Automobility in Flux: More Women and Older Drivers at the Wheel

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Having barely registered an increase at the beginning of the new millennium, during the economic upturn after 2009, there was significant growth in the mileage by registered motor vehicles in Germany, both in the case of utility vehicles and automobiles. Overall, in 2011, automobiles covered a higher mileage than ever before. Despite more efficient engines, this resulted in fuel consumption stagnating in recent years, although the long-term trend is one of decline. With an 85-percent share of total mileage, automobiles dominate our roads. This transport demand pattern is predominantly created by the needs of private households and it is currently in a state of flux when it comes to gender and age balance. Women's growing presence in education and on the labor market has, in turn, resulted in an increase in their car ownership and mileage. At the same time, men and women are maintaining a more mobile lifestyle by retaining their cars into older age. However, more limited car use has been observed, particularly among young people who, more frequently than previously, seem to be opting for the most suitable form of transport rather than traveling exclusively in their own vehicles.

The development of transport demand is closely related to important components of economic progress. Passenger transport[1] is strongly correlated to household consumer spending and freight transport services[2] have a clear correlation to gross value added. To accurately depict and understand transportation, regular information is required that gives an insight into the causal relationships. Information about the socio-economic and demographic determinants of mobility are essential for transport policy and planning, and for evaluating them.

This report first outlines the development of mileage and fuel consumption by motor vehicles. Commercial vehicles have covered approximately 15 percent of total distances, passenger cars around 85 percent. Furthermore, this report analyzes in more detail the changes that have taken place in socio-demographic factors and in the behavior of car users in recent years (see box), based on data from the German Mobility Panel.

Further Increases in Registrations and Mileage by Commercial Vehicles

New registrations of trucks and semi-trailers continued to rise in 2011 and reached 316,000 units, more than in the years immediately before the crisis of 2008/2009. These commercial vehicles traveled more than 80 billion kilometers which exceeded the mileage in more recent years. 2.7 million trucks and semi-trailers contributed to one tenth of total mileage by German vehicles (see Figure 1).

The heavier trucks and semi-trailers with a payload of 3.5 tonnes or more are mainly used for freight transport over longer distances. In 2011, the mileage by these vehicles, currently 460,000, exceeded 30 billion kilome-

1 Expressed as the sum of the distances traveled—passenger-transport performance in passenger-kilometers.

2 Freight transport performance in tonne-kilometers.

Box

Data on Vehicle Use and Mobility

In addition to official statistics, representative surveys of passenger, commercial and vehicle transport are carried out at irregular intervals.[1] The Federal Ministry of Transport, Building and Urban Development surveys the mobility of households and their vehicle use with annual sampling for the German Mobility Panel. In addition, DIW Berlin calculates annual mileage (in vehicle-kilometers) by German vehicles by type of vehicle and engine as an essential component of transport demand.

Calculating Mileage by German Vehicles

Complete and consistent information about the distance driven by German vehicles is not available at regular intervals. Official statistics only provide annual information on mileage for heavy goods vehicles over 3.5 tonnes, and for tractors and buses. These figures are recorded by the Federal Motor Transport Authority (KBA) and the Federal Statistical Office.[2] Representative surveys on the usage and mileage by passenger cars and light commercial vehicles have only been conducted at long intervals, most recently in 1993 and 2002.

To obtain a consistent data basis, DIW Berlin has calculated the development of annual mileage and fuel consumption according to vehicle and propulsion type.[3] DIW Berlin has estimated the mileage based on the fuel consumed by road traffic, the number of vehicles, the average consumption per vehicle, and the average mileage.[4]

In addition to making calculations based on fuel consumption, the development of the mileage of cars is estimated using structural features. These estimates are based on known usage parameters for vehicle types from the survey of mileage from 2002. Variance analyzes of data from the 1993 and 2002 surveys on mileage show that average distance driven can be estimated from vehicle characteristics, such as vehicle age, propulsion type, capacity, engine power, top speed, tare weight and holder category.[5] The average consumption values for passenger cars are calculated on the basis of test consumption data.

German Mobility Panel

The travel behavior survey by the German Mobility Panel (MOP) is commissioned by the Federal Ministry of Transport, Building and Urban Development. The fieldwork is carried out by specialized research institutes. The Institute for Transport Studies at the Karlsruhe Institute of Technology (KIT) is responsible for the design and for the scientific management and analysis of the survey.

Since 1994, almost 2,000 people have been asked annually about their mobility behavior for the MOP. Participants in the study reported socio-demographic characteristics about their households and the people living in them as well as all trips taken in a week, the reasons for taking those trips, the modes of transport used and the distances and duration of those trips. The same people were interviewed in the two subsequent years. This everyday mobility data can be used to analyze the travel behavior of the German population, and to identify and interpret changes in that behavior.

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1 The nationwide sample surveys relevant to passenger transport are Mobilität in Deutschland from 2002 to 2008 (mobilitaet-in-deutschland.de) and the annual German Mobility Panel (mobilitaetspanel.de). Kraftfahrzeugverkehr in Deutschland was a survey carried out in Germany in 2002 and 2010 on commercial and freight transport vehicles (kid2010.de). Freight vehicle transport statistics continuously monitor German commercial vehicles over 3.5 tonnes (kba.de). The mileage of all German vehicles were last recorded in the Fahrleistungserhebung 2002 (bast.de).

2 Federal Motor Transport Authority, Verkehr deutscher Lastkraftfahrzeuge. The Federal Statistical Office, Specialist Series 8, Series 3.

3 The mileage is calculated for compiling Verkehr in Zahlen on behalf of the Federal Ministry of Transport, Building and Urban Development (BMVBS) (ed.), compiled by S. Radke, DIW Berlin, annually, Hamburg. This Economic Bulletin publishes information and estimates that extend beyond this publication.

