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## Steering Consumers Toward Driverless Vehicles: A Federal Rebate Program as a Catalyst for Early Technology Adoption

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## NOTE

# STEERING CONSUMERS TOWARD DRIVERLESS VEHICLES: A FEDERAL REBATE PROGRAM AS A CATALYST FOR EARLY TECHNOLOGY ADOPTION

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## ABSTRACT

*In the not-too-distant future, your car could drive itself; technology companies and automobile manufacturers alike are currently developing driverless vehicle technology. While there are many touted benefits to driverless vehicles, perhaps the most important societal benefit is a reduction in automobile accidents. Currently, car crashes are one of the leading causes of death in the United States, and the majority of accidents are caused by human error. Unlike humans, driverless vehicles will not get distracted, significantly decreasing the number of car crash fatalities that happen each year.*

*In order for driverless vehicles to save lives, driverless vehicles must be on the roads. This means people must be willing and able to buy them. Millennials have demonstrated interest in the technology, keeping in line with their reputation for being early technology adopters, but unfortunately this demographic has limited buying power - a problem when early driverless vehicles could command a premium of up to \$10,000.*

*To bridge the gap between desire and accessibility, the government should enact a driverless vehicle subsidy program. The United States government has, in recent years, implemented two different programs to subsidize individuals' vehicle purchases - The Energy Improvement and Extension Act and the CARS program. Both programs successfully influenced buyer behavior for vehicle purchases, but the CARS program, which offered consumers a rebate at the time they bought their car, was particularly well-received.*

*This note proposes a government subsidy for driverless vehicles closely mirrored after the Cash for Clunkers program. By offering a rebate to*

*the consumer at the time of sale, individuals will be better able to afford driverless vehicles, thereby accelerating the overall adoption of this potentially life-saving technology.*

## INTRODUCTION

The potential benefits of driverless vehicles, the “next profound transportation technology,”<sup>1</sup> are vast. Researchers suggest that driverless vehicles will increase mobility for those currently unable to drive, decrease energy use and pollution, and allow commuters to create value in their travel time by engaging in work or leisure activities instead of operating their vehicles.<sup>2</sup> The most touted benefit of driverless vehicles is that they will be safer than their human-operated counterparts.<sup>3</sup> But while the safety benefits of driverless vehicles could be vast, driverless vehicles will be expensive, with some reports speculating that they will be \$7,000-\$10,000 more expensive than human-operated vehicles.<sup>4</sup> This premium price could make driverless vehicles inaccessible to interested buyers, thereby slowing the critical early adoption of the technology.

This note proposes a new federal incentive program to overcome the cost barrier. Part I discusses the potential safety benefits of driverless vehicles. Part II introduces the technology adoption lifecycle and proposes millennials, a tech-savvy and price-sensitive demographic, as the likely adopters of driverless technology. Part III examines two previously enacted federal incentive programs – the Energy Improvement and Extension Act of 2008 and the Car Allowance Rebate System (“CARS”) – that offered car buyers tax credits or rebates when they purchased particular vehicle models. Part IV recommends a federal incentive program to encourage and foster early purchases of driverless vehicles.

## PART I. SAFETY AND DRIVERLESS VEHICLES

Motor vehicle crashes are one of the leading causes of death in the United States.<sup>5</sup> The National Safety Council estimated that, in 2015, “38,300 people were killed on U.S. roads, and 4.4 million were seriously injured,”

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1. David Levinson, *Climbing Mount Next: The Effects of Autonomous Vehicles on Society*, 16 MINN. J.L. SCI. & TECH. 787, 794 (2015).

2. *See generally* JAMES M. ANDERSON ET AL., RAND CORPORATION, AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS (2016), [http://www.rand.org/pubs/research\\_reports/RR443-2.html](http://www.rand.org/pubs/research_reports/RR443-2.html).

3. *See id.*

4. *See* J.C. SULLIVAN, AMERICAN ENTERPRISE INSTITUTE, WHAT WILL DRIVE THE FUTURE OF SELF-DRIVING CARS?, at 9 (2015), <https://www.aei.org/wp-content/uploads/2015/05/Future-of-driverless-cars.pdf>.

5. CENTERS FOR DISEASE CONTROL AND PREVENTION, INJURY PREVENTION & CONTROL: DATA & STATISTICS (2014), <http://www.cdc.gov/injury/wisqars/leadingcauses.html>.

making it the deadliest driving year since 2008.<sup>6</sup> The majority of these car crashes – a number as high as 94% according to the National Highway Traffic Safety Administration – were likely caused by human error.<sup>7</sup> But unlike humans who get distracted, disobey traffic laws, and sometimes fail to see what is happening around them on the road, driverless cars “do not get distracted or tired, have almost instantaneous perception-reaction times, and know exactly how hard to brake or when to swerve.”<sup>8</sup> Indeed, Google’s driverless cars have traversed more than 1.3 million miles since 2009, and of the fleet’s 17 minor accidents, all but one were caused by human error.<sup>9</sup>

With up to 94% of current car accidents being caused by human error,<sup>10</sup> it is natural to assume that having more driverless vehicles on the road would result in fewer auto accidents. Researchers at the University of Utah and the University of Texas have predicted the safety impact that driverless vehicles could have at 10%, 50%, and 90% market penetration rates.<sup>11</sup> At 10% market penetration, researchers estimate that there would be 211,000 fewer car crashes and 1,100 fewer car crash fatalities each year.<sup>12</sup> At 90% market penetration these numbers jump to 4,220,000 and 21,700, respectively,<sup>13</sup> an approximately 57% decrease in crash fatalities when compared to 2015.<sup>14</sup>

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6. NAT’L SAFETY COUNCIL, MOTOR VEHICLE DEATHS INCREASE BY LARGEST PERCENT IN 50 YEARS (2016), <http://www.nsc.org/Connect/NSCNewsReleases/Lists/Posts/Post.aspx?ID=104.e4535-5dc3-45d6-b190-9b49c7229931&ID=103&var=hppress&Web=36d1832e-7bc3-4029-98a1-317c5cd5c625>.

