CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

Traffic Congestion in California: Implementation of Congestion Pricing in Los Angeles County as an Effective Traffic-Reducing Strategy

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By

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Abstract

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Traffic congestion is an issue that many metropolitan cities face. Amongst a number of different strategies to help mitigate the problem, the use of congestion pricing is one strategy that has shown to be successful according to the literature. This research study proposes to evaluate the feasibility of implementing a congestion pricing strategy in Los Angeles County. As a car-dependent city with some of the worst traffic congestion in the country, it is crucial that future transportation legislation in Los Angeles take into consideration the use of congestion pricing as a traffic-reducing strategy. However, without public and political support, implementing such a strategy could be a significant challenge. This proposed study intends to shed light on how the public perceives the implementation of congestion pricing, how marketing strategies may manipulate the public's perspective, and how the public's response may impact policymakers when it comes time to roll out new transportation legislation.

Introduction

Vehicle mass production started at the beginning of the 19th century, and by the 1920s automobile registrations had begun to increase by the thousands. Automotive vehicles had become the vital form of transportation in California. Construction of California highways started as early as 1912; however, by the 1940s, to accommodate the mass number of vehicles on roads and long distances needed to be traveled across the state, the construction of freeways had started. On the federal level, after several years of wrangling, the Federal-Aid Highway Act of 1956 was passed. The law authorized the construction of a 41,000-mile network of interstate highways that would span the nation (California Department of Transportation [DOT], n.d.).

Approximately 200,000 new vehicles are registered every year just in Los Angeles County. A total of 8,037,441 registered vehicles were reported at the end of 2017 (Department of Motor Vehicles [DMV], 2017). According to the Federal Highway Administration, California has more road miles than most other states and more vehicles on the road than most states (Federal Highway Administration [FHWA], n.d.). It is also a bigger state than most, meaning motorists spend more time on the road driving farther to and from work, and for most motorists, traffic congestion is just unavoidable.

The Challenge

California has some of the most severe traffic congestion, not only in the United States but around the world, and though just occupying an inconsiderable portion of land in the area, freeways and major highways now dominate the physical and rational

landscape, serving as the primary means of connection between the region's numerous towns, suburbs, and neighborhoods.

Traffic congestion in California is only expected to become worse. Even with better public transportation, subjects with long commutes prefer to travel in their privately own vehicles which are more comfortable, private, and faster, and more convenient, concerning timing and flexibility. Traffic congestion is a mobility problem, in the sense that most people want to travel at the same time each day. Our road systems cannot handle the load of vehicles on the roads during peak-hours without forcing commuters to wait in line for the limited road space.

Major issues faced with traffic congestion are the amount of time wasted being non-productive, increasing stress which may lead to reduced economic health, delays which may result in late arrivals, wasted fuel and the impact on air pollution, wear and tear of vehicles and infrastructure, and increasing the chance of collision. Therefore, excessive traffic congestion can detract from quality of life, is economically wasteful and environmentally damaging. Dealing with traffic congestion on a daily basis can commonly lead to becoming frustrated and engaging in road rage, and can also manifest itself in the workplace as absenteeism, missed deadlines, poor performance, health issues, and attrition (Sweet 2011). Drivers who believe that it is likely that they will encounter traffic congestion may decide to forgo an activity altogether, consequently leading to less consumer spending and lower event attendance. Traffic delays can also slow down the shipping of cargo if delivery trucks cannot remain on schedule due to a congested route. From an economic standpoint, higher levels of congestion appear to be associated with slower productivity growth per worker (Sweet 2014).

According to Hartgen and Fields (2009), major cities that wisely invest on infrastructure that helps eliminate gridlock and improve traffic flow will see a boost in the local economy, and thus tax revenues. “Reducing congestion and increasing travel speeds enough to improve access by 10 percent to key employment, retail, education and population centers within a region increases regional production of goods and services by 1 percent” (Hartgen & Fields, 2009, p.2). Reducing congestion and increasing travel speeds can lead to billions of dollars for a region’s employers and workers due to the benefits of productivity and efficiency (Hartgen & Fields, 2009).

