

Rethinking Fuel Tax in the Age of Increased Fuel Economy

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1 Introduction

Increased fuel economy and alternative fuel technology vehicles are gaining momentum in the passenger car market lately [1] due to their promise of decreased life-cycle operational costs [2]. The automobile market is constantly evolving with the introduction of innovative technologies that lead to decreased fuel consumption. Major vehicle manufacturers have introduced hybrid, plug-in hybrid and battery electric vehicles in order to comply with the corporate average fuel economy (CAFE) standards, improve fuel efficiency of their production and reduce tailpipe emissions [3]. The light-duty vehicle market is undergoing rapid changes, however government regulations do not seem to keep up with the fast production pace.

The Federal Highway Trust Fund (HTF) is partially financed by motor fuel taxes, tires, trucks and trailer sales and heavy-duty vehicle usage [4]. The fuel tax is not collected directly from the consumer; instead, the tax is collected from the importer or the producer of the taxable fuel product [4]. Federal Highway Administration reports the tax rates for main passenger car fuels: 18.4 cents per gallon for gasoline and 24.4 cents per gallon for diesel [4]. In the long run, revenue shortfalls are expected assuming the structure and collection remains the same due to inflation. What is more, the average fuel economy of the passenger vehicle mix is expected to increase significantly due to the aforementioned DOE mandates [5]. CAFE standards for passenger cars require a production vehicle mix of 36.2 mpg in average for 2015, which should reach 54.9 mpg by 2025 [6]. Therefore, changes need to be made in the fuel tax mechanism or else the financing of the Highway Trust Fund could be at stake. Table 1 quantifies the revenue using average historical data and projections for the vehicle market and travel patterns. The revenue is calculated based on Eq. 1 for the forthcoming 2025 year and compared to a past year, 2011. The historical data for 2011 come from [6], the alternative vehicle population and registration data projections for 2015 come from [7] and the vehicle miles traveled (VMT) projections from [5]. It is assumed that all the non alternative fuel vehicles are gasoline ones, therefore the total revenue from the fuel tax might be underestimated in this case.

$$R = VMT * (1/MPG) * C * N \quad (1)$$

where R is the revenue in \$, MPG is the fuel economy in miles per gallon, C is the fuel tax in \$ per gallon per vehicle, and N is the number of the non alternative fuel vehicle registrations. Using average values, the fuel tax revenue of 2011 could be decreased by 0.37% in 2025.

This essay aims at showcasing the caveats of the current fuel tax structure and proposes alternative methods to collect fees that will fund the Highway Trust Fund in the near future so as to account for its

Year	2011	2025
Alt. fuel vehicle population (thousands)	1,191.786	15,000
Total vehicle registrations (thousands)	125,657	270,000
Average population mpg	24.4	54.9
Average annual VMT (miles)	11,601	12,700
Revenue from fuel tax (\$)	$1.089 \cdot 10^{10}$	$1.085 \cdot 10^{10}$

Table 1: Revenue from fuel tax due to increased fuel economy, based on avg. values.

financial sustainability. Last, this study showcases the advantages and disadvantages of alternative fees and concludes with recommendations on future research needed to address the issues raised.

2 Fuel Tax versus Mileage-Based User Fees

2.1 Fuel Tax: Issues and Recommendations

Can federal fuel tax keep up with those vehicle fuel economy changes? Weatherford supports that if Congress decides to regularly increase fuel tax, the system in place will be able to keep on generating revenue for the HTF [8]. Not only those political decisions are hard to coordinate to reach consensus in the first place but also HTF would be at risk every other year if the taxes to be charged were not optimized. Apart from the legislative issues, federal fuel tax has been extensively criticized in the literature, as in many cases is found inequitable. For example, West uncovers that low-income households, due to financial constraints, tend to own older and lower fuel economy vehicles and are disproportionately charged compared to their wealthier counterparts [9]. Also, as it is reported by the Congressional Budget Office (CBO), the federal fuel tax is not equitable for rural households, as in those areas distances between activities are greater and fuel consumption is inherently higher [10]. As CBO proposes, apart from the fuel tax, in order for the taxation to be optimal, users of the highway network should be charged a combination of taxes, following the concept of the full-marginal cost pricing.

Despite the current system's disadvantages, there is an important reason for its prevalence. The collection system is simple and efficient, as it is not directly collected from the consumers but from the producers of the fuel. Therefore, the implementation cost of the tax collection is small and the procedure is simple.

