DAILY TRAVEL AND CO₂ EMISSIONS FROM PASSENGER TRANSPORT: A COMPARISON OF GERMANY AND THE UNITED STATES

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Overview

- Why Germany and the USA?
- Trend in CO$_2$ Emissions from Passenger Transport in Germany and the USA
- Technology
- Travel Behavior and Policies
- Conclusion/Lessons
Similarities between Germany and the USA

- Federal systems of government, local self-government
- Strong economies, high standards of living
- Important automobile industry
- Highest levels of car ownership in the world
- Most adults have a driver’s license
- Extensive road networks
- Much urban & suburban (re) development since WWII

New Jersey Turnpike, 2007
First “Autobahn”, 1931, (Source: BMVBS, 2007)
## Trends and Levels CO₂ Equivalent Emissions from Ground Passenger Transport

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><strong>Total CO₂ Equivalent (Tg)</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>117</td>
<td>119</td>
<td>115</td>
<td>107</td>
<td>100</td>
<td>-2</td>
<td>-8</td>
<td>-15</td>
</tr>
<tr>
<td>USA</td>
<td>1,039</td>
<td>1,116</td>
<td>1,216</td>
<td>1,259</td>
<td>1,165</td>
<td>17</td>
<td>21</td>
<td>12</td>
</tr>
<tr>
<td><strong>Ratio USA/Germany</strong></td>
<td>8.9</td>
<td>9.4</td>
<td>10.6</td>
<td>11.7</td>
<td>11.7</td>
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<tr>
<td><strong>CO₂ Equivalent per Capita (Kg)</strong></td>
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<td></td>
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<tr>
<td>Germany</td>
<td>1,470</td>
<td>1,455</td>
<td>1,399</td>
<td>1,303</td>
<td>1,217</td>
<td>-5</td>
<td>-11</td>
<td>-17</td>
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<tr>
<td>USA</td>
<td>4,166</td>
<td>4,246</td>
<td>4,309</td>
<td>4,255</td>
<td>3,793</td>
<td>3</td>
<td>2</td>
<td>-9</td>
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<tr>
<td><strong>Ratio USA/Germany</strong></td>
<td>2.8</td>
<td>2.9</td>
<td>3.1</td>
<td>3.3</td>
<td>3.1</td>
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</tr>
<tr>
<td><strong>CO₂ Equivalent per Passenger km (G)</strong></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>134</td>
<td>121</td>
<td>119</td>
<td>113</td>
<td>107</td>
<td>-11</td>
<td>-16</td>
<td>-20</td>
</tr>
<tr>
<td>USA</td>
<td>214</td>
<td>228</td>
<td>217</td>
<td>214</td>
<td>208</td>
<td>1</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td><strong>Ratio USA/Germany</strong></td>
<td>1.6</td>
<td>1.9</td>
<td>1.8</td>
<td>1.9</td>
<td>1.9</td>
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<tr>
<td><strong>CO₂ Equivalent per Constant $1,000 GDP (using PPP) (Kg)</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>57.0</td>
<td>52.4</td>
<td>46.2</td>
<td>41.8</td>
<td>36.4</td>
<td>-19</td>
<td>-27</td>
<td>-36</td>
</tr>
<tr>
<td>USA</td>
<td>129.4</td>
<td>122.7</td>
<td>108.4</td>
<td>99.7</td>
<td>89.0</td>
<td>-16</td>
<td>-23</td>
<td>-31</td>
</tr>
<tr>
<td><strong>Ratio USA/Germany</strong></td>
<td>2.3</td>
<td>2.3</td>
<td>2.3</td>
<td>2.4</td>
<td>2.4</td>
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</tbody>
</table>

*Note: CO₂ equivalent emissions are based on national fuel consumption estimates. The data do not capture ‘gray imports’ due to refueling abroad.*
Fuel-Efficiency and CO₂-Emission Standards

- U.S. CAFE standards
  - Improved efficiency of fleet: 16-21mpg 1980 to 1991 and then 24mpg in 2009;
  - Problems: light trucks and (lack of) revisions over time;
  - New revised standards: 2015 and 2020 translate to 181 and 144 g CO₂/km for new light duty vehicles (and 107g by 2025).

- No fuel efficiency standards in Germany
  - Higher taxes on fuel;
  - Failed 1990s/early 2000 voluntary agreement of car industry (140g but 160/km 2006; gains in dieselization, but higher energy & carbon content)
  - EU standards: 130 g CO₂/km by 2015 and 95g CO₂/km by 2020 → German government tries to change this.