Keeping traffic congestion under control is an ongoing, never-ending task. Strategies must be developed to cultivate mechanisms for growth, sustainability, and quality of life for all residents (Hysing & Isaksson, 2015). What we now must ask ourselves is, what types of traffic-reducing strategies are the most effective in tackling the issue of traffic congestion and which strategy(ies) could work best in reducing traffic congestion across metropolitan cities in California.

Background

Although policies exist and have existed for the past several decades, tackling the issue of congested roadways has proven to be more challenging than initially expected. Traditionally, traffic congestion in California has been addressed by adding additional roadway capacity; however, studies have consistently shown that adding capacity to roadways fails to alleviate congestion (Handy 2015). Trends suggest that without significant policy intervention, traffic congestion will continue to worsen in the coming years.

In 2000 California attempted to tackle the issue of traffic congestion by developing a 4-year state transportation improvement program for purposes of planning the appropriation and allocation of available transportation funds to state, regional, and local transportation projects. In the process, the Traffic Congestion Relief Fund (TCRF) was established in the State Treasury and would disperse the money in the TCRF to the department for allocation, as directed by the commission, to the department and specific regional and local transportation entities for transportation projects. In order to be able to manage the allocation of funds for transportation projects, the Traffic Congestion Relief Program (TCRP) was born as a series of legislative projects throughout California to improve traffic mobility and relieve congestion, provide for safe and efficient movement of goods, and provide system connectivity (DOT, n.d.).

The anticipated outcome was to preserve public peace, health, or safety by creating a significant program designed to reduce traffic congestion, which would improve the public's health and safety. Assembly Bill 2928 is what allowed the creation of TCRF and TCRP. The primary purpose of AB 2928 was for the California Department

of Transportation (Caltrans), in collaboration with regional transportation agencies to establish a task force to develop a strategy for avoiding congestion on intermodal highway corridors of economic significance. The bill would establish a list of transportation projects eligible for funding with money from the TCRF. There were a total of 141 specific projects identified throughout California that would help meet the goals (California State Legislature, 2000).

Literature Review

Many definitions have been developed to describe traffic congestion on highways in metropolitan areas. However, there is no universally accepted definition of traffic congestion (Downs, 2004). Traffic congestion can be defined as the state of traffic flow on a transportation facility characterized by high densities and low speeds, relative to some chosen reference state (with low densities and high speeds)(Bovy & Salomon, 2002). It is a condition of traffic delay, when the flow of traffic is slowed below reasonable speeds because the number of vehicles trying to use the road exceeds the traffic network capacity (Weisbrod, Vary, & Treyz, 2001). The goals of the literature review will be to explore how traffic congestion has become a problem and what governments are doing to mitigate the issue. It will also look at policy strategies that have been implemented in other major cities and lessons learned. The section will conclude with identifying the gap presented in the research that focuses on effective policy strategies and implementation in relation to recent advancements in U.S. transportation planning.

Defining the Problem and Government's Role

Congestion often means stopped or stop-and-go traffic. Traffic congestion may be the result of one or multiple causes. Traffic congestions can be a side-effect of an accident on the road, faulty signaling equipment, road work, or bad weather. However, traffic congestion can also be the result of more lasting issues, such as having a heavy concentration of vehicles (bottlenecks), absence of adequate public transport, and inadequate road infrastructure (Kim & Wang, 2016).

Transportation engineers have evaluated the physical capacity of roadways for years, attempting to optimize the maximum amount of traffic capable of being safely absorbed by a given highway section. A variety of factors measures capacity: the number and width of lanes and shoulders; merge areas at interchanges; and roadway alignment (grades and curves) (FHWA, 2016). Toll booths may be understood as a particular case of bottlenecks as they significantly impair the physical flow of traffic. Besides, individual driver behavior has an unpredictable effect on capacity. Research shows that drivers familiar with routinely congested roadways space themselves more closely together than drivers on roads with less traffic, increasing the amount of traffic that can be reasonably absorbed (Li, Fu, Wang, Lu, Berezin, Stanley, & Havlin, 2015).

