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Brave New World: The Economic Impact of the Driverless Car: A Bumpy Road Ahead?

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Abstract - In Japan and in states such as Nevada and California, autonomous cars[1] have obtained permission to operate on the roads. While the technology is being perfected so these "driverless" vehicles will be sold by 2020, there are concerns about the far-reaching economic impact of these vehicles.

1. Introduction

Driving assistance technologies have been developed since the 1940's (Beiker, 2012) and have become so sophisticated that it is estimated that autonomous cars will be marketed to consumers as soon as the 2020 model year (White, 2013). While these driverless cars are viewed as a potential boon to the elderly and disabled, there are many issues that have not been resolved. This article addresses some of those issues and offers possible solutions.

2. The Issue of Control

It is estimated that worldwide there are approximately one billion cars on the road and that number is likely to double by 2035 (Lester, 2014). China and India are becoming car cultures that will likely surpass that of the United States.

More problematic is the fact that each gallon of gas burned releases 55 pounds of carbon into the air, which, when combined with oxygen, creates 20 pounds of carbon dioxide contribution to global warming.

What can be done to mitigate this problem? Abandoning the car is not a likely solution. As one author put it, "During the past century, we've invested far too much in driving- economically, culturally and psychologically to be able to give it up anytime soon." In his book Ingenious, Jason Fagone states that the only realistic solution is to design a radically new kind of car. He recommends one that gets higher mileage than anything currently available, say, 100-200 miles per gallon that would be safe and appeal to the mass market.

Fagone favors a car made by a German named Oliver Kuttner called the Very Light Car that weighs 1000-1500 pounds. Kuttner believes that if cars are made lighter it will not matter what kind of fuel is used – electric, internal combustion or hydrogen. But aren't lighter cars less safe in an accident? It is possible to look at the safety issue in different ways. One aspect is "surviving a crash but another is avoiding it." That is where autonomous cars come into play. With advanced technology, some of which is available in some high end cars on the road now, a driverless car will offer an additional benefit of using materials that are lighter weight which will conserve energy and benefit the economy.

Can economic growth be spurred by the introduction of the driverless car? The answer is "yes" because the innovation will likely have far reaching effects. People get in cars to go somewhere from home to work or home to shopping. Once they are in the car there is little difference as to whether the car

[1] Autonomous vehicle means a motor vehicle that uses artificial intelligence, sensors and global positioning, and system coordinates to drive itself without the active intervention of a human operator. NRS 482A. 030

drives itself (Gordon, 2012). The autonomous car will offer more mobility to those who are left out of the current car culture the elderly, disabled, sight and hearing impaired. Teenagers who are involved in the highest number of accidents will still have mobility without concern for the consequences of their inexperience behind the wheel which will spare parents untold hours of worry and the expense in purchasing cars as well as the high cost of insuring them.

3. Technology of the Driverless Car

While some are hailing the impending arrival of autonomous cars as a technological breakthrough, (White, 2013) the fact is that driverless cars have been arriving piecemeal for the past several years in the form of sensors and microprocessors, especially in more expensive cars (Stenquist, 2013). Such vehicles have made the driver's job easier and safer. For example, there are devices like parking assist, lane change warning, cruise control, and a variety of crash avoidance devices.

The 2014 Mercedes S-class represents a significant step toward autonomous cars. The car contains many sensors that gather data about driving conditions. The car offers a package of technologies called Intelligent Drive which has the capacity to steer, brake, cover blind spots, and watch for pedestrians and animals, and monitor the road to avoid potholes. The car's computing power is sophisticated, using processors and algorithms.

The car also has cameras, which are mounted on the front rear and side. The cameras provide 3D imaging which help the car make decisions. The Mercedes S 550 has Magic Body Control. The lenses of the stereo camera record images of the road ahead, which generate a three dimensional view of the pavement. If there is a bump or hole in the road, a microprocessor adjusts the car's suspension to overcome the rough spot.

Other devices include two short-range radar units that monitor an area behind the car for 200 feet. Ultrasonic sensors locate objects alongside the car. Front facing radar monitors up to 200 feet ahead.

Lane keeping and blind spot assist help to keep the car in the correct lane. Cameras and radar combine to provide brake assist and collision prevention assist at speeds about 45 mph. The system can monitor vehicles ahead to determine the danger of a collision. The system is capable of applying the brakes to prevent a collision below 30 mph. The effect of an accident at 45 mph is mitigated. As the technology becomes more advanced, some experts believe that the vehicle will assume all the driving responsibilities that current drivers have.

How will these developments impact the economy? First, drivers will no longer own cars. Manufacturers and their dealerships will supply vehicles, but they will be licensed for use by those who need transportation. This development will end the need for driver's licenses. Everyone will be a passenger. Cars will be registered in the name of the dealerships which will dispatch the vehicles to those who need to be transported. This will solve the problem of who will be liable if the car malfunctions. The liability will be in the hands of the manufacturer, who will bear the responsibility for maintaining the car's systems. The dealerships will perform the task of checking cars before they are dispatched to transport licensees. The price for licensing the car's time for transport will include cost of fuel and insurance and other incidental charges like repair and maintenance. No longer will individuals have to worry about purchasing car insurance or repairs. These expenses will be included in the charge for the car's usage fees.