4 Important data sources for these calculations are the Federal Motor Vehicle Office, Federal Statistical Office, Association of the German Petroleum Industry. This report takes account of all motor vehicles registered in Germany and their mileage, including journeys traveled abroad. It does not include the mileage of vehicles registered abroad. For procedures and revisions compared to calculations up to 2002, see J. Kloas, H. Kuhfeld and U. Kunert, "Straßenverkehr: Eher Ausweichreaktionen auf hohe Kraftstoffpreise als Verringerung der Fahrleistungen," Wochenbericht des DIW Berlin, no. 41 (2004).

5 See D. Kalinowska, J. Kloas, H. Kuhfeld, and U. Kunert, Aktualisierung und Weiterentwicklung der Berechnungsmodelle für die Fahrleistungen von Kraftfahrzeugen und für das Aufkommen und für die Verkehrsleistung im Personenverkehr (MIV) (2005). On behalf of the Federal Ministry of Transport, Building and Housing, Berlin; D. Kalinowska and H. Kuhfeld, "Motor Vehicle Use and Travel Behaviour in Germany: Determinants of Car Mileage," DIW Berlin Diskussionspapier, no. 602 (2006).

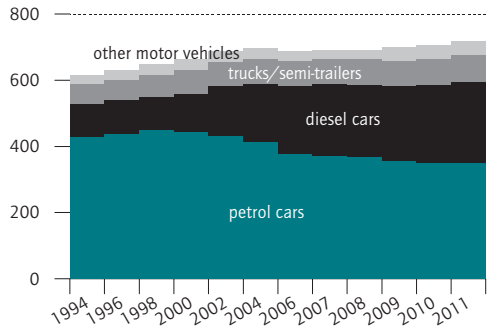
In addition, the mileage driven as well as tanked and consumed fuel volumes are recorded as part of MOP's odometer reading and fuel consumption survey for all vehicles in participating households for eight weeks in spring, to analyze the mileage and real consumption values of all German passenger cars.

The MOP provides representative results for Germany and publishes annual results for mobility parameters, such as transport participation, number of trips per person, vehicle performance (kilometers per person per day), modes of transport and data on the use of passenger cars (distance driven and consumption figures). The longitudinal nature of the survey (data over a week and for three consecutive years) makes is possible to analyze changes in respondents' travel behavior. Linking data from the MOP everyday mobility survey with data from the MOP odometer reading and fuel consumtion survey allows detailed analyzes of the interactions and relationships of the mobility behavior of individuals across different modes of transport and the mileage and fuel consumption of the cars.

Figure 1

Mileage by Motor Vehicles Registered in Germany

In billion vehicle-kilometers



Source: calculations by DIW Berlin.

Is the decline of mileage by petrol cars phasing off?

ters. Corresponding to this rise in mileage, transport performances (in tonne-kilometers) of goods vehicles has also increased.[3]

Commercial vehicles are almost exclusively powered by diesel engines. Their share of diesel fuel consumption in 2011 was 47 percent (see Table 3).[4]

Passenger Cars: Significant Increase in Numbers and Mileage

At the beginning of 2012, there were nearly 43 million registered passenger cars in Germany. New car registrations were below the long-term average in 2011 at almost 3.2 million. However, the stock of vehicles grew by more than 600,000. This is due to only 2.5 million cars being scrapped or exported, which is below the average of previous years. Obviously, the effects of the scrapping premium, which led to the disposal of around 3.5 million cars in 2009, were still ongoing today. But, at the same time, this means that the average age of German cars continues to rise and now stands at a new high

3 For the current statistics on transport services, see S. Radke, Verkehr in Zahlen 2012/2013.

4 Here and in the following the fuel data include biogenic shares which in 2011 had an energy share of 5.5 percent of total fuel consumption (gasoline and diesel), see Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), Renewable Energies in Figures (Berlin: 2012). Consumption figures include refueling abroad.