7. See SANTOKH SINGH, NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., TRAFFIC SAFETY FACTS: CRITICAL REASONS FOR CRASHES INVESTIGATED IN THE NATIONAL MOTOR VEHICLE CRASH CAUSATION SURVEY (2015), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812115>; see also Laiza King, *Top 15 Causes of Car Accidents and How You Can Prevent Them*, HUFFINGTON POST (Aug. 31, 2016), [http://www.huffingtonpost.com/laiza-king-/top-15-causes-of-car-accidents\\_b\\_11722196.html](http://www.huffingtonpost.com/laiza-king-/top-15-causes-of-car-accidents_b_11722196.html).

8. Levinson, *supra* note 1, at 795.

9. See Eric Tegler, *Why It’s Impossible to Tell How Safe Self-Driving Cars Really Are*, POPULAR MECHANICS (Apr. 12, 2016), <http://www.popularmechanics.com/cars/a20367/and-self-driving-study/> (noting Google’s accident statistics but also warning that the overall safety of driverless vehicles shouldn’t be extrapolated from Google’s data – “autonomous cars would have to be driven hundreds of millions of miles, and under some scenarios, hundreds of billions of miles to create enough data to clearly demonstrate their safety.”). But see Alison Griswold, *Uber’s Self-Driving Cars Are Already Getting Into Scrapes on the Streets of Pittsburgh*, QUARTZ (Oct. 4, 2016), <http://qz.com/798092/a-self-driving-uber-car-went-the-wrong-way-on-a-one-way-street-in-pittsburgh/> (revealing that other driverless vehicles haven’t had a track record as impressive as Google’s. Residents in Pittsburgh have observed several accidents and driving errors committed by Uber’s driverless cars).

10. See SINGH *supra* note 7.

11. Daniel J. Flanagan & Kara Kockelman, *Preparing a Nation for Autonomous Vehicles: Opportunities, Barriers and Policy Recommendations*, 77 TRANSP. RES. PART A 167 (July 2015).

12. *Id.* at 175.

13. *Id.* at 175.

14. See *supra* note 6.

Recognizing the prevalence of car crash fatalities caused by human error, the United States federal government is committed to automated solutions. One of the Department of Transportation's primary goals is to "improve public health and safety by reducing transportation-related fatalities, injuries and crashes."<sup>15</sup> A recent strategic report reveals that the Department of Transportation is encouraging "the deployment of effective advanced vehicle automation technologies to enhance safety."<sup>16</sup> The National Highway Traffic Safety Administration agrees that automated vehicle technologies could be the key to safety improvements; in its 2017 budget plan, NHTSA allocated \$200 million, nearly 17% of its \$1.181 billion budget, for "Autonomous Vehicle Deployment," funds to "help ensure rapid adoption by the public" given the technology's "potential to reduce crashes."<sup>17</sup>

While driverless vehicles currently exist and, in limited circumstances, are driven on public roads,<sup>18</sup> no one knows when driverless cars will make their commercial debut.<sup>19</sup> Even if automakers can overcome all engineering roadblocks, existing legal and regulatory obstacles may slow the commercial availability of driverless vehicles.<sup>20</sup> For example, although Google has been testing its driverless vehicles on public roads since 2009,<sup>21</sup> the National Highway Traffic Safety Administration - the agency that issues mandatory Federal Motor Vehicle Safety Standards - just released its first set of guidelines for self-driving cars in September of 2016.<sup>22</sup> And, as of December 2016, Florida and Michigan are the only states that allow completely driver-

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15. U.S. DEP'T OF TRANSP., FY-2015 ANNUAL PERFORMANCE REPORT/FY-2017 ANNUAL PERFORMANCE PLAN, at 11 (2016), <https://www.transportation.gov/sites/dot.gov/files/docs/FY15-PerformanceReport-FY17-PerformancePlan-508.pdf>.

16. U.S. DEP'T OF TRANSP., TRANSPORTATION FOR A NEW GENERATION: STRATEGIC PLAN FISCAL YEARS 2014-18, at 24 (2013), [https://www.transportation.gov/sites/dot.gov/files/docs/2014-2018-strategic-plan\\_0.pdf](https://www.transportation.gov/sites/dot.gov/files/docs/2014-2018-strategic-plan_0.pdf).

17. U.S. DEP'T OF TRANSP., *Budget Estimates Fiscal Year 2017: National Highway Traffic Safety Administration*, 26-27, [https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/fy2017-nhtsa\\_cbj\\_final\\_02\\_2016.pdf](https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/fy2017-nhtsa_cbj_final_02_2016.pdf).

18. Beginning in August 2016, Uber allowed customers to summon its self-driving cars in downtown Pittsburgh. See Max Chafkin, *Uber's First Self-Driving Fleet Arrives in Pittsburgh this Month*, BLOOMBERG (Aug. 18, 2016), <http://www.bloomberg.com/news/features/2016-08-18/uber-s-first-self-driving-fleet-arrives-in-pittsburgh-this-month-is06r7on>.

19. Some automakers have revealed aspirational dates for the rollout of driverless vehicles. For instance, Ford announced that it would have fleets of driverless vehicles on the road in a ride-hailing service by 2021. Neal E. Boudette, *Ford Promises Fleets of Driverless Cars Within Five Years*, N.Y. TIMES (Aug. 16, 2016), <http://www.nytimes.com/2016/08/17/business/ford-promises-fleets-of-driverless-cars-within-five-years.html>.

20. See generally, ANDERSON, *supra* note 2.

21. See Tegler, *supra* note 9.

22. See generally NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., FEDERAL AUTOMATED VEHICLES POLICY: ACCELERATING THE NEXT REVOLUTION IN ROADWAY SAFETY (2016).

less vehicles to operate on public roads.<sup>23</sup> But even in a world with no red tape, in order for driverless vehicles to achieve significant market penetration consumers must be willing, and able, to buy them.

