Congestion Solutions:
Using America’s Auto-Dependence to Generate Revenue

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July 20, 2020
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Abstract

This paper analyses automobile-related taxes and fees that can be used to generate revenue for state and local governments. Three roadway and automobile-related taxes — congestion pricing, high-occupancy toll (HOT) lanes, and demand-based parking rates — will be examined based on their theory, case studies of their implementation, and their adherence to best practices in tax policy. The taxes will also be assessed in terms of their ability to relieve congestion and other externalities caused by automobile usage. The paper concludes with recommendations for how the taxes and fees discussed in this paper can be implemented.

Executive Summary

Nationwide, state and local governments are facing structural budget challenges. Their tax systems are limited in the revenue they are able to generate, even as the cost of essential services and obligatory expenditures grows. While the predicament that these governments face is similar, there is a difference between specific challenges facing state governments and those facing localities.

At the state level, there has been a shift over the last 50 or so years in funding responsibilities away from the federal government and toward states. This devolution has required state governments to administer and pay for programs — welfare, highway maintenance, Medicaid spending, and public education, among others — that had traditionally been the responsibility of the federal government. At the same time as state budgets have grown to account for these new expenditures and responsibilities, states have seen the erosion of an outdated tax system. In particular, state transportation budgets, which are dependent on state and national gas taxes, have become structurally challenged due to improving fuel efficiency, stagnant gasoline costs, and growing infrastructure repair needs. This has resulted in
the already-strained state budgets providing relief to their underfunded transportation departments.

At the municipal level, the property tax, formerly the bedrock of the tax base, has been under siege since the 1970s “property tax revolts”. The political unpopularity of property taxes has led to states placing limits on local governments’ ability to raise or even maintain property tax rates. In response, city governments have shifted to less sustainable, predictable, and equitable sources for their revenue — such as occupational taxes, local-option sales taxes, and user fees.

Within this reality, state and local governments are faced with a task of growing revenue in order to meet the ever more pressing demands on their budgets. To that end, this paper will explore ways in which governments can derive revenue from the use of automobiles in order to create more structurally sustainable budgets. In particular, this paper will explore the following potential revenue-generating solutions for localities and states: congestion pricing in urban centers, high-occupancy toll (HOT) lanes on highways, and dynamic parking fees for high demand areas. While not widespread, these solutions have been implemented in a handful of cities and states within the US as well as internationally.

Due to the US’s dependence on the private automobile for transportation, such taxes and fees promise considerable revenue streams for governments. The roadways that move vehicles and the land that has been used for parking spaces are public resources. However, in many cases, they are valuable commodities that have been underpriced by their owners, the government. The economic theory of induced demand suggests that low fuel taxes, cheap and plentiful parking, and abundant highway infrastructure have encouraged pervasive automobile use. Selling something for less than it is worth increases demand for that item. This is precisely what has occurred across much of the US with roadways and parking lots, and as the owners of
these resources, state and local governments should seek to value them properly in order to
generate needed revenue.

Undoubtedly, such changes (or simply the proposals for such changes) will bring with them considerable political pushback. However, driving has a number of side effects, and in general, these negative externalities are not priced into the cost that driving places on society at large. Thus, this paper will include in its exploration of potential revenue streams built around vehicle usage a discussion of how such taxes address congestion and other externalities caused by driving.

**Literature Review**

*Trends in Road Spending*

As noted above, highway maintenance and construction is one area where responsibility has shifted from the federal government to state governments. In general, state transportation departments have their own funding sources for their budgets, which are considered separately from general fund budgets. However, these funding sources — tolls, state fuel taxes, and licensing fees — have not been adequate to meet the spending levels of the transportation department budgets. Nationwide, user fees and gasoline taxes pay for only 68% of the total expenses on roads. Roughly 50% of the spending comes from state roadway fees and taxes, while about 18% comes from the federal gas tax. The remaining 32% of funding comes from general funds from the states (20%) and the federal government (12%).
According to a study of 2011 spending, government road construction and repair costs 5.1 cents per mile driven. However, Americans pay only an average of 0.4 cents per mile in tolls and user fees, 2.0 cents per mile in gasoline taxes, and 0.8 cents per mile in vehicles license taxes (3.3 cents per mile total). Joseph Henchman of the Tax Foundation argues, “When road funding comes from a mix of tolls and gasoline taxes, the people that use the roads bear a sizeable portion of the cost. By contrast, funding transportation out of general revenue makes roads ‘free,’ and consequently, overused or congested,” (Henchman, 2014).

At the same time that existing fees and taxes are not adequately funding the budgets of transportation departments, the nation’s highway infrastructure is in severely poor condition. According to a survey by the Federal Highway Administration (FHWA), roughly 20% of the country’s roads are in poor condition. The American Society of Civil Engineers (ASCE) gave existing US infrastructure a D+ rating overall and estimated the cost of repairs for roads, bridges, and transit at $2 trillion. A CBPP report notes that there is a $1.1 trillion “funding gap” between what states have pledged and what, based on the ASCE estimate, is needed (McNichol, 2019).
Thus, we see interconnected and compounding problems in transportation funding. Gas taxes and other fees are not adequately funding state transportation budgets — even as those budgets are not allocating enough funds to meet the vast infrastructure repair needs of the nation. To make up for the revenue shortcomings in transportation budgets, states are shifting funds away from their general fund budgets — which further exacerbates the structural budgetary problems that state governments are experiencing.

