

SHOULD THE U.S. MOTOR FUEL TAX BE RETAINED OR REPLACED?
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ABSTRACT

Two national commissions established by the U.S. Congress advocate replacing the current system of funding transportation based on the gas tax with a new distance-based system of user fees. The State of Oregon has done a pilot project demonstrating a system for transitioning to mileage-based fees by paying the fees at the gas pump. The University of Iowa is currently conducting pilot tests around the country to determine how drivers respond to a mileage-based fee approach using GPS-based technology.

While there is a growing consensus among many transportation leaders that the gas tax is no longer a good way of financing the transportation system, there is by no means a public understanding of why this is so. The public assumes that the taxes they pay at the pump are paying for the system, and that whatever funding problems exist with the system are due to waste and inefficiency. This paper will examine the gas tax on the basis of tax policy principles – Efficiency, Equity, Revenue Adequacy and Sustainability, Environmental Sustainability, and Feasibility.

Keywords: fuel taxes, transportation funding, tax policy, VMT fees

INTRODUCTION

This examination of motor fuel taxes, which is part of a larger research effort regarding transportation-related user fees, endeavors to answer the question, “Should the U.S. motor fuel tax be retained or replaced?” This somewhat provocative question is being asked in the context of recent reports by two national commissions charged by the U.S. Congress to examine the state of current and future funding mechanisms for financing the nation’s transportation infrastructure. These reports, one by the National Surface Transportation Policy and Revenue Commission (2007), and one by the National Surface Transportation Infrastructure Commission (2009), examined motor fuel taxes as well as other taxes and fees currently being used to fund the surface transportation infrastructure. These reports point out the many historical and current shortcomings of motor fuel taxes, and recommend that more direct forms of transportation user fees (such as mileage-based user fees) be seriously considered as future alternatives to fuel taxes.

This paper is a synthesis of previous research and analysis regarding motor fuel taxes. However, our novel approach has been to examine the attributes of the motor fuel tax in a comprehensive way, evaluating them from the perspective of five tax-financing principles, namely: Efficiency, Equity, Revenue Adequacy and Sustainability, Environmental Sustainability, and Feasibility. This paper focuses on the U.S. Federal and state surface transportation funding mechanism that is characterized by fuel-tax based trust funds. Thus, our discussions primarily center on highway development. We do address transit funding, but only to the extent that Highway Trust Fund proceeds are partially allocated to transit.

This paper is the first phase of a four phase project which seeks to set the stage for a policy discussion on transportation-related user fees in the United States. In subsequent papers, we will also evaluate the attributes of alternatives to the motor fuel tax, particularly mileage-based user fees, using the same principles enumerated above. In addition, we will explore the outreach and education effort—with the public, stakeholders and policy-makers—that will be necessary if we are to transition to a more direct user fee approach for transportation system funding. Although this paper will not directly answer the question of whether the fuel tax should be replaced or retained, when viewed along with the other phases of our research insights can be gained on the relative strengths and weaknesses of the fuel tax when compared to mileage-based user fees.

Before we begin our analysis, it is important to note the distinction between the terms tax and fee. From a public finance perspective, a tax is a charge levied upon individuals and corporations for general revenue purposes. A user fee, on the other hand, is a targeted fee levied upon users of a specific government service for the use of that service. In this paper, we examine how fuel taxes as user fees perform under public finance principles.

EFFICIENCY

Under the efficiency principle we evaluate fuel taxes on three different criteria: how well they lead to efficient user behavior, how well they direct transportation investment, and how well they lead to efficient land use. For a tax to encourage efficient user behavior, it should send the right price signals to drivers so that only those drivers who value the use of the road above the cost they impose will use it. As we will see, fuel taxes send weak price signals to drivers and thus lead to inefficient overuse of the highways. This is the result of users underpaying for system use, and users being unaware of what they do pay in fuel taxes. Overuse, in turn, leads to high levels of congestion, emissions, and an unbalanced ratio of auto to other transportation modes. In addition to sending weak price signals, fuel taxes also fail to provide proper price signals to public officials and investors and thus fail to direct investment to the most economically worthwhile projects. Finally, fuel taxes have little connection to efficient land use, and do not discourage urban sprawl or violation of livability principles.

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Overuse of transportation system

For a tax to lead to efficient use of the transportation system it must make users pay the full costs to society of their use. As stated by Small et al. (1989, p. 9),

“The best way to economize...is to apply a user charge equal to the actual cost each user imposes on society through his effect on the road’s condition and on the speed that other users can travel. Such a charge, known as the marginal-cost user charge, ensures that the independent decisions by users reflect the interests of all...If road users are required to incur this entire amount themselves, they will use the highway (at that time and place) only if the value to them of doing so exceeds the amount society must pay...”

In our current transportation system, fuel taxes cannot be considered what Small et al. calls marginal-cost user charges, as they fall short of covering the costs imposed on the system by each individual user and thus lead to an inefficient overuse. While the average user only pays about three cents per vehicle-mile travelled in fuel taxes, a driver on a congested highway imposes costs of 10 to 29 cents per vehicle- mile travelled (Atkinson 2009). As noted by Robinson (2008, p. 2) and others, “Unpriced commodities, such as the current transportation system capacity, are viewed by users as being “free” and lead to excessive use. In the case of roads, this unconstrained demand results in high levels of congestion and delays and an associated reduction in safety and air quality.”

Users underpaying for system use, and the unconstrained demand that results, can lead to over-production of highway capacity. This is because the congestion that results from underpayment sends signals to public officials that highways need to be widened and expanded to accommodate peak travel demand. Furthermore, it is possible that user underpayment leads to under-investment in some instances, because insufficient fuel tax revenue is raised to complete worthwhile projects.

In addition to user underpayment, and the resulting system overuse, many users are unaware of what they pay to use the system. In its findings and recommendations, the National Surface Transportation Infrastructure Financing Commission (2009, p. 7) noted that, “[S]ystem users are typically unaware of how much they pay in fuel taxes (as distinct from the price of gasoline), such that daily swings in price mask the tax component and blunt its effect on demand...” Surveys show that users are typically unaware of the amount they actually pay in fuel taxes. A report prepared for the Minnesota Department of Transportation found that, in general, survey participants were unaware of what they paid in gas taxes (Fichtner et al. 2007). Participants’ estimates of the current gas tax rate (the state gas tax was 20 cents at the time) ranged from .009 cents to one dollar per gallon. If users are unaware of how much they pay in fuel taxes, they will also be unable to make the connection between what they pay and the effect their travel has on congestion, emissions, and the unbalanced ratio of auto to transit use.

Effect on roadway congestion

When drivers use a congested road, the cost they impose on society is higher than the cost when using an uncongested road. One of the main impacts of congestion on road system expenditures is the pressure it puts on road authorities to “fix” the congestion problem. The fix often takes the form of costly road capacity expansion, or sometimes costly transit capacity and service improvements, or setting up less costly, but often less effective, congestion management programs. A study by Winston and Langer (2006) estimated that one dollar of government spending on highways reduced road users’ congestion costs by only eleven cents. From this finding the study went on to estimate that states would have to spend nearly \$350 billion annually to eliminate congestion costs. These costs, and the need for costly road expansions, could largely be reduced if demand during peak-use periods were reduced. A second cost factor resulting from congestion is the increase in emissions, which impose

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health as well as environmental costs to society. A third factor is the increase in cost associated with each user slowing the speed of all other users on a part of the system at a particular time. This cost is expressed in terms of time lost due to delays times the value of time of different users.

Another reason why fuel taxes send weak price signals is that they are fixed, per-gallon taxes. As stated by the National Surface Transportation Policy and Revenue Study (2007 p. 5.39), “Motor fuel taxes are not economically efficient because they do not vary as the cost of travel increases. They do vary with vehicle fuel efficiency, but the decline in fuel efficiency when vehicles operate in congested traffic does not reflect the full costs of travel in congested conditions.” Since fuel taxes are undifferentiated for different times of use or different parts of the system being used, they are unable to effectively price for congestion and avoid overuse of the system. Experience has confirmed that when pricing mechanisms are implemented to make users face the full costs of their travel, users do in fact change their behavior (Rufolo 2003). In fact, in the first few months after congestion pricing was implemented in London, automobile traffic declined by about 20 percent (Litman 2004). Similar results were experienced in Stockholm (Robinson 2006).