Table 1

Fleet and Mileage by Motor Vehicles Registered in Germany

		1996	1998	2000	2002	2004	2006	2008	2010	2011
Mopeds or similar[1]										
Fleet[2]	1,000	1,667	1,747	1,595	1,584	1,786	1,930	2,043	2,043	2,096
Average mileage[3]	1,000 km	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3
Total mileage[3]	Million km	4,168	4,280	3,827	3,754	4,232	4,575	4,700	4,699	4,821
Motorcycles[4]										
Fleet[2]	1,000	2,470	2,926	3,338	3,643	3,814	3,956	3,659	3,828	3,908
Average mileage[3]	1,000 km	4.1	3.9	3.9	3.3	3.3	3.3	3.0	3.0	3.0
Total mileage[3]	Million km	10,131	11,411	13,017	12,167	12,739	13,213	11,122	11,646	11,887
Passenger cars										
Fleet[2]	1,000	40,988	41,674	42,840	44,605	45,258	46,427	41,321	42,302	42,928
Average mileage[3]	1,000 km	13.2	13.2	13.1	13.1	13.0	12.6	14.1	14.2	14.2
Total mileage[3]	Million km	539,473	550,779	559,467	583,560	590,409	583,905	584,589	599,010	608,769
Motor bus[5]										
Fleet[2]	1,000	85	83	86	85	86	84	75	76	76
Average mileage[3]	1,000 km	43.4	45.0	43.7	42.5	41.5	41.7	44.1	43.6	43.6
Total mileage[3]	Million km	3,683	3,752	3,740	3,634	3,562	3,502	3,322	3,336	3,316
Trucks[6]										
Fleet[2]	1,000	2,273	2,371	2,527	2,632	2,579	2,584	2,347	2,441	2,529
Average mileage[3]	1,000 km	23.5	23.5	23.3	22.1	22.4	22.3	25.7	24.9	24.7
Total mileage[3]	Million km	53,446	55,714	58,878	58,210	57,702	57,649	60,291	60,705	62,537
Semi-trailers										
Fleet[2]	1,000	130	141	162	179	182	201	177	178	184
Average mileage[3]	1,000 km	73.7	86.6	78.2	76.6	83.0	82.6	102.0	94.9	94.8
Total mileage[3]	Million km	9,585	12,211	12,695	13,702	15,104	16,604	18,039	16,904	17,472
Other tractors[7]										
Fleet[2]	1,000	603	690	769	850	921	992	1,065	1,155	1,209
Average mileage[3]	1,000 km	4.4	4.4	4.4	4.4	4.3	4.3	4.3	4.2	4.2
Total mileage[3]	Million km	2,626	3,008	3,352	3,705	3,971	4,281	4,528	4,896	5,125
Other motorized vehicles[8]										
Fleet[2]	1,000	625	630	655	680	692	284	261	264	267
Average mileage[3]	1,000 km	11.7	12.0	12.3	12.4	12.5	12.6	13.5	13.6	13.6
Total mileage[3]	Million km	7,307	7,546	8,069	8,461	8,678	3,568	3,525	3,583	3,632
Total motor vehicles										
Fleet[2]	1,000	48,843	50,262	51,970	54,258	55,318	56,458	50,947	52,287	53,197
Total mileage[3]	Million km	630,419	648,701	663,045	687,325	696,399	687,297	690,116	704,780	717,559

1 At the beginning of the insurance year, including wheelchairs.
2 Up to 2006, annual mean values, including from 2007 year-end values excluding vehicles temporarily deregistered.
3 Mileage of domestic vehicles including distances abroad.
4 Including light motorcycles and mopeds.
5 Including trolley coaches.
7 Including common tractors.
8 Including work machines without vehicle registration documents but with a registration plate.
Sources: Federal Motor Transport Authority; Federal Statistical Office, calculations by DIW Berlin.

The total mileage reached a new high in 2011.

of 8.5 years.[5] Total car use increased this year to almost 610 billion kilometers (see Table 1).

Due to their lower average use of 11,500 km per year, the 30.5 million passenger cars with petrol engines (71 percent of all units) only contribute 350 billion kilometers (57 percent) to the total mileage by cars (see Table 2). However, 11.9 million diesel cars drove almost 250 billion kilometers at an average of 20,700 kilometers which is equivalent to 41 percent of total mileage by cars (see Figure 1 and Table 3). A further 13 billion kilometers were driven by 530,000 cars that can run on liquid petroleum or natural gas. In addition, 49,000 cars were equipped with hybrid engines.[6]

5 Source: Federal Motor Transport Authority.

6 Since they can only draw their operating power from internal combustion engines, cars with hybrid drive are included in the driving performance of conventional engines. Approximately 4,500 cars are electrically operated, see

Table 2

Consumption Figures Calculated for Motor Vehicles Registered in Germany with Petrol Engines

		1996	1998	2000	2002	2004	2006	2008	2010	2011
Mopeds or similar[1]										
Fleet[2]	1,000	1,667	1,747	1,595	1,584	1,786	1,930	2,043	2,043	2,096
Average mileage[3]	1,000 km	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3
Total mileage[3]	Million km	4,168	4,280	3,827	3,754	4,232	4,575	4,700	4,699	4,821
Average petrol consumption /100 km	Liters	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total petrol consumption[4]	Million L	83	86	77	75	85	91	92	92	94
Motorcycles[5]										
Fleet[2]	1,000	2,471	2,926	3,338	3,643	3,814	3,956	3,659	3,812	3,897
Average mileage[3]	1,000 km	4.1	3.9	3.9	3.3	3.3	3.3	3.0	3.0	3.0
Total mileage[3]	Million km	10,131	11,411	13,017	12,167	12,739	13,213	11,122	11,587	11,848
Average petrol consumption /100 km	Liters	4.5	4.5	4.7	4.8	4.8	4.7	4.7	4.7	4.7
Total petrol consumption[4]	Million L	456	525	612	584	611	621	521	543	555
Passenger cars										
Fleet[2]	1,000	35,357	36,187	36,879	37,297	36,446	35,944	31,031	30,545	30,505
Average mileage[3]	1,000 km	12.4	12.4	12.0	11.6	11.3	10.5	11.9	11.4	11.5
Total mileage[3]	Million km	438,564	449,475	442,855	431,246	412,820	378,705	367,959	349,416	349,301
Average petrol consumption /100 km	Liters	9.1	8.8	8.6	8.5	8.4	8.3	8.1	7.9	7.9
Total petrol consumption[4]	Million L	39,691	39,747	38,129	36,633	34,582	31,157	29,031	27,724	27,705
Motor buses[6]										
Fleet[2]	1,000	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1
Average mileage[3]	1,000 km	11.0	11.0	11.0	11.0	11.0	11.0	15.5	15.5	15.5
Total mileage[3]	Million km	7.0	4.9	3.6	3.1	2.4	2.2	2.0	1.5	1.4
Average petrol consumption /100 km	Liters	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
Total petrol consumption[4]	Million L	1.3	0.9	0.7	0.6	0.4	0.4	0.3	0.3	0.2
Trucks										
Fleet[2]	1,000	330	305	284	264	224	193	142	136	132
Average mileage[3]	1,000 km	12.0	12.0	12.0	11.9	11.9	11.9	14.0	14.0	14.0
Total mileage[3]	Million km	3,956	3,657	3,410	3,144	2,666	2,291	1,991	1,904	1,850
Average petrol consumption /100 km	Liters	12.9	12.7	12.5	12.4	12.4	12.4	12.0	11.5	11.5
Total petrol consumption[4]	Million L	510	464	426	390	331	284	229	219	213
Tractors[7]										
Fleet[2]	1,000	12.0	12.0	13.3	14.7	16.2	15.9	21.0	30.5	32.7
Average mileage[3]	1,000 km	2.1	2.1	2.1	2.1	2.1	2.1	2.0	2.0	2.0
Total mileage[3]	Million km	25	25	28	31	34	33	43	61	65
Average petrol consumption /100 km	Liters	18.0	18.0	18.0	18.0	18.0	18.0	17.0	17.0	17.0
Total petrol consumption[4]	Million L	4.5	4.5	5.0	5.5	6.1	6.0	7.0	10.4	11.1
Other motorized vehicles[8]										
Fleet[2]	1,000	154.0	137.0	121.5	109.5	95.0	37.6	30.0	26.6	24.9
Average mileage[3]	1,000 km	8.3	8.3	8.5	8.5	8.4	8.4	10.0	9.9	9.9
Total mileage[3]	Million km	1 278	1 137	1 033	930	798	316	295	263	247
Average petrol consumption /100 km	Liters	18.0	18.0	17.8	17.6	17.6	17.6	17.0	17.0	17.0
Total petrol consumption[4]	Million L	230	205	184	164	140	56	50	45	42
Total motor vehicles										
Fleet[2]	1,000	39,992	41,314	42,231	42,913	42,381	42,076	36,926	36,593	36,689
Average mileage[3]	Million km	458,129	469,991	464,175	451,275	433,291	399,135	386,111	367,933	368,134
Total mileage[3]	Million L	40,977	41,032	39,433	37,852	35,756	32,216	29,931	28,633,	28,621
Total petrol consumption[4]	1,000 t	30,733	30,774	29,575	28,389	26,817	24,162	22,448	21,475	21,466