**Trends in Roadway Taxes and Fees**

While state and local governments face funding problems in their general fund and transportation budgets, many governments globally are reconsidering how they price the cost of driving. Congestion caused by too much driving is a worldwide phenomenon, regardless of budget issues, and governments everywhere are beginning to explore strategies to counteract its effects.

One of the most discussed innovations in transportation taxation in recent years has been congestion pricing — a scheme that aims both to lessen automobile traffic and generate revenue from it. Currently, congestion pricing systems exist in only three major global cities — Singapore (started in 1998), London (2003), and Stockholm (2007) — with New York State recently approving a plan to implement congestion pricing for a section of Manhattan. The New York model is scheduled to start-up in 2022, with its revenues directed primarily toward funding the subway, commuter rail, and bus systems of the perpetually-strained Metropolitan Transportation Authority (MTA) (Rosenthal, Fitzsimmons, and LaForgia, 2017).

Looking more globally, the Chinese government has commissioned studies of the major world congestion pricing systems. Reports such as Shunfeng Song’s “Should China Implement Congestion Pricing?” and Yanhong Yuan et al’s paper “Congestion Charges in Mega Cities”
address the topic of congestion pricing from the perspective of its potential impact Chinese cities. Shunfeng’s paper, for instance, argues that the country should implement such systems in its major cities in order to reduce traffic congestion and “internalize traffic externalities (Song, 2019; Yuan, 2020).

In the US, a number of media outlets and advocacy organizations based in New York City reported on the successes of London’s congestion pricing system in the years before New York’s approval of a similar system. The Tri-State Transportation Campaign’s 2018 report Road Pricing in London, Stockholm and Singapore argued that New York City should implement a congestion pricing system, and NY1, a cable news channel in New York City, issued a series of reports on London’s system as the New York State government considered and then passed congestion pricing legislation in 2019 for New York City (Pavonsha and Sifuentes, 2018).

More broadly, in 2008 the FHWA issued a “primer” on the general need for congestion pricing in American cities. The FHWA primer was based on a longer report prepared for them by KT Analytics. Both documents highlight the congestion pricing systems in place in Singapore, London, and Stockholm. The FHWA report, notably, also proposes HOT lanes (or, as they are also called, Express Toll lanes) for the American interstate system. The HOT lanes proposal serves as a variation of traditional congestion pricing, which typically focuses on congestion zones in cities, and high-occupancy vehicle (HOV) lanes, which have existed on the interstate highways in and around American cities going back to 1973 (FHWA, 2008). The Urban Land Institute’s paper When the Price Is Right provides a comprehensive look at the history of tolling on the interstate system and the recent change in federal law that has made HOT lanes more viable (Urban Land Institute, 2013). National publications such as USA Today, local media outlets such as Miami’s WLRN, and niche, urbanist publications like NextCity.org have all
written on the controversial aspects of the lanes — namely, the regressive nature of their fee structure (Copeland and Overberg, 2012; Cohen, 2017).

While solving congestion has been one major focus of the innovations in roadway taxes and fees, economists, urban planners, and advocates have also been studying and pushing for reform in the pricing of parking resources in American cities. Both Donald Shoup’s *The High Cost of Free Parking* and Jeff Speck’s *Walkable City* focus on the negative externalities caused by abundant, underpriced parking. Shoup and Speck argue that required parking minimums, cheap on-street parking, and overbuilt parking structures contribute to congestion, urban sprawl, energy waste, and the devolution of urban land values. As a solution, they argue that governments should charge market-rate values for parking resources and that they should reinvest those funds into urban destination districts, as a means for creating more demand for both urban land and parking (Speck, 2012).

The remainder of this paper will explore the potential impacts and benefits of implementing congestion pricing, HOT lanes, and demand-based parking rates. Our discussion will focus on the theory of these taxes and how principles of fair, high quality taxation applies to them. The paper will conclude with case studies of their implementation and recommendations for governments looking to implement such strategies.

**Looking Ahead**

The remainder of this paper will consider how governments can meet the budgetary problems they are facing by enacting new taxes and fees based on roadway usage. Policies such as congestion pricing, high-occupancy toll (HOT) lanes, and demand-based parking rates are solutions that can be used to address the budgetary strains discussed above. In our consideration of these potential solutions, the paper will (1) provide a description of and discuss
the theory behind each tax, (2) provide case studies for each tax, and (3) analyze how each tax abides by the guiding principles of fair taxation. The paper will conclude by offering recommendations of the appropriate circumstances for where such solutions could be implemented.

**Research Design**

The research for this paper begins by acknowledging two issues currently facing government budgets nationwide:

- At the state and city level, governments are facing structural budget challenges from revenues that have become increasingly inadequate and unreliable for meeting growing obligatory spending demands.

- State transportation budgets are buttressed by general fund allocations due to the inadequacy of the revenue being generated by the current roadway taxes and fees. Although these taxes and fees are supposed to provide sufficient funding to make transportation departments self-sustaining, the additional funding that these departments demand further stresses the already structurally unsound state budgets.

Given these realities, this paper’s research has been guided by the central, framing question of:

- How can governments tax vehicular and roadway usage in order to generate revenue that supports more fiscally sustainable governments?

As part of this exploration, there are a number of additional questions to consider around this topic:

- How can road and vehicular taxes be improved to abide by the fair tax policy principles of equity, adequacy, simplicity, exportability, and neutrality?

- What taxes and fees are available to and appropriate for use by states?

- What taxes and fees are available to and appropriate for use by municipalities?