It is claimed in the literature that modifications of the current fuel tax structure can be a short-term solution for the problems that we have identified previously. As reported by Wachs, projections of fuel prices in the future show increasing trends, therefore if federal tax was a fix percentage of the fuel price, this mechanism would produce growing revenue streams in the future [11]. Another approach proposed by the Financing Commission is an increase of the gasoline tax by 10 cents per gallon, which could effectively generate approximately 50% more revenue, as well as reduce the VMT by approximately 2%[12].

2.2 User-Based Fees: Substitute or Trouble?

User-based fees per mile and tolls for the users of the road network have been identified as alternatives to the traditional fuel tax system. Those fees would account for the heterogeneity of the network users, as those could adhere to a 'pay-as-you-drive' concept [11]. Wireless communications, GPS trackers and on-board device readers could be effectively used in order to collect the mileage information needed to impose the fee. Thus, the collection of user-based fees is possible in the recent years due to technological advances. Baker and Goodin evaluated VMT fees, mileage-based user fees and time/distance/place financing options that could substitute the current fuel tax [13]. Hanley and Kuhl conducted a national

level experiment for the evaluation of drivers mileage-based fees [14]. Hereinafter, research analyses findings on the aforementioned fee mechanisms are presented.

The VMT fee is the most prevalent alternative in the literature. Rufolo and Bertini (2003) note that VMT fees can be flat or vary based on time of day or location [15]. VMT fees are believed to contribute towards reducing congestion by providing incentive to reduce VMT [13]. Effective VMT fee charge can, thus, achieve the stability of the revenue much needed for the HTF in the long run, since it is not impacted by the fuel economy of the vehicles. However, does this tax also impose a greater burden for households with certain characteristics? Based on 2001 National Household Travel Survey data analysis, Weatherford finds that for “87 percent of the population the driving cost per mile will increase by maximum 5 percent”, under the assumption that the fee imposed is revenue-neutral. Their research shows that such a fee leaves low-income population and population of rural areas better off but imposes larger charges to those driving vehicles with increased fuel economy and households with a greater number of children. Robitaille et al. conducted analysis with 2001 NHTS data and found that both fuel tax and VMT fee are inequitable and disproportionately impact different areas, income and race groups [16]. Sorensen et al. suggests that VMT fees could be set so as to impose higher charges for fuel-inefficient vehicles in order to penalize their increased emissions [17].

Literature is inconclusive regarding the effects of the VMT fee on the social welfare and equity. However the greatest barrier of imposing such a fee is the high implementation cost and the data handling of sensitive public location information. In order to effectively measure the annual VMT of a household, large investments need to be made so as every vehicle to be equipped with tracking devices. Those devices need to be regularly tested to provide accurate VMT information. Tracking X and Y household vehicle coordinates would be essential for spatial differentiated fees, but this could be considered as an evasion of privacy. Alternatives for accurate measurement of the annual VMT per household need to be proposed in order to guarantee privacy and just charging. On the other hand, Sorensen et al. suggest that the investment for the tracking devices and the collection of anonymous data could also allow improving operations and achieving effective management of the transportation network[17].

Last, VMT measurement and fee payment enforcement should become publicly accepted before implemented. Hanley and Kuhl national level user fee experiment revealed that approximately 70 percent of the participants were favorable to the mileage-based fee system [14]. Still, substantial research efforts should be put so as to showcase the advantages of this fee structure and build public consensus. Across the literature, experts pinpoint that maybe more than one system should be in place, i.e., increased flat fuel tax and VMT fee, in order to provide options to the public and address their concerns.

3 Conclusions

The impacts of a mileage-based fee are still questionable. The aforementioned literature emphasizes on the advantages of a VMT fee over the fuel tax currently in effect but also identifies the barriers that should be broken down to proceed with such an implementation.

It is clear that part of the Highway Trust Fund revenue is at stake if the current tax measure is not effectively revised in order to avoid shortfalls. Researchers need to provide ways to equitably impose user charges and ensure the financial sustainability of the Fund.

Public acceptance is another crucial component of the success of the proposed fees application, therefore it is important to engage stakeholders into the system planning, allow jurisdictions to collaborate and jointly raise awareness on this structure, provide different ways to measure annual VMT and reassure the privacy of the sensitive location datasets. Research could involve pilot programs in every state that could be conducted through cooperation with universities and intelligent technology system vendors that would support the efforts by providing equipment.

Given all the evidence, it is now time to rethink the fuel tax and start planning for proper system improvements or substitutes that would guarantee the funding mechanism’s sustainability, maximize social welfare and account for environmental externalities.

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