- Problem: how to design and update standards?
  - Track width (USA) vs weight (EU)
  - German automobile & light truck vehicle fleet 55% more fuel efficient than US fleet in 2010 (35 vs. 23 mpg or 7.5 vs. 11.2 l per 100km of travel)

Note: Miles per gallon (mpg) values presented in this paper are based on the U.S. CAFE testing cycle. Liters per 100 kilometers (l/100km) values are based on the NEDC. CO₂ per km also based on NEDC.
Incentivizing Less Polluting Cars and Fuels

- German annual vehicle registration fees for new cars include a small share based on CO₂ emissions; electric exempt;
- Federal tax incentives (tax credits) and privileges for certain cars in the U.S. (hybrid, electric, etc.);
- ‘Cash-for-Clunkers’ programs (€5 billion in Germany and $3 billion in USA )
  - U.S. program more environmentally friendly by design;
  - Pro: New vehicles purchased under these programs were more fuel efficient and had lower CO₂ emissions per km than the vehicles traded-in;
  - Con: Life-cycle analysis, higher levels of use in newer cars, volume)
- Both countries support alternative fuels and alternative fuel vehicles
  - Longer history in USA;
  - ‘Fear’ of E-10 in Germany and E-15 in USA.
## Percent of Trips by Means of Transport in the USA and Western European Countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Car (%)</th>
<th>Public Transport (%)</th>
<th>Cycling (%)</th>
<th>Walking (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>'09</td>
<td>67%</td>
<td>10%</td>
<td>7%</td>
<td>16%</td>
</tr>
<tr>
<td>Canada</td>
<td>'06</td>
<td>64%</td>
<td>10%</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>France</td>
<td>'08</td>
<td>67%</td>
<td>10%</td>
<td>7%</td>
<td>25%</td>
</tr>
<tr>
<td>UK</td>
<td>'08</td>
<td>67%</td>
<td>10%</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>Norway</td>
<td>'09</td>
<td>62%</td>
<td>10%</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>Finland</td>
<td>'05</td>
<td>59%</td>
<td>9%</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>Denmark</td>
<td>'08</td>
<td>58%</td>
<td>9%</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>Germany</td>
<td>'09</td>
<td>57%</td>
<td>9%</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>Sweden</td>
<td>'06</td>
<td>44%</td>
<td>9%</td>
<td>18%</td>
<td>16%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>'08</td>
<td>44%</td>
<td>9%</td>
<td>18%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Travel Behavior and CO$_2$ Emissions Per Capita

Walk, Bike, Public Transport Share of Trips

Travel Behavior

- Americans drive almost twice as many km per year: 21,700 vs. 11,000 passenger km.
- Longer average trip distances in the USA (15.7 vs. 11.2km) do not fully explain different driving rates:
  - In both countries a similar share of all trips (32% in Germany and 27% in the USA) is shorter than 1 mile (1.6km).
  - However, Americans drive for 65% of these short trips compared to only 28% of Germans.
- Public policies at federal, state, and local levels of government help explain differences in car use and CO₂ emissions.
Americans Use the Car for the Majority of Short Trips

- USA: <1.6km - Walk: 28.9%, Bike: 1.6%, Transit: 2.3%
- Germany: <1.6km - Walk: 56.9%, Bike: 14.5%
- USA: <3.2km - Walk: 18.4%, Bike: 5.1%, Transit: 0.9%
- Germany: <3.2km - Walk: 13.5%, Bike: 3.7%
- USA: <4.8km - Walk: 10.3%, Bike: 1.95%, Transit: 4.04%
- Germany: <4.8km - Walk: 9.3%, Bike: 0.5%
Americans Living at High Densities Make a Similar Share of Trips by Car as Germans at Lower Densities

<table>
<thead>
<tr>
<th>Population per km²</th>
<th>USA</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1000</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>1000 &lt; 2000</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>2000 &lt; 3000</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>3000 &lt; 4000</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>4000 &lt; 5000</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>5000+</td>
<td>13</td>
<td>28</td>
</tr>
</tbody>
</table>

- **Walk**
- **Bike**
- **Transit**
Policies that Restrict Car Use and make it More Expensive

- Gasoline taxes
- Sales tax for new cars
- Road revenues & expenditures
- Traffic calming & speed limits in urban areas
- Roadway & parking supply in urban areas
Premium Unleaded Gasoline Prices and Share of Taxes in 2011 (Selected OECD Countries, U.S. $ per Liter)

Policies that Promote Public Transport, Cycling, and Walking as Viable Alternatives to Driving for Daily Travel

- Public transport
  - Quantity and quality of service
  - User information
  - Discounts
  - Region-wide integration

- Walking and Cycling
  - Car-free zones
  - Traffic calming
  - Pedestrian facilities
  - Bikeway networks
  - Traffic education
CO$_2$ emissions from transport are higher in the USA than in Germany, even when controlling for population, economic activity, and travel distance.

Between 1990 and 2010, Germany has reduced CO$_2$ emissions from ground passenger transport (more than the US).

Efficiency standards can help boost fuel efficiency of new vehicles, but it also highlights the difficulty of adapting the standards to changing technology, politics, and societal preferences.

Government incentives for the purchase of more fuel efficient cars with lower CO$_2$ emissions, such as special tax credits or no/lower annual registration fees, can help increase demand for those vehicles, but the overall volume of the programs is often too small or incentives are too little.
Germany achieved higher fuel economy of its vehicle fleet and greater reductions in CO₂ emissions from transport than the USA without fuel economy or CO₂ emission standards.

Technological improvements alone are prone to the potential rebound effect of heavier vehicles, larger engines, and greater car travel demand.

Policies focusing on technological improvements can only be part of a policy package geared at reducing CO₂ emissions from transport.

Germany’s experience shows that public policies can also help reduce car travel demand while making walking, cycling, and public transport more attractive modes of transport.

Recent trends in travel demand and travel preferences among young adults may provide a window of opportunity for policies that promote walking, cycling, and public transport.
Thank you!

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