Cross-Sector - Europe
Autonomous Vehicles Will Drive Change from Auto Manufacturing to Insurance

One of the most debated technologies currently under development is the autonomous, or self-driving, road vehicle. While the widespread adoption of fully autonomous vehicles in Europe is still decades away, some features are already being incorporated into newer vehicle models. Driverless car technology has the potential to make road travel safer and less costly for households and companies, and to significantly affect vehicle production, spending and usage.

While there are many uncertainties about the future of autonomous road travel, there are potential credit implications for a wide array of industries:

**Auto manufacturers** could benefit from a price premium for these vehicles, although the replacement rate could decline because optimized driving by a computer would reduce wear and tear. Slow initial demand due to high production costs should pick up dramatically once costs decline and vehicles are available at attractive price points. Over the long run, fewer cars could be sold due to lower wear and tear of autonomous cars.

**Technology companies** would benefit to the extent that the technical capabilities of the vehicles become the true value for consumers. Software and semiconductor firms are best placed to benefit from demand for driverless cars as software and electronic hardware will become even a more integral part of automobiles. Data and Internet providers will also benefit from requirement of continuous data feeds on driving conditions.

**Insurance sector** could see dramatic change, particularly if manufacturers accept product liability for accidents. Automobile insurance is one the most profitable segments for insurance companies. As accidents decline, automobile premiums are also very likely to fall reducing insurers’ profitability.

**Toll road operators** would benefit as autonomous vehicles reduced congestion and increased road capacity. Better utilization of roads due to smoother driving will improve per mile toll revenue yield, resulting in better returns on investment and shorter payback periods.

**Automobile financing industry** is likely to face different annuity streams from financing more expensive automobiles in the short term, and software and battery renting revenue in the long term.
A transformative technology
Work on autonomous road vehicles – both household cars and commercial freight – has been underway for many years, with US pioneers such as Google having been joined by several large European car manufacturers including Volvo and Daimler. The ultimate aim of this research and development is to create vehicles that can completely drive themselves on existing roads without any human interaction.

New but not so new
Automated travel is not new in Europe. Several train lines, such as the Docklands Light Railway in London, already rely, to a large extent, on computerised driving systems. Similarly, modern aircraft often require little pilot interaction in flight, with the exception of take-off and landing. The same holds true for road vehicles. Through the use of GPS technology and in-built car sensors, vehicles are able to create a picture of the road both in front of and behind them, and adjust the speed and location of the vehicle accordingly. Self-parking systems already allow vehicles to parallel or reverse park without driver engagement. Tests of driverless cars are increasing apace in Europe, as elsewhere: in April 2016, two Citroen cars drove more than 300 kilometres from Paris to Amsterdam without any required driver engagement. Some manufacturers are optimistic about being able to offer driver-monitored automated features within the next couple of years.

In early stages of development with a variety of challenges
However, fully automated road travel in Europe is probably still some distance away, and certainly unlikely before the late 2020s. While driverless cars are being tested in a number of locations around the globe, establishing the logical rules for the underpinning computer algorithms remains challenging, both technologically and even ethically. One hypothetical example that is often given is when an accident is unavoidable and the computer driving the car must choose between hitting one vehicle or another, or even pedestrians. In principle, this decision can be determined ex ante by government or regulatory authorities, and can be incorporated into the software that ‘drives’ the vehicle. But, as yet, these issues remain unresolved. It is likely that, even when they are addressed, many vehicles may maintain an ‘override’ function, and human drivers will still be needed to take over if required. Similarly, existing rules and regulations on road travel will need to be amended. For instance, the Vienna Convention on Road Traffic previously stated that ‘every moving vehicle … shall have a driver’ who will be able to control the vehicle at all times.

Benefits from automated road travel
There are many potential benefits from automated road travel. One first benefit is that it should, in principle, lead to a substantial reduction in the frequency of traffic accidents, given some estimates that driver error currently contributes to well over 90% of accidents. Any dramatic reduction in this frequency, as implied by these data, would significantly lower the risk of road travel.