The inability of fuel taxes to price congestion is one of the contributing factors in our nation’s growing congestion problem. Annual delay per peak period traveler rose from 21 hours in 1982 to 51 hours in 2007 in the nation’s 14 largest urban areas (Texas Transportation Institute 2009). This growing rate of congestion imposes real costs to users and the economy as a whole. Using value of travel time (estimated at \$15.47 per hour of person travel and \$102.12 per hour of truck time) and excess fuel consumption (estimated using state average cost per gallon), the Texas Transportation Institute (2009) estimates the total cost of congestion in the nation’s urban areas for 2007 at approximately \$87.2 billion. In addition to individual users, businesses are also hurt by congestion. In part because of rising congestion, the logistic costs for American businesses rose to 10% of GDP in 2006 (National Surface Transportation Policy and Revenue Study Commission 2007).

Effect on mode shift

In part because fuel taxes are unable to price congestion, they send poor price signals to users regarding the tradeoff between using the highway system versus using transit. Lewis (2008) notes that it should come as no surprise that while our roadways are congested, there is little use of public transit. This is due, in part, to users not being aware of the true cost of their travel. Because the cost users pay for auto and truck use on the highway system is below the socially optimal cost, auto and truck use looks relatively inexpensive compared to transit and freight rail. If the gas tax reflected true costs, including congestion and environmental costs, it is likely that, over time, some users would shift to transit and freight rail. As Wachs (2003a) points out, raising the gas tax sends price signals to motorists to use the transportation system more efficiently as it encourages motorists to switch to public transit to save money.

While our highway system is experiencing growing levels of congestion, our freight rail system remains relatively uncongested. In 2006, 88% percent of the freight rail corridors were operating at below practical capacity (National Surface Transportation Policy and Revenue Study Commission 2007). Thus, if fuel taxes were reformed to more accurately price highway use, the result would most likely be a more balanced use of the highway system compared to the rail system. It should be noted however, that although fuel taxes introduce a distortion to the balance of the transportation system, there are other reasons for the unbalance (Mohring 1972). Furthermore, transit, like the highway system, is underpriced and thus costs are not fully covered.

In addition to sending price signals that lead users to shift away from peak period travel, and auto and truck trips to shift to transit and freight rail, respectively, a properly set tax could help reduce the number of less-than-full truckload and empty trips. Once again, because fuel taxes do not price the use of the system at the full cost imposed by users, shippers have less of an incentive to reduce less-than-

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full truckload trips, including “empties”. Robinson (2008) found that the introduction of heavy vehicle tolling in Germany, which priced trucks per-kilometer of use of the Autobahn and more closely reflect full internal costs (on top of the gas tax), resulted in about a 20 percent reduction in the number of empty truck trips. The pricing of trucks was based on maximum rated gross vehicle weight, which meant that empty trucks were charged the same rate per mile as fully-loaded trucks. This gave rise to load consolidation brokers, and led to greater efficiency in truck operation.

Inefficient investment in transportation

Small et al. (1989, p. 9) explains that, in addition to leading to a more efficient use of transportation capacity by users, another advantage of marginal-cost user charges is that, “[T]he resulting revenues provide a tangible signal to public officials as to whether additional investments to provide more or better services are likely to be worthwhile.” Thus, by properly pricing roads to reflect the true costs of use, public officials and investors are able to get a more accurate picture of the demand for more or better service.

As we have seen, fuel taxes do a poor job of accurately pricing the social costs of highway use and lead to inefficient overuse of the capacity. Because of this, they also lack price signals to help direct investment to the most worthwhile projects. Users underpaying may cause too little transportation investment, as fuel taxes do not raise sufficient funds for economically justifiable projects. Users underpaying and the resulting unconstrained demand, may also lead to over production in some instances. As stated by Lewis (2008, p. 30), “Because the absence of congestion pricing encourages peak period demand that would not otherwise arise, the need for highway investment is increased accordingly... the federal taxpayer should not be burdened by investment costs that are not economically justified.” Thus, fuel taxes not only lead to excessive congestion, but also to excessive highway investment. A study by Boarnet (1997), which estimated county level production functions, found that while there was strong evidence that congestion reduction can affect county output, there was weaker evidence that street and highway capital stock increases were productive. In their findings and recommendations, the National Surface Transportation Financing Commission (2009) concluded that greater use of pricing mechanisms such as a mileage-based pricing approach may lead to more efficient investment and reduce the need for additional capacity that may otherwise be built, by shifting demand to off-peak hours and to other transportation modes.

Inefficient land use

In addition to failing to provide price signals which lead to a more efficient use of the roads and to more efficient investments, fuel taxes also fail to lead to efficient land use. On this criterion, fuel taxes are problematic; as Langer et al. (2008, p. 127) states,

“By undercharging vehicles for using the nation’s roadways, policymakers have also reduced the per-mile cost of commuting...and distorted the development of metropolitan areas by inducing households to live in more distant, lower-density locations, thereby contributing to urban sprawl...it is likely that households’ decisions regarding residential locations...have resulted in socially inefficient outcomes because they reduce economies of agglomeration.”

Once again fuel taxes’ inability to price roads to reflect the true costs imposed by the user leads to inefficiencies. Long-distance commuters do not have to pay their full cost of travel, which is a built-in incentive to locate to more distant locations to take advantage of lower home prices, which in turn contributes to urban sprawl. According to the census, from 1970 to 2000 central city density declined by approximately 35% (Langer 2008). It should come as no surprise that during this same time period fuel taxes’ ability to recover the full costs of use was significantly eroded.

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Summary

On efficiency grounds, fuel taxes fare poorly:

- Fuel taxes do not price for the total cost to the system for each trip, which leads to inefficient overuse. Fuel taxes' inability to price for congestion exacerbates this problem and leads to excessive delays, which comes with stiff costs to users and businesses.
- Use of fuel taxes as pricing mechanisms may also contribute to an unbalanced ratio of auto and truck use versus transit and freight rail use, leaving our highways congested while use of public transit and freight rail remain, generally, below capacity.
- In addition to contributing to an inefficient use of the system, fuel taxes lead to inefficient system investments as they provide poor price signals to public officials and investors: Investments are sometimes made in projects that are overused, rather than in the most worthwhile projects.
- Finally, fuel taxes' failure to accurately price the use of the system has contributed to urban sprawl because fuel taxes result in low per-mile cost of commuting and induces households to live in farther, low-density locations.

EQUITY

In revenue analysis, the equity criterion is often assessed based on two principles: (1) a benefit-received (or "user-pays-and-benefits") principle, which is applied to user fees to examine the extent to which users pay in proportion to their amount of use and to the costs they impose on the system, and (2) the ability-to-pay principle (social equity), which relates relative revenue burden to people of different income brackets. In the US, the motor fuel tax system was originally created as a user fee, and thus we focus the majority of our analysis on the user-pays-and-benefits principle. Nonetheless, we will also consider social equity considerations in our analysis.

Motor fuel taxes as user fees

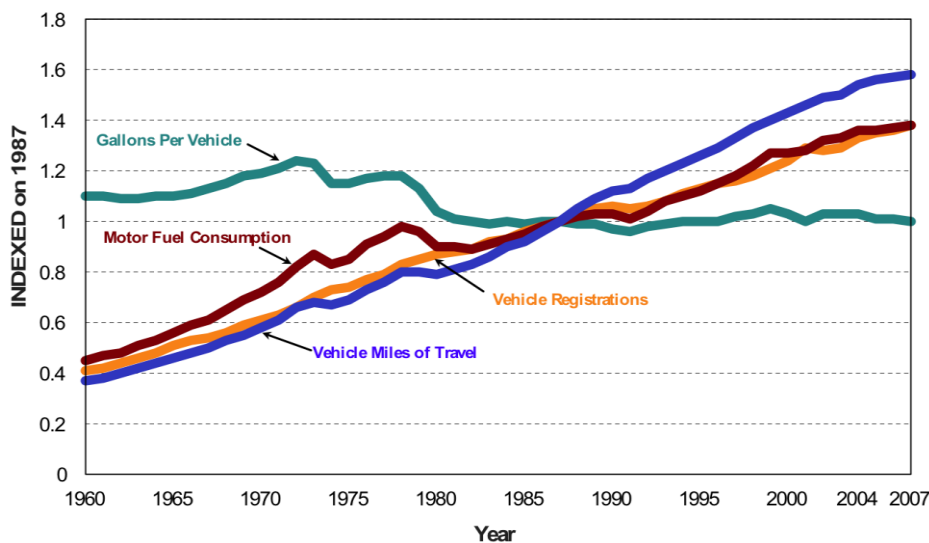
In this section, we begin our analysis with an evaluation of how closely motor fuel taxes, as user fees, adhere to the user-pays-and-benefits principle. It is important that we remind ourselves what we mean by user fees. These are fees collected from those who use a particular service, as opposed to fees collected from the public-at-large. User fees apply to activities that generally provide special benefits to identifiable recipients or beneficiaries, and fees generally vary in proportion to degree of use.

