



Transportation
Investment
Advocacy Center

American Road & Transportation Builders Association

How State Motor Fuel Tax Increases Affect the Retail Price of Gasoline

An Economic Analysis of Rate Changes
and Daily Gasoline Prices, 2013 to 2018



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EXECUTIVE SUMMARY

With more state legislatures approving transportation investment packages that include a change in the motor fuel tax on gasoline, there is a common misconception any change in the rate automatically triggers an increase in the retail price of gasoline paid at the pump.

An empirical analysis by ARTBA's Transportation Investment Advocacy Center (ARTBA-TIAC) found that on average, one-third of an increase—or decrease—in state gasoline tax rates is passed through to consumers in the retail price on the day the change takes effect, with no significant impact after that time. These results confirm previous research that suggest state gas taxes are just one component of a complex pricing scheme that includes consideration of the price of crude oil and other state specific factors.

One study concluded that gas prices can be “sticky,” in that the “fundamentals driving the price change continuously and prices change only occasionally.” The study concludes a retail firm’s decision to change wholesale gasoline prices is based on the “benefits of having an optimal price” and the strategic considerations of “how customers and competitors will react to a particular change.”¹

Other work suggests although the retail gasoline market may appear to be competitive, there are a number of “institutional features” that actually deter some competitive characteristics of the market.² The authors note pricing decisions by retail gasoline stations are influenced by demographics, local competition and consumer travel costs. They observe that while fuels tax rates vary across states “the extent of taxes passed onto consumers will depend on how relatively inelastic state demand for gasoline actually is.”

As part of its study, ARTBA-TIAC examined 113 changes in state gasoline tax rates in 29 states between 2013 and 2018.

The rate changes include measures approved through the state legislative process and automatic adjustments based on a pre-determined variable, such as inflation. The results show the impact on retail gasoline prices was the same for both types of increases.

¹ Michael C. Davis, & James D. Hamilton, *Why Are Prices Sticky? The Dynamics of Wholesale Gasoline Prices*.

² Mark Holmes, Jesus Otero & Theodore Panagiotidis, *Of the Dynamics of Gasoline Market Integration in the United States: Evidence From A Pair-Wise Approach*.

The analysis used data from the Oil Petroleum Information Service (OPIS) and the U.S. Energy Information Administration (U.S. EIA). The ARTBA-TIAC results are in line with other academic studies, which found the price of crude oil is the main driver of changes in the retail price of gasoline. One analysis found retail gasoline prices are largely “unpredictable” and “depend primarily on developments in the global crude oil market.”³

Research shows gasoline prices respond to crude oil price shocks in different ways—prices adjust quickly to shocks that are considered long-term changes and do not adjust if the increase in the crude price is seen as temporary.⁴ As part of their analysis, the authors included a variable to take into account that the federal gasoline tax rate had increased on October 1, 1993, which might be considered a possible long term shock to the market that, in theory, would affect gasoline prices. The model results, however, showed the 4.3 cents-per-gallon tax increase was insignificant, having no impact on retail prices.

As most drivers have observed when filling up their gas tank, pump prices can change daily—even by as much as several cents-per-gallon. It is not uncommon for gas prices at one station to differ significantly from a competitor across the street.

The variability of gasoline prices is common—but what consumers, media, or politicians may not fully understand is the motor fuel tax, while folded into the overall price at the pump, is not collected by retail sales outlets. Federal and most state gasoline taxes are collected either when motor fuel is removed from the bulk storage terminal or at the distributor level.⁵

The price change consumers pay at the station has very little to do with any changes in state gas taxes, which are levied to build and repair the roads and bridges they use every day. This “pass through” rate for gasoline and diesel fuel taxes to retail prices is affected by such things as “supply elasticity, including refinery capacity utilization, inventory levels, gasoline content regulations and the utilization of diesel for home heating,” according to a Harvard University study.⁶

Price variability is most impacted by crude oil prices, refining costs, profit margins, and retail and distribution factors, according to the U.S. EIA.⁷ The agency’s analysis concluded, “It is the variability in crude oil prices and spot gasoline prices that causes most of the variation in retail gasoline prices.”

³ Lutz Kilian, *Explaining Fluctuations in Gasoline Prices: A Joint Model of the Global Crude Oil Market and the U.S. Retail Gasoline Market*, September 2, 2009.