- How, if at all, do such taxes and fees address congestion and the other negative externalities caused by vehicular use?
In addressing the roadway-related revenue possibilities for governments, the issue of how to account for the negative externalities imposed by cars quickly becomes one of the foremost concerns. Thus, the last of the additional questions serves as one of particular importance to this research. This paper will evaluate the externalities of driving in terms of the costs they impose on governments: the loss in land value (and thus, property tax revenue) caused by urban sprawl, the maintenance funding required for large-scale highway projects, among others. In addition to congestion’s affect on government budgets, the taxes and fees discussed in this paper will be considered in terms of the vehicular externalities that they attempt to solve. One of the goals of this paper is to make clear how the taxes and fees discussed address such vehicular externalities as air pollution, personal danger, and congestion, while also accounting for how they affect government budgets.

The solutions discussed in this paper are still being tested, and there are very few definitive answers, very little available data. Congestion pricing has not yet been implemented anywhere in the United States. The federal law that allows HOT lanes to exist on the interstate system is not yet ten years old, and there are more HOT lanes being built than are currently complete. Dynamic parking rates have only been tried in one American city.

With those limitations around conclusive evidence in mind, this paper will take a qualitative approach to the study of this issue. After establishing how the taxes work in practice and their guiding theories, the paper will offer case studies in each of the proposed taxations. The cases chosen are some of the few instances of these taxes existing anywhere in the US or world. As such, they serve as the prototype for what the tax is and how it can be implemented. As a means of research, case studies allow for exploration and understanding of complex systems, and a view that is more holistic in nature. As more examples of these tax systems emerge, quantitative data and statistical analysis will prove valuable. But as yet, there is too
much local variance and too few instances of these taxes to be able to draw strong conclusions from existing data sources (Zainal, 2007).

In light of the limitations on data, after reviewing the case studies for the tax types, we will offer an analysis of how the principles of fair taxation apply to each. Our discussion of the issue will conclude with recommendations based on the theory and case studies, with proposals for how and where such solutions could be implemented in US cities and states.

**Innovations Roadway Taxes and Fees**

**What is Congestion?**

Before examining how these systems work, it will be useful to understand what congestion is and what precisely it describes. *Congestion* refers to three distinct types of impacts on a road network:

- Less reliable, more unpredictable travel times (a trip could take 30 minutes or 2 hours)
- Longer durations of heavy use (“rush hour” starts at 3:00 and ends at 7:00)
- Increased severity in slowed traffic (peak hour delays used to add 16 minutes, but now add 37 minutes to a travel time)

In essence, congestion implies an unreliable and unpredictable roadway transportation system, where trips vary widely in the amount of time they take depending on the day of the week or the hour of the day.

**Innovation 1: Congestion Pricing**

**Overview / What It Is**

In congestion pricing systems, users are charged for entering high congestion zones or driving on high congestion routes. Usage rates in these zones and routes are often variable, with higher
fees charged for “rush hour” usage and free usage allowed in the late evening and early morning hours. The primary goals of congestion pricing are to reduce traffic volume, especially during hours with the highest usage, while also charging users for the externalities imposed by driving. The application of congestion pricing is currently limited to a small number of cities worldwide: notably Singapore, London, and Stockholm, with New York City planning a system to come online in 2022.

Theory

Paying for road access is not a new idea. Toll roads and bridges have existed for centuries and are a familiar feature of vehicular travel for drivers worldwide. Congestion pricing, however, is a novel approach to road fees primarily because of what goals the fees attempt to address. On a typical turnpike or toll bridge, and even with the traditional gas tax, collected revenues pay for the maintenance and improvements of the infrastructure being used. For users, there is an implied one-to-one relationship between the payment of the fee and the access being received.

By contrast, users in congestion pricing systems are paying a toll for the negative externalities caused by their driving — namely, more congestion. Congestion is a negative externality of driving. It lowers quality of life for citizens by taking up time that could otherwise be spent productively at work or recreationally with family and friends. It wastes additional fuel, which costs large sums of money and degrades air quality for the public at large. It also negatively impacts other modes of transportation — in particular, congestion makes bus service less reliable.

Congestion pricing functions as a Pigouvian tax — that is, one aimed at limiting the externalities that driving creates. Unlike with a toll bridge, there is no one-to-one relationship between the fee and the service received. Instead, the tax attempts to shape user behavior by
discouraging driving, particularly during peak hours. By introducing an additional cost to driving, congestion pricing induces road users to change their behavior, which reduces the number of cars on the roadway. In turn, this improves journey time reliability for road users and environmental factors such as air quality. And with trips spread more evenly throughout the day, the overall system operates more efficiently.

In many systems, the intent of congestion pricing is to create a positive feedback loop for the transportation system as a whole — investing revenues into expanded transit service (particularly buses), more robust cycling and pedestrian facilities, and reduced capacity for vehicles in order to further lessen the demand for driving.

**Innovation 2: HOT Lanes**

*Overview / What It Is*

On state and federal highways in and around major US cities, high-occupancy toll (HOT) lanes run alongside the general use lanes. Drivers of single-occupancy vehicles are able to access HOT lanes for a variable fee — one that is based on current traffic conditions. Buses are given
access to these lanes at no charge, as too are high-occupancy vehicles (HOVs — vehicles with two or more occupants). As of 2013, in states such as California, Texas, Maryland, Colorado, Georgia, and Florida, there were about 300 miles of HOT lanes, with more than 150 new lane miles under construction (Urban Land Institute, 2013).