This users-pay-and-benefit principle was well understood at the state level in the 1950s when several states were dedicating their gas tax revenue for highway improvements (Patashnik 2000). The Federal Government first imposed a tax on gasoline fuel under the Revenue Act of 1932 (Federal Highway Administration 2008); however, the federal gas tax could not be considered a user fee that upheld the user-pays-and-benefits principle until the creation of the Highway Trust Fund in 1956, when gas tax revenue began to be specifically allocated for transportation (Small 1989). In his book, Putting Trust in the US Budget: Federal Trust Funds and the Politics of Commitment, Eric Patashnik states, "The Highway Trust Fund also signaled a political commitment that Congress would forgo the temptation to use highway revenues as a lucrative source of funding other programs. [In addition,] Highway tax rates would be kept no higher than necessary to meet the costs of the highway program." (2000, pp. 117-118). Thus, with the inception of the Highway Trust Fund, the gas tax would satisfy the user-pays-and-benefits principle, since fees collected from users would benefit users through improvements to the highway system, and fees would be set to meet the costs imposed on the system by the users. Today fuel taxes still function as a user fee; however, as currently applied, fuel taxes violate the user-pays-and-benefits equity principle in many ways.

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Improvements in fuel efficiency

One of the most significant reasons why fuel taxes no longer uphold the user-pays-and-benefits principle has been the improvements in motor vehicle fleet fuel efficiency that have occurred since the 1970s. In 1975 the average fleet fuel economy was 13.1 miles per gallon; by 2008 it was 20.4 mpg, a 56 percent improvement. This significant improvement has caused users on the whole to pay less per vehicle-mile travelled. The Environmental Protection Agency (EPA) estimate of 20.4 mpg fleet average for 2008 light duty-vehicles is an eight percent increase from their estimate for model year 2004 (Environmental Protection Agency 2008). These increases in fuel efficiency are a large reason why today's overall user fee, estimated at three cents per mile (Atkinson 2009), is well below the six cents-per-mile user fee of the 1960s (Morris 2006). Figure 1, taken from the Federal Highway Administration's website, shows that the increase in vehicle-miles travelled has outpaced the increase in motor fuel consumption. In fact, from 1987 to 2007, vehicle-miles travelled increased by approximately 58 percent, while motor fuel consumption increased by approximately 38 percent (Federal Highway Administration 2009d).



(Federal Highway Administration 2009d)

Figure 1: Motor Fuel Consumption, Vehicle Miles of Travel, and Vehicle Registrations

The trend of increasing fuel efficiency for the overall fleet is expected to continue as average fuel economy for new vehicles accelerates (Energy Information Administration 2009). The Energy Information Administration (2008) estimates that average fuel efficiency for all light-duty vehicles on the road will grow from 20.4 mpg in 2008 to 28.9 mpg by 2030. A report of the National Surface Transportation Infrastructure Financing Commission (2009) found that the current federal surface transportation funding structure, which relies heavily on motor fuel taxes, is not sustainable and is likely to erode more quickly than previously thought due, in large part, to a drive for greater fuel efficiency caused both by heightened concerns over global climate change and by an effort to reduce dependence on foreign energy sources. The commission went on to state that fuel taxes and other user fees account for less than 60 percent of total transportation system revenue (federal, state, and local), which clearly shows that users do not bear the full cost of their travel. Going forward, as fuel efficiencies increase and users pay less in fuel taxes per mile travelled, fuel taxes will account for less and less of the system cost imposed by users.

The Energy Information Administration (2009), gives the projected fuel economy of new light-duty vehicles under five different scenarios: high oil prices, high levels of technological advancement, a reference group, low oil prices, and low levels of technological advancement. Under all five scenarios average fuel economy of new light-duty vehicles is expected to grow to between 36 and 39 miles per

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gallon by 2030. This level of fuel efficiency may be reached even sooner, as the current administration has set a new CAFE (Corporate Average Fuel Economy) standard of 39 miles per gallon for new passenger cars and 30 miles per gallon for light trucks by 2016. These increases in fuel economy will exacerbate the equity problem under the user-pays-and-benefits principle, as those with newer cars pay increasingly less in fuel taxes per mile travelled than drivers with similar, but older and less fuel-efficient vehicles, even if both types of vehicle owners travel the same distance and impose the same cost on the highway system.

Use of alternative fuel vehicles

While increasing fuel efficiencies have allowed users with more fuel efficient vehicles to pay less in taxes per vehicle mile travelled, the introduction of alternative fuel vehicles makes it possible for some users to pay very little or no fuel taxes. The Environmental Protection Agency (2008) estimates that 2 percent of the model year 2009 fleet will be hybrids. While plug-in hybrids and electrical vehicles still make up a small minority of all drivers, they nonetheless represent a significant violation of the user-pays-and-benefits principle since a substantial part of their propulsion is powered by electricity and thus not subject to fuel taxes. For users with vehicles powered entirely by alternative fuels, the user-pays-and-benefits principle is completely violated since these users pay no fuel taxes, even though they impose costs on the system and benefit from system improvements paid for by other users.

Not all users pay the fuel tax

The user-pays-and-benefits principle for fuel taxes is further eroded by the extent that groups of users do not pay their fair share of fuel taxes. This comes in the form of exemptions and outright evasion.

Federal law exempts users such as state government, non-profit educational organizations, and emergency vehicles from having to pay gas taxes (National Surface Transportation Infrastructure Financing Commission 2009). Subsidies are also provided for users of gasohol (National Research Council 2006). In terms of evasion, there are several forms including bootlegging across state lines, diluting the blend, and “daisy chains” (creating a dummy corporation and a fraudulent and complex trail of paperwork) (Denison et al. 2000a). As stated by Denison and Eger (2000b, p. 171), “Like all types of tax fraud, evasion of the motor fuels tax is an elusive and burgeoning threat, its methods constantly evolving and adapting to new enforcement methods.” The National Surface Transportation Infrastructure Financing Commission (2009) notes that evasion remains a problem, even though progress has been made in recent years through legislative changes and increased enforcement. Total fuel tax evasion at the state and federal level may exceed one billion dollars annually or 3.5 percent of total federal motor fuel tax revenue.

Other studies have tried to estimate motor fuel tax evasion. The Federal Highway Administration (1992) estimated that in 1993 the evasion rate for federal gas tax was between three and seven percent and the evasion rate for federal diesel tax was between 15 and 25 percent. The Federal Highway Administration (1999) estimated that in 1994 the combined state and federal fuel tax evasion approached three billion dollars annually. In their article, *Cheating Our State Highways: Methods, Estimates and Policy Implications of Fuel Tax Evasion*, Denison et al. (2000a) state that, for Kentucky, diesel revenue would increase by eight percent and gas revenue would increase by three percent if evasion was completely eliminated in the state. Their study also suggests that increasing the gas and diesel fuel tax in the state of Kentucky by 10 cents may increase evasion by 37.5 percent. While various estimates of fuel tax evasion have been made, changes in enforcement have made estimating evasion difficult, and the Federal Highway Administration’s Office of Transportation Policy Studies (2009b) now states that reliable estimates of evasion are not available. While an estimate of losses due to evasion is not currently known precisely, it can credibly be stated that significant losses do occur.

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Full cost recovery of internal costs

Closely related to the user-pays-and-benefits principle is the concept that payments should be based on full cost recovery. This encompasses both internal costs, such as road construction and maintenance, and external costs, such as pollution and congestion effects. Users do not bear the full costs of their travel, and fuel taxes make up less than 60 percent of total system revenue (National Surface Transportation Infrastructure Financing Commission 2009). In 2008 the Highway Trust Fund necessitated an eight-billion dollar transfer from the general fund to keep it solvent and, in the face of continuing deficits, the fund will require additional regular infusions unless structural problems faced by fuel taxes are corrected. Several studies and economists have noted that fuel taxes would need to be greatly increased to be able to meet full cost recovery, with some estimates suggesting increases to over \$1.00 (Wachs 2003a).

