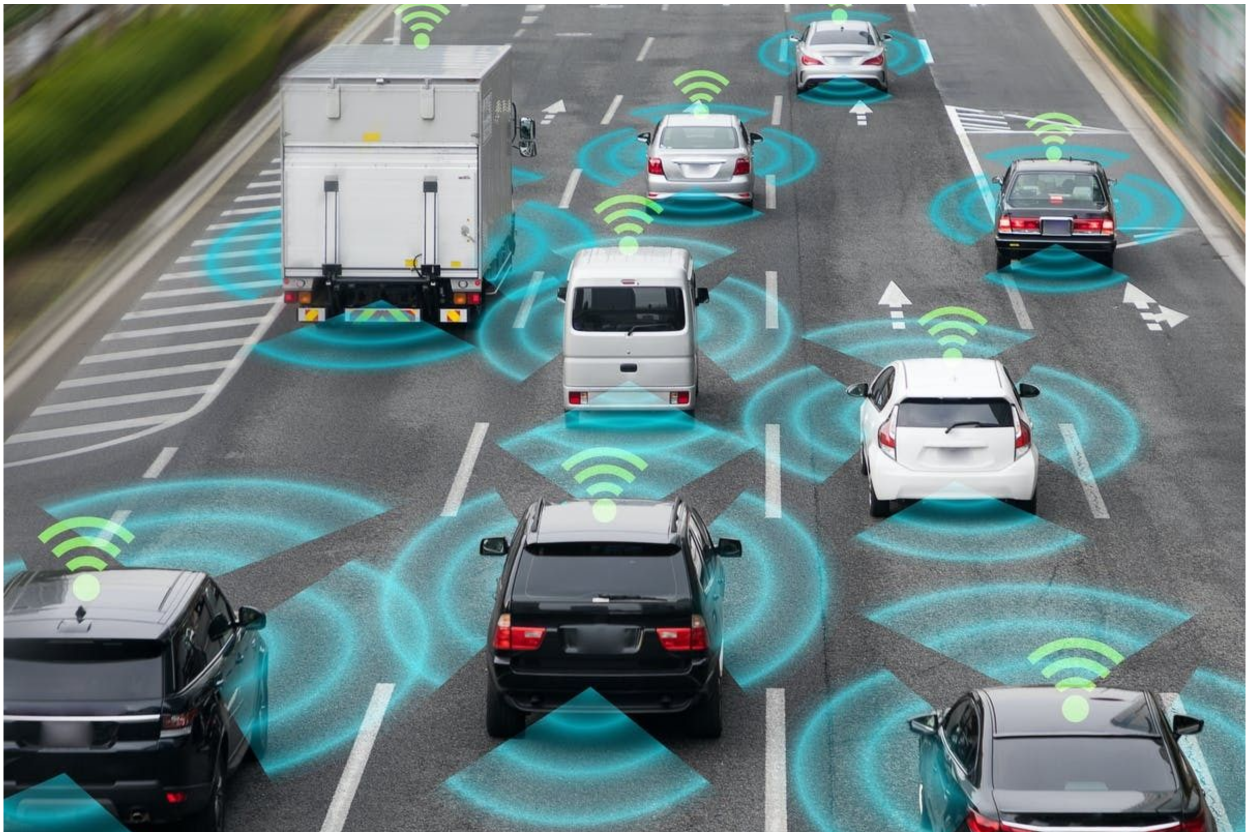

E-392 Final Project

05.01.2020

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Overview

This project is designed to outline the effects of mass adoption of autonomous vehicles on individual governments revenue from standard traffic tickets. To model out the scope of the reliance of traffic data for individual governments, I used two datasets from 2017 census data. The reason why I used datasets from 2017 is because this proved to be the most actively participated survey by governments. The projections used for adoption and growth rates for autonomous vehicles are from multiple sources that are outlined in the works consulted. I did my best to use conservative rates and outline the multiple outcomes of this emerging technology.

Assumptions

1. The government data is incomplete. I used the data available to me as a working model for the reliance on revenue generated from traffic tickets.
2. The adoption of autonomous vehicles will render standard traffic tickets obsolete. Since autonomous vehicles will remove the human error out of driving, barring technical failures, an autonomous vehicle will be able to follow the rules of the road.

Government Revenue Breakdown/Interpretation

Before delving into the data provided in this paper, I think that it is necessary to outline some of the missing information that lies within the data. For one, some States did not provide information, but this source is the best aggregated information without paying or having access to government records. Even though the data is not complete it works as a model for the functional economy and the potential diminished revenue from the adoption of driverless vehicles.

36 States participated in the survey that the data is derived from in this paper. Of those 36 States 52% of their local governments derive 10-20% of their revenue from traffic tickets, 25.22% of the States local governments derive 21-30% of their revenue from traffic tickets, 15.9% of the States local governments derive 31-50% of their revenue from traffic tickets and 7.1% derive over 50% of their revenue from traffic tickets. This is indicative of the excessive over ticketing in this country that many municipalities rely heavily on. A consideration that only scratches the surface of revenue generated from ticketing, as many individual governments are not required to publicly report those figures and can be hard to maintain proper documentation.

