How Much Gasoline Tax Do U.S. Electric Vehicle Owners Not Pay?

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Americans have now purchased more than 800,000 electric vehicles, counting both all-electric and plug-in hybrid models. This is a large increase compared to the fewer than 5,000 electric vehicles that were on the road in 2010, and policymakers are setting aggressive goals for continued growth. California, for example, aims to have 5 million electric vehicles on the roads by 2030.

Electric vehicle owners do not pay gasoline taxes, and plug-in hybrid owners pay gasoline taxes only to the extent they use gasoline. In this paper, we measure the tax revenue shortfall from electric vehicles. Using newly-available U.S. nationally representative data on vehicle ownership, we calculate how much federal and state gasoline tax is not being paid. Then we estimate a model of electric vehicle adoption to forecast the tax revenue shortfall 2020-2030.

Our results have implications for the U.S. Highway Trust Fund (HTF). The U.S. federal gasoline tax of 18 cents per gallon is used to pay for interstate highways, large infrastructure projects, and public transportation. The HTF is already insolvent, needing an estimated 9 cents per gallon increase just to equate current tax revenues with spending projections. Increased electric vehicle adoption will further erode the financial viability of the HTF, so understanding and quantifying this impact is a policy priority.

We will measure current and projected future tax revenue shortfalls for federal, state, and local governments. In addition, we will examine distributional impacts, showing how these avoided taxes are distributed across households with different income levels. Previous research has shown that electric vehicle ownership is concentrated among high-income households (Borenstein and Davis, 2015), but we are not aware of any previous research looking at what this pattern of electric vehicle ownership means for who pays gasoline taxes.

Roadmap for Empirical Analysis

Our primary dataset will be the newly-released *National Household Travel Survey* (NHTS) from the U.S. Department of Transportation. The NHTS is clearly the right dataset for this exercise. Not only does the NHTS provide detailed information about household characteristics and vehicle ownership, but it also provides odometer readings by vehicle, which we can use to measure "avoided" miles. Surveying for the latest NHTS took place during 2016 and 2017, with a total sample size of 129,696 households.

According to the NHTS, there are over 800,000 electric vehicles in the United States including 425,000 all-electric vehicles and 360,000 plug-in hybrids. As a simple back-of-the-

envelope calculation, suppose these drivers would otherwise be driving a 30 MPG vehicle 15,000 miles annually. This would imply 400 million gallons of gasoline annually that are not being purchased.

As of April 2018, the average tax on gasoline in the United States is 52 cents per gallon (American Petroleum Institute, "State Motor Fuel Taxes", 2018). This includes 18 cents per gallon for the federal tax and 34 cents per gallon for state and local taxes. Thus a shortfall of 400 million gallons of gasoline annually means $208 million in lost total tax revenue, with $72 million in lost federal revenue, and $136 million in lost state and local revenue.

This preliminary back-of-the-envelope calculation suggests that these impacts are large enough to matter. Much additional work is needed, however. The assumption of 15,000 miles per year has been used before in electric vehicle research (see, e.g., Holland, Mansur, Muller, and Yates, 2016), but we plan to use the NHTS odometer readings to refine this measure of avoided gasoline consumption. We also need to do additional analysis and robustness for the plug-in hybrids as these vehicles use both electricity and gasoline.

State gasoline tax rates vary widely, from Pennsylvania at 58 cents per gallon (not counting the federal tax) to Alaska at just 12 cents per gallon. Thus another part of the work of the project will be to use the actual distribution of electric vehicles across U.S. states to more accurately calculate the total fiscal impact, as well as to calculate a ranking of the most affected states.

Predictions

We also plan to forecast the tax revenue shortfall going forward to 2030. Making predictions is inherently difficult, particularly for an early-stage technology like electric vehicles. Whether or not consumers opt for electric vehicles depends on prices for gasoline and lithium ion batteries, neither of which can be predicted with confidence. Moreover, although the federal tax credit for electric vehicles remains in place, national and state policies could change quickly.

We nonetheless want to put forward a couple of different scenarios to begin to assess future fiscal impacts. We will start by estimating a model of electric vehicle adoption. The NHTS provides information on household income, age of the driver, and state-of-residence, as well as about whether a household owns its own home, a factor that has been shown in previous work to be a strong predictor of electric vehicle adoption (Davis, forthcoming).

We will then use the model to predict which households are most likely to become electric vehicle owners in the future. We will report fiscal impacts for low-, medium-, and high-saturation scenarios between now and 2030. Finally, we will highlight which states are most likely to experience large tax shortfalls, and assess how the distributional impacts are likely to change over time.