Taking a closer look at costs, we first turn to a discussion of internal costs. Small et al. (1989, p. 10) states, "Charges associated with scarce durability, which causes road wear (that is, pavement deterioration), should reflect a vehicle's contribution to this wear." In other words, part of user fees should go towards recovering the costs they impose on the deterioration of the roads they use. Martin Wachs (2003a) suggests that fuel taxes fare relatively well in recovering internal costs: heavier vehicles pay more in fuel taxes because they are less fuel efficient. Small et al. (1989), however, notes that, while structural damage to roads is caused mostly by trucks and buses, it is not total weight but weight per axle that is important. (It should be added, however, that total weight is relevant when assessing structural damage to bridges.) Since fuel taxes, as collected in most states, do not discriminate based on weight or number of axles, they are unable to have much precision in charging users to make up for internal costs (Small et al. 1989). Furthermore, while heavier trucks do pay more in fuel taxes than lighter trucks, the extra amount they pay normally does not make up for the sizable added amount of wear and tear they impose (National Surface Transportation Infrastructure Financing Commission 2009). According to the Federal Highway Administration's (2000) Cost Allocation Study, updated in 2000, the equity ratio (ratio of tax and fee payments by type of vehicle and highway costs imposed by those vehicles) is 0.53 for heavier single-unit trucks (over 25,000 pounds) and 0.48 for the heaviest combination trucks (over 80,000 pounds). Even for the bread-and-butter five-axle combination units (50,000 to 80,000 pounds) the equity ratio is 0.83 (Federal Highway Administration 2000). This means that, while it is true that heavy trucks pay higher transportation taxes and fees than light vehicles, they in turn impose substantially higher costs than are recovered through their payments. As the equity ratios for trucks show, automobiles and light trucks are actually subsidizing the cost of wear and tear imposed by trucks on the transportation infrastructure, thus introducing an inequitable situation.

Full cost recovery of external costs

In addition to internal costs, vehicular traffic creates indirect or external costs such as congestion, adverse air quality and health effects, noise and greenhouse gases, among others. These costs are not borne solely by users of the highway system, but by society at large. To be equitable, and to comply with the user-pay-and-benefits principle, fuel taxes, as user fees, should also move towards full recovery of external costs. The idea of correcting externalities with taxes was first developed by English economist A.C. Pigou (1920) in his work, The Economics of Welfare.

In a report by the National Surface Transportation Policy and Revenue Study Commission (2007, pp. 3-13) the authors state, "Without a doubt, congestion is one of the greatest threats to the integrity of the Nation's transportation system and the country's overall vitality and quality of life. Over the past decade, congestion has reached alarming levels across the United States." The external costs from congestion come in the form of economic value of time wasted, extra operating costs of driving under congested conditions, and damage to the environment and human health (Lewis 2008). As stated earlier, while a user on a congested highway generates between \$0.10 to \$0.29 per mile travelled in

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costs, an average user only pays \$0.03 in fuel taxes per mile travelled (Atkinson 2009). As stated by Lewis (2008, p. 19), “By making people aware of the full economic costs of their travel choice, the widespread application of congestion pricing would encourage roadway users to determine whether the benefits of using the road at busy times of the day are worth the full economic implications of doing so.” Lewis goes on to explain that congestion charges are calculated to reflect the costs one driver imposes on all other drivers on the same roadway, and that estimates of these costs range from \$18 to \$40 per hour depending on the given road and time of travel.

Absent congestion pricing, fuel taxes fail to recover the full costs of travel because of their inability to discriminate between users travelling on congested roads and those that do not. Furthermore, congestion costs can vary depending on the time of travel (Small et al. 1989). Since we are unable to vary fuel tax rates for users who travel at peak hours and those that travel during off peak hours, we are also unable to accurately recover costs resulting from different times of travel. As noted in a report by the National Surface Transportation Infrastructure Financing Commission (2009), fuel taxes do not come close to requiring users to bear the full costs of their travel, in part because they have no direct link to the segment of the roadway system being used nor to the time of day.

Fuel taxes are also problematic when trying to recover the external costs associated with pollution. Although vehicles that are less fuel efficient and, generally dirtier, pay more in fuel taxes per mile travelled, the extra amount they pay is usually exceeded by the cost of the extra amount of pollution they contribute (National Surface Transportation Infrastructure Financing Commission 2009).

Fuel tax revenues are used for other purposes

In concluding our analysis of how closely fuel taxes adhere to the user-pays-and-benefits principle, it is important to note that a not-insignificant portion of fuel tax revenues are used for non-highway purposes. Since 1983, a portion of the revenues collected from fuel taxes have been used to fund mass transit projects and, since 1987, a small percentage has been allocated to the Leaking Underground Storage Tank Trust Fund (Transportation Research Board 2006). The user-pays-and-benefits principle was further diminished from 1990 to 1997 when a portion of fuel tax revenues were used for federal budget-deficit reduction (Transportation Research Board 2006). Funds from the Highway Trust Fund have also been used for such things as graffiti elimination in New York, and films about state roads in Alaska (Williams 2007). Some analysts have suggested that nearly 40 percent of federal fuel tax revenues are spent on non-general road projects (Utt 2003).

Ability-to-pay considerations

Horizontal equity

We conclude our discussion of equity and fairness with an analysis of users’ ability to pay. We will do this through the lenses of horizontal and social equity. Horizontal equity can be defined as, “People in equal positions should be treated equally” (Rosen 2005, p. 571). Several issues related to horizontal equity have already been touched on in prior sections. As already mentioned, some users such as emergency vehicles are exempt from the tax and others such as those who use gasohol or have more fuel efficient vehicles pay reduced rates. With the great variation in fuel efficiencies and possibilities for alternative fuel usage, the assumption that heavier vehicles that contribute more to road damage pay more in fuel taxes because they are less fuel efficient no longer holds (Rufolo 2003). The inability of fuel taxes to price congestion also contributes to horizontal inequity as those travelling at peak hours impose more of a cost on the transportation system, but pay relatively the same amount as those travelling at off peak times (Rufolo 2003).

Another horizontal equity issue occurs in the form of jurisdictional inequity. If individual users were to receive benefits in proportion to their user fees, it should follow that states should receive federal

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funds equivalent to their contributed fuel tax revenues. Throughout the years this has not been the case, and a system of donor states and beneficiary states has arisen under the fuel tax system. From the founding of the Highway Trust Fund in 1956 through fiscal year 2005, Texas has been the largest donor state, receiving 88 cents in federal transportation spending for every dollar contributed to the Highway Trust Fund. Alaska has been the largest beneficiary state, receiving \$6.66 in federal spending for every dollar contributed (Williams 2007). In fiscal year 2005 Minnesota was the largest donor state, receiving 87 cents in federal spending for every dollar contributed (Williams 2007).

The Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) attempted to correct jurisdictional inequities by ensuring that states would receive at least a specified percentage of their contributions (Williams 2007). For 2009, the floor rate for federal spending has been set at 92 percent of contributions (Federal Highway Administration 2009a). While the SAFETEA-LU approach lessens the jurisdictional equity problem, it leaves room for persistent inequities as it does not ensure that a state will be compensated at 100 percent, nor does it correct for beneficiary states that receive more than 100 percent of their contributions. In addition to the federal level, jurisdictional inequity can occur at the state level. In many places, the fuel tax penalizes urban areas and benefits rural areas or the suburban fringe (Puentes 2003).

Social equity

Fuel taxes exhibit some social equity issues as well. Social equity can be defined as, “Distributing tax burdens fairly across people with different abilities to pay” (Rosen 2005, p. 576). It is important to note that there is often a trade-off between the user-pays-and-benefits principle and social equity. As mentioned before, since 1983 a portion of federal fuel tax revenues have been spent on mass transit projects. Currently, 2.86 cents of the 18.4 cents federal fuel tax goes to the mass transit account (Williams 2007). In 2004, highway user fees collected at all levels of government, of which fuel taxes are the main component, transferred \$11 billion to transit projects, which amounted to approximately 10 percent of total user fee revenue collected at all levels of government (Transportation Research Board 2006). While this transfer violates the user-pays-and-benefits principle, since highway users do not necessarily benefit directly from these expenditures, using a portion of fuel taxes for mass transit helps provide mobility for disadvantaged groups, but also provides transit choices for auto owners and non-owners alike. Thus, individuals who are unable to drive or afford to drive or choose not to drive, are still granted access and mobility through the mass transit that is funded in part by fuel taxes.