1 At the beginning of the insurance year, including wheelchairs.
2 Up to 2006, annual mean values, including from 2007 year-end values excluding vehicles temporarily deregistered.
3 Mileage of domestic vehicles including distances abroad.
4 Including light motorcycles and mopeds.
5 Including trolley coaches.
7 Including common tractors.
8 Including work machines without vehicle registration documents but with a registration plate.
Sources: Federal Motor Transport Authority; Federal Statistical Office, calculations by DIW Berlin.

The consumption of petrol continues to decline.

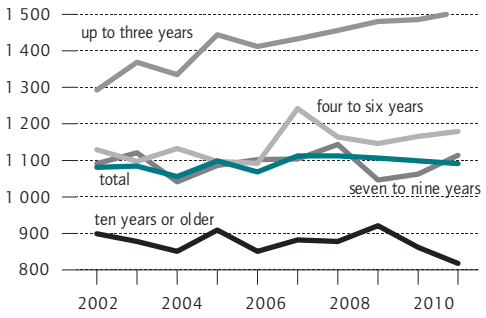
The analysis of the German Mobility Panel produced similar results for average mileage for cars. The MOP records kilometers driven in Germany in the spring. Differentiating average mileage by vehicle age, there have been increases among newer cars (especially in cars up to three years old, and even among four to six-year-old-cars) in recent years, whilst the mileage by older cars has stagnated or declined slightly (see Figure 2).

Furthermore, analyses based on data from the German Mobility Panel show that there was an increase in mileage when newer, more fuel-efficient vehicles replaced older cars. Car users compensate for specific savings in cost per kilometer, at least partially, by increases in mileage.[7]

Figure 2

Mileage in Spring Months According to Vehicle Age

Kilometers per car and month



Source: German Mobility Panel.

The use of new cars is still increasing.

Fuel Consumption Stagnates

At almost 28 billion liters, petrol consumption from passenger cars accounted for almost all petrol consumption from road transport. Due to the reduction in the number of vehicles and improvements in efficiency, petrol consumption has decreased by about one-quarter in the last ten years. However, diesel consumption has risen almost continuously. In 2011, it was approximately 17 billion liters for cars, that is an increase of 60 percent in ten years. Including demand from commercial vehicles, that is a total of over 37 billion liters of diesel consumed. Total fuel consumption has tended to decline slightly since 2000, but it has stagnated in recent years at 66 billion liters.

Fuel Consumption of Cars Much Higher Than Officially Stated

Data on fuel consumption for new cars are a deciding factor for car buyers who are informed of standard EU fuel consumption figures by car dealerships (car label). For annual registrations of petrol cars, standard EU fuel consumption[8] has decreased by almost a quarter since 1998, to 6.3 liters per 100 kilometers in 2011. Having stagnated for some years, average consumption for new diesel cars fell in 2011 to 5.5 liters per 100 kilometers, a decrease of 20 percent since 1998. In 2011, all new cars were calculated to have an average standard consumption of 5.9 liters of fuel per 100 kilometers. This corresponds to CO_2 emissions of about 146 grams per kilometer driven.[9]

However, standard consumption data for individual vehicles is 20 to 30 percent lower than actual consumption values, since they do not reflect everyday driving conditions. For example, standard consumption figures do not include journeys at more than 120 km/h or with the use of air conditioning.[10] But in determining annual mileage, DIW Berlin had to take into account actual consumption. These actual consumption values are estimated annually based on available empirical data.[11] When comparing actual and standard fuel consumption values, it becomes apparent that the differences increase over time, particularly for newer diesel vehicles. For new diesel cars, actual consumption is, on average, one-fifth more than standard values. As a result, car buyers receive insufficient information if they want to take account of future operating costs in their purchasing decision. In 2011, car users spent more than 65 billion euros on fuel. Had their cars consumed fuel accor-

W-P. Schill, "Elektromobilität: Kurzfristigen Aktionismus vermeiden, langfristige Chancen nutzen," Wochenbericht des DIW Berlin, no. 27-28 (2010).