## PART II. PUBLIC OPINION AND CONSUMER BEHAVIOR

Studies indicate that millennials are poised to be early adopters of driverless vehicles. Millennials are the generation most interested in the technology,<sup>24</sup> but they are also the most price-sensitive purchasers of vehicles – a recent Kelly Blue Book study reported that the primary reason 57 percent of millennials are not buying cars is due to cost, especially as the average price of a new car has climbed to nearly \$35,000.<sup>25</sup> This economic sensitivity combined with driverless vehicles' premium price supports the notion that monetary incentives are necessary in order to achieve important early market penetration.

### A. Millennials and the Technology Adoption Lifecycle

The adoption of new technologies tends to play out along a bell curve.<sup>26</sup> The technology adoption lifecycle, a theory popularized by Everett Rogers, categorizes consumers into five groups – innovators, early adopters, early majority, late majority, and laggards.<sup>27</sup> Innovators, the first individuals to adopt a new technology, represent 2.5% of an invention's market share, and tend to be young, connected, and willing to take risks.<sup>28</sup> Early adopters, 13.5% of the market share, also tend to be young and have a high degree of opinion leadership, which means they influence whether an innovation is eventually adopted by the early majority, late majority, and laggards.<sup>29</sup> Generally, manufacturers expect millennials (people aged 18-34) to be innovators and early adopters, especially in the technology sphere;<sup>30</sup> they were

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23. While ten states and the District of Columbia have enacted legislation concerning autonomous vehicles, Florida and Michigan are the only two states whose legislation does not preclude driverless vehicles. See NAT'L CONF. OF ST. LEGISLATURES, AUTONOMOUS SELF-DRIVING VEHICLES LEGISLATION, Dec. 12, 2016, [http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx#Enacted Autonomous Vehicle Legislation](http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx#Enacted%20Autonomous%20Vehicle%20Legislation).

24. See HILLARY ABRAHAM ET AL., MIT AGE LAB, AUTONOMOUS VEHICLES, TRUST, AND DRIVING ALTERNATIVES: A SURVEY OF CONSUMER PREFERENCES, at 9 (2016), [http://age-lab.mit.edu/files/publications/2016\\_6\\_Autonomous\\_Vehicles\\_Consumer\\_Preferences.pdf](http://age-lab.mit.edu/files/publications/2016_6_Autonomous_Vehicles_Consumer_Preferences.pdf).

25. See Robert Duffer, *Why Aren't Millennials Buying Cars? They Are, Despite Record Prices*, CHI. TRIB. (Dec. 7, 2016), <http://www.chicagotribune.com/classified/automotive/sc-millennials-autocover-1208-story.html>.

26. See generally EVERETT ROGERS, *DIFFUSION OF INNOVATIONS* (Simon & Schuster eds., 5th ed. 1962), at 281.

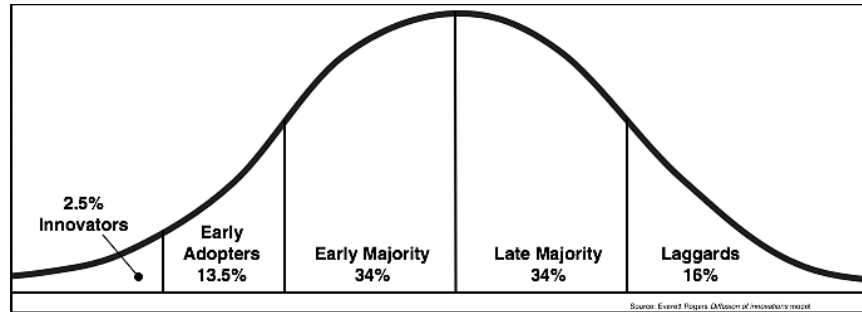
27. *Id.*

28. *Id.* at 281-83.

29. *Id.*

30. See Adrienne LaFrance, *One Thing Baby Boomers and Millennials Agree On: Self-Driving Cars*, ATLANTIC (Oct. 16, 2015), <https://www.theatlantic.com/technology/archive/2015/10/snake-people-cars/410923/>.

among the first to adopt MP3 players, social media networks, gaming platforms, smartphones, and tablets.<sup>31</sup>



Consistent with the belief that millennials are innovators and early adopters, research suggests that they are the population most interested in driverless vehicles. According to a 2016 MIT AgeLab survey, 40% of participants aged 25 to 34 were comfortable with the idea of driverless cars, compared with only 18.9% of participants aged 55 to 64.<sup>32</sup> Similarly, a 2014 survey conducted by Deloitte reported that 47% of surveyed millennials were comfortable with driverless cars, an opinion shared by only 31% of respondents from all other generations.<sup>33</sup>

### B. Millennials and Car Buying

The United States' auto market is currently booming. In 2015, 17.39 million cars were sold in the United States, an all-time record and a 5.8% increase over 2014; there has been year-over-year sales growth for six consecutive years.<sup>34</sup> While car sales have increased over this time period, car manufacturers have struggled to reach millennials.<sup>35</sup>

Rather than buy their own vehicles, some millennials instead choose to rely on rideshare services like Uber and Lyft.<sup>36</sup> A wholesale shift to “access over ownership”<sup>37</sup> could slow down the adoption of driverless vehicle tech-

31. See MARKETING CHARTS, *MILLENNIALS CHALLENGE STEREOTYPES, BUT ARE RAPID TECH ADOPTERS* (Apr. 17), 2012, <http://www.marketingcharts.com/television/millennials-challenge-stereotypes-but-are-rapid-tech-adopters-21814/>.

32. ABRAHAM ET AL., *supra* note 24, at 9.

33. DELOITTE, 2014 GLOBAL AUTOMOTIVE CONSUMER STUDY: EXPLORING CONSUMERS' MOBILITY CHOICES AND TRANSPORTATION DECISIONS, at 17 (2014), <https://www2.deloitte.com/content/dam/Deloitte/us/Documents/manufacturing/us-auto-global-automotive-consumer-study-100914.pdf>.

34. AUTO ALLIANCE, *AUTO MARKETPLACE SALES DATA*, <http://www.autoalliance.org/auto-marketplace/sales-data> (last visited Nov. 13, 2016).