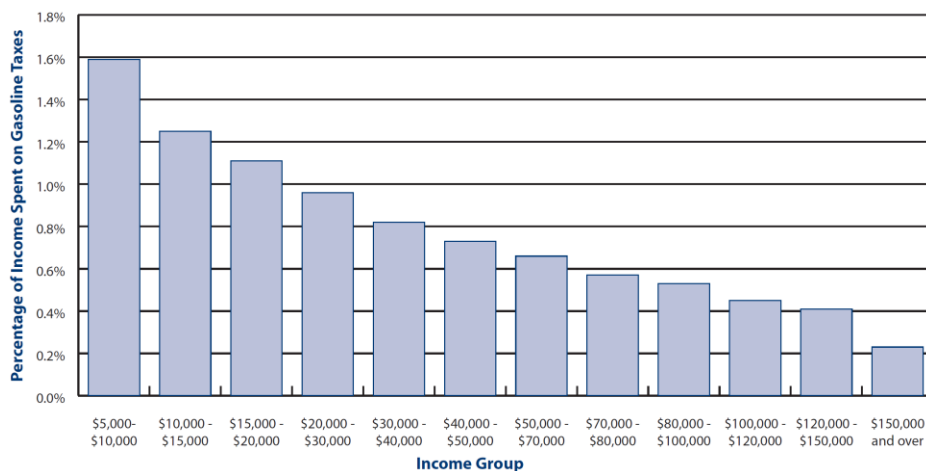
While fuel taxes may aid in providing mobility to disadvantaged groups, it has other social equity issues that negatively affect low income groups. Wachs (2003a) cites fuel taxes as being fairer to the poor than other alternatives as one of his 12 reasons for why fuel taxes should be raised. Wachs concedes that fuel taxes are moderately regressive, but then lists three ways in which fuel taxes are fairer than other forms of funding transportation. First, only the poor who drive, and thus benefit from the roads, pay the tax, while those whose poverty precludes them from driving are not charged. Second, lower income groups are the primary beneficiaries of expenditures on transit funded by fuel taxes, since--on the whole--public transit users have lower incomes than highway users. Finally, in jurisdictions where fuel taxes are kept low, sales taxes, which are roughly as regressive as fuel taxes, are increasingly being used to fund transportation. Thus, by keeping fuel taxes dedicated for transportation, sales taxes can be kept low and sales tax revenue can be used for programs and services that aid the poor (Wachs 2003a).

In contrast, the National Surface Transportation Infrastructure Financing Commission (2009) concluded that fuel taxes were “highly regressive”, and more regressive than a general sales tax. The Commission also indicates that higher income groups are more likely to shift to more fuel efficient vehicles and thus pay less in fuel taxes. Whitty and Svadlenak (2009) build off the Commission’s assertion that higher income groups are more likely to buy fuel efficient vehicles and state that, as new vehicles become more fuel efficient, the stratification between what owners of old vehicles and new

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vehicles pay may become greater without a justification based on road use. Whitty and Svadlenak conclude that the unfairness of this situation might be a worthy reason for certain segments of society to object to fuel tax increases.

Backing the Commission's claim that fuel taxes are highly regressive are estimates found in a Tax Foundation report by Williams (2007). Figure 2, taken from the report, demonstrates the regressive nature of the gas tax. While Americans earning less than \$40,000 pay between .8 and 1.6 percent of their income in gas taxes, those earning over \$100,000 pay between .25 and .45 percent of theirs (Williams 2007). It is important to once again note the trade-off between the user-pays principle and the ability-to-pay principle. While fuel taxes should be increased to adhere to the user-pays principle, this increase would make fuel taxes even more regressive. In his article, published by the Tax Foundation, Williams (2007, p. 17) also adds, "When...serving as a true user fee, the gas tax is simply... 'regressive', only in the same way that...everything else is regressive. But when gas taxes fund 'deficit reduction,' i.e., flow into a general fund with income tax revenue and are spent on general government operations, then the income patterns of gas tax payers becomes a major concern." Williams concludes that lawmakers should keep in mind the regressive nature of fuel taxes when considering whether to raise fuel taxes for non-highway uses.



Source: Tax Foundation, Bureau of Labor Statistics

(Williams 2007)

Figure 2: Percent of Income Spent on Gas Taxes by Income Group

Summary

As we have seen through this discussion, fuel taxes have moved away from the user-pays-and-benefits principle:

- Improvements in motor vehicle fleet fuel efficiency that have occurred since the 1970s have allowed drivers to pay less in fuel taxes per vehicle mile travelled. This trend of increasing fuel efficiency for the overall fleet is expected to continue.
- The introduction of hybrids and alternative fuel vehicles has created an even greater disconnect between system costs and user benefits.
- Not all users pay fuel taxes as some are exempt while others evade payment.
- Fuel tax payments do not cover total internal costs associated with road construction and maintenance. This is especially true for heavy trucks.
- Fuel tax payments do not recover external costs such as congestion and pollution.
- Finally, the user-pays-and-benefits principle is violated as some fuel tax revenues have been used for non-highway purposes such as mass transit.

Fuel taxes are also problematic under the ability-to-pay principle.

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- From the perspective of horizontal equity, several issues touched on regarding violations of the user-pays-and-benefits principle lead to problems in which people in equal positions are treated unequally. Furthermore, as currently allocated, fuel taxes have a jurisdictional equity problem in which there is a disconnect between what a state pays in fuel taxes and what it receives in federal funding.
- Finally, although fuel taxes do help to promote mobility for disadvantaged groups, through public transit funding, there remain social equity issues that negatively affect lower income groups.

REVENUE ADEQUACY AND SUSTAINABILITY

For a tax to perform well under the revenue adequacy and sustainability criterion, the revenue collected should ideally be from a broad base and collected using a low rate. Furthermore, this revenue should be adequate to meet spending demands. Thus, under this principle fuel taxes should collect enough revenue to fund the construction, maintenance, operation and reconstruction of the transportation system. Fuel taxes should also remain a stable and adequate funding mechanism regardless of changes in external factors.

Revenue adequacy

As stated in the equity and fairness section, in 2008 the Highway Trust Fund (which is primarily funded by fuel tax revenue) necessitated an eight-billion dollar transfer from the general fund to keep it solvent. This one time infusion, while significant, only tells part of the story. According to the National Surface Transportation Infrastructure Financing Commission (2009, p. 3),

“Without changes to current policy, it is estimated that revenues raised by all levels of government for capital investment will total only about one-third of the roughly \$200 billion necessary each year to maintain and improve the nation’s highways and transit systems... At the federal level, the investment gap is of a similar magnitude, with long-term annual average Highway Trust Fund (HTF) revenues estimated to be only \$32 billion compared with required investments of nearly \$100 billion per year.”

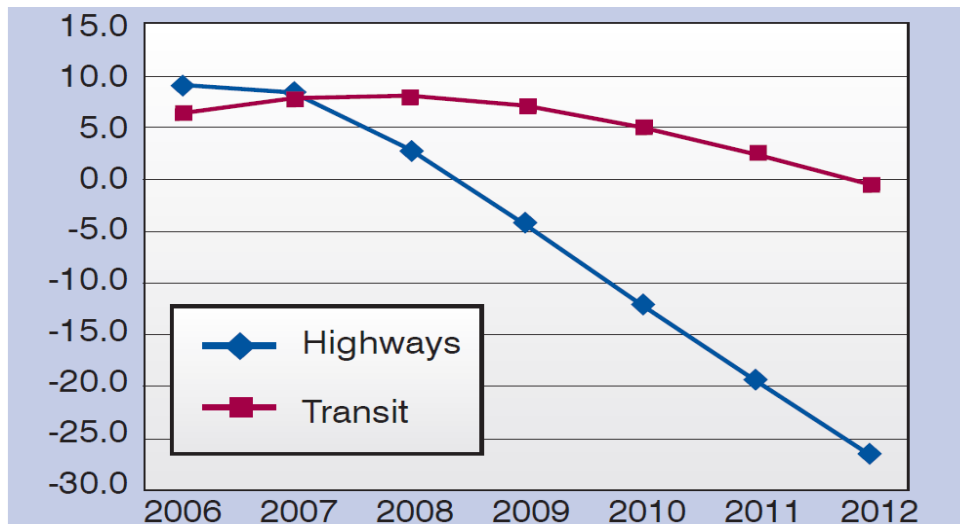
The Commission goes on to explain that the current investment gap is too great to be solved by the economic stimulus package alone. The Commission notes that a stimulus package, which includes \$40 billion for highway and transit projects, would only pay for three months of the annual national funding gap to maintain and improve the system.