7 For the rebound effect, see U. Kunert and S. Radke, "Kraftfahrzeugverkehr 2010: Weiteres Wachstum und hohe Bedeutung von Firmenwagen," Wochenbericht des DIW Berlin, no. 48 (2011).

8 EU Directive 93/116/EC (New European Driving Cycle, NEDC) applies in determining the standard consumption of new registrations.

9 See Federal Motor Transport Authority, Neuzulassungen und Besitzumschreibungen von Kraftfahrzeugen nach Emissionen und Kraftstoffen (2012).

10 See G. Fontaras and P. Dilara, "The evolution of European passenger car characteristics 2000 to 2010 and its effects on real-world CO2 emissions and CO2 reduction policy," Energy Policy 49 (2012): 719-730 and ICCT, "Discrepancies between type-approval and "real-world" fuel-consumption and CO2 values. Assessment for 2001–2011. European passenger cars," Working Paper 2012–02 (2012).

11 For example, Motor Presse Stuttgart GmbH & Co. KG, spritmonitor.de, German Mobility Panel.

Table 3

Consumption Calculation for Motor Vehicles Registered in Germany with Diesel Engines

		1996	1998	2000	2002	2004	2006	2008	2010	2011
Passenger cars										
Fleet[1]	1,000	5,631	5,487	5,961	7,308	8,812	10,483	10,290	11,267	11,891
Average mileage[2]	1,000 km	17.9	18.5	19.6	20.8	20.2	19.6	21.1	21.1	20.7
Total mileage[2]	Million km	100,909	101,304	116,612	152,315	177,589	205,200	216,630	237,700	246,580
Average diesel fuel consumption[3]/100 km	Liters	7.4	7.3	7.1	6.9	6.9	6.9	6.8	6.8	6.74
Diesel consumption,[3] total[4]	Million L	7,498	7,389	8,260	10,529,	12,210	14,058	14,717	16,149	16 613
Motor buses[5]										
Fleet[1]	1,000	84.3	82.8	85.2	85.1	85.5	83.7	75.0	74.8	74
Average mileage[2]	1,000 km	43.6	45.2	43.8	42.6	41.6	41.8	44.2	43.5	43.5
Total mileage[2]	Million km	3,676	3,747	3,736	3,631	3,560	3,500	3,320	3,252	3,234
Average diesel fuel consumption[3]/100 km	Liters	31.0	30.8	30.4	30.2	30.1	30.2	29.0	29.0	29.0
Diesel consumption,[3] total[4]	Million L	1,140	1,154	1,136	1,097	1,070	1,057	963	943	938
Trucks[6]										
Fleet[1]	1,000	1,944	2,066	2,243	2,368	2,355	2,391	2,204	2,282	2,371
Average mileage[2]	1,000 km	25.5	25.2	24.7	23.3	23.4	23.2	26.4	25.5	25.3
Total mileage[2]	Million km	49,490	52,056	55,468	55,066	55,036	55,358	58,300	58,116	59,951
Average diesel fuel consumption[3]/100 km	Liters	22.6	21.5	21.5	20.3	19.5	20.2	19.5	19.0	18.8
Diesel consumption,[3] total[4]	Million L	11,175	11,205	11,953	11,179	10,756	11,189	11,393	11,059	11,293
Semi-trailers										
Fleet[1]	1,000	130	141	162	179	182	201	177	178	184
Average mileage[2]	1,000 km	74.0	87.0	78.0	76.6	83.0	83.0	102.0	94.9	94.7
Total mileage[2]	Million km	9,585	12,211	12,695	13,702	15,104	16,604	18,039	16,856	17,423
Average diesel fuel consumption[3]/100 km	Liters	37.9	36.3	36.6	36.9	36.0	36.4	35.6	35.6	34.6
Diesel consumption,[3] total[4]	Million L	3,633	4,433	4,646	5,052	5,444	6,038	6,426	6,005	6,024
Other tractors[6]										
Fleet[1]	1,000	591	678	755	835	905	976	1,043	1,124	1,177
Average mileage[2]	1,000 km	4.4	4.4	4.4	4.4	4.4	4.4	4.3	4.3	4.3
Total mileage[2]	Million km	2,600	2,983	3,324	3,674	3,937	4,248	4,485	4,835	5,060
Average diesel fuel consumption[3]/100 km	Liters	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1	30.1
Diesel consumption,[3] total[4]	Million L	783	898	1,000	1,106	1,185	1,279	1,350	1,455	1,523
Other motorized vehicles[7]										
Fleet[1]	1 ,	471	493	533	570	597	246	231	237	242
Average mileage[2]	1,000 km	12.8	13.0	13.2	13.2	13.2	13.2	14.0	14.0	14.0
Total mileage[2]	Million km	6,029	6,409	7,036	7,530	7,880	3,252	3,230	3,320	3,385
Average diesel fuel consumption[3]/100 km	Liters	23.7	23.7	23.7	23.7	23.7	23.7	23.3	23.5	23.5
Diesel consumption,[3] total[4]	Million L	1,429	1,519	1,667	1,785	1,868	771	753	780	796
Total motor vehicles										
Fleet[1]	1,000	8,851	8,948	9,739	11,345	12,937	14,382	14,021	15,162	15,939
Total mileage[2]	Million km	172,289	178,710	198,870	235,918	263,107	288,162	304,004	324,078	335,633
Diesel consumption,[3] total[4]	Million L	26,356	27,397	30,062	32,418	34,133	35,791	36,901	37,862	38,606
Diesel consumption,[3] total[4,8]	1,000 t	22,007	22,877	25,101	27,069	28,501	29,886	30,813	31,615	32,236