⁴ Stanislav Radchenko, *Lags in the response of gasoline prices to changes in crude oil prices: the role of short-term and long-term shocks*, January 2004.

⁵ U.S. Federal Highway Administration, Motor Fuel Tax Compliance Outreach.

⁶ Justin Marion & Erich Muehlegger, “Fuel Tax Incidence and Supply Conditions, HKS Faculty Research Working Paper series, RWP 10-014, John F. Kennedy School of Government, Harvard University.

⁷ U.S. Energy Information Administration, What Drives U.S. Gasoline Prices?, October 2014.

The Association for Convenience and Petroleum Retailing found factors that contribute to retail gasoline price variations in different geographic areas include distribution costs, regulatory mandated fuel blend requirements, business costs, market conditions, the brand of fuel, taxes, and the pricing strategy of the individual retail outlet.⁸

State gasoline and diesel fuel taxes are an important way to fund state transportation improvement programs—accounting for an average of 45 percent of all user fee revenues collected at the state level and 18 percent of all state highway program funding.⁹

Fuel tax revenues are used for different parts of state highway and bridge programs, such as new construction, major repairs, routine maintenance, and grants for county and local governments.

State Gas Tax Changes, 2013 to 2018

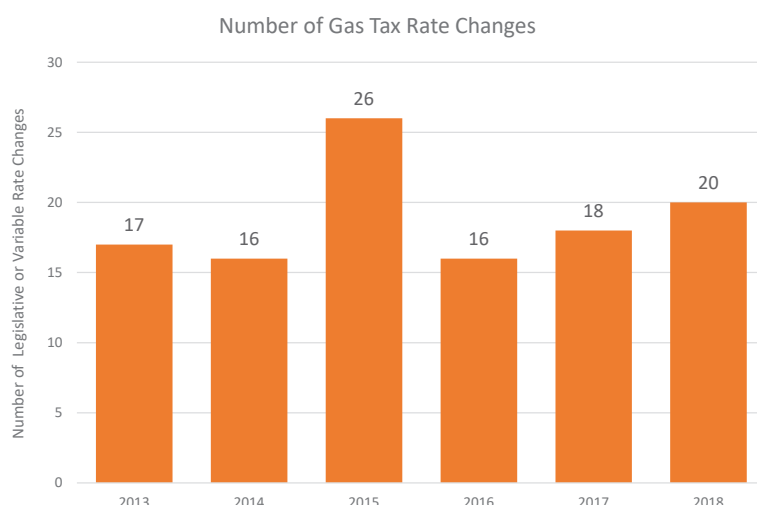
Twenty-nine states made changes to their gas tax rates—both increases and decreases—from 2013 to 2018, a total of 113 adjustments ranging from one-time increases approved by the state legislatures to automatic changes for variable rates based on formulas written into law. There were also 28 times where state variable rates did not change, and the gas tax rate remained the same.

Of the 113 changes, the rate increased 75 times and decreased 38 times.

The average state gas tax increase was 3 cents-per-gallon, but on average only 1 cent—or one-third if the increase—was passed through to the consumer in the retail price of gasoline, according to ARTBA-TIAC’s model. The average decrease in the tax rates was 1.4 cents-per-gallon, with just under one-half cent of that decline passed through in retail prices.

During this time, the average retail price of gasoline fluctuated between \$1.33 per gallon in Oklahoma (Feb. 12, 2016) up to \$4.40 per gallon in Hawaii (March 8, 2013). Nationwide, the average retail price of gasoline ranged from \$1.70 to \$3.79 per gallon.

The daily change in the national retail price fluctuated from a 2.7 cents-per-gallon decline to a 7.3 cents-per-gallon increase, averaging to flat prices over the five-year period. Overall, the national average retail price per gallon of gasoline declined from \$3.29 on Jan. 1, 2013, to \$2.26 on Dec. 31, 2018.