HOT lanes have evolved from HOV lanes (lanes available exclusively to buses and carpooling vehicles), and have grown in popularity in recent years. Before 2012, HOT lanes existed only on state highways due to federal restrictions that forbade tolling on highways built with federal dollars. However, with the passage of the Moving Ahead for Progress in the 21st Century Act of 2012 (MAP-21), HOT lanes are now allowed on the federal interstate system. One of the important stipulations of MAP-21 is that it permits states to convert existing HOV lanes to HOT lanes. New HOT lanes can be built from scratch, but existing general use lanes cannot be converted. The law also stipulates that toll revenue must first be used for the facility itself, with revenues going to other transportation purpose only after the facility’s proper maintenance has been certified.

In Seattle, HOVs with two or more passengers can access the HOT lane for free, while single occupancy vehicles pay a toll based on distance traveled in the lane and current levels of congestion.
Theory

As a response to the problems of congestion, HOT lanes use many of the same technologies and ideas as congestion pricing. However, they do so to achieve a different kind of solution. Whereas congestion pricing charges a rate on road usage in order to address the broad negative externalities that driving imposes, HOT lanes offer specific users a way to avoid congestion.

The concept, in economic terms, is referred to as value pricing — charging customers based on how much they value the service they are receiving. As congestion increases, so does the demand to avoid it, and thus, so does the price of accessing the HOT lane. Conceptually with HOT lanes, there is an implied one-to-one relationship in this transaction. Money paid allows users to avoid the congestion that plagues rest of the system. In comparison to congestion pricing, the goals and potential ramifications of HOT lanes are not as far-reaching. Due to the restrictions on how toll revenue can be spent, governments are not able in most cases to fund other transportation options, such as improved bus service. In sum, congestion pricing attempts to solve congestion for society at large; HOT lanes attempt to offer individuals a way to avoid it.

Innovation 3: Demand-Based Parking Rates

Overview / What It Is

In 2008, at the depths of the financial crisis, the City of Chicago sold its 36,000 parking meters to Morgan Stanley for $1.2 billion. The investment firm responded by more than doubling rates in the city center, where parking in an on-street spot was, on average, less than one-tenth the cost of off-street parking. Such a change suggests the immense value of parking resources, as well as its under-market pricing by governments (Speck, 2012).
In value-based rates for on-street parking, pricing for on-street parking meters can be adjusted based on the parking availability within an overarching district. In such instances, the variable rates can be preset based on proximity (the closer-in spots are more expensive) or on timing (parking rates in a “restaurant district” apply into the evening hours), or they can adjust dynamically through the use of technology. The general rule is the same in each case: the price of parking varies to reflect changes in demand.

Theory

Just as congestion pricing and HOT lanes charge variable rates for road access based on demand, urban land use advocates, city planners, and economists have begun arguing for market-based solutions to the way cities understand their parking resources.

On-street parking in many cities is underpriced — especially in very dense, very urban cities and in smaller cities’ “restaurant districts” where it is often free after 6:00pm. Variable rates for on-street parking is a similar proposition to congestion pricing on city roads and HOT lanes on highways — all are examples of value pricing, with rates going up as demand does and an implicit question to users of, “How much is this resource worth to you?” In some instances, as in a congestion pricing system, the revenue generated from parking is invested back into the district from where it came in order to create a positive feedback loop: more demand creates more revenue creates more investment creates more demand. In such a scenario, variable rate parking can be thought of as a benefits tax — that is, one that raises revenue locally to support local public services (Brunori, 2020).
Case Studies

Congestion Pricing: Singapore

Established in 1975 as the Area Licensing Scheme (ALS), Singapore’s congestion pricing system is credited as the world’s first. As an analog model, the system made use of toll booths placed along specific routes in the city center. In 1998, ALS was upgraded to an automated, technologically sophisticated system called Electronic Road Pricing (ERP). In the modern system, variable rates are based on real-time travel speeds and congestion on the ERP roadways, and vehicles are automatically charged as they pass under one of the city’s ERP gantries. Annual net revenue for ERP is about $100 million, with operating costs of $18 million.

An ERP gantry in Singapore displays the time and current rates for entry as vehicles pass underneath.
The city’s Land Transportation Authority (LTA) estimates that road traffic during peak hours is 25,000 vehicles less than it would be without ERP and down 13% overall, with travel speeds up about 20%. The LTA also reports changes to traffic patterns as users choose to avoid the high toll rates of the ERP during peak hour driving. Vehicular traffic has spread into off-peak timeframes, and traffic has increased onto parallel and outer roads that are not part of the ERP system. These changes result in a more efficient use of the existing road resources; however, they also represent new negative externalities introduced to the traffic system by congestion pricing (Provonsha, 2018).

**Congestion Pricing: London**

Originally proposed in 1964, London’s congestion pricing system was debated politically for nearly 40 years before being implemented in 2003. Unlike Singapore’s system which applies variable rates on specific routes, London’s congestion pricing is a flat rate per day for vehicles that enter into a congestion pricing zone — an 13 square mile area in the city center. Like Singapore, the system is fully automated and relies on sensors at gantries to identify vehicles. Annual operating costs for London’s system are estimated at $80 million, with net revenues of $182 million.