35. See Nin-Hai Tseng, *Why Car Companies Can't Win Young Adults*, FORTUNE (Aug. 16, 2013), <http://fortune.com/2013/08/16/why-car-companies-cant-win-young-adults/>.

36. See J.C. SULLIVAN, *supra* note 4, at 6.

37. *Id.*

nology, a fear that has caused some car manufacturers to explore the intersection of driverless vehicles and ridesharing.<sup>38</sup> But the enthusiasm for and prevalence of ridesharing may be overstated. Currently the services are only available in metropolitan and suburban areas; 28% of urban residents aged 18 to 49 have used ridesharing services compared to only 4% of rural residents in the same age bracket.<sup>39</sup> But even among those who have access to and frequently use ridesharing, the majority of users – 63% – own and drive a car on a daily or weekly basis.<sup>40</sup> Additionally, a 2014 survey revealed that 80% of millennials intended to purchase or lease a car within five years,<sup>41</sup> suggesting that traditional car ownership is still a priority for most millennials.

### C. Affordability as an Obstacle to Adopting Driverless Vehicles

Despite their interest in car ownership, millennials are delaying their vehicle purchases.<sup>42</sup> Research indicates that affordability is the top reason why millennials don't own cars;<sup>43</sup> in an online survey conducted by the University of Michigan's Transportation Research Institute, 32% of adults under the age of 40 said that owning and maintaining a vehicle is too expensive.<sup>44</sup> Analysts have proposed that poor economic conditions – burdensome student debt and entry-level salaries or unemployment – have caused millennials to seek transportation alternatives until they're better positioned to buy a car.<sup>45</sup>

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38. For example, Ford has announced its intent to have driverless vehicles in commercial operation in a ridesharing service by 2021, and General Motors has pursued an alliance with Lyft. FORD, FORD TARGETS FULLY AUTONOMOUS VEHICLE FOR RIDE SHARING IN 2021; INVESTS IN NEW TECH COMPANIES, DOUBLES SILICON VALLEY TEAM (Aug. 16, 2016), <https://media.ford.com/content/fordmedia/fna/us/en/news/2016/08/16/ford-targets-fully-autonomous-vehicle-for-ride-sharing-in-2021.html>; Michelle Krebs, *Autonomous Cars with Ridesharing Key to GM's Vision for Future Mobility*, AUTOTRADER (June 2016), <http://www.auto trader.com/car-shopping/autonomous-cars-with-ridesharing-key-to-gms-vision-for-future-mobility-254768>.

39. *Shared, Collaborative and On Demand: The New Digital Economy*, PEW RES. CENTER (2016), <http://www.pewinternet.org/2016/05/19/on-demand-ride-hailing-apps/#fn-15814-2>.

40. *Id.*

41. DELOITTE, *supra* note 33, at 5.

42. Ultimately, this delay could help the widespread adoption of driverless technology since Americans tend to keep their cars for roughly 11 years. See Mike Spector & Mike Ramsey, *U.S. Proposes Spending \$4 Billion to Encourage Driverless Cars*, WALL STREET J. (Jan. 14, 2016), <http://www.wsj.com/articles/obama-administration-proposes-spending-4-billion-on-driverless-car-guidelines-1452798787>.

43. DELOITTE, *supra* note 33, at 6.

44. BRANDON SCHOETTLE & MICHAEL SIVAK, U. MICH. TRANSP. RES. INST., *THE REASONS FOR THE RECENT DECLINE IN YOUNG DRIVER LICENSING IN THE U.S.*, at 11 (2013), <https://deepblue.lib.umich.edu/bitstream/handle/2027.42/99124/102951.pdf>.

45. See Marc Fisher, *Cruising Toward Oblivion: America's Once Magical – Now Mundane – Love Affair with Cars*, WASH. POST (Sept. 2, 2015), <http://www.washingtonpost.com/sf/style/2015/09/02/americas-fading-car-culture/>; Dee-Ann Durbin, *4 Reasons Millennials are*



But once millennials do visit dealerships to purchase cars, there is still a limit on how much they are willing to spend for autonomous features. Seventy-nine percent of millennials would be willing to pay extra for driverless vehicle technology, but only 27% would be willing to pay a premium of \$2,500 or more.<sup>46</sup> Unfortunately, the sensor technology needed for driverless cars could initially inflate vehicle prices by \$7,000 to \$10,000.<sup>47</sup> To encourage the widespread adoption of driverless vehicles and achieve the safety benefits flowing from high market penetration, the gap between the price of these vehicles and millennials' willingness to pay for them must be closed.

### PART III. FEDERAL INCENTIVES TO SUBSIDIZE THE COST OF VEHICLES

Federal and state governments have previously encouraged the American public to purchase new vehicles by making the vehicles more affordable; this has been achieved primarily through tax incentives and rebate programs. In the past decade alone, Congress has enacted two such incentive programs – the Energy Improvement and Extension Act of 2008<sup>48</sup> and the Car Allowance Rebate System, commonly referred to as “Cash for Clunkers,” in 2009.<sup>49</sup>

#### A. *The Energy Improvement and Extension Act of 2008*

The goal of the Energy Improvement and Extension Act of 2008 (“the Energy Improvement and Extension Act”) is to reduce the United States’ dependence on petroleum “by promoting expanded use of advanced, more fuel-efficient vehicle technologies.”<sup>50</sup> Recognizing that electric vehicles often “cost thousands of dollars more to purchase than conventional vehicles of comparable size and performance,” the Energy Improvement and Extension Act introduced a tax credit for consumer purchases of plug-in electric vehicles.<sup>51</sup>

Under the Act, upon purchasing a plug-in electric vehicle, a taxpayer may claim a \$2,500 federal tax credit, plus an additional \$417 credit for each

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*Buying Cars in Big Numbers*, CHI. TRIB. (March 10, 2016), <http://www.chicagotribune.com/classified/automotive/sc-millennial-car-buyers-autos-0317-20160309-story.html>.