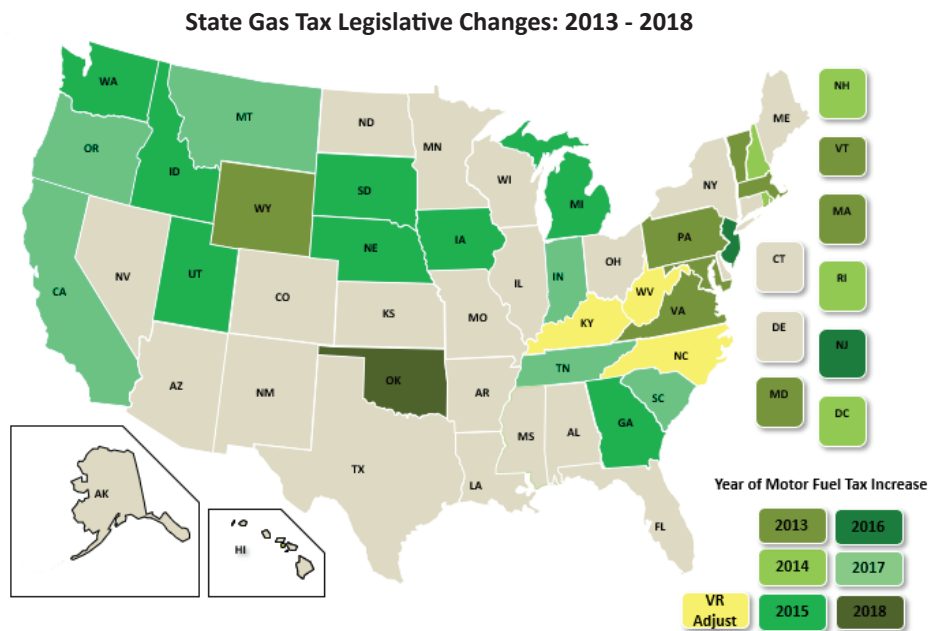
⁸ NACS Gas Price Kit

⁹ U.S. Department of Transportation, Federal Highway Administration Highway Statistics 2017, Table SF-1.

State gasoline prices also fluctuated on the day after a gas tax increase or decrease was enacted.

Between 2013 and 2018, there were 75 times when a state gas tax rate increased. For half, the retail price of gasoline declined the day after the state gas tax increase went into effect. For 8 of them, the retail price of gasoline did not change at all.

For states where the gas tax rate decreased, the average retail price of gasoline declined the next day 90 percent of the time.



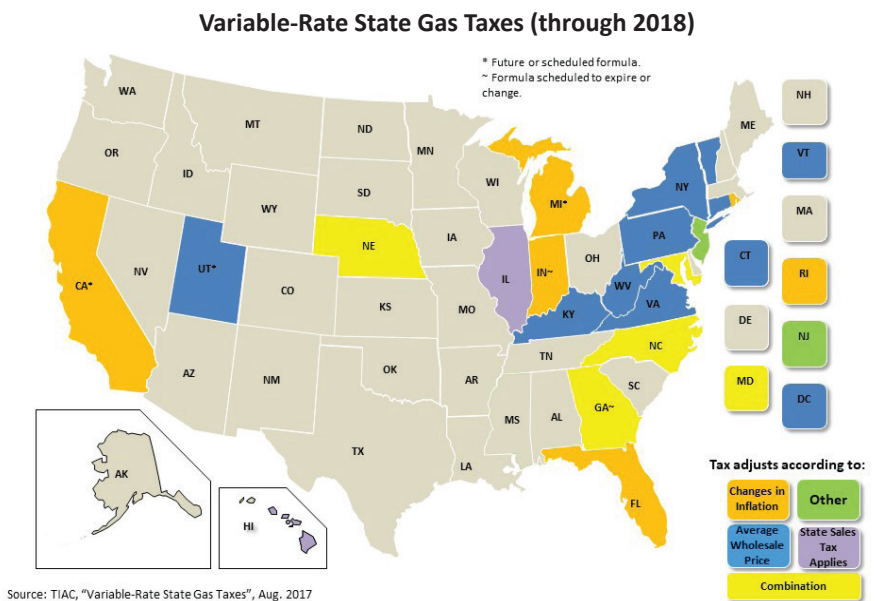
The ARTBA-TIAC analysis also examined changes in retail gas prices for the 15 days preceding a state gas tax rate change, considering there is often time between when rate changes are approved (or announced) and enacted. There was no significant increase in prices before the rate change went into effect, meaning that daily prices were not rising in anticipation of a rate increase.

Variable Gas Tax Rates

States routinely evaluate their transportation infrastructure needs to determine if revenues meet demand.