The streets within London’s congestion zone saw a 10% reduction in traffic volume compared to the pre-congestion pricing baseline. Transport for London (TfL), the government body responsible for the city’s transportation system, estimates that the number of chargeable vehicles (private vehicles, primarily) entering the zone decreased by 30% after the implementation of congestion pricing, with increases in nonchargeable vehicles like taxis, buses, and bicycles.
Studies have shown that traffic speeds have remained static or even moderately slowed since the implementation of the congestion pricing. It is broadly understood that this slowing is due to efforts by TfL to reduce vehicular capacity in the city in order to address the other, more holistic goals of the congestion pricing system: better air quality, improved access for bicyclists, a more robust bus system, and greater overall road safety. These goals are a response to the negative externalities of congestion. They are aimed at contributing to an improved urban environment and people-moving capacity for the transportation network as a whole. While air quality metrics in the city have not changed perceptibly since the implementation of the system, rates for cycling and bus ridership have grown, with TfL using revenue generated from
congestion pricing to invest both in building new bicycle infrastructure and adding new bus lines. Moving forward, London is planning to change its flat daily rate to variable rates depending on the time of day. TfL is also doing away with exemptions for electric and low-emission vehicles that were aimed at improving air quality but did not address, and probably worsened, overall congestion (Provonsha, 2018).

**HOT Lanes: Colorado**

Since the passage of MAP-21 in 2012, Colorado has constructed 56 miles of HOT lanes in and around Denver. By 2023, the state projects that it will have built 155 more miles of HOT lanes in the area around its largest metropolitan area. Rates for accessing the HOT lanes by non-HOVs vary depending on the route, the time of day, and the day of the week. For instance, the six-mile I-25 “Central Express Lane” in downtown Denver varies between $0.95 and $5.25 on weekdays, and is stable on the weekends at $0.95. The 12-mile I-70 route, by contrast, has three tolls, which vary in cost from $3.00 to $30.00, but are generally $6.00 to $7.00.
Funding for Colorado’s HOT lanes comes from a variety of sources: the Colorado Department of Transportation (CDOT), local governments, general federal funds, federal grants, and the High Performance Transportation Enterprise (HPTE), a public-private partnership established to manage the construction and operations of Colorado’s HOT lanes. In the 2018-19 fiscal year, the I-25 HOT lane generated $8.2 million in tolling revenue and $680,000 in transponder revenue against $3.3 million in operating costs, while the state’s I-70 corridor collected $2.4 million in tolls versus $1.4 million in operations. Over the existence of its HOT lanes program, CDOT shows an accumulated amount of $32 million in surplus, unbudgeted funds.

Regarding its impacts on congestion, the government’s advertising campaign markets the program under the tagline, “Fast. Not Furious.” As a selling point, this mantra underscores the benefit to individual users — a way to avoid the headaches of congestion. Testimonials on the CDOT website convey the same message: users express pleasure at being able to choose the HOT lane during instances when they wanted to avoid interstate traffic. CDOT, however, also cites statistics that show benefits to the overall transportation system: a 6% one-year increase in HOV usage, with 18% of the total HOT lane use coming from HOVs; the construction of a bike path adjacent to one of the HOT lanes; a 70% improvement in on-time bus arrivals along the I-25 corridor; and a 60% four-year increase in bus ridership along the US 36 route. The state also notes that HOT lanes serve 9% of the total traffic on their routes, providing a modest amount of congestion relief to the 91% of drivers in the general use lanes (Colorado HPTE, 2020).
**Demand-Based Parking Rates: San Francisco**

The City of San Francisco implemented SFpark in 2011 as a two-year, federally funded pilot project for managing on-street parking through dynamic pricing. As a demonstration project managed by the San Francisco Municipal Transportation Agency (SFMTA), the program was tested on 7,000 of the city’s 28,000 parking meters in eight city neighborhoods.

The primary goal of SFpark was to achieve a minimum level of parking availability so that at least one on-street parking space per block would be open. SFMTA used occupancy data from in-ground parking sensors to gradually adjust rates up or down depending on demand levels, with the goal of achieving a 60-80% occupancy level. Rates could fluctuate between $0.25 per hour to $6.00 per hour, with rates adjusting based on the followed rules: at 80-100% occupancy, the hourly rate increases $0.25; at 60-80% occupancy, no change in the hourly rate; at 30-60% occupancy, the hourly rate decreases by $0.25; and at less than 30% occupancy, the hourly rate decreases by $0.50 (SFMTA, 2014a).

*The SFpark pilot study focused on neighborhoods in the city where parking occupancy rates frequently were 90-100%.*
The SFpark study noted secondary benefits (positive externalities) in addition to making it easier for drivers to find a parking space. Greenhouse gas emissions decreased due to less driver circling; peak period parking congestion decreased due to higher fees; parking citations decreased; longer parking times were allowed at low-demand areas; and double-parking decreased by 22%. Over the course of the two-year pilot, parking meter revenue increased by $3.3 million, while citation revenue decreased by $500,000 and growth in revenue from garages slowed by about $900,000 annually. Overall, the SFpark system increased SFMTA annual net parking revenue by $1.9 million, a positive change of 24%. SFMTA also receives revenue from a “parking tax” that comes from private paid parking in the city. For the duration of the SFpark pilot, revenue from the parking tax in pilot areas increased by $6.5 million, or 43% (SFMTA, 2014b).

SFMTA continued and expanded its SFpark program after the end of the federally-funded pilot. By 2018, the program included all 28,000 of the city’s parking meters, and the upper limit on hourly rates had grown to $7.00 (Chinn, 2017).

**Applying the Principles of Fair Taxation**

According to the Institute on Taxation and Economic Policy’s (ITEP) Guide to Fair State and Local Taxes, there are five guiding principles for tax policy. Each of the proposed sources of revenue in this paper will be considered based on how it abides by these principles. Below, each of the five principles is described according to the questions it poses about a given tax policy (Institute on Taxation and Economic Policy, 2011).

| **Equity** | Does the tax system treat different users fairly? Does the tax system ask citizens to contribute according to their ability to pay? |
Adequacy: To what degree does the tax policy contribute to the overall system’s ability to raise enough money to finance public services?

