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Revenue Impacts of a Gasoline Tax Cut in West Virginia

By **Eric Bowen, PhD,** Research Assistant Professor
Christiadi, PhD, Research Associate
John Deskins, PhD, Director

Introduction

In this report we consider how a reduction in West Virginia's gasoline excise tax rate would likely affect gasoline purchases in the state. In particular we focus on the question of whether a reduction in the gasoline excise tax rate – currently set at 34.6 cents[1] - would increase purchases to such an extent that overall gasoline excise tax revenue would be unchanged. Overall, our examination of data related to consumers' response to gasoline price changes indicate that it is unlikely that an increase in gasoline purchases following a reduction in the excise tax rate would be sufficient to render revenue neutrality.

Effect of a Tax Cut on Gasoline Purchases

When the tax rate on gasoline changes, we can expect that consumers will change how much they purchase in response to this change in the price. Economists measure how much consumers will change their purchasing habits as an elasticity of demand, which is defined as the percent change in quantity of the good purchased ($\%\Delta Q$) divided by the percent change in the price of the good ($\%\Delta P$):

$$\epsilon_D = \left|\frac{\%\Delta Q}{\%\Delta P}\right|$$

Price elasticities of demand are almost always negative, meaning that if the price rises, the quantity purchased falls. However, to assess the magnitude of the relative changes in quantity purchased and price, elasticities are generally expressed as the absolute value of this equation.

We can use the concept of price elasticity to evaluate how responsive consumers' demand for gasoline would have to be in order for a tax rate reduction to be revenue neutral. As an example, we consider the existing gasoline excise tax rate in West Virginia of 34.6 cents per gallon, and assume a gasoline price of

[1] West Virginia has a two-part gasoline excise tax rate that totaled 34.6 cents per gallon in 2015. This rate consists of a 20.5 cent per gallon fixed rate and a variable rate that is calculated as 5 percent of the average gasoline price from the preceding July 1 – December 31 period. The law also sets a minimum variable rate of 11.7 cents per gallon.

$1.79 (the average statewide price as of Feb. 5, 2016). We also assume that the entire tax cut would be passed on to consumers through a lower gasoline price.

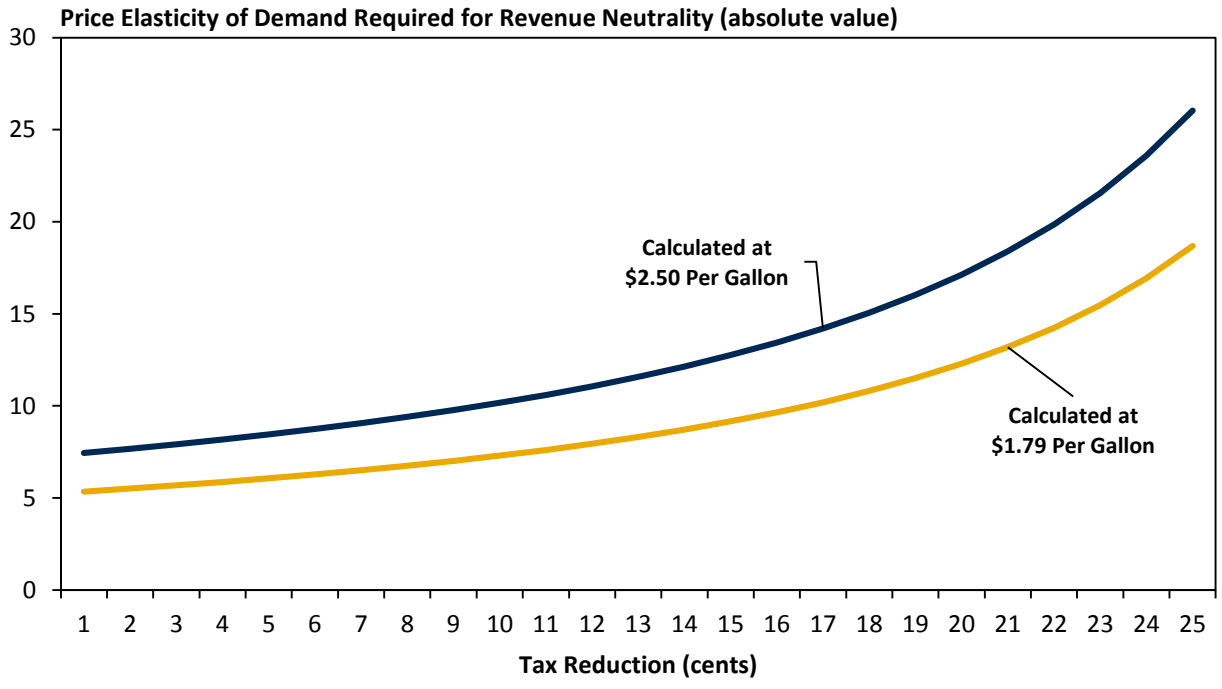
Consider, for instance an excise tax rate reduction of one-half – a reduction of 17.3 cents per gallon. This change would reduce tax revenue per gallon of gas sold in half, correspondingly. Therefore, in order to maintain revenue neutrality, gasoline retailers in the state would have to sell two gallons of gasoline for every one gallon sold previously, which is equivalent to a 100 percent increase in gasoline purchases. However, this level of tax cut would reduce the price per gallon by about 10 percent (around 17 cents per gallon tax relative to a retail price of $1.79 per gallon). Using these numbers, we can calculate the price elasticity of demand required for revenue neutrality as follows:

$$\epsilon_D = \left|\frac{100\%}{-10\%}\right| = 10$$

This shows that in order for a 10 percent gasoline tax cut to generate tax revenue neutrality, the price elasticity of demand for gasoline would have to be 10.