If a state determines the need is greater than current revenues, it may choose to increase the state gas tax—the primary source of transportation revenue in most states—to close the shortfall.

Most states do this through the legislative process, meaning lawmakers must propose and approve the tax increase. In most states, majority approval is sufficient to pass the bill—in 15 states¹⁰ a percentage higher than a simple majority may be necessary. At least two states—Colorado and Missouri—must submit any tax increase that will generate more than a certain amount to voters for approval through the ballot process.



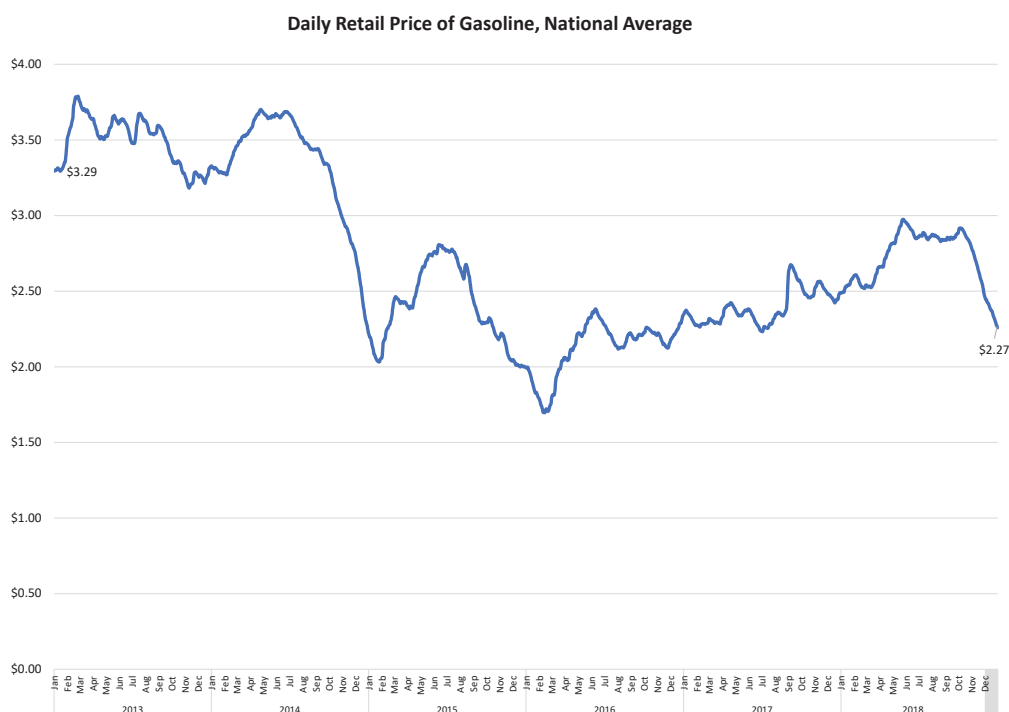
Source: TIAC, "Variable-Rate State Gas Taxes", Aug. 2017

¹⁰ National Conference of State Legislators, "Supermajority Vote Requirements to Pass the Budget." 11/9/2018

In addition to legislation, by 2018 20 states had created variable-rate formulas that adjust the cents-per-gallon charge at the pump based on external factors, including changes in the wholesale price of gasoline, general economic inflation, construction prices, or other factors. In 2019, two additional states converted their flat tax to a variable-rate formula.

Most of these states evaluate their current gas tax rate annually and make adjustments based on the factors included in their variable-rate formula. However, DC and Nebraska adjust their tax every six months, South Carolina and Alabama (2019) adjust every two years, and Vermont state adjusts quarterly.

The TIAC analysis found the type of state gas tax increase—legislatively approved or an automatic change in the variable rate—did not have a significant impact on how much of the rate change was passed through in the retail price of gasoline.



Implications for the Federal Gas Tax

Federal funds, on average, provide 51 percent of annual state department of transportation capital outlays for highway and bridge projects.

However, the federal gas tax—the primary revenue source for the nation’s transportation investment program, the Highway Trust Fund (HTF)—has not been increased since 1993.

To supplement the decreased purchasing power of the federal gas tax, Congress has instituted multiple one-time general fund transfers to the HTF since 2008. Uncertainty related to the HTF’s financial condition has caused states to delay transportation improvements.