Simplicity: Is the tax easy to understand for users? What is the administrative overhead for the government?

Exportability: Do users from outside the state or locality benefit from the government’s services? Do such users contribute their fair share to its continued operation?

Neutrality: Does the tax or fee impact the decisions that users make? Does it “stay out of the way” of economic decisions?

Principles of Fair Taxation: Analysis of Congestion Pricing

Equity. For users in congestion pricing systems, the tax itself is regressive, as everyone pays the same fee. Furthermore, the fees are generally high enough that driving in congestion zones becomes prohibitively expensive for low income earners. However, in many congestion pricing systems (such as London and Stockholm and the model proposed by New York City), the government uses the revenue generated to fund improved transit service, which primarily serves lower income populations. In such instances, the overall policy aims for progressive outcomes even as this is not a feature of congestion pricing tax.

Adequacy. Congestion pricing systems offer considerable opportunities to generate revenue. An urban center with 100,000 vehicles per day and an average charge of $5 per vehicle would generate $125 million in a year. Existing systems report revenue of more than $150 million annually, with operating expenses generally less than $20 million annually.

Simplicity. Cameras identify and bill roadway users as they pass beneath gantries. In some models, payment is immediately and automatically withdrawn from user accounts; in others, users receive a monthly bill with their charges (similar to a utility bill). Overall, the
systems are clear to users, though they do require considerable investment and operational resources from governments to administer.

*Exportability.* Congestion pricing is highly exportable — and in many cases, it is designed specifically for this purpose. Suburban commuters are a primary target for the tax, and in London and Stockholm, for example, the revenue goes to improve transit service and other amenities that serve urban residents. Thus, the exportability becomes a means for addressing the negative externalities that driving imposes on urban street networks and residents.

*Neutrality.* Congestion pricing explicitly aims not to be a neutral tax. Because it is a Pegovian tax, its objective is to change user behavior by accounting for the externalities of driving. In the systems discussed, user behavior has changed — with vehicle volume diminishing overall and rush hour peaks shifting to other times in the day.

**Principles of Fair Taxation: Analysis of HOT Lanes**

*Equity.* One of the standing critiques of HOT lanes is their inequity. Nicknamed “Lexus Lanes”, HOT lanes have the reputation, and one confirmed by studies, of being viable only to high-income individuals as a way to “pay their way out of traffic” (Malone, 2014). However, because accessing HOT lanes is optional and the lanes themselves do not take away resources (lane miles) from the general public, they do serve as a purely voluntary fee. This voluntary fee pays for and sustains for the resource, with additional income (when it is available) going to pay for other transportation needs.

*Adequacy.* The first priority of HOT lanes is to pay for themselves — a benchmark that gas taxes and other road fees are not currently capable of doing. That said, the high cost of their construction and maintenance inhibits their ability to contribute revenue that is able to greatly impact the overall transportation or general fund budgets.
Simplicity. Like with congestion pricing, the technology for implementation is readily available, while the concept is broadly understood. As on most modern-day toll bridges, cameras identify and bill roadway users as they drive along HOT lane corridors. Overall, the systems are clear to users and not complex to administer for governments.

Exportability. HOT lanes are generally a state government response to a metropolitan issue. The central question of exportability is if non-local users benefit from local resources, and if so, are they asked to pay for it. In the case of HOT lanes, the answer to both these concerns is yes.

Neutrality. Like congestion pricing, HOT lanes specifically aim not to be neutral. As an instance of value pricing, they encourage users to consider how much they value being able to avoid traffic congestion.

Principles of Fair Taxation: Analysis of Demand-Based Parking Rates

Equity. The implementation of demand-based parking rates introduces less equity to on-street parking. Like with HOT lanes, value pricing for parking creates a system where higher-income individuals can afford better access.

Adequacy. The ability to generate significant revenue from such changes depends largely on an area’s existing parking stock. In large, dense cities such as San Francisco, Chicago, or New York, where parking comes at a premium, value pricing can generate significant revenue (see: case study below). In smaller cities, such systems can serve to fund Parking Benefits Districts that reinvest funds back into the areas where they were earned — paying for capital improvements such as street furniture, trees and landscaping, or even more major undertakings such as the burying of overhead wires (Speck, 2018).
Simplicity. Value priced parking can be implemented as a low-tech solution (some parking meters cost more than others) or through sophisticated technology (roadways sensory systems) that requires substantial investment. Thus, the degree of simplicity is somewhat varied.

Exportability. Value priced parking is exportable in that it generates revenue from local and non-local users alike.

Neutrality. As was the case with both congestion pricing and HOT lanes, value pricing for parking explicitly attempts to impact user decision-making; thus, it is a fee that is distinctly not neutral.