46. DELOITTE, *supra* note 33, at 16.

47. See SULLIVAN, *supra* note 4, at 9; see also Levi Tillemann & Colin McCormick, *This Could Be the Biggest Hurdle for Driverless Cars*, FORTUNE (Feb. 15, 2016), <http://fortune.com/2016/02/15/driverless-cars-google-lyft/>; but see Alex Davies, *Turns Out the Hardware in Self-Driving Cars is Pretty Cheap*, WIRED (April 22, 2015), <https://www.wired.com/2015/04/cost-of-sensors-autonomous-cars/>.

48. 26 U.S.C. § 30D (2008).

49. See *infra* Part III.

50. 154 Cong. Rec. S9,256-57 (daily ed. Sept. 23, 2008) (statement of Sen. Levin).

51. CONG. OF U.S. CONG. BUDGET OFF., EFFECTS OF FEDERAL TAX CREDITS FOR THE PURCHASE OF ELECTRIC VEHICLES, at 6 (2012), [http://www.cbo.gov/sites/default/files/cbofiles/attachments/09-20-12-ElectricVehicles\\_0.pdf](http://www.cbo.gov/sites/default/files/cbofiles/attachments/09-20-12-ElectricVehicles_0.pdf).

kilowatt-hour of battery capacity above five kilowatt-hours.<sup>52</sup> The federal credit is capped at \$7,500,<sup>53</sup> although some state governments passed legislation extending additional state tax credits.<sup>54</sup> The federal tax credit includes a “phaseout period” wherein the credit may only be claimed for the purchase of the first 200,000 units of a particular model of plug-in electric vehicle.<sup>55</sup>

President Obama’s initial goal for the Energy Improvement and Extension Act was to get 1,000,000 electric plug-in vehicles on the road by 2015;<sup>56</sup> but, as of August 2016, only 500,000 electric plug-in vehicles have been sold in the United States.<sup>57</sup> The slow adoption of electric plug-in vehicles has been attributed to everything from “range anxiety” – the fear that an electric car will not have enough stored power to complete one’s intended route<sup>58</sup> – to a general lack of familiarity with the technology,<sup>59</sup> the perceived inconvenience of installing a charging station at home,<sup>60</sup> and falling gasoline prices.<sup>61</sup> Analysts have also pointed to various financial obstacles; electric plug-in vehicles “often cost \$8,000 to \$10,000 more than equivalent sized gasoline powered cars.”<sup>62</sup> Making the problem worse, buyers may not be aware of the available tax incentives designed to mitigate the higher price tag of electric vehicles.<sup>63</sup>

Since its adoption, the Energy Improvement and Extension Act has faced criticism and failed attempts at reform. In 2011, Senator Debbie Stabenow of Michigan reintroduced the Charging America Forward Act, a proposal to convert the Energy Improvement and Extension Act’s maximum

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52. 26 U.S.C. § 30D (2016).

53. *See id.*

54. Some states have offered additional tax credits, most of which range from \$2,500 to \$6,000. In addition to tax credits for the purchase of plug-in electric vehicles, some states have offered plug-in electric vehicle buyers credits for the installation of charging stations, access to high-occupancy vehicle lanes, lower licensing fees, reduced toll fare, and free parking. *See* Kristy Hartman, *State Efforts Promote Hybrid and Electric Vehicles*, NAT’L CONF. OF ST. LEGISLATURES (Dec. 3, 2015), <http://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx>.

55. *See* 26 U.S.C. § 30D (2016).

56. *See* David Shepardson, *U.S. May Not Hit One Million Electric Vehicles Until 2020: Official*, REUTERS (Jan. 21, 2016), <http://www.reuters.com/article/us-autos-electric-moniz-id-USKCN0UZ2MK>.

57. *See* Jeff Cobb, *Americans Buy Their Half-Millionth Plug-in Car*, HYBRIDCARS (Sept. 1, 2016), <http://www.hybridcars.com/americans-buy-their-half-millionth-plug-in-car/>.

58. *See* Joel Hruska, *New MIT Study Claims ‘Range Anxiety’ Fears About Electric Vehicles Are Overblown*, EXTREME TECH (Aug. 17, 2016), <https://www.extremetech.com/extreme/233832-new-mit-study-claims-range-anxiety-fears-about-electric-vehicles-are-overblown>.

59. *See* Yuliya Chernova, *What’s Holding Back Electric-Car Sales?*, WALL STREET J. (Sept. 28, 2014), <http://www.wsj.com/articles/what-s-holding-back-electric-car-sales-1411937798>.

60. *See id.*

61. *See* Cobb, *supra* note 54.

62. Shepardson, *supra* note 56.

63. *See* Chernova, *supra* note 59.

\$7,500 tax credit into a rebate.<sup>64</sup> Unlike tax credits that may, due to the delay between the purchase of the vehicle, the buyer's tax filing, and the issuance of a tax return, take more than a year to "affect a buyer's cash position," a buyer would be able to receive the proposed rebate within weeks of purchasing a qualifying plug-in electric vehicle.<sup>65</sup> Additionally, the proposed rebate would have equalized the monetary incentive for all buyers regardless of federal income tax liability; under the tax credit system, those with low tax liability may not always receive the full value of the credit because their total tax liability may not match or exceed the amount of the credit awarded.<sup>66</sup> President Obama echoed the superiority of the rebate system, proposing that the rebate could be claimed by car dealers and passed on to the consumer.<sup>67</sup> Other politicians took a different approach and advocated for raising the cap on the number of plug-in vehicles eligible for the tax credit; Carl Levin, also a Michigan senator, advocated to raise the cap from 200,000 vehicles to 500,000.<sup>68</sup> Ultimately none of these reforms were adopted and the tax credit persists in its original form.<sup>69</sup>

Despite criticisms of the Energy Improvement and Extension Act and the fact that sales of plug-in electric vehicles in the United States are approximately 500,000 vehicles shy of President Obama's goal, the tax credit still appeared to motivate consumers to buy plug-in electric vehicles. According to a 2016 study conducted by researchers at the University of California, Davis, 92% of plug-in electric vehicle buyers reported that the federal tax credit was the most important monetary incentive for their purchase decision.<sup>70</sup> Ultimately, the study found that "the federal incentive increased the sales of [plug-in electric vehicles] by about 32.5% between 2010 and 2014"<sup>71</sup> and has advanced the purchase timing of these vehicles by a year or more.<sup>72</sup>

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64. John Voelcker, *Senator Stabenow: \$7,500 Electric-Car Credit Should Be Rebate*, GREEN CAR REPORTS (Feb. 8, 2011), [http://www.greencarreports.com/news/1055032\\_senator-stabenow-7500-electric-car-credit-should-be-rebate](http://www.greencarreports.com/news/1055032_senator-stabenow-7500-electric-car-credit-should-be-rebate).