The current federal-aid highway and transit law, the FAST Act, expires Sept. 30, 2020. Estimates are that one year later, there will be an average annual shortfall of \$18 billion between HTF revenues and the amount necessary to preserve current federal highway investment levels.

The results of ARTBA-TIAC’s analysis suggest an increase of 20 cents-per-gallon in the federal gas tax rate would increase the retail price by about 6 cents-per-gallon. With the price of gasoline averaging \$2.69 per-gallon in 2019, that additional 6 cents-per-gallon represents an increase of just 2 percent.¹¹

For the average driver who buys 560 gallons of gasoline per year, this totals an additional \$33.60 annually—or less than \$3 per month.

At the same time, drivers and businesses would save money as highway, road and bridge conditions and travel times improve. Safety upgrades would help prevent fatalities and reduce crash injuries.

The additional 20 cents-per-gallon also would support an estimated \$28 billion in annual highway, bridge, and transit investment above current levels. This would not only close the funding shortfall in the HTF, but also allow additional improvements to be made.

Republicans and Democrats have voted for increasing transportation investment in recent years. Legislation to raise the gas tax was approved in 16 states with a Republican governor and GOP majority legislature, and seven states with a Democratic governor and Democratic majority legislature. Control of the executive and legislative branches was split in five states.

¹¹ U.S. EIA, national average for retail gasoline prices, 2019.

About OPIS

Oil Price Information Service (OPIS) is one of the world's most comprehensive sources for petroleum pricing and news information. In 1980, OPIS pioneered "rack" price discovery for thousands of wholesalers, and now maintains the world's most comprehensive database of U.S. wholesale petroleum prices, publishing more than 30,000 rack prices each day at over 1,500 terminals in nearly 400 market locations.

In 1999, OPIS launched the first retail fuel pricing database in North America. With its unique ability to map retail prices back to wholesale markets, it quickly launched a retail margin service. OPIS now receives daily gasoline and diesel prices for more than 130,000 retail outlets in the U.S. and Canada. OPIS prices are used by AAA, Microsoft (MSN Autos), Garmin, MapQuest and dozens of other website and mapping companies, in addition to its core oil company base.

About the Model

A fixed effects regression model includes a series of group-specific constant terms to consider unobserved characteristics that do not change over time. The model can be expanded to include a time trend variable to capture time-specific effects. By using a fixed effect specification, the model considers unique factors that the state level and over different time periods that would have an impact on the state level retail price of gasoline. For example, if a state is located near a refinery, that would have a consistent impact on the competitive environment and an individual state's retail price of gasoline.

Difference in variable versus flat

The data in this report concluded there is no difference in the impacts of a variable-rate gas tax change and a legislative gas tax change. The average legislative increase (decrease) was 6 cents-per-gallon (- 4 cents-per-gallon). The average variable-rate rate increase (decrease) was 1.6 cents-per-gallon (- 1.2 cents-per-gallon).

The model estimates the log of the daily state retail price of gasoline. The independent variables are the log of the price of Brent crude oil for 30 days prior to each observation, the log of the state gas tax related rate and a series of dummy variables to capture the impact of the rate change for a 30-day period. Additional models examined the impact of the rate change in the 15 days preceding the effective date. The final model also includes fixed effects for states and each month of the year, plus an interactive term to capture any combined state and monthly time effects.

Overall, there were over 110,200 observations included in the data set. The overall r-squared of the model was .80, indicating the independent variables in the model explain about 80 percent of the variation in the dependent variable, the daily change in the retail price of gasoline.

About the Authors

This research was conducted by Dr. Alison Premo Black, senior vice president and chief economist for the American Road & Transportation Builders Association (ARTBA) in Washington, D.C.

Dr. Black earned her Ph.D. in economics at The George Washington University in Washington, D.C. She also earned an M.A. in international economics and Latin American Studies from the Johns Hopkins School of Advanced International Studies, in Washington, D.C.

Since joining ARTBA in 2000, Dr. Black has led teams and authored over 100 studies examining state transportation funding and investment patterns.

Carolyn Kramer, director of the ARTBA Transportation Investment Advocacy Center (TIAC), is responsible for significant research and background work on the report. She graduated from Rutgers College with a B.A. in political science. Kramer has tracked and analyzed over 1,000 state and local ballot initiatives, 600 state legislative measures, and the reelection rates of over 3,000 state lawmakers since 2012.