Studies have shown that traffic congestion is the number one concern of individuals in rapidly growing areas in the U.S., often ranked higher than crime, school overcrowding, and housing shortages (Morrison & Lawell, 2016). Traditionally, traffic congestion in California has been addressed by adding additional roadway capacity; however, studies have consistently shown that adding capacity to roadways fails to alleviate congestion, so it is important to reevaluate whether continued plans for major highway expansion projects still make sense (Handy, 2015; Dutzik & Baxandall, 2013). According to research conducted by Duranton and Turner (2011) and Goddard (1997), increasing road capacity in congested conditions can make congestion worse. Duranton & Turner's study focused on the concept of the "fundamental law of traffic congestion" suggested by Downs (1962). The fundamental law of road congestion refers to the idea that when adding 10 percent more lane miles to a city, it increases vehicle miles traveled by 10 percent. Meaning, that in less than ten years new roads cause traffic increases

directly proportional to the increase in capacity (Duranton & Turner, 2011 citing Downs, 1962).

According to Beaudoin, Farzin, and Lawell, (2018), governments have two roles in the public transportation sector. The first is to provide transportation infrastructure in the form of roads and public transit systems and to operate public transit services. With infrastructure in place, the second is for governments to employ policy instruments, such as taxes and other forms of regulations relating to safety, environmental standards, travel demand management policies, and so forth, and also to determine the operational aspects of public transit services. In relation to governments' role, Dutzik and Baxandall (2013) believe that transportation policy in the United States has failed to catch up with the times, leaving the nation at risk of overinvesting in transportation infrastructure that we do not need while under-investing in the repair of our existing transportation network and the broader range of transportation choices Americans increasingly seek in the 21st century. The nation needs a new transportation policy, one that embraces the recent change in driving patterns and tries to maximize their benefits (Dutzik & Baxandall, 2013).

When observing patterns, it is essential to recognize that Millennials (those born between 1983 and 2000) are the nation's largest generation, making their transportation needs particularly crucial (Dutzik, Inglis, & Baxandall, 2014). Millennials are less dependent on cars as their primary mode of transportation than those of older Americans and are more likely to use transit and active transportation. Transportation experts and policy-makers guide their assessments of changing driving trends by assuming that a series of independent factors determine the demand for transportation. In turn, these

factors must supply the optimal amount of service or capacity to meet that demand. However, we can infer from years of experience that transportation investments do not merely accommodate demand; they shape it (Dutzik et al., 2014). New transportation policy should acknowledge that future transportation demands are uncertain and that investments that would deliver benefits under a broad range of potential futures must be prioritized (Greenstone, Sunstein, & Ori, 2017). Revised transportation policy should create a coherent and refocused role for the federal government in ensuring that our transportation infrastructure is well-maintained and in partnering with cities and states that seek to provide new transportation options to their people (Dutzik & Baxandall, 2013). An excellent example of "preparing for the future" with regards to Millennials, is that the oldest Millennials are just a few years away from entering their peak driving years (roughly age 35 to 55) that is the peak period for employment and child-bearing and, by extension, the period during which people make the greatest use of the transportation system. Millennials will almost certainly drive more miles per person as they age than they do today (Dutzik et al., 2014).

Over the past century, California has continued to struggle with implementing an effective transportation policy, underinvesting in its aging infrastructure and failing to establish new strategies and long-term solutions to help mitigate traffic congestion. Barriers to introducing change are mainly due to the lack of public and political acceptance. Change comes at a price, and it often requires to impose new charges, fees, or by increasing tax revenues. For this reason, the key obstacles are political rather than technical (Harman & Quigley, 2010; Goddard, 1997).

Strategies and Lessons Learned

Research strongly supports the idea that roads cause traffic and that expanding their capacity are an ineffective tool for combating traffic congestion. Research also shows that investments in public transit may have benefits in congestion reduction, but only when playing a complementary role to efficient pricing of vehicle travel, such as congestion pricing/charges (Beaudoin, Farzin, & Lawell, 2016). While investment in infrastructure may create short-term reductions in congestion, it becomes ineffective over time as it encourages drivers to make trips they otherwise would not have taken. This effect is known as induced demand (Beaudoin, Farzin, & Lawell, 2018). To deal with the excess demand of road use, major cities have opted to implement different strategies to help regulate traffic congestion. For example, Mexico City chose to implement a no driving day program. This command and control program mandates not driving one day during the week, and on the weekends, odd and even license plate numbers are used, causing one half of the fleet to be parked (Goddard, 1997). However, such a program showed to be ineffective given that the public adjusted by purchasing additional vehicles, which in turn, increased the number of vehicles on the road (Goddard 1997; Davis, 2008).