Summary Table

<table>
<thead>
<tr>
<th></th>
<th>Congestion Pricing</th>
<th>HOT Lanes</th>
<th>Demand-Based Parking Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity</strong></td>
<td>✗ ✗ ✗ (as a tax)</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td></td>
<td>✓ ✓ ✓ (as a policy)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Adequacy</strong></td>
<td>✓ ✓ ✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td><strong>Simplicity</strong></td>
<td>✗ ✗ ✗</td>
<td>✓</td>
<td>✓ (low-tech)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>✓ (high-tech)</td>
</tr>
<tr>
<td><strong>Exportability</strong></td>
<td>✓ ✓ ✓</td>
<td>✓ ✓ ✓</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td><strong>Neutrality</strong></td>
<td>✗ ✗ ✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td><strong>Type of Congestion</strong></td>
<td>Regional</td>
<td>Highway</td>
<td>On-Street Parking</td>
</tr>
<tr>
<td><strong>Solves Congestion</strong></td>
<td>✓ ✓ ✓</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>
Recommendations

As solutions to structural budget challenges, each of the proposed tax policies offers the promise of generating considerable revenue. Congestion pricing is, by far, the farthest reaching in terms both of revenue and of impact — so much so that it is probably too narrow to call it simply a roadway tax, as its impacts are intended to be wide-ranging. Regions use congestion pricing as a way to transform the entirety of their urban transportation systems, allocating revenues generated by drivers to provide more frequent and widespread transit service and to build a more pleasant urban environment — one with more trees, wider sidewalks, less congestion, less noise, fewer crashes, less severe injuries, and higher air quality — all while re-orienting transportation spending to be more fiscally sustainable for the government.

Viewed narrowly through the lens of financial viability, there are very few metropolitan areas in the US with the critical factors — density and reliable mass transit, most notably — to support a congestion pricing system. Stockholm is the least dense of the global cities that have implemented congestion pricing, with 11,000 people per square mile. Eight US metropolitan areas meet that threshold for density (New York City, Los Angeles, Chicago, Miami, San Francisco, Boston, Philadelphia, and Washington, DC), and only six of those cities (New York, Chicago, San Francisco, Boston, Philadelphia, and Washington, DC) have the mass transit infrastructure in place such that a congestion pricing system would not impose an undue burden on a significant percentage of their populations. Discussions of a region’s density and overall transit system are inexact metrics, to be sure. But with only three large-scale systems existing in the world, there is no formula that can model precisely how a metropolitan region will respond to such a jolt to its transportation system.
As a thought experiment, one can imagine that in the large, dispersed metropolitan regions common in the American South (Raleigh-Durham, Houston, Dallas-Fort Worth, Nashville, Atlanta, etc.), a congestion zone in an urban center would not address the area’s congestion problems, since such a large percentage of the region’s economic activity occurs outside of the zone. The large majority of drivers, without having to change their behavior, would be able to avoid the congestion charge, even as they still created congestion in the region.

However, the more densely populated coastal cities in the US serve as potential testbeds for congestion pricing systems. The Boston metropolitan region, for example, is a place where congestion pricing could thrive. A congestion zone such as pictured below is 13 square miles, the same size as London’s and 60% the size of Stockholm’s (which is 22 square miles). The enclosed zone encompasses all of downtown Boston, parts of Cambridge and Somerville, and includes many of the region’s cultural attractions (Fenway Park, the Museum of Fine Art, Harvard, MIT, the North End, Boston Common, etc.).
Boston’s congestion levels are some of the nation’s worst, with one transportation analytics firm calculating that the average Bostonian lost 164 hours and $2,300 to congestion in 2018, making it the most congested city in the country (INRIX, 2019). Meanwhile, the region’s transit system, the Massachusetts Bay Transit Authority (MBTA), suffers from a structural deficit of $37 million, with annual debt servicing costs of nearly $500 million and an estimated backlog of $10 billion in needed capital investments (Acitelli, 2019; MBTA, 2019). Just as New York State is planning to use funding from its congestion pricing system to invest in the MTA, Massachusetts could establish congestion pricing in the Boston region in order to provide sustainable revenues to the MBTA to create a more adequate funding system.

While congestion pricing systems are suitable only to a select few metropolitan regions in the US, interstate congestion is pervasive, making HOT lanes a solution that many states are already pursuing. The passage of MAP-21 opened up federal funding for projects to implement tolled highways and has resulted in significant growth in HOT lanes. As shown in our case study of Colorado, the state’s number of HOT lane miles has grown from 12 in 2013, the year after MAP-21 was passed, to an expected 223 miles by the year 2023. Washington State implemented a HOT lane on I-405 with federal funding in 2015. By 2024, the state expects to have built a continuous 40-mile HOT lane corridor that spans from south of Tacoma to north of Seattle (WSDOTa). The financial reports from state transportation agencies indicate that this type of infrastructure is successful at raising revenue. For instance, Washington’s I-405 HOT lanes generated more than $100 million in revenue over their first four years, with only one-third of that money going to cover operating expenses (WSDOTb).

Restrictions on how toll revenue can be spent, however, limit the ability of state transportation agencies to invest the funds outside of the immediate corridor. Even with that limitation acknowledged, transportation funding across the nation currently pulls from federal
and state general fund sources. If these HOT lane projects simply create highway infrastructure that is fiscally self-sustaining, they will create massive amounts of savings for transportation agencies that will allow other general fund and transportation department needs to be addressed.

The primary shortcoming of HOT lanes is that they do not solve congestion on a societal level — they only address it for the individual. This differs from congestion pricing and demand-based parking, which are aimed at addressing the impacts of traffic and parking congestion so that all users of the system benefit. HOT lanes, by contrast, depend on congestion as a means for generating revenue. Without it, there is no need for drivers to use a HOT lane. As such, HOT lanes are an inequitable approach to addressing congestion — a solution that does not serve society at large and is priced specifically toward those who can afford it. HOT lanes are almost literally a work-around, not a solution, to the problem.

With this in mind, CDOT’s efforts to implement bike paths and bus lines along their HOT lane corridors point to a way by which transportation departments can use the federal restrictions on revenue spending to create interstate highways that are multimodal. Such changes would serve a broader spectrum of users and incentivize means of transportation that do, in fact, mitigate congestion.