The model for this system is the current Zipcar, Cars 2 Go, and Enterprise Car Share Program (Boehret, 2013). Car sharing and ride sharing are common in many cities not only in the United States but also around the world. People are doing without cars to save money and to protect the environment. This is a model for how driverless cars might be made available to the public. Current short-term rentals in which people need a car for an hour or a day or merely to share a ride are simply a smart phone app, a telephone call or an email away.

Zipcar, Car 2 Go, and Enterprise let users pick up or drop off cars on streets or at parking garages. These companies require a membership which involves a fee as well as a driver's license, age, and moving violation record. The latter information will not be necessary with the autonomous car service. The companies also require information about how the user will pay.

The company will send a membership card, which one will slide over a panel on the windshield, which unlocks the car and starts tracking the time the car is used. The keys are inside the car and remain there. The user swipes the card again when the ride is over.

The charges for the use of the car vary depending on how long it is used. Some companies charge monthly or annual fees. The cost covers insurance and gas but there is a penalty fee for late return of the car, smoking, or losing the keys.

4. Other Economic Implications of Autnomous Cars

While the number of automobile fatalities per million miles traveled has dropped by a factor of ten since 1950, accidents are a major cost to the healthcare system and the economy (Gordon, 2012).

A 2013 study by Morgan Stanley revealed that the adoption of driverless cars in the United States could save $1.3 trillion a year plus $158 billion in fuel costs, productivity increases of $507 billion, and a savings of $488 billion in accident-related expenses (White, 2013).

If only ten percent of vehicles were autonomous, according to the Eno Center for Transportation, a foundation whose mission is to improve transportation, they could reduce traffic deaths by 1000 each year and produce nearly $38 billion in economic and other savings (Connecticut Post, 2013)

If 90 percent of vehicles were autonomous, almost 21,700 lives could be saved each year. Eno estimates that the benefits could reach $447 billion.

Research indicates that the driver error accounts for 90 percent of all fatal accidents. Moreover, over 40 percent of fatal accidents involve alcohol and drugs as well as distraction and fatigue. Since autonomous cars would be unaffected by those factors there could be a 40 percent reduction in fatal accidents.

Other causes of highway crashes include speeding, aggressive driving, inexperience, slow reaction, and inattention, which also would be alleviated by computer-driven cars.

With an estimated 33,000 people killed each year in car accidents in the United States and 1.2 million worldwide, (Beiker, 2012) driverless cars could drastically reduce the human costs as well as the economic impact of such losses.

5. Promote Efficiency in Use of Time and Highway Capacity

The advent of the driverless car will cause a revolutionary redesign of vehicles. Cars will be reconfigured to reflect the fact that there will no longer be a driver behind the wheel.

The passenger cabin will be redesigned to allow “former drivers” to work on laptops, read books, watch movies, call friends and business associates, and eat meals en route to their destination (Connecticut Post, 2013). Time currently spent in commuting, which is well over one hour per day in busy metropolitan areas, will now be put to better use by extending the work day or by pursuing leisure activities.

Time spent in traffic jams is unproductive and stressful. Once driverless cars are on the road in significant numbers, they will be able to form “pods,” which means they will drive close together and keep a distance among them. This will avoid the fuel-wasting stop and go of traffic congestion. This coordination will smooth the flow of traffic, reduce the time spent commuting, and increase highway efficiency.

Since charges for the use of autonomous vehicles will likely be based on the miles used per month, the introduction of these vehicles may reverse the exodus to the suburbs where cars are a necessity and encourage people to live in urban areas closer to their jobs. More efficient vehicles will also have the environmental effect of reducing the need to build or expand highways.

Driverless cars will always be in motion except for downtime late at night and in the early morning hours when they will be parked at the dealerships pending their dispatch to pick up passengers during the busy early morning 6-10 A.M. and late afternoon hours of 3-7 P.M.

Another consequence of this technology will be the decline of the need for parking lots and garages. Formerly used to park or house cars during working or shopping time, these areas can now be used for more productive purposes. Office buildings, shopping centers, and other facilities will have to be

reconfigured to provide drop off and pickup spots for patrons. Statistics show that personal vehicles are parked 95 percent of the time each day. Autonomous cars could reduce the number of vehicles by a factor of ten (Web-1).

6. The Cost of Autonomous Cars

Among the most significant hurdles to the introduction of the driverless car is the cost, which is currently $100,000 per vehicle, [34] which is not affordable for most car owners but large scale production will bring the price down and make the product mainstream.

Hybrid and electric cars are more expensive than their internal combustion counterparts and still are a relatively small share of the market (Connecticut Post, 2013) even though hybrids have been sold in the United States since 2000.

Even high-end cars today offer some features that will be part of the self-driving cars of the future. For example, the Infinity Q50 sells for between $37,955 and $53,000 (Ulrich, 2013). To add the Technology Package, which provides a variety of electronic gadgets including blind-spot and lane-departure warning and prevention as well as forward collision warning, emergency braking, backup collision intervention, active lane-keeping, and intelligent cruise control costs $3,200.