Higher efficiency, cleaner environmental and better infrastructure utilization
Automated road vehicles should also lead to higher efficiency and lower emissions. Driverless vehicles should optimize speed levels and smooth changes in speed, thereby lowering average fuel consumption, petrol costs and emissions. Similarly, physical depreciation should be lower, meaning that individual cars last longer. At the same time, fully automated road travel will also boost road capacity: having consistent speeds and gaps between vehicles should boost the number of cars that can use a stretch of road in any given period. In practice, this means that driverless technologies are likely to be of most value for freight transport, given the typically long routes along high-speed road networks, as opposed to urban travel (which often involves shorter journeys). The lack of need for human drivers would also boost mobility for those people that are unwilling or unable to drive, and may not have good access to public transportation. Similarly, people without driving licenses would also be able to access road travel, notwithstanding the ‘override’ function noted earlier.

The net impact of these changes could be to make road travel less costly and more attractive for both households and companies, boosting demand for both personal and freight transport, although some existing drivers may still prefer to control their own vehicles. One offsetting impact on demand might arise from increased car sharing and pooling among households, which would reduce the total number of vehicles on the roads. But greater individual use of road travel would also negatively impact on substitute forms of travel.
There are also potential benefits from automated vehicles that tie into other ongoing technological developments. With reducing emissions still a key goal for many car producers, many have spent several years developing electric cars; autonomous travel would complement this trend. Similarly, the increasing interconnection of many household appliances and objects – the internet of things – should also boost the attractiveness of driverless vehicles; for instance, an autonomous car could let a heating system know when to turn itself on, prior to the owner’s arrival.

Driverless cars could also free up time for drivers: people can spend their time concentrating on things other than driving. In principle, this could boost workers’ productivity, if put to business use. If time were spent instead on leisure activities, that could still increase wellbeing.

**Credit implications would be widespread and varied**

Given the many uncertainties about the future of autonomous travel, it is impossible to be sure about the credit implications of driverless cars and trucks. However, we can establish likely impacts from the broad trends outlined above.

**Automobile manufacturers face changing product and revenue mix**

To start with, driverless cars are likely to be more expensive than older technologies. This is consistent with premium brands currently spending more on development of such vehicles than other producers, and the higher price may limit their appeal to lower-income households. Over time the marginal cost of production should continue to fall, boosting sales; but to start with limited demand could limit the impact of autonomous cars more broadly. As demand for automated cars increases, the premium brands that have developed these models may capture market share from other producers, who will be playing catch-up. Manufacturers may also benefit from increased types and versioning of software, driving higher servicing levels.

Automated vehicles could also lead to a reduction in overall sales volumes; because cars last longer when driven more smoothly, there may be a reduction in the replacement rate of vehicles (even if the absolute number of vehicles remains unchanged). We are likely to see increased regulations around driverless vehicles, increasing both their cost and the incentive for manufacturers to boost their longevity in order to lower effective running costs for households (as longer-lived vehicles will need replacing less frequently). This negative volume effect could offset the premium price effect noted above.

**Autonomous driving technology will bring new entrants to transportation industry**

Driverless cars and other vehicles are also likely to open up new forms of competition for traditional car manufacturers, with software and data firms such as Google entering the market. Ultimately, it is possible that the car itself may become (relatively) more commoditised, with the key service and ‘value added’ being the car’s ability to drive autonomously. In this instance, software and semiconductor firms may be best placed to reap the benefits of demand for driverless cars, particular those that can order data streaming in from car sensors (e.g., distance between vehicles, road conditions) and internet messaging (traffic and roadwork alerts, map updates, etc.) in order to adjust speed and direction. Secure IT hardware and software will also be critical to protect autonomous vehicles from both inadvertent and malicious interference, which will benefit semiconductor firms alongside software companies. Similarly, hardware producers who build the sensors and cameras for autonomous vehicles should also benefit.

This greater competition from software and data firms is likely to be one reason why several car manufacturers acquired maps businesses from other firms, in order to garner some advantage. Similarly, the shift towards autonomous vehicles could lead more auto manufacturers to establish ‘corporate venturing’ arms, which could lead investigation and investment into new technologies relating to driverless cars. We have seen similar moves in other industries, such as the establishment of Airbus Group Ventures, an in-house venture capital fund at the aerospace manufacturer. In this manner, manufacturers may be able to mitigate the risks of new entrants disrupting their businesses, as existing investee firms can more easily be monitored and acquired at a later date.

