**Assumptions behind the Model**

In the interest of transparency, we wanted to clearly state our assumptions in building this model. We intentionally tried to err on the side of overly modest assumptions in order not to inflate the number of additional lives lost as a result of regulatory delay.

In this model we have assumed a number of parameters:

*HAVs will be adopted along a normal logistic function.* The academic literature has shown that new technologies are typically adopted along an “S” type logistic function.[[1]](#footnote-1)

*The deployment process for driverless cars will begin in 2017.* Automated vehicles with human supervision are currently operating in Pittsburgh with Uber,[[2]](#footnote-2) and all Tesla cars currently in production have hardware capable of autonomous driving at SAE-5 levels.[[3]](#footnote-3) Additionally, both Ford[[4]](#footnote-4) and Lyft[[5]](#footnote-5) have stated publicly that they plan to have significant fleets of consumer HAVs ready by 2021. These timelines are consistent with the projection of the model.

*The estimated initial transition time for the rollout of driverless cars is 30 years.* This is consistent with NHTSA’s proposed “Road to Zero” goal of having zero traffic fatalities in 30 years. The only realistic way of reaching anywhere close to this ambitious goal is a speedy rollout of driverless cars, with the vast majority of consumers using driverless cars by the end of this 30-year window. It can be argued that the rollout of HAVs will take longer than 30 years, but extending the rollout time frame in the model would only increase the number of lives lost due to regulation over a longer time span.

*The average growth rate in miles driven per year is 2 percent.* This has been the average increase in total miles driven in the United States over the past five years.[[6]](#footnote-6)

*The fatalities per hundred million miles driven by nonautonomous vehicles will continue at a rate of 1.106.* This has been the average rate of the five most recent years for which we have data, from 2010 to 2014.[[7]](#footnote-7) Note that this rate does not include data from 2015 or 2016; in both of these years, the auto fatality rate in the United States has been higher than in previous years.

*Autonomous vehicles will initially be 2 times safer than human drivers and grow to be 10 times safer by the end of the original 30-year period.* This assumption mirrors those made by professors Daniel J. Fagnant and Kara Kockelman in a paper for the Eno Center for Transportation.[[8]](#footnote-8) Additionally, Tesla has driven over 222 million miles in autopilot mode, according to Elon Musk’s statement of the most recent figures.[[9]](#footnote-9) With only one US fatality as a result of autopilot to date,[[10]](#footnote-10) HAV technology is more than twice as safe as the average human-driven US automobile. While this figure is still unreliable because of a small sample size, it represents the best real-world estimate we have to date about the relative safety of HAVs.

*Every HAV on the road will drive 1.5 times as many miles as a human driver.* This assumption accounts for the decreased marginal cost of driving an extra mile using an HAV and the corresponding increase in miles driven we would expect as a result. The actual displacement effect is impossible to know beforehand, but we thought it was important to assume a generous rate to ensure our final projections were not artificially high.

*The maximum crowd-out of HAVs in the market is 95 percent.* While HAVs are likely to be widely adopted once they are available, there are holdouts with every technology. Unless HAVs become federally mandated to use when driving on highways, we will not reach 100 percent HAV market crowd-out.

1. Paul Geroski, “Models of Technology Diffusion,” *Research Policy* 29, no. 4–5 (2000): 603–25. [↑](#footnote-ref-1)
2. Signe Brewster, “Uber Starts Self-Driving Car Pickups in Pittsburgh,” *TechCrunch*, September 14, 2016. [↑](#footnote-ref-2)
3. “All Tesla Cars Being Produced Now Have Full Self-Driving Hardware,” *Tesla Blog,* October 19, 2016. [↑](#footnote-ref-3)
4. “Ford Targets Fully Autonomous Vehicle for Ride Sharing in 2021; Invests in New Tech Companies, Doubles Silicon Valley Team,” Ford Motor Company Media Center, August 16, 2016. [↑](#footnote-ref-4)
5. Darrell Etherington, “Lyft’s Ambitious Future Vision Includes Self-Driving Dominance by 2021,” *TechCrunch*, September 18, 2016. [↑](#footnote-ref-5)
6. US Department of Energy, “Annual Vehicle Miles Traveled in the U.S.,” Alternative Fuels Data Center, Chart 10315, August 2016. [↑](#footnote-ref-6)
7. NHTSA, “Fatalities and Fatality Rates, 1994–2014—State: USA,” Fatality Analysis Reporting System (FARS) Encyclopedia, accessed November 21, 2016, http://www-fars.nhtsa.dot.gov/Trends/TrendsGeneral.aspx. [↑](#footnote-ref-7)
8. Daniel J. Fagnant and Kara Kockelman, “Preparing a Nation for Autonomous Vehicles; Opportunities, Barriers and Policy Recommendations,” *Transportation Research Part A: Policy and Practice* 77 (2015): 167–81. [↑](#footnote-ref-8)
9. Elon Musk, Twitter status update, October 7, 2016, 4:15 p.m., https://twitter.com/elonmusk/status/784487348562198529. [↑](#footnote-ref-9)
10. “A Tragic Loss,” *Tesla Blog,* June 30, 2016. [↑](#footnote-ref-10)