It should come as no surprise to many Americans that we have large gaps in financing our transportation system, despite our relatively large tax base. In 2007, there were approximately 205 million licensed drivers in the United States, which represented approximately 68 percent of the population (Federal Highway Administration 2009c). While this is a sizable tax base, current fuel tax rates are below the rate needed to raise sufficient revenue. To get an idea of the U.S.’s relatively low fuel tax rates, it is useful to compare our rates to those of other industrialized nations. While Americans currently pay on average \$0.49 per gallon in federal, state, and local fuel taxes, Canadians pay approximately \$1.26 per gallon, and the Dutch pay \$5.57 (Marsh 2008).

Writing in 2007, the National Surface Transportation Policy and Revenue Study Commission (2007) noted that since 2000 balances in the Highway Account of the HTF have been declining as expenditures have exceeded revenue. Figure 3 illustrates the expected shortfalls in the Highway Account of the HTF in coming years assuming no changes in revenues or program levels.

One of the recommendations made by the Commission to keep the HTF solvent and to make up for the investment gap is to increase the federal fuel tax by five to eight cents per gallon per year for the next five years.

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Source: U.S. Department of the Treasury projections.
 (National Surface Transportation Policy and Revenue Study Commission 2007)
 Figure 3: Projected Highway and Transit Account Balances

Revenue sustainability

Not only are fuel taxes inadequate for generating sufficient revenue, they are unsustainable in the long run. A proper user fee should ensure that revenues are self-sustaining and predictable regardless of changes in external factors. Inflation, changes in the price of fuel and in fuel efficiency, and the introduction of alternative fuels, all lead to revenue sustainability problems. The National Surface Transportation Infrastructure Financing Commission notes (2009, p. 7), “The current...funding structure that relies primarily on taxes imposed on petroleum-derived vehicle fuels is not sustainable in the long term and is likely to erode more quickly than previously thought. This is due in large measure to a drive for greater fuel efficiency, alternative fuels, and new vehicle technology.”

Effects of inflation

Fuel taxes fail to collect adequate revenue, in part, because they are not indexed to inflation. Although the federal gas tax has been raised many times since its inception, it has not kept pace with inflation. In fact, although the federal gas tax has more than doubled since 1983, in terms of purchasing power it remains at approximately the 1983 level (National Surface Transportation Policy and Revenue Study Commission 2007). This Commission suggests that since 1993 the federal gas tax rate has decreased by 40 percent when compared to the Producer Price Index for Highway and Street Construction. The National Surface Transportation Infrastructure Financing Commission (2009) estimates that since it was last raised in 1993, the federal gas tax has experienced a 33 percent loss in purchasing power.

The Policy and Revenue Commission (2007) notes that, since 1980, the Highway Trust Fund has seen substantial growth in current dollars, however growth in constant dollars has been much more subdued. Writing in 2007, the Commission noted that since 2003 HTF revenue had fallen four percent per year in real dollars.

The corrosive effect of inflation on revenue could be eliminated by indexing fuel taxes to inflation. In its findings and conclusions, the Policy and Revenue Commission (2007) notes that a limitation of the fuel tax is that it is not currently able to react to increasing construction costs, and adds that this could be remedied by indexing it to the Consumer Price Index or a targeted measure such as the Producer Price Index for Highway and Street Construction.

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Changes in fuel prices

Small et al. (1989, p. 6) state, “The fuel tax has not always proven a reliable source of revenue; since 1973 receipts have fluctuated along with economic conditions and fuel prices.” Most notably, fuel tax revenue dwindled during the 1970s in part due to the energy crisis (Patashnik 2000). While price spikes tend to cause a reduction in the amount of fuel consumed and thus fuel tax revenue raised, they also lead to a drive for more fuel efficient vehicles thus further reducing the sustainability of fuel taxes. Some analysts have estimated that the average gallons of fuel consumed per vehicle mile by the light-duty fleet could fall by 20 percent if new regulations or large and sustained fuel price increases drive fuel economy improvements (TRB 2006).

Fuel efficiency changes

The Environmental Protection Agency (2008) notes that fuel efficiencies have been improving since 2005. Several analysts expect this trend to continue and accelerate. The Energy Information Administration (2008) estimates that the average fuel efficiency for all light-duty vehicles on the road will grow from 20.4 mpg in 2008 to 28.9 mpg by 2030. Although this is a positive trend for the environment, it also means lower fuel tax revenues. As users consume less fuel, they pay less in fuel taxes per vehicle-mile travelled. Between 1980 and the present, VMT has grown by approximately 100 percent while fuel consumption has grown by about 50 percent (Sorensen 2009). This is bad news for transportation funding: As demand for road capacity increases and as road damage grows with VMT, revenues needed to address capacity and maintenance needs continuously decline.

A report of the Transportation Research Board (2006) suggests that given a 15 percent reduction in the fleet average fuel consumption per mile, a 17.6 percent increase in the combined average state and federal fuel tax rate would be necessary to maintain a constant revenue per vehicle mile. Thus, for the fuel taxes to be self-sustaining in the face of fuel efficiency changes, the tax rates would have to be continuously altered. Sorensen (2009, p. 2) notes that raising fuel taxes has become increasingly unpopular and states, “[T]he frequency and magnitude of the recent fuel tax increases has been grossly insufficient to maintain comparable purchasing power in terms of real revenue per mile of travel.”

Introduction of alternative fuels

Like improving fuel efficiencies, the introduction of alternative fuels poses a substantial risk to the sustainability of fuel taxes as a funding mechanism. While increases in fuel efficiency decrease the rate users pay in fuel taxes per vehicle-mile travelled, the introduction of alternative fuels could potentially narrow the tax base as some users stop using petroleum-based fuels to power their vehicles. Sorensen (2009, p. 2) notes, “Additionally, as alternative fuel vehicles begin to achieve market penetration, a greater share of the motoring public may be able to avoid paying motor fuel taxes by, for instance, charging an electric vehicle at home or at work.”

Summary

As currently structured, fuel taxes fare poorly on revenue adequacy and sustainability grounds:

- Inflation has eroded the purchasing power of revenue collected through fuel taxes, making the current rate too low and the funding inadequate.
- Fuel taxes are unsustainable going forward. Inflation, changes in the price of fuel and fuel efficiency, and the introduction of alternative fuels conspire to reduce the tax base and the amount of fuel tax revenue collected.

ENVIRONMENTAL SUSTAINABILITY

With the advent of the current administration, environmental sustainability has been added to the national agenda when discussing the maintenance and improvement of the transportation system. On June 16, 2009, the EPA, jointly with the U.S. Department of Housing and Urban Development and the U.S. Department of Transportation, announced that one of their aims was to improve the transportation system while protecting the environment (Environmental Protection Agency 2009). Furthermore, recent reports by the National Surface Transportation Infrastructure Financing Commission (2009) and the National Surface Transportation Policy and Revenue Study Commission (2007) included protecting the environment in their review and analysis. Thus, it has become vital to explore the degree to which fuel taxes as user fees support environmental sustainability.

Broadly speaking, environmental sustainability involves improving transportation system efficiency so as to reduce emissions and greenhouse gases, and maintaining and implementing policies and practices that protect and improve the environment. To achieve this goal, fuel taxes should adhere to the polluters-pay principle, whereby those responsible for producing pollution pay for the environmental damages they impose on society. By this measure, the current fuel tax approach has mixed results in reducing petroleum-based fuel consumption and greenhouse gas emissions, and in promoting the use of less polluting fuels.