Such a car is beyond the reach of most Americans. The 2012 prices for the top twenty-seven vehicles ranged from $16,000-27,000 (Relaxnews, 2013). As the cost of technologies decrease, the price of driverless cars will be $25,000 to $50,000 during the first decade of production.

A study done by J.D. Powers in 2012 found that 37 percent of drivers would consider buying driver assistance technologies and would be willing to pay $2,500-3000 more to acquire them (Griffith, 2012).

7. The Economic Impact on the Insurance Industry and Liability

One of the key issues posed by autonomous cars is the issue of liability and who will carry the insurance for these vehicles. Who will be blamed if the driverless car gets into an accident?

Although it has been proposed that a driver supervise an autonomous vehicle, this would further complicate the issue of liability. The average driver will not be capable of actively monitoring the car's systems. Accidents will occur because some drivers will not be able to react quickly enough to assume control. How will the "user" be able to distinguish what situations call for human intervention and which ones the car's technologies can handle? (Hars, 2013)

It will be difficult for the manufacturer to anticipate all situations that the car cannot handle and the "user" will not be able to learn all of those potential problems. What about those that the manufacturer did not warn about?

If a car is truly autonomous, it will be equipped with an array of devices that will assess the environment in which it is operating. Before a driverless car can be certified for operation on the road, the driver should not be burdened by trying to determine what the car should be doing automatically. A truly autonomous vehicle is just that: capable of operating without human intervention.

If an accident occurs, there should be no doubt about who is in control of the vehicle. The liability should rest in the hands of the manufacturer and dealer. This is why autonomous vehicles should not be privately owned and be licensed for use only when needed for transportation. There can be no doubt about who has the responsibility for maintaining a vehicle with many complex systems. It is well known that many car owners are not as conscientious or they might be about maintaining their cars. With driverless cars any failure of maintenance could be catastrophic.

Another concern is the possibility that computers governing the car might be hacked. If an autonomous vehicle is privately owned, there's a concern that the vehicle might be modified (Web-2). Keeping ownership in the hands of manufacturers and dealers eliminates that problem. Moreover, manufacturers could equip the cars with data collectors (like airline black boxes) to monitor systems and make repairs (Web-3).

Another factor is the economic impact on the insurance industry. If autonomous vehicles are not privately owned, insurance companies will not be writing individual insurance policies any longer. Thus, a large segment of the business will disappear. However, the manufacturers and dealers who are

providing these vehicles to licensees will have to carry the insurance. Some believe that if driverless cars will be as safe as they are advertised to be, many companies will go out of business (Web-4). The manufacturers and suppliers will likely turn to commercial insurers or self-insure because not all risk can be removed from these cars. This is especially true during the transition period in which there are relatively few autonomous cars on the road as they are being introduced. They may be involved in accidents with vehicles still being driven by humans (Turner, 2013).

There will be other collateral consequences for the economy with the introduction of autonomous vehicles. Experts anticipate that among the positive effects will be more fuel efficiency because driverless vehicles will spend less time in traffic jams and in looking for parking spaces (Plumer, 2013). Since there will be in fewer accidents, cars might weigh as little as 750 pounds. Car sharing will increase so there will be fewer cars on the road. This will lead to more bike riding and walking since these vehicles will pose less of a threat. Cities could become more attractive places to live, thus contributing to energy efficiency.

Alternatively, more people will use driverless vehicles including children, elderly, the disabled, and those who are on medication. Studies show that younger people are "not as enamored of driving" as their Baby Boomer parents. Since they also are not adverse to the use of technology they may welcome the systems that relieve them of the burden of driving (White, 2013).

Another negative effect of this technology is that cars might have to be replaced more often because they would be operating more, so the lifespan of a driverless car might be more like three to five years like police cars rather than eleven years (Plumer, 2013). Also if more people used driverless cars, public transportation like trains, buses, or electric rail might lose ridership. There is a school of thought which says that urban sprawl might increase if driverless cars offer efficient transportation to the suburbs. There are undoubtedly many other consequences of this technology like the demise of independent auto repair garages and auto parts stores. If these vehicles are merely licensed for transport all repairs would be done in house. There would also be less pressure on car manufacturers to change their models since users would be more likely to eschew styling and color because they do not own the car anymore (Glancy, 2012; Wood et al, 2012).

8. Conclusion

Some observers believe that the age of innovation in America is over. They argue that economic growth was spurred by an age of invention between 1875 and 1900. The electric light bulb, the power station, the internal combustion engine, running water, indoor plumbing, telephone, phonograph, motion picture, and radio were products of that era (Gordon, 2012). The post World War I period saw the development of television, air conditioning, jet planes, and interstate highways.

Computers sparked another era in the post 1970s replacing human labor and increasing productivity. PCs, ATMs, and barcode scanning, iPhones and other technologies have transformed the economy.

Marrying computer technology and artificial intelligence with the automobile may be the next catalyst to the economy and create the brave new world of the mid-21st century.

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