In relation to the example from Mexico City, in recent development, other major cities are looking to establish programs that completely ban vehicle use in city centers. Cities such as Madrid, Oslo, London and Paris have plans to implement policy that bans vehicles, in some cases only diesel vehicles, from entering the city center, encouraging the public to walk or use non-polluting alternatives as a mode of transportation such as bicycles (Urry, Leach, Dunn, & Coulton, 2017; Nieuwenhuijsen & Khreis, 2016). The

push for this type of policy is mainly to help regulate the high levels of air pollution in these areas and subsequently also helping with traffic congestion and noise problems. As an alternative, the plan is to develop bike lane capacity further to encourage the use of bicycles. Following Copenhagen as an example of how a city can successfully move away from the use of vehicles for mass transportation. Today, over half of the population in Copenhagen bikes to and from work every day (Nieuwenhuijsen & Khreis, 2016).

When Timilsina and Dulal (2008) looked at policy instruments for reducing traffic congestion, they looked at congestion pricing, vehicle tax, fuel tax, and emissions tax, and found that the use of congestion pricing seemed to produce the best-desired impact in reducing vehicle mileage. With advances in electronic technologies, there are experiments and applications underway in which road authorities collect toll charges with the use of these new technologies. These are viewed mainly as cordon pricing technologies for rationing access to the central business districts of central cities (Goddard, 1997). The use of congestion pricing as an effective strategy to reduce congestion and increase travel times is also shown in the findings of studies conducted in cities in which this type of strategy has been implemented (Börjesson, Eliasson, Hugosson, & Brundell-Freij, 2012).

Congestion pricing are fees on vehicles traveling during certain hours (peak hours) and has been used in large cities such as London, Stockholm, and Singapore. The principal goal is to accelerate traffic flow in a congested area, benefitting transit by including faster travel times of those who choose to drive, reduced vehicle emissions, and lower fuel consumption. A report on London's system, established in 2003, shows that

the implementation of congestion pricing has diminished trips by 12%, with more than 50% of those traveling shifting to public transportation (Börjesson et al., 2012).

Some regard congestion pricing as an essential element of transportation policy (Börjesson et al., 2012; Harsman & Quigley, 2010). The congestion problem can never be solved by building more and more capacity, but rather, by using pricing to manage the use of the capacity that has already been created. Despite widespread agreement that congestion pricing could have a positive impact on traffic congestion, there is still minimal social consensus in support (Börjesson et al., 2012). It is difficult to convince the public to pay additional fees for congestion pricing when they are already having to pay high fuel taxes. The public believes that they have already paid for the maintenance of roads through fuel taxes and that imposing a congestion charge is just another way for the government to take away money. There's also a concern on the potential impact on the poor, and lower-income citizens such as working mothers, who are likely to need to travel during peak hours because of childcare obligations (Bonsall & Kelly, 2005).

> "Congestion pricing pose the policy dilemma of balancing several factors: the management of a quasi-public good (i.e., transport corridors); the correction of negative externalities (e.g., travel delays, lost productivity, greenhouse gas emissions, accidents, and wear and tear on road infrastructure); the needs of economic, demographic, and urban growth; and citizen acceptance" (Althaus, Tedds, & McAvoy, 2011, p.542).

In the case of Stockholm, what allowed the public to change their negative support towards congestion pricing and turn them into positive, was the implementation of a trial period (Hysing & Isaksson, 2015). Eliasson and Jonsson (2011) found that in

Stockholm low car dependence and good transit supply are associated with high acceptability. They also found that when emphasizing the positive effects of congestion pricing with regards to environmental concerns (positive effects on air quality) and re-labeling the congestion pricing to "environmental charges", it yielded a positive impact on acceptability. Harman and Quigley (2010) found that that the pattern of time savings and incremental costs, exerted a powerful influence on voting behavior. Hysing and Isaksson (2015) also found that Stockholm citizen voters behaved as if they value commute time highly, and when they experienced first-hand the out-of-pocket costs and time savings of a specific pricing scheme, they were prepared to adopt freely policies that reduce congestion on urban motorways.