Effect of fuel taxes on petroleum-based fuel consumption and greenhouse gas emissions

Fuel taxes have some effect in reducing petroleum-based fuel consumption and greenhouse gas emissions. One could argue that the polluters-pay principle is in effect since drivers with lower fuel efficiency vehicles do pay more in fuel taxes per vehicle mile. Also, it is possible that increases in fuel taxes may encourage some motorists to purchase more fuel efficient vehicles and tune their vehicles to get better gas mileage (Wachs 2003a). Writing in 1994, Hsing (1994) estimated the impact of the newly passed 4.3 cents per gallon increase in the tax on gasoline. Hsing found that the 4.3 cents per gallon increase was expected to reduce gasoline consumption by 2.0 percent, which amounted to 53.4 million barrels of oil per year.

While, in the short-run, fuel tax increases are likely to have marginal effects on fuel consumption, the price elasticity of fuel in the long run is much more significant (Sterner 2007). Analysts have suggested that the price elasticity for fuel in the United States in the short run is around -0.18, while in the long-run it is closer to -1.0 (Sterner 1992). Sterner (2007) estimates that if, for a long period of time, the United States would have applied the tax policy of the European nations with the highest taxes on fuel, then U.S. gasoline consumption would be reduced by approximately 57 percent. Furthermore, the estimated reduction in CO₂, if all OECD countries applied the highest fuel tax rates found in Europe, is estimated to be 8.5 billion tons of CO₂ over a decade (Sterner 2007).

Promotion of less-polluting fuels

Fuel taxes promote less-polluting fuels insofar as they raise the price of petroleum-based fuels, thus creating an incentive to develop and use alternative fuels. The Transportation Research Board (2006, p. 14) notes, “[S]ubsidies in the form of waivers of excises have been a popular way to promote alternative energy development (e.g., the fuel tax subsidy granted to gasohol).” While one could argue over the degree to which gasohol is a less-polluting fuel than gasoline, the argument that fuel taxes promote the use of less-polluting fuels could be extended to other fuels. As long as there is a tax on petroleum-based fuel, there will be an incentive to develop and use other forms of fuel. However, as fuel taxes in the United States are both historically and comparatively low in real terms, the extent to which they provide an incentive to use less-polluting fuels is also low. It should be noted, alternative fuels are not necessarily less polluting fuels.

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Summary

The gas tax shows mixed results when it comes to environmental sustainability:

- Fuel taxes weakly adhere to the polluters-pay principle, and are a blunt tool in promoting environmental sustainability.
- In looking at fuel taxes and their ability to reduce petroleum-based fuel consumption and greenhouse gas emissions, their effect in America are limited, mainly due to the low rate.
- Finally, fuel taxes also provide some incentive for the use of less-polluting fuels; however, because of the low fuel tax rates in the United States, this effect is marginal.

FEASIBILITY

Under the feasibility principle we evaluate fuel taxes on two different criteria: political feasibility and administrative feasibility. Under the political feasibility criterion, a tax fares well when it ensures taxpayers' privacy and system security and generates less political resistance. Furthermore, a tax tends to enjoy higher rates of popularity when visibility is low and tax exportation is high. Under the administrative feasibility criterion, a tax fares well when its implementation, operation, enforcement, and compliance costs are reasonable. As we will see, fuel taxes fare reasonably well when considering both political feasibility and administrative feasibility.

Political feasibility

As the fuel tax system already exists, we focus not on whether it is politically feasible to implement fuel taxes, but rather on the feasibility of future fuel tax increases. As described in the revenue sustainability section, because of fuel efficiency improvements and the effects of inflation, the real value of the revenue collected from fuel taxes has been declining. Thus, if we want to maintain and improve the transportation system, it is important to consider whether it is politically feasible to raise fuel taxes. Small et al. (1989, p. 6) notes, "Yet despite the occasionally severe erosion of real revenues, states have found it politically difficult to raise gasoline taxes." Their assertion that the states have found it politically difficult to raise gasoline taxes can be extended to the federal level where taxes on gasoline and diesel have not been increased since 1993, despite shortfalls in highway funding. Wachs (2003a, p. 237) asks, "Why is it assumed to be a political liability to raise fuel taxes by a few pennies when fuel prices routinely change by more than that several times every year."

Fuel taxes initially had great public support. In discussing the popularity of state gasoline taxes in the 1930s, Williams (2007, p. 4) states, "Gasoline taxes met with little public resistance and in fact became quite popular with the general public. Citizens saw the benefit principle in action, as gas taxes served mostly as user fees, generating revenue for more and better roads." As we have documented in the equity section, however, fuel taxes have since moved away from the user-pays-and-benefits principle. As fuel taxes have moved away from this principle, their popularity has dwindled. The 2009 Tax Foundation/Harris Interactive poll (2009) found that at the state and local level, respondents found the gas tax to be the least fair tax when compared to state income taxes, retail sales taxes, motor vehicle taxes, local property taxes, and taxes on cigarettes, beer and wine, with only 7% of respondents finding the gas tax "very fair". At the federal level, the only tax respondents found more unfair than the gas tax was the estate tax, with once again only 7% of respondents finding the gas tax "very fair". It should be noted, other taxes were also not seen as "very fair", and taxes of any kind are generally unpopular.

This weakening of public opinion for fuel taxes has coincided with less political support as well. As stated by Sorensen (2009, p. 2), "With rising anti-tax sentiment among the populace, elected officials have become wary of this politically unpopular task, and the frequency and magnitude of the recent fuel tax increases has been grossly insufficient to maintain comparable purchasing power in terms of real revenue per mile of travel." As noted before, the federal tax on gasoline and diesel has not been

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significantly raised since 1993. Thus, it would appear that future attempts to raise fuel taxes may be politically difficult, especially if these increases do not adhere to the user-pays-and-benefits principle.

Political feasibility is typically evaluated by also looking at visibility to taxpayers and the potential for tax exportation, as well as general political support and public opinion. In our analysis we also include driver's privacy and system security, as these issues have been raised when comparing fuel taxes with transportation funding alternatives such as VMT fees.

Visibility to taxpayers

Broadly speaking, tax visibility can be defined as the extent to which users are aware of a tax. The popularity of a tax with the public tends to decrease as the tax becomes more visible. When the visibility of a tax is low, it may be tempting for government to increase the tax. Visibility should not be confused with transparency: the extent to which taxpayers know the actual costs they incur as a result of the tax.

The National Surface Transportation Infrastructure Financing Commission (2009, p. 7) notes, "...system users are typically unaware of how much they pay in fuel taxes (as distinct from the price of gasoline), such that daily swings in price mask the tax component..." As mentioned before, a study prepared for the Minnesota Department of Transportation by Fichtner and Riggelman (2007), found that, in general, participants were unaware of what they paid in gas tax. Thus, it would appear that fuel taxes are in fact visible in that users know that they are paying them; however, are not very transparent as most users do not know precisely how much they pay. How this translates into the political feasibility of raising fuel taxes is somewhat unclear. It should be noted, however, that the study prepared for the Minnesota Department of Transportation also found that many participants were aware that the gas tax had not been raised in many years, and that comments were often made that they would be willing to pay a higher gas tax, particularly if the increased revenues were spent on roads.

Tax exportation

Tax exportation pertains to the potential for nonresidents to pay a tax. Tax exportation increases the popularity of a tax for residents, as residents are able to benefit from revenues derived from taxes that they did not have to pay. For the most part, fuel taxes in the United States do not benefit from tax exportation. While foreign tourists and shippers traveling in the United States by auto or truck do pay fuel taxes when they refuel, this is an insignificant portion of total federal fuel tax revenues. Nonetheless, in citing a January 23, 1919 article in the *Portland Oregon Journal*, Williams (2007, p. 4) states, "Needless to say, state lawmakers also strongly approved of the gas tax. Also, many lawmakers saw gasoline taxes as a way to 'export' their state's tax burden to travelers from other states."

Driver's privacy and system security

For a user fee system to be politically feasible it is important that the system ensure drivers' privacy and provide system security. Ensuring drivers' privacy entails taking measures so that information collected, kept and disseminated is limited to the level needed to administer the user fee system and ensure data confidentiality. Ensuring system security entails making sure the system is designed with security features to protect it from unauthorized access and improper or illegal use. Little has been written on driver's privacy and system security as it pertains to fuel taxes. This is likely so, because the simplicity of the fuel tax system minimizes any sort of risk to drivers' privacy or the overall system's security. Furthermore, drivers are not the legal payers of the tax. Fuel taxes are built into the price that drivers pay at the pump and, thus, unlike VMT fees, do not involve the need for any device being installed in vehicles or for driver data to be collected, stored, and sent to remote billing locations.

