Attachment B

2013 Colorado Senate Bill 016

Concerning the Use of Guidance Systems to Drive a Motor Vehicle

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The premise of 2013 Senate Bill 16 (SB16) is that by increasing certainty through assigning liability, the institutional framework will create the right conditions that would allow a market for manufacturing automated vehicles to emerge more rapidly. Indeed a useful theorem in economics is the Coase Theorem that shows how certainty from the assignment of property rights, including liability, is a necessary component of market design because without them, transaction costs are too high for the liability of externalities to be mitigated between parties. Externalities are negative social costs and positive social benefits not included in the price of a good or service. Problems in transportation systems such as accidents, pollution, and congestion are often used to exemplify the economic concept of externalities with negative social costs. While drivers utilizing automated guidance systems on their cars could be expected to produce less negative externalities, these externalities will not be zero. Assigning property rights concerning liability in advance should provide the certainty to stimulate the market and increase its feasibility. SB16 provides such a framework for the automated vehicle market and should be implemented now to begin market stimulation. In the absence of law, would-be manufacturers face too much uncertainty to enter the market because they do not know how much risk they face.

The introduction of an automated vehicle market would be an overall benefit for consumers. Consumers would have the option to purchase an automated vehicle or a non-automated vehicle. The consumer could choose to drive the car or not drive the car and instead gain utility by doing something more fun. Many new activities would be made available to the driver, some permitted by law and some not. The bill in question specifically mentions texting as an alternate activity to driving. Added choice will always make an individual better off[1]. This is especially true for individuals that are restricted from operating a non-automated vehicle by means of a disability. Automated vehicles could be especially

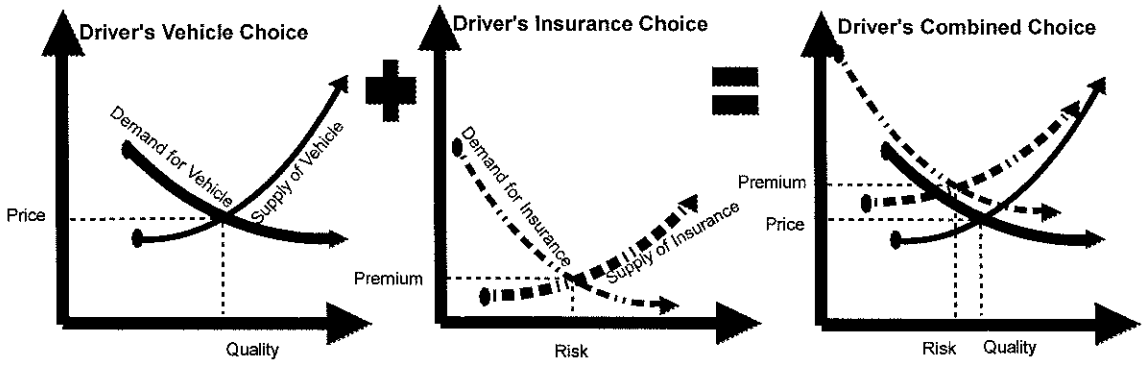
advantageous for these individuals as their choice would not be between texting or not texting while driving, but rather between driving and not driving at all.

The added benefits of automated vehicles to consumers would be likely to encourage people to drive more, but it is possible that they could have a reducing effect on congestion and pollution[2]. Using GPS navigation, automated vehicles could coordinate their paths with each other and reduce human bias. The shortest route between two points may not be the fastest route because if too many people choose the shortest route, it will be over congested. Whether or not an individual should take the highway is a function of how many other people are planning to take the highway, which can lead to over congestion through information asymmetry[3]. Denver currently has a dead weight loss from congestion of $4,700,000 per day[4]. Programmers are can design algorithms that can overcome such problems because the vehicles will be part of an integrated system. Thus, it is possible that automated vehicles could reduce pollution and congestion even if they caused people to drive more. However, the benefits of this could be counteracted simply by the driver gaining control of the vehicle long enough to divert it from its chosen path. Thus, the automated vehicles can at best reduce this problem and not eliminate it entirely[5].

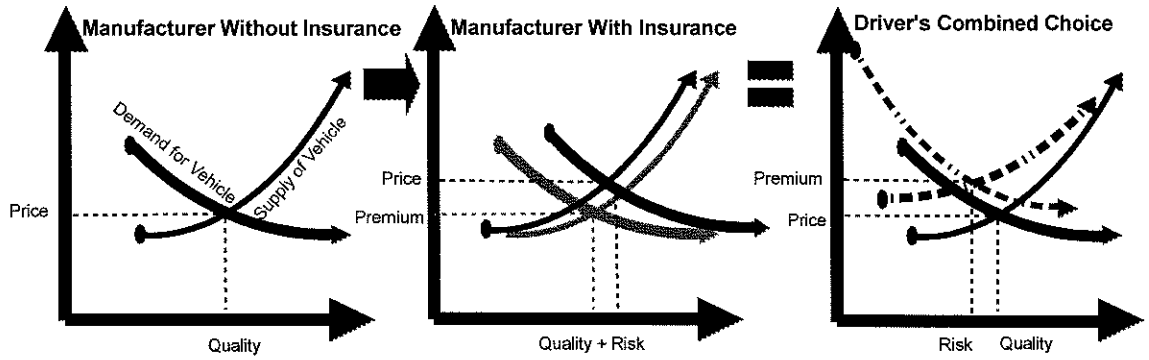
SB16 addresses externalities with specific victims by requiring the drivers of automated vehicles to have a driver's license and insurance. What the Coase Theorem tells us is that protecting property rights by assigning liability reduces transaction costs, which allows the liability to be traded[6], in this case to the insurance company.