Despite the theoretical appeal of congestion pricing as a policy solution, only a handful of cities have pursued such charges. This dichotomy suggests that there remain challenges surrounding the feasibility of implementing such policy. Many variables are at play in implementation, and no amount of theoretical guidance will substitute for practical and context-specific application (Althaus et al., 2011).

Winston (2000) argues that it is pointless to expect public officials to help fix the issue of traffic congestion by pursuing more efficient policies such as congestion pricing. The problem is that transportation policy is largely shaped by deep-rooted political forces that inhibit constructive change, and the only way to improve the system is by exposing it to market forces by privatizing. His position is supported by empirical evidence based on simulations for the UK's early experience with privatization. To be able to implement effective transportation policies in California, such as congestion pricing, further exploration of planning approaches need to be studied.

Research Gap

Future research should build upon recent advancements in U.S. transportation planning, focusing on those that look at alternative policies in response to tackling the traffic congestion issue, including those already underway in California. Additionally, research could look at how lessons learned from other cities that have successfully implemented effective transportation policies, influence how planning takes shape. There is currently a lack of evidence about the effectiveness of the use of congestion pricing as a traffic-reducing strategy, specifically in the Los Angeles County area.

Research Design

Introduction

The purpose of this research study is to explore the possible implementation of congestion pricing across California highways as a strategic transportation policy to effectively reduce traffic congestion in metropolitan cities. Congestion pricing referred to as the money motorists have to pay in the form of toll fees or road use permits to drive in some city centers. The idea that implementing congestion pricing on highways across metropolitan cities in California would work as a traffic-reducing strategy is yet to be determined. Effective implementation of congestion pricing would require that we assess the public's perception, identify the impact that marketing strategies may have on their perspective, and determine how that information would affect the decision of policy-makers to push new legislation. California's territory is vast with more than 50,000 miles of highways (CalTrans, n.d.), and for that reason, the researcher will only be focusing on the Los Angeles County area. This will be further narrowed down to select, at random, five cities within the Los Angeles County from which data will be collected through surveys and interviews.

Research Question

This research study will attempt to answer the following question:

Is the implementation of congestion pricing feasible on highways in Los Angeles County?

Aims

To be able to potentially answer the research question, study-related activities will focus on collecting research data to help achieve the following aims:

- To explore the public's perception of the implementation of congestion pricing.
- To determine whether marketing strategies could impact the public's perspective.
- To assess whether a positive response to congestion pricing by the public could affect the decision of policy-makers to push legislation.

Approach

The intent of this research study will not be to find a conclusive response but to explore and gain insight on how to possibly implement an effective traffic-reducing strategy such as congestion pricing. The researcher will collect data to gather information from stakeholders regarding congestion pricing to be able to identify themes and patterns and develop a theory. With more in-depth knowledge gained from this research project about the state of the public's opinion and the policy-making climate with regards to congestion pricing, the researcher hopes that it will help shed some light on the feasibility of implementing congestion pricing to help alleviate the issue of traffic congestion in the Los Angeles area.

A two-phase mixed methods approach will be used in gathering information. Phase one will consist of collecting quantitative data by way of conducting surveys with the public. This will be done with two different groups. The first will be a comparison group (control) with which the researcher will look to collect general information about the public's understanding of congestion pricing and their perception, along with other

demographic data (e.g., commute times, average daily miles driven, etc.). The second group (intervention) will require to complete a survey which has been prefaced with a description of what a congestion charge is and how it may have a positive impact on commute times and the environment, and get their perspective, along with other demographic data (e.g. commute times, average daily miles driven, etc.). Phase two will consist of gathering qualitative data by way of conducting interviews with policy-makers and asking questions regarding their perspective on congestion pricing, thoughts on advocating legislation that backs this type of strategy, and how the publics' opinion could impact being a proponent of congestion pricing.

Participation by subjects in any of the two phases will be voluntary and subjects can opt to withdraw from participating at any moment. The survey will be anonymous, and the interview questions will be designed in a way that do not require the collection of personally identifiable information (e.g., names, addresses, etc.), and only responses will be recorded as part of the data collection process. Subjects completing the survey will only be presented with an oral description of the purpose of the study before their participation. Subjects who agree to be interviewed will be presented with a study information sheet which will provide information regarding the purpose, procedures, risks, benefits, confidentiality and rights of the participant. Approval from an Institutional Review Board will be pursued before starting any research activities.

