transitory<sup>4</sup> demotorisations should be omitted).

The travel figures before (n) and after (n+1) are nearly the same: obviously people have suffered no real loss of mobility as a result of demotorisation. The basic mobility patterns seem not to be affected. A possible interpretation of this is that people have already learned to manage to live with fewer cars. Thus the adaptation in the number of cars in a household may be seen as a delayed effect of already changed mobility requirements, the actual causes having taken place earlier. Other results from Germany (Chlond, Waßmuth 1997) show that

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<sup>4</sup> As mentioned above the transitory demotorisation from the year n to the year n+1 is cancelled or compensated for by a following motorisation between the year n+1 and n+2. Therefore in the analysis of the effects of demotorisation on mobility these cases have to be omitted.

a demotorisation in certain cases takes place when travel demand has previously been rather low, so that the giving up of a car can be regarded as logical consequence. As mentioned above demotorisation is mainly partial, so that it can be expected that the use of the remaining cars within the households will increase. The disposed car may not be necessary for travel needs since other cars are available at the same time.

Table 21 Demotorisation and mobility. Results from the German MOP of persons in households with a reduction in the level of car ownership\*

|                                   | # of Pers. [#] | km per person day [km] |      | No of trips and per person day [#] |     | travel time per person day [minutes] |      | km with priv. cars [km] |      | km with public transport [km] |     |
|-----------------------------------|----------------|------------------------|------|------------------------------------|-----|--------------------------------------|------|-------------------------|------|-------------------------------|-----|
|                                   |                | N                      | n+1  | n                                  | n+1 | n                                    | n+1  | N                       | n+1  | n                             | n+1 |
| Altogether                        | 224            |                        |      |                                    |     |                                      |      |                         |      |                               |     |
| - Relative demotorisation         | 80             |                        |      |                                    |     |                                      |      |                         |      |                               |     |
| Real demotorisation               | 144            | 44.4                   | 45.8 | 3.8                                | 3.7 | 87.1                                 | 86.1 | 37.5                    | 35.9 | 4.0                           | 6.3 |
| - Transitory                      | 41             |                        |      |                                    |     |                                      |      |                         |      |                               |     |
| Neither relative / nor transitory | 103            | 45.3                   | 45.3 | 3.7                                | 3.5 | 84.7                                 | 80.4 | 39.0                    | 36.8 | 3.5                           | 5.8 |

\*Analyses on the level of persons in demotorising households

Considering the results on modal split the results are plausible: the relative share of kilometres travelled by private cars decreases, while the share by public transport increases. In spite of the small absolute figure the share of PT increases by about 60%. Since travel time decreases while kilometres travelled increase, there appears to be no real loss in terms of time.

## Conclusions

From the panel data sets for Britain, France and Germany we have been able to explore question of demotorisation i.e. the extent to which individual households reduce the number of cars they own (partial demotorisation) or give up car ownership entirely (full demotorisation). At the aggregate level, car ownership has been increasing over the past decades more-or-less continually in all three countries, but we have seen how these small net changes conceal rather large changes for individual households. The change in the number

of cars owned by a household over time is a measure of the volatility of household behaviour with respect to car ownership, and can be seen as an indication of the potential for influencing behavioural change.

Although the surveys for the three countries are not strictly comparable as survey methods, definitions, representativeness and variables included differ, they provide sufficient information and consistency to analyse a number of questions related to demotorisation.

A descriptive analysis of the data and the comparison of the three countries shows that:

- About 7% of British, 5% of French and 4% of German households reduce car ownership between any two years, but a slightly larger proportion increase car ownership
- The majority of demotorisations are partial; in all countries the majority of demotorisations are from 2 to 1 car
- Full demotorisation occurs in 1% of French households and 1.7% of British households, but is very rare amongst German households (0.2%); the “norm” appears to be to own at least one car
- British households show the greatest volatility in car ownership and German households the least; this may partially be explained by the relatively high costs of keeping a car in Britain and the low costs in Germany, but further work is needed to explore this
- The likelihood of reducing car ownership increases with the number of cars in the household
- “Young” households are most likely to demotorise and “old” households are least likely to demotorise
- Where the head is 50 years and older the number of households who demotorise is greater than the number who increase car ownership; car ownership declines after the head reaches the age of 50, which is in agreement with evidence found elsewhere
- Demotorisation is highest amongst the unemployed and lowest amongst the retired
- A large proportion (about 1/4 to 1/3) of demotorisations are only transitory, i.e. car ownership increases again the year following the reduction; the percentage would probably be larger over a longer period.
- 

Concerning the factors influencing demotorisation, the main results can be summarised as follows:

- Between 29% (France) and 38% (Britain) of car households demotorise when an adult leaves the household, most of these are partial; thus a substantial share of demotorisation is only relative (27% in Britain and 40% in Germany)

- Moving house doubles the likelihood of demotorisation; between 10% (Germany) and 15% (Britain) of car households who move house reduce car ownership within the same year (but slightly larger proportions increase car ownership)
- Changing employer increases demotorisation, but the effect appears to be smaller than of moving house
- Demotorisation is greater when a change in workplace is associated with an improvement in accessibility by public transport or non-motorised modes and a difficulty with car parking (Germany)
- Demotorisation is greater when individuals become unemployed than when they retire; in both cases a larger number of households reduce car ownership than increase it so that overall car ownership declines; fewer demotorisations are associated with these changes in employment status, than with changing employer or moving house
- The most common reasons mentioned for total demotorisation in the French survey are: change in household structure, costs, preference for public transport and difficulties in driving and parking.

The study also shows that dynamics are important; often car ownership continues to decrease for a number of years after a change in household circumstance. Specifically, we find:

- Demotorisation associated with an adult leaving the household generally occurs within the same time period (year); however, if relative demotorisations are excluded, effects can be observed even after 3 years
- The effects of unemployment occur within 1 year, moving house and retirement appear to be complete within 2 years, while demotorisations associated with changing employer can take at least 3 years.
- 

Regarding the effects of demotorisation on mobility, we find that:

- In France, many households greatly reduce their car travel when they partially demotorise, even if the use of the remaining car increases significantly. For 20%, however, this reduction appears to be small. Based on car ownership and car use, the French panel gives no information on the use of other travel modes
- In Germany, mobility in terms of kilometres, trips and travel time per person and day are nearly the same before and after partial demotorisation; this suggests that the use of one or all of the cars had been low or reduced previous to the demotorisation and that the use of the remaining car(s) increases; also there is a slight increase in the use of public transport.

Of course, a more detailed study based on statistical tests and modelling procedures will need to be undertaken to verify these results. As indicated, there are frequently several factors occurring at the same time when a demotorisation takes place. With the exception of relative demotorisation, this suggests that reducing car ownership becomes more likely when different changes in the household occur at the same time. This will be the subject of further work. In addition, we plan to extend the study in the coming year to other countries of the European community, using the data of the European Community Household Panel (ECHP, Eurostat).

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