65. *Id.*

66. *See* CONG. OF THE U.S. CONG. BUDGET OFFICE, *supra* note 47, at 25.

67. Nick Chambers, *White House Pushes for a \$7,500 Instant Cash Rebate Towards Electric Car Purchases*, PLUG-IN CARS (Feb. 9, 2011), <http://www.plugincars.com/white-house-pushes-instant-7500-cash-rebate-towards-electric-car-purchases-106794.html>.

68. *See* Voelcker, *supra* note 64.

69. *See id.*; *see also* Chambers, *supra* note 67.

70. Gil Tal & Michael Nicholas, *Exploring the Impact of the Federal Tax Credit on the Plug-In Vehicle Market*, 2572 TRANSP. RES. REC. 95, 97 (2016).

71. *Id.* at 101.

72. *Id.* at 95.

### B. The Car Allowance Rebate System

The Car Allowance Rebate System (“CARS”) was enacted in July 2009.<sup>73</sup> The primary goal of the CARS program, commonly referred to as “Cash for Clunkers,”<sup>74</sup> was to stimulate the economy and aid a struggling auto industry by accelerating households’ automobile purchases while putting more fuel-efficient cars on the road.<sup>75</sup> Under the CARS program, buyers could receive a “bonus” for trading in their existing “clunker” and purchasing a new vehicle with improved gas mileage.<sup>76</sup> To be eligible for the credit, the trade-in vehicle must have been manufactured in 1984 or later and must have had a mileage rating of 18 miles per gallon or worse.<sup>77</sup>

The credit, distributed in the form of a voucher, was for either \$3,500 or \$4,500 depending on the improvement in mileage between the trade-in vehicle and the newly purchased vehicle – improvements of four to nine miles per gallon allowed buyers to claim the \$3,500 credit, while improvements of ten miles per gallon or more earned buyers \$4,500.<sup>78</sup> When making a sale under the CARS program, upon an eligible buyer trade-in, car dealers would deduct the \$3,500 or \$4,500 credit from the price of the new vehicle; under the CARS program, the dealers were the parties who sought repayment from the government.<sup>79</sup>

Congress initially allocated \$1 billion in federal funding to the CARS program, but following widespread participation and demand in its first month alone, Congress added \$2 billion in additional funding.<sup>80</sup> This additional funding was quickly exhausted; the popular “Cash for Clunkers” program ended on August 24, 2009, approximately two months after the program was first introduced.<sup>81</sup> “According to the Department of Transportation, there were 690,114 applications for vouchers under the program.”<sup>82</sup>

Even though the program was a hit with consumers, critics attacked the CARS program on a number of fronts. Many critics argued that the program failed to create positive environmental effects; some focused on the high levels of carbon dioxide emitted into the atmosphere due to the production

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73. EXEC. OFF. OF THE PRESIDENT COUNCIL OF ECONOMIC ADVISORS, ECONOMIC ANALYSIS OF THE CAR ALLOWANCE REBATE SYSTEM (“CASH FOR CLUNKERS”)(2009).

74. *See generally id.*

75. *See id.* at 1.

76. *See generally id.*

77. Consumer Assistance to Recycle and Save Act of 2009, Pub. L. No. 111-32, § 1302, 123 Stat. 1972.

78. *Id.* at 1909-10.

79. Matthew L. Wald, *In Congress, a Jump-Start for Clunkers*, N.Y. TIMES (July 31, 2009), <http://www.nytimes.com/2009/08/01/business/01clunkers.html?pagewanted=all>.

80. *See id.*

81. Peter Valdes-Dapena, *Cash for Clunkers Ending*, CNN MONEY (Aug. 21, 2009), [http://money.cnn.com/2009/08/20/autos/cash\\_for\\_clunkers\\_end/index.htm?postversion=2009082016](http://money.cnn.com/2009/08/20/autos/cash_for_clunkers_end/index.htm?postversion=2009082016).

82. EXECUTIVE OFFICE OF THE PRESIDENT COUNCIL OF ECONOMIC ADVISORS, *supra* note 73, at 2.

of new cars,<sup>83</sup> while others complained that, due to fuel-efficient vehicles' decreased cost-per-mile-driven, consumers would drive their new vehicles more and completely mitigate the program's intended reduction in fuel consumption.<sup>84</sup> Other studies suggested that the program did not significantly impact vehicles' average fuel economy.<sup>85</sup> But data released by the Department of Transportation revealed that the "clunkers" destroyed under the CARS program "averaged 15.8 [miles per gallon], compared with 25.4 [miles per gallon] for the new vehicles purchased, for an average fuel-economy increase of 6.1%."<sup>86</sup>

Other critics focused on the program's economic effects, claiming that the CARS program merely accelerated new vehicle purchases but did not change the cumulative number of cars purchased over a one-year period.<sup>87</sup> Stated another way, the only people who bought new cars under "Cash for Clunkers" were people who planned on buying new cars anyway; various studies have resounded this suspicion.<sup>88</sup> But, given the dual purpose of the CARS program—stimulating car sales and encouraging consumers to buy fuel-efficient vehicles<sup>89</sup>—it is worth noting that during the duration of the program, there was an increase in sales of vehicles that met the program's fuel efficiency requirements, and an accompanying decrease in sales of vehicles that failed to meet the program's fuel efficiency requirements, suggesting that some consumers "switched" their purchases from gas guzzlers to fuel-efficient cars.<sup>90</sup> In short, the CARS program influenced consumers' decisions about which vehicle to buy.