Sampling

For the quantitative portion (phase one) of the data collection, the target population will be individuals ages 18-55 years old that reside in one of the five randomly selected cities within the Los Angeles County. The lower age range was chosen

with the understanding that the average age in which subjects start driving is 18 years of age, and this is also the average age in which subjects start working, and therefore, commuting. The upper age range was selected with the understanding that the average age of retirement in the United States is between 62-65 years of age (Dixon, 2017). The researcher anticipates to able to survey 125 subjects per group for a total sample size of 250 subjects. Subjects will be selected at random in each of the different cities. The goal will be to survey fifty subjects per city from two different locations (25 subjects per site) within each city. Busy intersections and shopping centers will be the types of locations targeted. With this type of approach, the researcher hopes to achieve a 100% response rate and anticipates it that it may take about five weeks to collect (one city per week).

For the qualitative portion (phase two) of the data collection, purposeful sampling will be used. The target population will be representatives of the California State Senate and members of the California State Assembly with offices in Los Angeles County. The researcher anticipates having to reach out to twelve subjects to achieve a 50% response rate with the goal of interviewing at least six subjects. To accomplish this, a list of the twenty-three Los Angeles elected officials comprised of members of the California State Assembly and Senate will be generated, and a sampling frame will be created by randomly selecting the first subject at random and subsequently choosing every second subject on the list until twelve subjects are identified. Subjects will be initially contacted via email and/or phone. Once a subject agrees to be interviewed, the interview process can be done in-person or remotely through a phone call or email. The researcher anticipates that this data collection process may take up to three months.

Data Collection Tools

The type of tool to be used to gather quantitative data for this research study will be a survey. For both the control and intervention groups, a short eight to ten question survey will be developed. Given that the researcher will be targeting subjects in public spaces, the survey needs to be short and precise, for subjects to agree to participate and to retain their attention. The survey will consist of questions asking about demographics (age, gender, and education level), as well as questions regarding average daily commute distance (mileage), average commute times (minutes), time of the day commuting, time spent in traffic congestion, level of knowledge about congestion pricing, and perception of congestion pricing. Subjects will be able to choose from multiples answers, and a combination of dichotomous (e.g., Yes-No, Good-Bad) and rating scales (e.g., 1-10 scale, Likert scale). The difference between the tool used with the control and intervention groups is that the survey used with the intervention group will be altered to have a preface that explains what a congestion charge is and how it can have a positive impact on commute times and the environment (less pollution). The intervention group will also be asked about their perspective rather than their perception of congestion pricing.

With results from phase one, a set of interview questions will be developed to gather qualitative data. The interview will consist of five to eight questions regarding the perspective of congestion pricing (effective strategy or not), why they think it could be effective or not, thoughts on advocating legislation that backs this type of strategy, and how the public's opinion could impact being a proponent of this type of legislation.

Data Analysis

For phase one univariate analysis will be performed with the data collected from surveys (quantitative). This type of analysis will allow the researcher to summarize the data and find patterns in the data. Then the datasets from the two different groups will be compared to establish patterns further and develop theories. With the qualitative data collected from the interviews in phase two, the researcher will first categorize the data, identify patterns, and make connections from the different responses, and interpret the data and explain the findings.

Issues/Concerns

The lack of resources limits how big the sample sizes are for the collection of quantitative and qualitative data. For the quantitative approach it would be difficult for a single researcher to collect data from a sample size large enough to produce truly generalizable information. Surveying a greater number of subjects across all of Los Angeles County would result in stronger findings with more robust sample size. Moreover, the recruitment of subjects in the five randomly selected cities could introduce socio-economic bias, as the random selection could result in only targeting cities with higher poverty rates (e.g., Compton, Lynwood, etc.), or the opposite, and only target cities with higher median incomes (e.g. Beverly Hills, Brentwood, etc.). Additionally, surveying subjects in public spaces is time-consuming and require a lot of persistence and patience. A more effective method of surveying subjects would be to generate an online survey and send email blasts to a large publicly available listserv; however, this also presents a challenge because people are typically reluctant to open email correspondence from an unknown sender. Keeping the survey tool short and precise, with eight to ten

questions that subjects must complete, could work when conducting surveys in public spaces; however, that also means that the research is limited to the amount of information that can be gathered. This could potentially exclude valuable information, leaving the researcher with incomplete data which could affect the overall validity of the findings. The development of the research questions could also be strengthened by gathering preliminary data from focus groups. This could yield information about the types of variable worth studying and help to precisely target the intended results.