1 At the beginning of the insurance year, including wheelchairs.
2 Up to 2006, annual mean values, including from 2007 year-end values excluding vehicles temporarily deregistered.
3 Mileage of domestic vehicles including distances abroad.
4 Including light motorcycles and mopeds.
5 Including trolley coaches.
6 Including common tractors.
7 Including work machines without vehicle registration documents but with a registration plate.
8 Including unallocated consumption from road transport.
Sources: Federal Motor Transport Authority; Federal Statistical Office, calculations by DIW Berlin.

The consumption of diesel fuel is increasing for both passenger cars and commercial vehicles.

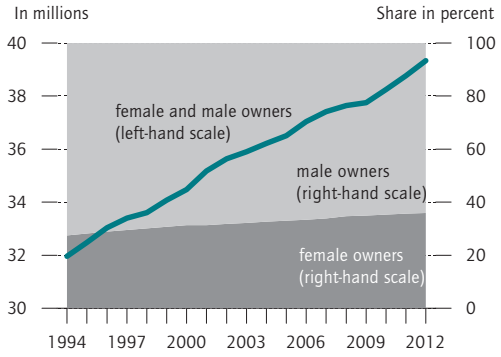
ding to standard values, this figure would have been at least eight billion euros lower.[12]

How consumers take into account fuel economy and future savings has not been clearly documented, based on the numerous studies that have examined this issue. However, the majority of findings suggest that these future

12 Estimated based on the differences between fuel consumption and standard data for all vehicles from individual years.

Figure 3

Car Owners[1] by Gender



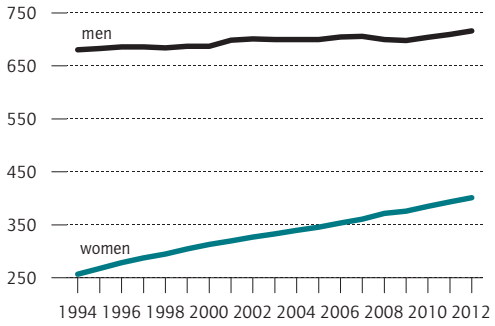
1 Not including legal entities and unknown, excluding cars temporarily off the road/not registered.
Source: Federal Motor Transport Authority, calculations by DIW Berlin.

The share of women owning cars is increasing and has reached 36 percent of 39 million.

Figure 4

Motorization by Gender

Cars per 1,000 inhabitants aged 18 or over



Sources: Federal Motor Transport Authority; Federal Statistical Office, calculations by DIW Berlin.

The share of women with their own car is rising.

savings are undervalued.[13] Certainly, there is less incentive for consumers to purchase more efficient technologies as a result of the incorrect consumption figures.

The actual specific consumption of all passenger cars is significantly higher than the values for newly registered vehicles because usage intensities vary across vehicle classes (for example, new cars and more powerful cars are used more intensively) and because older cars consume more fuel. This is taken into account in the consumption calculations shown in Tables 2 and 3.

More and More Vehicle Owners Are Women …

Over four-fifths of all vehicles on the road are passenger vehicles, which account for around 85 percent of the mileage by German motor vehicles. 38.6 million of a total of almost 43 million passenger vehicles are owned by private households, while households also have around 2.5 million company cars at their disposable for private use.[14] Approximately 80 percent of kilometers driven by all passenger vehicles are for private use. There has been a change in the use of vehicles, for example, through higher labor market participation and altered gender roles. Although overall demand in passenger transport is only rising slightly, there has nevertheless been a marked increase in commuter and leisure travel in recent years.[15]

With higher levels of motorization, women play an increasingly important role as vehicle owners and users. In 1994, 8.8 million passenger vehicles were registered to women, while the corresponding figure today is 14.1 million, that is, 5.3 million more.[16] At the same time, the number of cars registered to men has increased from 23.2 to 25.2 million—up two million (see Figure 3). Therefore, 36 percent of passenger vehicles were owned by women at the beginning of 2012.[17] This equates to 1,000 women (aged 18 or over) sharing 400 cars compared to approximately 715 vehicles for 1,000 men (see Figure 4). This difference is still significant and will continue to decrease in future as mobility habits are maintained in old age (cohort effects) because ownership of passenger vehicles by women is considerably more widespread in the middle-aged groups than for women aged over 64. For men, too, these cohort effects

13 See U.S. Environmental Protection Agency, How Consumers Value Fuel Economy: A Literature Review (2010).

14 See FiFo, Klinski, FÖS (Forum Ökologisch-Soziale Marktwirtschaft), Steuerliche Behandlung von Firmenwagen in Deutschland. Research project commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), (Cologne: 2011).

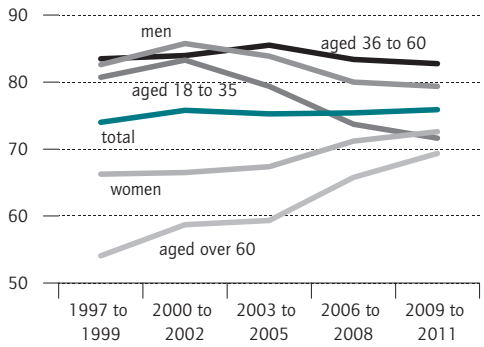
15 On overall transport demand and the purposes of travel, see U. Kunert and S. Radke, "Personenverkehr in Deutschland – mobil bei hohen Kosten," Wochenbericht des DIW Berlin, no. 24 (2012) and Verkehr in Zahlen (2012).