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83. See Christopher Joyce, *Critics Say 'Clunkers' Program Isn't Very Green*, NPR (Aug. 3, 2009), <http://www.npr.org/templates/story/story.php?storyId=111511131>.

84. See Edward Glaeser, *Program Has Clunky Reasoning*, BOSTON GLOBE (Aug. 8, 2009), [http://archive.boston.com/bostonglobe/editorial\\_opinion/oped/articles/2009/08/08/program\\_has\\_clunky\\_reasoning/](http://archive.boston.com/bostonglobe/editorial_opinion/oped/articles/2009/08/08/program_has_clunky_reasoning/).

85. See generally MICHAEL SIVAK & BRANDON SCHOETTLE, U. MICH. TRANSP. RES. INSTITUTE, *The Effect of the "Cash for Clunkers" Program on the Overall Fuel Economy of Purchased New Vehicles* (Sept. 2009), <https://deepblue.lib.umich.edu/bitstream/handle/2027.42/64025/102323.pdf?sequence=1>.

86. Bryan Walsh, *Cash for Clunkers: How Big an Environmental Boost?*, TIME (Aug. 5, 2009), <http://content.time.com/time/health/article/0,8599,1914602,00.html>.

87. See Brad Plumer, *Almost Anything Would Have Been Better Stimulus Than 'Cash for Clunkers'*, WASH. POST (Oct. 31, 2013), [https://www.washingtonpost.com/news/wonk/wp/2013/10/31/almost-anything-would-have-been-better-stimulus-than-cash-for-clunkers/?utm\\_term=.5ffe612bcfa0](https://www.washingtonpost.com/news/wonk/wp/2013/10/31/almost-anything-would-have-been-better-stimulus-than-cash-for-clunkers/?utm_term=.5ffe612bcfa0).

88. *Id.*; see Stan Veuger, *A Clunker of a Program*, U.S. NEWS, Aug. 14, 2014, <http://www.usnews.com/opinion/economic-intelligence/2014/08/14/obamas-cash-for-clunkers-stimulus-bailout-failed-car-companies>; but see Shanjun Li et al., Resources for the Future, *Evaluating "Cash-for-Clunkers": Program Effects on Auto Sales and the Environment*, 18 (2011), <http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-10-39-REV.pdf>.

89. See *supra* Part III.

90. Li, *supra* note 85, at 17.

PART IV. PROPOSED FEDERAL INCENTIVE PROGRAM  
FOR DRIVERLESS VEHICLES

A driverless vehicle incentive program should strive to achieve the goals of the Energy Improvement and Extension Act while being modeled after the CARS program. The goal of a driverless vehicle incentive program should parallel the goal of the Energy Improvement and Extension Act—encouraging Americans to adopt a new automotive technology that has societal benefits. Despite this similarity, the federal government’s driverless vehicle incentive program should emulate the CARS program because the CARS program successfully served a dual purpose, was enthusiastically accepted by consumers, and spurred rapid behavior change. The federal government should allocate additional money to the National Highway Traffic Safety Administration in order to create a rebate system, modeled closely after CARS, for driverless vehicles.

As discussed in Part I, motor vehicle crashes are one of the leading causes of death in the United States.<sup>91</sup> Driverless vehicles are predicted to decrease the number of annual automobile crashes and related fatalities because driverless vehicles, unlike humans, don’t get distracted or make other driving errors.<sup>92</sup> The more driverless vehicles are on the road, the more safety benefits are expected. But even if only 10% of the cars on United States roads are driverless, it is predicted that there will be 211,000 fewer car crashes each year and 1,100 fewer car crash fatalities.<sup>93</sup> If 90% market penetration is reached, it is predicted that there will be 4,220,000 fewer crashes each year and 21,700 fewer fatalities.<sup>94</sup>

Naturally, 90% penetration can only be achieved if consumers are able to buy driverless vehicles, and early adopters play a critical role in the dissemination of new technologies. Early adopters stimulate behavior among later adopters by spreading information about their own use of the product—this sharing of information will be especially important for driverless vehicles since giving up control over one’s own vehicle, a new notion in transportation, could “pose considerable uncertainty for a potential adopter.”<sup>95</sup> Additionally, early adopters accelerate the reduction of a product’s price over time, further encouraging widespread adoption.<sup>96</sup>

Like CARS, the Driverless Vehicle Rebate program should be a direct rebate applied at the time of purchase. The amount of the rebate should equal the premium price of the driverless vehicle as compared to human-

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91. See Centers for Disease Control, *supra* note 5.

92. See Levinson, *supra* note 1, at 795.

93. See Flagnant, *supra* note 11.

94. *Id.*

95. Federico Frattini et al., *The Role of Early Adopters in the Diffusion of New Products: Differences Between Platform and Nonplatform Innovations*, 31 J. PROD. INNOVATION MGMT. 466, 469 (2014).

96. See *id.*

operated models, which is currently predicted to be \$7,000 to \$10,000.<sup>97</sup> Assuming \$2 billion in initial funding for the rebate program—the same amount allocated to CARS—a rebate of \$10,000 per driverless car, and negligible administrative costs, the initial rebate would apply to 200,000 vehicles. These 200,000 vehicles would likely represent more than 10% of total annual auto sales in the United States.<sup>98</sup>

The rebate program for driverless vehicles should be modeled after CARS primarily because CARS was consumer-friendly. Rather than requiring consumers to calculate the value of the credit that they would then declare on their income taxes, the CARS program shifted the responsibility of reimbursement to the car dealerships. Additionally, the rebate was applied at the time of purchase and the effect of the rebate was not distorted by the buyer's declared income.<sup>99</sup>

Shifting the responsibility to dealerships also served an important marketing function: “[T]he onus of promotion [was taken] off the government because industries that stood to benefit had incentive to promote [the program].”<sup>100</sup> Car dealers’ interest in promoting the program paired with the memorable moniker —Cash for Clunkers—solved the problem of low consumer awareness that may have troubled the Energy Improvement and Extension Act.<sup>101</sup> Additionally, the CARS program model has been applied to other consumer goods including computers and home appliances;<sup>102</sup> this implies that the mechanism for reimbursement is easily developed and could be implemented for a new class of automobiles.