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Administrative feasibility

Administrative feasibility includes administrative costs, such as the costs of implementation, operation, and enforcement, and compliance costs, which entail the costs associated with the public compliance with the tax policy.

Implementation, operation, and enforcement costs

Fuel taxes have relatively low implementation costs. Unlike other alternatives for funding the transportation system, fuel taxes do not involve the construction of tollbooths or developing a system for recording vehicle-miles traveled. Furthermore, increasing fuel taxes does not come with additional implementation costs, as a framework for collecting fuel tax collection is already in place. In listing the attributes that make fuel taxes attractive sources for funding transportation, the National Surface Transportation Policy and Revenue Study Commission (2007) notes fuel taxes', "low administrative and compliance costs" as well as their "ease of implementation".

Fuel taxes also have relatively low operation and enforcement costs. Martin Wachs (2003a) notes fuel taxes' low collection costs and the fact that they are relatively fraud proof, as one of his 12 reasons for why gasoline taxes should be raised. Wachs (2003a, p. 239) states, "Governments have a responsibility to be concerned about the cost of collecting revenues and...evasion...the fuel tax is unusually efficient in this regard. Whereas traditional manual toll collection, for example, incurs costs that range from 20% to 25% of the revenue produced, the cost of administering the fuel tax is typically only 1% or 2% of the revenue." Others have estimated the cost to administer and enforce the federal motor fuel taxes to be as low as .2 percent of gross receipts (Peters et al. 2003).

If fuel taxes are to be raised, however, enforcement costs will most likely have to increase as well to counter the added incentive to evade the tax. As mentioned earlier, it has been estimated that a proposed ten cent increase in the tax on both gasoline and diesel fuels in the state of Kentucky would lead to increased fuel tax evasion by 37.5 percent (Denison et al. 2000).

Compliance cost

Finally, when evaluating the administrative feasibility of a tax we consider how difficult it is for the public to pay the tax. Unlike the federal income tax, which costs non-business tax payers on average 10.7 hours of time and 129 dollars per year in record keeping, tax planning, form-completion and submission, and other activities (Internal Revenue Service 2009), fuel taxes have very low compliance costs for the general public. As fuel taxes are collected from wholesalers and passed on to drivers when they refuel, there is no need for the general driving public to keep records of the fuel taxes they pay or complete and submit any forms documenting their payments.

Summary

On both political feasibility and administrative feasibility grounds, fuel taxes fare relatively well:

- From a political feasibility perspective, while it is true that states and the federal government have had a difficult time raising fuel taxes, some suggest that raising fuel taxes should not be seen as a political liability.
- Because of the simplicity of the system, fuel taxes do a good job of ensuring driver privacy and system security.
- While fuel taxes are visible to a degree and currently have low levels of political and public support, if they more closely adhered to the benefit principle, as they did in the early and middle decades of the 1900s, they would most likely garner greater support.
- Fuel taxes benefit from some low levels of tax exportation.

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- On administrative grounds, fuel taxes perform very well. Not only are implementation, operation, and enforcement costs relatively low, especially when compared to methods such as manual toll collection, but compliance costs are minimal as well.

CONCLUSIONS

As we have seen, fuel taxes are problematic under several different public finance principles. When considering efficiency, it is important to note that fuel taxes do not recover the total cost to the system. This under-pricing of the roads leads to inefficient overuse of the system, causing excessive delays and an unbalanced ratio of auto and truck use versus transit and freight rail. Fuel taxes also contribute to urban sprawl and fail to direct efficient investment in the transportation system.

Fuel taxes also fare poorly on equity grounds. Due in large part to increases in fuel efficiencies and the introduction of hybrid and alternative fuel vehicles, fuel taxes have moved away from the user-pays-and-benefits principle. Through evasion or exemptions, some users pay nothing. Fuel taxes do not cover the costs associated with road construction and maintenance nor do they cover external costs such as congestion and pollution. Furthermore, the user-pays-and-benefits principle is not adhered to as some fuel tax revenue is used for non-highway purposes. When considering ability-to-pay issues, fuel taxes have both jurisdictional equity and vertical equity problems. It should be noted, however, that while lower income groups see a greater share of their income taken by fuel taxes, they also benefit from fuel taxes since a share of fuel tax revenues are used for public transit.

Much like with efficiency and equity, because current fuel tax rates are low, revenue adequacy and sustainability problems persist. While fuel taxes are paid by a relatively large base, the revenue collected remains inadequate. Because fuel taxes are not indexed to inflation, the purchasing power of revenues collected has been eroding. Going forward, fuel taxes are unstable and unsustainable as external changes such as increasing fuel economy negatively affect revenue.

Fuel taxes fare somewhat better when considering their effect on environmental sustainability. If sufficiently high, fuel taxes are better equipped to reduce petroleum-based fuel consumption and emissions than general sales taxes or income taxes, and have proven to be an effective tool for sustaining the environment. Fuel taxes also have some effect on promoting the use of less-polluting fuels. In the United States, however, fuel taxes are relatively low and thus are a blunt tool for promoting sustainability.

Finally, fuel taxes fare best when considering their political and administrative feasibility. Fuel taxes ensure driver privacy and system security and do benefit from some tax exportation. While fuel taxes do have high visibility, it is likely that they would have greater support if they were more closely adhered to the user-pays-and-benefits principle. Furthermore, when looking at implementation, operation, enforcement, and compliance costs, fuel taxes are generally viewed as superior to alternative funding approaches.

Figure 4 scores the fuel tax on the various principles and sub-principles discussed in this paper. Although a scorecard may not add much research value, we include it because it is helpful for policy communication on this urgent issue. As mentioned in the introduction, this paper is part of a larger effort to set the stage for a policy discussion on transportation-related user fees in the United States.

*SHOULD THE U.S. MOTOR FUEL TAX BE RETAINED OR REPLACED?
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PRINCIPLES

**ABILITY TO ACHIEVE
PRINCIPLES**

Efficiency	Moderate
• Transportation system overuse	Moderate
• Efficient investment in transportation	Moderate
• Efficient land use	Weak
Equity	Moderate
• Adherence to user-pays-and-benefits principle	Moderate
• Horizontal equity	Moderate
• Vertical equity	Moderate
Revenue Adequacy and Sustainability	Moderate
• Revenue adequacy	Moderate
• Tax rate	Moderate
• Revenue sustainability	Weak
Environmental Sustainability	Moderate
• Reducing petroleum-based fuel consumption and emissions	Moderate
• Promoting less-polluting fuels	Moderate
Feasibility	Strong
• Public and Political Support	Moderate
• Implementation, operation, and enforcement costs	Strong
• Compliance costs	Strong

Figure 4: Fuel Taxes Assessment Scorecard

In this paper, we have looked at how well fuel taxes, as user fees, perform under public finance principles. As we have seen, fuel taxes have many shortcomings as user fees. The numerous deficiencies in the current system speak to the possibility of replacing fuel taxes with a system that better addresses the five principles discussed in this paper. While this paper alone does not answer the question of whether the fuel tax system should be replaced, the analysis here suggests that transportation finance in the United States may want to move past a system of fuel taxes. The National Surface Transportation Policy and Revenue Study Commission (2007), reviewed several different potential replacements to the fuel tax and concluded that VMT fees have many promising features. In the next phase of our research we plan to analyze VMT fees along the same principles presented in this paper to gain a deeper understanding of whether the fuel tax should be retained or replaced.

Many transportation researchers and stakeholders have advocated that the United States move away from our reliance on fuel taxes and instead move to an alternative system for funding the transportation system. While there is growing support among transportation researchers to both increase fuel taxes and eventually move towards VMT fees, these ideas are not currently in favor with the Obama administration nor are they with a majority of congress. Thus, further research should explore the lack of political will as well as effective methods of framing the issue and conducting public outreach.

The simplicity of the fuel tax system may be the single most important reason for why the United States has not moved to alternative funding mechanisms. With fuel taxes, system security and driver privacy are ensured. Funding alternatives, such as VMT fees, draw caution from the public as they are seen as a potential threat to privacy. Research exploring the existing and potential technologies involved with VMT fees, and the privacy and legal issues that arise is thus a critical area for further research. In conjunction with this research, it is important to make attempts to determine the threshold at which the public feel that their privacy is protected.

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