16 Federal Motor Transport Authority (KBA) (various years): Fahrzeugzulassungen. We refer to 1994 when the German Mobility Panel was founded. The data on existing vehicles refer to adjusted statistics, since as of 2007 the KBA's official figures do not include the vehicles which are temporarily not registered.

17 The data refer to just over 39 million cars for which the owner's gender is known, i.e., not including cars with the owner characteristics of legal entity or not known.

Figure 5

Car Availability—Driver's License and Car in Household (Persons Aged 18 Years or Over)
In percent

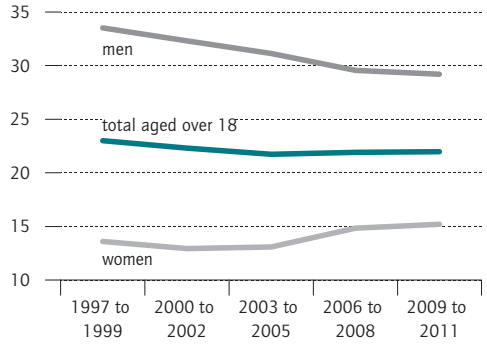


Source: German Mobility Panel.

Car availability in the age groups is developing differently.

Figure 6

Car Use by Gender (Drivers Only)
In kilometers per person and day



Source: German Mobility Panel.

The intensity of car use by women and men is converging.

are still evident, but the differences in ownership of passenger vehicles are significantly lower from the middle-aged cohorts onwards.[18]

Figure 5 illustrates this fact with regard to people having access to a car (i.e., a person has a driver's license and there is a car in the household) while particularly for younger men there is a decline in the number of people with access to a car, this increases for older men and women as a result of the cohort effect mentioned above. Both effects combined led to a stable level of car availability in the last ten years.

The use of vehicles has also changed in accordance with changes in vehicle-owner characteristics. Using data from the German Mobility Panel, it is possible to trace specific developments in the use of vehicles in households. More women have a car and they travel more kilometers per day (see Figure 6). While a reduction in car use can be seen over the last decade for men, this increases for women. Both demographic and socio-economic processes play a role here: the share of women in employment has increased in recent years. At the same time, retired women have maintained their travel behavior in old age. The share of retired women in particular with access to a car has increased, but this is still around 20 percentage points below that of men in this age group.[19]

A trend towards homogenization of travel behavior and car use can be observed across all age groups: among women, those who work full-time have the highest daily car use. In the course of just under a decade, a rise in car use of 23 to 25 kilometers per female driver per day was noted for this group of people. For men, there was a decline of 42 to 38 kilometers per day over the same period.

... and Older People

If we look at the age of vehicle owners (see Figure 7), there is a significant shift towards older people. While 17 percent of cars were still owned or being driven by people under 30 in 1994, at seven percent today, this share has more than halved. Also, the share owned by the second age group (30 to 39-year-olds) has declined. However, the number and share of cars of the middle-aged group has increased and people aged 65 or over own twice the share of vehicles (20 percent) today than this group did 18 years ago.

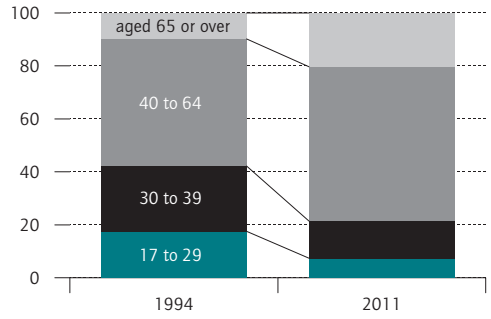
For young men (17 to under 30), car ownership in this period almost halved—down to 260 cars per 1,000 people today (see Figure 8). For several years now an—albeit weaker—decline in car ownership has also been recor-

18 On future motorization and transport demand, see also DIW Berlin and ifmo Mobilität 2025: der Einfluss von Einkommen, Mobilitätskosten und Demografie (Berlin: 2008).

19 See D. Kalinowska and U. Kunert, "Ageing and Mobility in Germany: Are Women Taking the Fast Lane?," DIW Berlin Diskussionspapier, no. 892 (2009).

Figure 7

Car Stock by Owners' Age Group
In percent

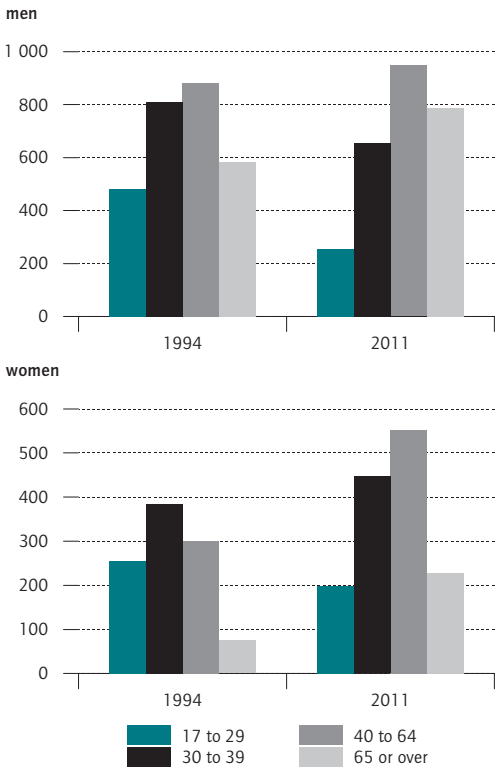


Source: Federal Motor Transport Authority, calculations by DIW Berlin.