Many of the criticisms of the CARS program wouldn't apply to a similar program for driverless vehicles. Unlike the CARS program, which many industry leaders hoped would stimulate the economy by boosting car sales,<sup>103</sup> the purpose of a driverless vehicle incentive program would be to change the behavior of consumers who already plan on buying a car. The incentive would focus on giving a sufficient discount on the price of the vehicle so cash-constrained innovators can afford to buy a driverless car instead of a less expensive human-operated model. The CARS program was successful in influencing this kind of behavior change —consumers who already planned on buying vehicles before the enactment of the CARS program tended to switch their purchase decision from a program-ineligible to a program-eligible car.<sup>104</sup>

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97. See Sullivan, *supra* note 4, at 9.

98. See Auto Alliance, *supra* note 34.

99. See discussion *supra* Part III.

100. Marianne Tyrrell & John C. Dernbach, *The “Cash for Clunkers” Program: A Sustainability Evaluation*, 42 U. TOL. L. REV. 467, 486 (2011).

101. See *supra* Part III.

102. See Tyrrell & Dernbach, *supra* note 100, at 486.

103. See *supra* Part III.

104. See Li, *supra* note 88.

Another potential obstacle is political. Because Congress approves the federal budget, proposed spending programs like the Driverless Vehicle Rebate program require bipartisan support, or nearly unanimous support by the controlling party. Given the profound impact driverless vehicles could have on the number of car crashes and related fatalities that occur each year,<sup>105</sup> and the Department of Transportation's interest in autonomous vehicle technology as a solution, one might think that Congress could easily agree on a federal program that incentivizes people to buy driverless vehicles. But, history has shown that fights along political party lines have frequently slowed or halted legislation related to automotive safety.<sup>106</sup> And opinions about government spending are even more contentious.<sup>107</sup> While the CARS program was adopted with great expediency—the idea was first distributed to Congressional offices in November 2008<sup>108</sup> and was enacted eight months later<sup>109</sup>—the program's primary focus was stimulating the economy,<sup>110</sup> not safety or promoting new technology. Additionally, the Democratic Party controlled both the house and the senate at this time, arguably contributing to the CARS program's speedy enactment.

Legislators serve the voting public, but it is unclear if the voting public would support a government incentive program for driverless vehicles. Fifty percent of the general public has expressed support for government incentives, like the Energy Improvement and Extension Act's tax credit, that reward consumers for adopting plug-in electric vehicle technology.<sup>111</sup> But even if all these individuals also supported incentives for driverless vehicles, this is hardly a resounding public endorsement that would cause Congress to unify quickly.

It's also uncertain how much money would need to be allocated to a driverless vehicle incentive program. The CARS program ended because it ran out of money,<sup>112</sup> and programs that rely on direct public subsidies are difficult to support over time. But data suggests that driverless vehicles, if their safety benefits are truly realized, could save the federal government money; “public revenues paid for roughly seven percent of all motor vehicle crash costs” in 2010, and \$10 billion came from federal funds.<sup>113</sup> Presumably

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105. See *supra* Introduction.

106. See *Contact Sport: The Politics of Auto Safety*, PBS, <http://www.pbs.org/wgbh/pages/frontline/shows/rollover/unsafe/ptheme.html> (last visited Nov. 13, 2016).

107. See *Political Polarization in the American Public*, PEW RESEARCH CENTER (June 4, 2014), <http://www.people-press.org/2014/06/12/political-polarization-in-the-american-public/>.

108. See Tyrrell, *supra* note 100, at 474.

109. See *supra* Part III.B.

110. *Id.*

111. DELOITTE, *supra* note 33, at 14.

112. See *supra* Part III.

113. NAT'L HIGHWAY TRAFFIC SAFETY ADMINISTRATION, THE ECONOMIC AND SOCIETAL IMPACT OF MOTOR VEHICLE CRASHES, 2010 (REVISED), at 239 (2015), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812013>.



the widespread adoption of driverless vehicles will reduce this financial burden, but the true monetary impact of driverless vehicles on the crash economy is difficult to predict.

#### CONCLUSION

Driverless vehicles, if adopted, could have a significant impact on mobility, the economy, and vehicle safety. As car crashes remain a leading cause of death, it's important to embrace and encourage technologies that can help keep people safe on the roads. Luckily, driverless technology has evolved rapidly, and law and regulations permitting, the United States could see driverless cars on its roads in less than a decade.

But while it's easy to get caught up in engineering and legal concerns, when designing a consumer product one must keep in mind the "four P's of marketing" – product, price, place, and promotion.<sup>114</sup> Some consumers, particularly millennials, are ready to adopt the product, but price sensitivity may prevent them from becoming the much-needed innovators and early adopters of the technology.

Subsidy programs can change a consumer's purchase behavior. A federal incentive program for the adoption of driverless vehicles, especially if modeled after the popular Cash for Clunkers program, could be a great success, but only if Congress can agree to implement such a program. And Congress should agree because the benefits of driverless vehicles – increasing mobility for those unable to drive, decreasing energy use and pollution, lessening traffic congestion, and most importantly, decreasing the number of car crashes and related fatalities – justifies investing in the technology. While the initial investment may outweigh the immediate return, driverless technology needs the support of forward-looking legislators in order to achieve significant market penetration. Lawmakers should familiarize themselves with driverless technology through research and product demonstrations, abandon any preconceived notions or fears about driverless cars, and consider implementing subsidies that will facilitate the widespread adoption of new and safer transportation technologies.

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114. See *The Four Ps of Marketing*, PURELY BRANDED, <http://www.purelybranded.com/insights/the-four-ps-of-marketing/> (last visited Nov. 13, 2016).