Finally, demand-based parking serves as a solution that can be implemented by cities in one of two ways — either through parking rates differing by location and time or through a technology-driven approach that dynamically changes pricing. Flat rates tend to undercharge the level of demand for on-street parking. Cities should recognize that their underpriced parking resources create parking congestion and represent lost potential revenue. Furthermore, for the vast majority of cities, it is not necessary to invest in sophisticated technology comparable to San Francisco in order to understand where parking demand is being undercharged.
On-street parking in the Bonnycastle neighborhood in Louisville, KY, is free after 6:00pm. However, due to its assortment of shops, restaurants, and bars, parking demand is often at its highest during when parking fees are no longer in effect. (Photo courtesy of Google.)

In Louisville, KY, for example, the Bonnycastle neighborhood is a social hub on weekend nights and evenings, at the same time when on-street parking is free. The city could simply extend parking meter hours past 6:00pm (when they currently end) until 10:00pm or 12:00am in order to generate additional revenue. In such scenarios, parking fee advocates Speck and Shoup suggest that cities should establish Parking Benefit Districts (PBD) that reinvest the parking revenues back into these areas as beautification projects — burying overhead power lines, planting trees in their place, extending curbs to calm traffic, adding street furniture, and installing more on-street parking meters — all as a way to drive more demand for the area, more parking revenue, and higher property values (Speck, 2018). A typical mid-sized US city such as Louisville might have three to five such areas where high demand in the evenings and on weekends could be met with a simple market-rate parking fee.
For the largest US cities where parking is almost always in high demand, San Francisco’s SFpark program should serve as a model. As evidenced by the pilot project, dynamic pricing can both alleviate parking congestion and produce millions of dollars in additional revenue.

**Key Takeaways**

<table>
<thead>
<tr>
<th>Congestion Pricing</th>
<th>While potentially transformative for a region’s transportation system, congestion pricing is probably only viable in very dense, urban regions with robust transit infrastructure.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOT Lanes</td>
<td>Though limited in their ability to address congestion for society at large, HOT lanes are capable of being fiscally self-sustaining infrastructure.</td>
</tr>
<tr>
<td>Demand-Based Parking</td>
<td>Viable in cities in all sizes and capable of addressing parking congestion in busy areas, the implementation of demand-based parking rates can be technologically sophisticated or simple and straightforward.</td>
</tr>
</tbody>
</table>

**Conclusion**

While this paper explored three potential solutions for generating revenue from overwhelming roadway demand (i.e., congestion), there are other relatively new roadway taxes and fees that also attempt to address funding gaps in state, transportation, and city budgets. For example, transportation budgets are broadly dependent on the gas tax, but as cars become more fuel efficient, electric and hybrid vehicles become more common, and gasoline prices stagnate, those budgets are becoming more strained. A vehicle miles traveled tax could serve as a replacement to the gas tax, in order to generate a more predictable and adequate amount of revenue. Oregon has piloted such a system, and many other states have discussed the idea.

In a number of cities, traffic signal cameras have been used to automatically fine drivers who are speeding or who run red lights. The dangers caused by reckless driving are yet another
externality of vehicle usage. Such camera systems would encourage safer driving, while charging drivers for the negative impacts their behavior imposes on society at large. In New York City, over a three year timeframe, the speed camera program collected $123 million in fines, against $70 million in operating expenses (Speck, 2018). Again, such systems are not widespread and are politically unpopular in many places, but the existing instances show that they can generate substantial revenue.

For the purposes of this paper, we have attempted to show that demand-based fees on roads and parking have the ability to provide considerable revenue to state transportation agencies and municipalities. Congestion pricing serves as an all-encompassing transportation solution — one that charges for the externalities of driving in order to generate revenue that builds a more fiscally and environmentally sustainable transportation system. As such, the potential revenue it can generate is immense, but so is the political will needed to implement it. Furthermore, in many American cities, it simply is not an appropriate solution — given its scale and the necessary conditions needed to make congestion zones viable. This paper has proposed that urban density and robust existing transit infrastructure are two of the necessary ingredients to make congestion pricing systems work. As the New York City system comes online in 2022, one expects to see comparably large American cities begin to consider similar systems, as well as academic research on the effects of the New York model — effects on congestion, effects on transit performance, effects on cycling and walking rates, effects on government budgets, effects on quality of life, and effects on property value, among others.

While congestion pricing is still not yet in its infancy in the US, HOT lanes have become popular and are moving into their adolescence. Many states, such as Colorado and Washington, have more HOT lanes planned than built — suggesting that early returns on the systems have been positive. This paper has argued that such systems do little to relieve
congestion for society at large, and that restrictions in the federal law MAP-21 make it difficult for transportation agencies to spend funds toward that end. Assuming congestion levels stagnate while revenues grow, it will be interesting to see if regulations loosen and states receive permission to allocate funds to other parts of their transportation system. Such a change could make HOT lanes more akin to congestion pricing in their ability to serve the entirety of the transportation network — while being a more politically palatable, less burdensome solution. As the number of HOT lane mileage and projects grow, future research should focus on best practices for funding their construction, for setting toll rates, and for improving equity and access.

For municipalities, demand-based parking rates can be a simple way to generate revenue from an underpriced resource. Using the parking as a benefits tax to improve specific districts is one possible implementation; however, the extra funding can also simply go toward general fund budget balancing. San Francisco, with its pilot program in a technology-driven dynamic parking rate system, demonstrates that parking revenues can be a robust source of revenue for city governments, especially large ones where parking congestion is pervasive.
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