An insurance company will maximize profits based on risk and operating costs which will be summed as a premium. The premium cannot be more than the demand for insurance will allow or there will be no market for the insurance. At the base level, the demand for insurance will be the same whether liability is assigned to the manufacturer or the driver of the vehicle. Consider two different scenarios, one where liability for accidents is assigned to the driver and number two where the liability for accidents is

assigned to the manufacturer. In scenario one, the driver buys two goods from two different providers which are both priced by supply and demand, the vehicle and insurance on top of the vehicle.



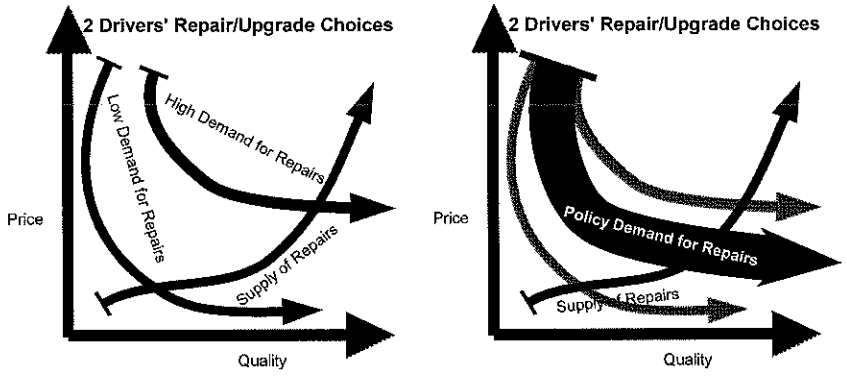
In the second scenario, the manufacturer is assigned liability for the actions of the automated vehicle. In order to cover the cost of the insurance premiums, the manufacturer's cost curve shifts upward as costs have increased by the amount of the net present value of the premium. Because the driver no longer has to insure their vehicle, they are willing to pay more for it and their demand curve shifts upward. This results in the same opportunity cost for the both driver and for the manufacturer in either scenario[7].



The assignment of the liability of property rights to someone is what allows this trade to take place. Without the certainty of assignment, every accident would have to be assigned individually resulting in extra court cases and increased risk of uncertain amounts. Neither driver nor manufacturer

would know if the price of the vehicle was a good deal. Thus, lack of certainty is a prohibitive transaction cost. Without the assignment of property rights, the needed insurance market could not emerge.

Once the market for insuring against assigned risk emerges, secondary conditions exist that require liability to remain with the driver. Repairs on a vehicle are easier on an individual case by case basis to do where marginal benefit meets marginal cost rather than with a blanket policy. When a consumer takes a car in for repairs, they often give input on how much repairs they want done because some accidents warrant more repairs than others. A driver that suffers a small accident has a smaller demand for repairs than one in a more serious accident. If a manufacturer were liable for the car, they would need to have a policy that made decisions regarding vehicle repair. The efficient choice for the manufacturer would be somewhere between the extreme cases. Through micro-managing, the manufacturer could make their policy cover a wider range of cases of damage, but would still be paying too much to inspect cases of very little damage and too little to repair or replace cars that have suffered very heavy damage. Further, it could be reasoned that the manufacturer might want the vehicle returned for the repairs or require a specific chain of repair shops that could be geographically remote from the customer, creating additional inefficiency. Thus, it is better to assign liability allows the insurance firm to have premiums rise dependent of the condition of the vehicle on a case by case basis as vehicles aged.



This can also be shown the other way with improvements to the vehicle rather than repairs. If the consumer is liable for their own vehicle, they could modify it to better fit their individual needs. Motor

enthusiasts might change the engine or tires. Some people might choose to have a sunroof installed. Programming enthusiasts might modify the automated guidance system of their vehicle by installing additional applications on it. A manufacturer that was responsible for all of the cars would want the vehicles' base condition to remain consistent with all of the other vehicles and would prohibit modifications.

In conclusion, SB-16 creates institutional framework necessary to allow the automated vehicle market to emerge. In the absence of law, would-be manufacturers face too much uncertainty to enter the market because they do not know how much risk they face.

ENDNOTES

[1] Schotter, Andrew. *Microeconomics: A Modern Approach.* Mason, OH: South-Western Cengate, 2009. Page 47.

[2] Cohen, Joel E. and Frank P. Kelly, Frank P. *A Paradox of Congestion in a Queuing Network.* Journal of Applied Probability. Vol. 27, No. 3 (Sep., 1990), pp. 730-734

[3] Braess, Dietrich. *On a Paradox of Traffic Planning.* Transportation Science Vol. 39, No. 4, November 2005, pp. 446–450 ©2005 INFORMS

[4] Denver Regional Council of Government Annual Report on Congestion 2010

[5] Pinto, Cyrus. *How Autonomous Vehicle Policy in California and Nevada Addresses Technological and Non-Technological Liabilities.* Interact, Vol 5, No. 1, pp 2-7. 2012

[6] Coase, Ronald. *The Problem of Social Cost.* Journal of Law and Economics, Vol. 3 pp. 1-44. 1960

[7] Schotter, Andrew. *Microeconomics: A Modern Approach.* Mason, OH: South-Western Cengate, 2009. Page 627.

[8] Mankiw,Gregory. *Principles of Micro Economics 4th ed.* Mason, OH: Thompson South-Western. 2007. Page 11.