The share of pensioners owning cars has doubled.

Figure 8

Motorization by Owners' Age Group
Car owners per 1,000 inhabitants



Sources: Federal Motor Transport Authority; Federal Statistical Office, calculations by DIW Berlin.

For men, the level of motorization only increases in older age; for women, on the other hand, it only falls in the youngest age groups.

ded for young women—recently down to 200 cars per 1,000 persons. In the three categories of older people, motorization rates among women were still increasing. However, car ownership for men is also decreasing in the cohorts of 30 to 39-year-olds.

Not only in terms of having access to a car (availability and driver's license) but also of car use (as a driver only), this trend of changed mobility has been observed in young people over the last 15 years (see Figure 9).

In the last 15 years, the average distance traveled by a car driver per day has remained approximately constant across all persons at just over 20 kilometers, but it varies significantly in the different age groups. For middle-aged people (aged between 30 and 64)—apart from sampling fluctuations—no changes have been observed. Conversely, for older persons (aged over 64) there has been an increase in the distance traveled in the last 15 years (from around ten kilometers per person per day to around 14 kilometers per person per day). However, a significant decrease from around 28 kilometers per person per day to 17 kilometers per person per day was recorded for younger people (aged between 18 and 29). But these different trends among younger and older people even out on average.

Existing studies on the changed travel behavior of young adults concluded that the decline in car use is largely for structural reasons. For example, there is an increase in the share of students, mainly living in cities, where use of a car has less appeal, partly because cities have good public transport systems and there are special offers for students using public transport.[20]

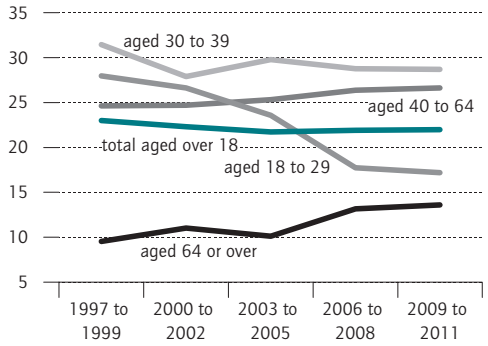
Modes of Transport Used More Flexibly

Moreover, there is a change in travel behavior because the available modes of transport are used more flexibly. People often no longer—as was more common in the past—tend to always use one mode of transport, but they use different ones depending on the situation and suitability. This altered multimodal behavior is becoming more established particularly among younger

20 See T. Kuhnimhof, R. Buehler, M. Wirtz, and D. Kalinowska, "Travel trends among young adults in Germany: increasing multimodality and declining car use for men," Journal of Transport Geography, vol. 24: (2012): 443–450; and ifmo, Mobilität junger Menschen im Wandel – multimodaler und weiblicher (Munich: Institute for Mobility Research, 2011).

Figure 9

Car Use by Age (Drivers Only)
In kilometers per person and day

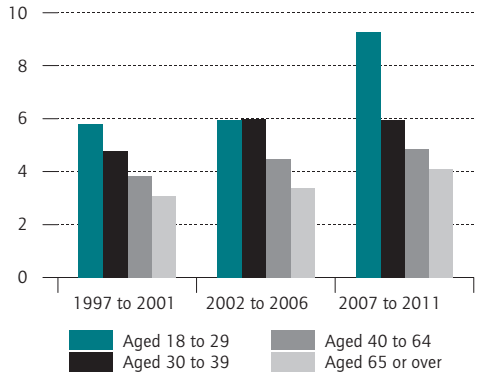


Source: German Mobility Panel.

There is a decline in car use among younger people.

Figure 10

Share of People with Multimodal1 Transport Behavior
In percent



1 Using car, bicycle and public transport in one week.
Source: German Mobility Panel.

Modes of transport are used increasingly flexibly.

people (see Figure 10);[21] over the last ten years, slight increases in multimodal behavior have been observed in people aged 65 or over. The share of people in this age group who are reliant on public transport (public transport captives) is decreasing. However, there is an increase in the share of those who have a car at their disposal and use this for most of their travel. This means there is also a higher share of people who potentially use multiple modes of transport. There is a slight increase in the share of people aged between 30 and 64 who use various modes of transport. For young people (aged 18 to 29), however, this figure has risen sharply in the last decade—by around 50 percent.

Conclusion

In recent years, car use has only increased slightly; the mileage today is only four percent higher than ten years ago. However, various opposing trends are concealed behind this apparent stability, as a result of a change in the significance of user groups and user behavior: on the one hand, people transfer their mobility habits to old age, meaning the mobility and car use of older people increases. Yet, over the last decade, young road users show a lower level of car use at the same time as stable overall mobility, mostly due to changes in circumstances (education or training, urban environment) and also because of a pragmatic attitude to cars: in the last decade, particularly for young people, the car has lost its status as a universal modes of transport for all types of journeys, not least because of increased costs. Today there is often ample opportunity for people to choose a mode of transport to suit their needs, so that many can do without their own private car. For young and middle-aged people, the use of modes of transport is becoming more diversified, with mobility needs better distributed across all modes of transport—there has also been an increase in the use of public transport and bicycles in recent years.[22] Most people retain their mobility behavior as they get older. Therefore, a rise in car use is to be expected in the future, particularly for older women. To what extent those who are still young today will maintain different mobility patterns in later stages of life still remains to be seen.

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21 A person's behavior is said to be multimodal if he or she uses more than one modes of transport on a regular basis. Here the definition of multimodal is rather narrow, since it means a person must have used a car and public transport and a bicycle at least once each during the course of just one week.

22 See U. Kunert and S. Radke, "Personenverkehr" (2012), op. cit.

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