In the qualitative approach to the data collection for this study, collecting a large enough sample size to find patterns in the information could be difficult and costly. The target population is one that may be difficult to reach, and have them agree to be interviewed. Persistence is key in this type of approach, and even then, response rates are usually lower than expected. Additionally, the quality of the interview questions is critical in that they must not reflect the researcher's personal biases which could gravely affect the validity of the findings. This is also true at the time the researcher is in the process of interpreting the information.

Discussion

This study intends to try to answer the research question of whether the implementation of congestions pricing in Los Angeles County is feasible. Research has shown that in other major cities, this method has been an effective strategy for reducing traffic congestion. The results of phase one of the research will show whether the public is willing to incur the cost of a congestion charge in exchange of having shorter commute times and benefiting from the positive environmental impacts it could have, such as better air quality and reducing global warming. The information then gathered from policymakers in phase two will provide insight on the political barriers currently present that prevent such a strategy to be implemented. The hope is that the information collected by this research study helps better understand where the public stands with regards to being for or against the implementation of congestion pricing and how that information can have an impact on policymakers when it comes to pushing new transportation legislation to help reduce traffic congestion in the future.

The implementation of congestion pricing is one of several strategies that could help in addressing the issue of traffic congestion in metropolitan cities. As part of the policy-making process, all options and alternatives need to be explored before the agenda-setting process can commence. One of the other strategies to consider is increasing and developing public transportation alternatives. This could include the addition of buses on roads and trains on subways and the addition of new routes and stops. On a bigger scheme, this could also include the development of new metro rail lines. There is limited evidence that the addition of public transit has much of an influence on road congestion; however, if well-designed, in the long-run it could reduce

the dependence on privately own vehicles. Benefits could include better access to metropolitan cities, which may also mean more comfortable access to jobs. The other option is to develop underground transportation tunnels. According to The Boring Company, owned by Elon Musk, to solve the problem of traffic congestion we need either flying cars or tunnels, the latter being the sensible solution. The major issue with tunnels is that they are expensive and take a long time to dig (The Boring Company, n.d.). The average cost of digging a tunnel is between one to four billion dollars (Hess, 2016; The Boring Company, n.d.). Increasing tunneling speeds and reducing the cost by a factor of ten or more is The Boring Company's goal. Fast digging and lower cost tunnels would make the addition of subway lines a feasible alternative and would also open the doors to develop new technologies such as loops and hyperloops further. Loops and hyperloops are high-speed underground public transportation systems in which autonomous electric pods transport passengers — the significant difference being that a hyperloop draws a vacuum inside the tube to eliminate air friction and can travel at speeds up to 600 miles per hour which is ideal for longer routes, while loops allow travel speeds of up to 150 miles and are ideal for shorter distances (The Boring Company, n.d.).

The use of autonomous vehicles is another new technological alternative which could be used on existing infrastructures and could help alleviate the issue of traffic congestion. Part of the fundamental challenge of traffic is that it is effortless for human drivers to create traffic, that's largely because of delayed human reactions (Morgan Stanley Research, 2013). If a driver sees red tail lights and taps his brake, each subsequent driver approaching from behind also must react, and that delay forces each one to brake harder than the next, resulting in a jam for no apparent reason (phantom