**Automobile insurance segment will be significantly impacted**

The impact on insurance could also be significant. Lower accident rates should result in lower costs and ultimately premiums. In the most competitive European markets, such as the UK, insurers may even pre-empt expected claims benefits by lowering premiums before they accrue, temporarily hitting profitability. Set against that, autonomous vehicles may be more expensive to replace, which could push up premiums. However, the biggest impact would be if car manufacturers accepted liability for accidents due to autonomous vehicles, which could dramatically reduce demand for traditional insurance: this shift in liability could also arise from new regulations or legislation. Ultimately, governments and regulators may need to decide how liabilities are shared between different
parties. Given that retail motor insurance is the largest line of property and casualty insurance in most large European economies, the impact could be dramatic. However, given the long lead times before autonomous vehicles become widespread, insurers should have time to innovate and adapt.

**Toll roads operators will realize higher revenue per mile and ROI**

Increased traffic volumes and reduced accidents could be credit positive for toll roads, if autonomous vehicles managed to reduce existing congestion (for a same number of cars) via smoother driving speeds and vehicle coordination. Such a reduction would increase effective capacity, which would be welcome given high road usage and hours wasted in some European countries.

**Exhibit 1**

**European Traffic Congestion**

**Hours wasted annually per driver in 2015**

<table>
<thead>
<tr>
<th>Country</th>
<th>Hours Wasted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>40</td>
</tr>
<tr>
<td>Netherlands</td>
<td>35</td>
</tr>
<tr>
<td>Germany</td>
<td>30</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>25</td>
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<tr>
<td>Switzerland</td>
<td>20</td>
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<tr>
<td>UK</td>
<td>15</td>
</tr>
<tr>
<td>France</td>
<td>10</td>
</tr>
</tbody>
</table>

Note: The average driver in England spends 235 hours driving each year (according to the UK Department of Transport), implying that hours wasted account for around 13% of total hours driven.

Source: INRIX Traffic Scorecard.

In some instances, existing constraints on vehicle numbers could drive new road investment to increase capacity, following higher demand with the advent of driverless vehicles. Given existing regulatory approaches, such investment could result either in increased tolls, which could weigh on demand, or via an extension of the right to operate the toll road. Similarly, such investments would have to be financed, which could increase leverage, at least in the short term before higher revenues accrue.

However, other entities may suffer; for instance, demand for bus or rail travel could fall, and parking companies may see reduced revenues if autonomous cars are able to pick up and drop off passengers when needed. More efficient driving could also reduce footfall and average spend at motorway service areas.

**Automotive financing industry will have more varied annuity streams**

The rise of autonomous cars could also lead to changes in car financing. ‘Captive’ banks of auto manufacturers generate most revenues from interest income based on their lending activities. In principle, the premium nature of autonomous cars could reduce the need for car financing (to the extent that richer households are less credit constrained).

However, there could be offsetting effects, as seen with electric cars. Given the high cost of electric car batteries, these are typically ‘rented’ to consumers in purchase agreements, allowing the running cost of electric cars to remain comparable to thermic vehicles; the financing of the car and rent of the battery are then bundled into the same package. For some captive banks of auto manufacturers, this has led to higher financing levels for electric cars, of around two-thirds, versus financing for thermic cars (around a third). In principle, auto manufacturers could adopt a similar stance with autonomous vehicles, with consumers ‘renting’ the operating systems and software that drive the vehicle. This could increase penetration rates for autonomous vehicles.
We are in the early days of autonomous driving technology, but there are already multitudinous opportunities in adjacent industries. These vehicles could, in principle, capture a large amount of information about households’ travel and other habits, particularly if the cars link with other household systems. These data are likely to be very valuable for banks, insurers and other companies, but could also allow manufacturers to identify new goods and services that households may want to purchase, further diversifying revenue streams. However, manufacturers will need to successfully address privacy concerns in order to exploit these data.
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