The next data set that I analyzed was the same 36 States reporting the number of tickets that they gave in the ranges of $100-$200, $200-300, $300-$500, and over $500. Since the numbers exist within a range of values for each threshold, I found it appropriate to total the amount of tickets within each range and then put that total number in a random number generator and sum those values. I did this for each range, disregarding the individual States, as I wanted to give a holistic view of the amount of money generated from traffic tickets. From the census data in 2017, which was the highest reported year, 723 tickets were issued in the $100-200 range, 363 in the $200-300 range, 233 in the $300-500 range, and 124 in the over $500 range. This totals 1443 tickets issued in 2017, which seems like a small number in the grand scheme of government revenue, but this analysis is supposed to function as a sample model of the potential diminishing of municipality revenue with the adoption of autonomous vehicles.

Autonomous Vehicle Breakdown/Interpretation

There are 6 levels of automation. 0) No Automation, 1) Driver Assistance, 2) Partial Automation, 3) Conditional Automation, 4) High Automation, 5) Full Automation. In both the private and public sector companord are collaborating to try and achieve level 5 autonomous driving. Although, this has not been achieved, with the release of Tesla autopilot, people are comfortably living with level 4 automation. Level 4 vehicles can operate in self-driving mode, but requires infrastructure evolution and general increase in market sentiment. Level 4 allows the driver to override the self driving component of the car, but enables the driver to fully regulate lane keeping, speed, breaking and stopping. Even though it can be argued that the adoption of driverless cars can increase productivity beyond the lost revenue from traffic tickets, this paper mainly focuses on the amount of revenue lost from mass adoption.

The information provided in this section are projections pulled from industry analysts outlined in the works consulted page. I use multiple adoption/growth rates, which are on the conservative side based on the research that is available. On average there are 17 million units or new cars sold a year in the United States. Starting in 2021 it is projected that 3% of new units will be level 4 autonomous vehicles, which means that there are driver override functions, but given a specified route is not needed.

There are roughly 246 million cars on the road in the United States, with 10-15 million scrapped every year on average. Assuming a base of zero for autonomous vehicles on the road, we can say that the amount of revenue generated from traffic tickets is represented by the 246 million that are currently on the road. With an adoption rate of 3% of new vehicles of the base year of 2021, the percent of cars on the road that are autonomous are .2% of all cars. Intuitively if we multiply the percent of autonomous vehicles on the road by the amount of government revenue generated from traffic tickets, we will have a rough estimate of lost revenue from autonomous vehicles. Assuming a base year of 3% of new cars being AVs, they are projected to grow 1.5% yoy.

My research shows that keeping a consistent 1.5% YOY growth rate, in 23 years 100% of new cars will be autonomous. This means that by 2044 there will be roughly 186 million autonomous vehicles on the road. Maintaining the scrap rate of 10-15 million cars per year, we can roughly say that 75% of the cars on the road will be autonomous. From the point of all new cars being AVs, I then estimated the amount of additional years, until all cars on the road are autonomous. This got me to the rough estimate that in 27 years there will be 254 million AVs on the road.

To ensure that I am not incorporating any bias or over estimates into my model I created a random number generator that iterates through possible growth rates with the max being 1.5% YOY. After running 100 different iterations for potential growth rates, I am comfortable with my estimates for the time frame and vehicles on the road.

Code Walk Through

Lines 6-8

Imported the data from the CSV files that I made from the data aggregated in my research

Lines 10-15

Created a data frame of the CSV file that consists of percentage of revenue from traffic data. This data has limits of 10%, 20%, 30% and over 50%. I then replaced empty values with zeros so I can perform operations on the column values for my research. I then labeled all the columns.

Lines 17-20

Converted the column values to floats so the data types of all values are the same, as to not come into trouble with dtypes as the code progresses.

Lines 22-27

Summed the individual values in each column and then aggregated each value. This is to frame a perspective of the reliance on traffic data for individual governments in the United States.

Lines 29-34

Found the total percentages of each percent range as an aggregated total. This was to further show the revenue generation.

Lines 36-45

Created the data frame for the second dataset that outlines the dollar ranges for the traffic tickets given. Then converted all column values to floats to ensure consistent data types throughout the code.

Lines 47-53

Totaled the amount of government revenue from the different ranges in the dataset.

Lines 55-60

Since the numbers within the dataset are ranges, I wanted to make sure that I was not overestimating or underestimating values. I created a random number generator with the high low limits as the thresholds outlined as the column headers and the summed number of tickets within each range as the size of the random number generator.

Lines 62-69

Created a function that sums each value outputted in the random number generator. This shows the total government revenue generated from traffic tickets.

Lines 73-91

Created function that establishes base year numbers. I used a base year of 2021. Then using any specific growth rate i calculated the amount of years until the production of all new cars are autonomous vehicles. Then figured out the amount of cars on the road at said year. After, calculate the amount of years until all cars on the road are autonomous. Function returns total years and amount of cars on the road.

Lines 93-97

Again, to ensure that I was letting the number speak for themselves, I created a random number generator for different growth rates of autonomous vehicle adoption and then ran each iteration through the function created previously. This made sure that my estimates were fair and accounted for different scenarios.

Lines 97-112

Calculates the amount of years government revenue will remain above zero given the base year growth rate and perpetuity growth rate.

Conclusion

This paper's intention is to outline the current reliance of many individual governments on traffic ticketing and then discuss the potential of that diminishing as autonomous vehicles are adopted as a norm. The time frame outlined in this paper is based off of industry experts and the current technology that is available. It is possible that going forward as new technologies emerge or government regulation takes place my time frame could be extended greatly or be cut in half. I think it is an interesting study as autonomous vehicles take the human error out of driving, what will traffic ticketing look like going forward. Autonomous vehicles can regulate speed, following distance, lane keeping and stopping, which are all traditional rationale for getting stopped by local police.

Works Consulted

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