jam) (Stern, Cui, Monache, Bhadani, Bunting, Churchill, Hamilton, Haulcy, Pohlmann, Wu, Piccoli, Seibold, Sprinkle, Work, 2017). A multi-institutional collaborative field study that took place at the University of Arizona suggested that the addition of just a small number of autonomous cars can ease the congestion on our roads. They found that by having an autonomous vehicle control its speed intelligently when a phantom jam starts to circulate, it is possible to reduce the amount of braking performed further back down the line. The presence of just one autonomous car reduces the standard deviation in speed of all the cars in the jam by around fifty percent (Stern et al., 2017). California is no stranger to autonomous vehicles, in fact, legislation was first enacted back in 2012 with the approval of Senate Bill 1298 (SB 1298) which required the Department of the California Highway Patrol (CHP) to adopt safety standards and performance requirements to ensure the safe operation and testing of autonomous vehicles (without a driver present in the vehicle) on public roads if specified conditions are met (California Legislative Information website [CLI], n.d.). This type of legislation initially started with the purpose of improving safety and reducing deaths due to auto accidents; however, improving traffic congestion has remained a major goal. Then in 2016 California also approved Assembly Bill 1592 (AB 1592) which authorizes the Contra Costa Transportation Authority (CCTA) to conduct a pilot project for the testing of autonomous vehicles (CLI, n.d.).

With all these strategies, there is a financial aspect that needs to be taken into account. In Los Angeles County Road pricing would have to be extended over an entire urban area, making it costly and a significant challenge to be able to develop a pricing scheme that could be effective (Goddard, 1997). To successfully implement any new

transportation policy, the money has to be there to back it up. Running a cost-effectiveness analysis could help compare the relative costs and outcomes (effects) of each of the strategies. The strategy that costs the lease to implement and yields the best results for reducing traffic congestions would be the sensible option. When talking about costs and who is to be held responsible for those covering the costs is also another aspect that needs to be considered. Do governments need to be the only ones responsible for backing up new transportation strategies and policies? Winston (2000) believed not, and that the only way to improve the system is by privatizing. The Boring Company and other private companies in the auto-making industry are already investing in making these alternatives possible. Perhaps governments need to be working more closely with private companies to come up with a cost-effective solution that does not require eating up all of the taxpayers' money. Financially, we also need to consider the impact of traffic congestions on local economies. According to Morgan Stanley (2013), American drivers travel over 3 trillion miles and spend 75 billion hours in a car every year, with the average commute time each day being over 26 minutes. If that time could be used to get work done rather than getting to work, productivity gains could reach the billions. Going back to autonomous vehicles, they believe that they can create substantial economic benefits, with an estimated total savings of 1.3 trillion dollars in the United States alone.

Another item to consider when talking about different strategies is their social pertinence. Concerns of justice and fairness come to mind when talking about the different strategies that could be implemented to combat traffic congestion. Is the implementation of congestion pricing fair to all social groups? The poor could see themselves most affected by having to pay an additional fee, as opposed to someone in

the middle or upper class that would be willing to pay the fee in exchange for convenience. Socially, we also need to look at the outlook of the different communities impacted by the implementation of transportation policies. Take for example the folks in Beverly Hills, who have been protesting the underground tunneling of Metro's purple line which will pass under the local high school. Even with no evidence at hand, the community of Beverly Hills argues that the tunneling is too dangerous and they do not want it passing under their high school (The Times, 2018). Another example is with autonomous vehicles, which would require that policymakers consider making ownership of an autonomous vehicle mandatory for all commuters using transit infrastructure. Again, this would present a challenge to lower class individuals given that owning an autonomous vehicle would initially not be an affordable option.

Conclusion

Rosenbloom (1978) was one of the first to attempt to define what traffic congestion means. He defined it as an event that occurs when travel demands exceed the existing road system capacity. Kockelman (2004) defined it as the presence of delays along a physical pathway due to the presence of other users. However, one thing that is universally agreed upon is that traffic congestion is not a good thing and for some metropolitan cities it is a significant issue that needs to be addressed. Several strategies have been developed, some that have been tested, other that are in the process of testing, and then there are the ones that are still concepts. As shown in the literature, the implementation of congestion pricing is one of those strategies that has been tested in major cities such as London, Singapore, and Stockholm and has proven to be successful in accelerating traffic flow and improving travel times. With the Los Angeles County having some of the worse traffic in the nation, actions need to be taken by policymakers to introduce legislation that adequately manages the issue. Out of all the strategies identified in this study, the implementation of congestion pricing seems to be an option that could be feasible, but only with the political support by elites and by the public (Hårsman & Quigley, 2010).

Relevant to the topic of how to deal with traffic congestion, this proposed study intends to show the feasibility of implementing congestion pricing on highways in the Los Angeles area. With the information gathered, the researcher hopes it will serve to better inform those in power and hopefully have a positive impact on future plans for pushing new legislation.

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