The Impacts of Switching from a Volumetric Fuel Tax to a Mileage Tax

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VMT Taxes: The Impacts of Switching from a Volumetric Fuel Tax to a Mileage Tax

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Background

As of April 2015, the national average gasoline and diesel tax rates were $0.49 and $0.54 per gallon, respectively (API 2015). Their contributions to fuel tax revenues and roadway construction/maintenance projects in real terms have been declining in the recent decade as they have failed to adjust with inflation and federal mandates continue to ramp up the average fuel efficiency of new light-duty vehicles (LDVs). Groups such as the National Surface Transportation Infrastructure Finance Commission support the replacement of fuel taxes with a Vehicle Miles Traveled or VMT tax applicable to all LDVs in order to correct the problem of eroding tax revenues and create more sustainable revenue streams for financing roadway construction/maintenance projects.

Objectives

- Implement a national flat-rate VMT tax within the U.S. MARKAL framework.
- Compare three versions of the VMT tax structure with the existing volumetric fuel tax system.
- Observe the interaction between the VMT tax and enacted policies such as the Renewable Fuels Standard (RFS) and the Corporate Average Fuel Economy (CAFE) Standard.
- Observe the impacts of the VMT tax on transportation sector emissions.

Methodology

U.S. EPA MARKAL Model

- An elastic version of the U.S. EPA MARKAL model – a bottom-up, linear programming, and partial equilibrium model – is used to observe the responsiveness of LDVs to a series of mileage taxes.
- Uses data supplied by the 2010 EPA National MARKAL database, which provides data on the five primary economic sectors (i.e. transportation, commercial, industrial, residential, and electricity generation) as well characterizations of hundreds of technologies that comprise the U.S. energy system.
- MARKAL minimizes total system costs by determining the most efficient, cost-effective set of resources and usage rates to meet exogenously specified end-use demands.

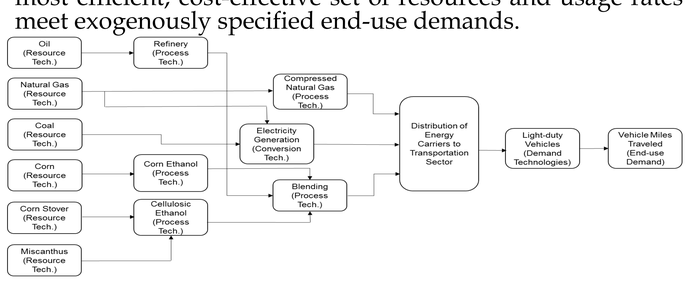

Figure 1: Sample MARKAL Reference Energy System (RES)

Policy Scenarios

1. *Reference*: Reflects a continuation of status quo which includes the national RFS and President Obama's recent increases in CAFE regulations. A $7,500 tax credit is applicable to all PHEVs and deducted from annual investment costs. Annual real fuel tax rates increase annually by 1%.
2. *VMT taxes consistent with fuel tax rates (VMT Charge #1)*: Reference gasoline tax rates are converted to a single uniform per-mile user charge or "equivalent" mileage tax and applied to all LDVs, by multiplying gasoline tax rates by the LDV fleet average baseline fuel economy. Volumetric fuel taxes are removed.
3. *Environmental externality VMT tax (VMT Charge #2)*: The costs of driving related externalities are internalized in the mileage tax rates. VMT tax rates begin at $0.13/mile (real 2000$) and grow 1.5% annually to reflect the rising value of externalities. (Note: This scenario was developed for direct comparison to an "optimal" gasoline and diesel tax internalizing similar externality costs.

The Decision Maker

MARKAL's "representative agent" faces the following relationship when deciding whether or not they should drive or purchase a vehicle, the type of vehicle to drive, and the type of fuel they choose to power it:

"Capital Costs + Operations and Fuel Costs + Volumetric Taxes + VMT Taxes"

Results

VMT Charge #1 vs. Reference

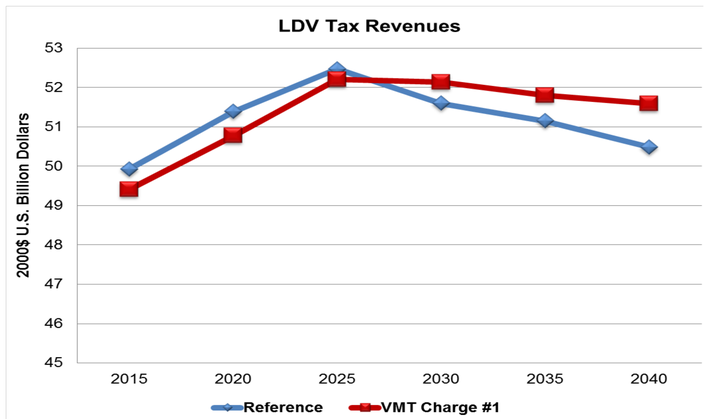

Figure 2: Collected fuel and VMT tax revenues from LDVs

- VMT taxes generate more revenues in the long-run.
- Significant erosion of fuel tax revenues begin to occur in periods after 2025 as a result of stricter fuel economy regulations – leading to a kink in the graph at year 2025.
- Unlike fuel taxes where energy-efficient vehicles like plug-in hybrids escape taxation, both conventional and energy-efficient vehicles are susceptible to a VMT tax, creating greater revenue streams.

VMT Charge #2 vs. Optimal Fuel Charges

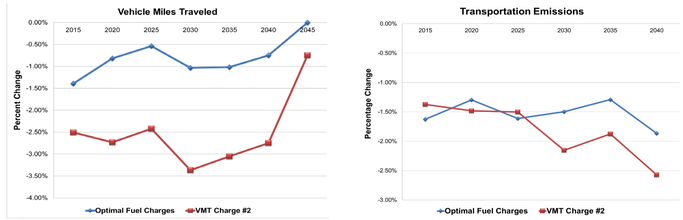

Figure 3: Percentage change in vehicle miles traveled and transportation emissions

- A direct tax on miles driven leads to noticeable reductions in VMT and transportation-based emissions in response to fewer cars being driven.
- VMT taxes are likely to yield more benefits than the fuel tax through reduced congestion levels, accident risk, and pollution levels.

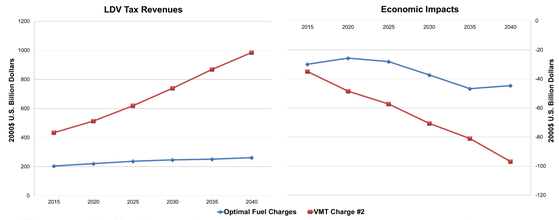

Figure 4: Collected tax revenues and economic impacts

- VMT taxes have the ability to generate more revenues and spur larger economic loses than a comparable externality fuel tax.

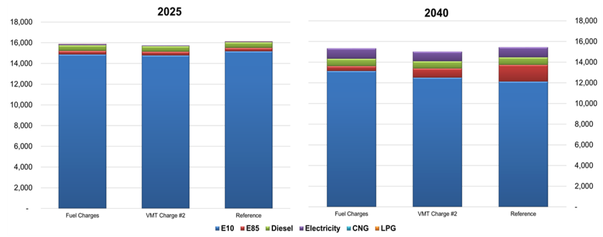

Figure 5: LDV demands for non-renewable fuel in 2025 and 2040

- Both tax structures lower gasoline demands (sum of E85 and E10).
- Increased fuel tax rates lead to a displacement of E85 for more E10 over the fifteen year period.
- Adoption of the VMT tax causes drivers to substitute E10 for some of the E85 fuel to power their flex-fuel vehicles.