Figure 1 charts the required elasticity of demand for revenue neutrality over a series of potential tax reductions. As the tax reduction rises, the elasticity required to remain revenue neutrality goes up substantially (in absolute value). The elasticity requirement also increases as the price of a gallon of gasoline rises because the tax reduction represents a smaller proportion of the price of a gallon of gasoline. In the figure, the yellow line shows the elasticities at the average price of $1.79 per gallon from February 5, 2016, while the blue line shows the elasticity requirement at a hypothetical price of $2.50 per gallon.

Figure 1: Elasticity of Demand Required for Revenue Neutrality in West Virginia



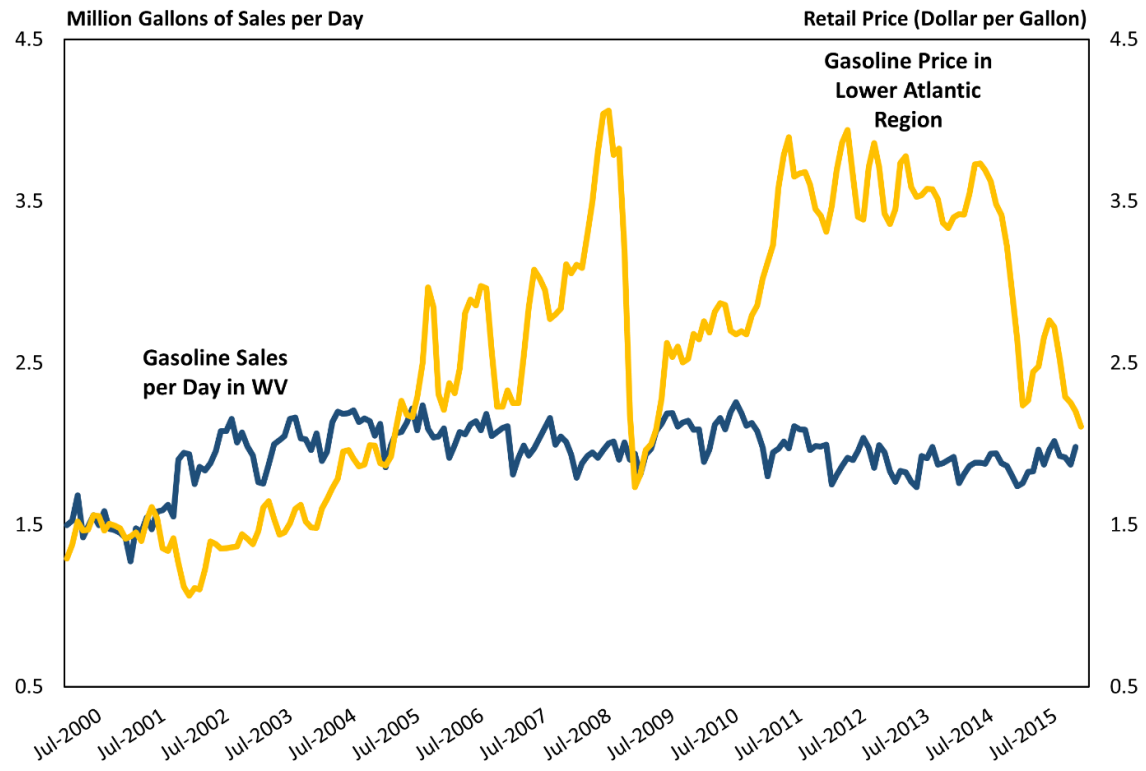
Source: Author Calculations

Estimates of the Price Elasticity of Demand

The price elasticity of demand for gasoline has been extensively studied in the United States. Instead of replicating this analysis, we review the economics literature to produce the best estimate of the price elasticity for gasoline.

In general the literature finds that consumers have a relatively low sensitivity to gasoline price changes. To illustrate, Figure 2 compares gasoline sales in West Virginia with the average price per gallon in the Atlantic Region, which includes West Virginia and Florida, Georgia, North Carolina, South Carolina, and Virginia. The figure reveals a relatively stable volume of gasoline purchases compared to the far more volatile price figure. Overall, gasoline purchase fluctuated by around 77 percent over the period, rising from their low in 2001 to their high in 2010, not accounting for seasonal factors. In contrast, the price fluctuated by around 277 percent.

Figure 2: Demand Response to Gasoline Price Fluctuations



Notes: Gasoline Retail Price represents the price for the Lower Atlantic Region
Source: US Energy Information Administration

Several academic researchers have attempted to quantify the elasticity of demand for gasoline in the United States. Lin and Prince (2013)[2] compiled the results from nine such studies published between 1991 and 2008. Their findings are replicated in Table 1. The authors' literature survey showed that on

[2] Lin, C., L. Prince. 2013. "Gasoline price volatility and the elasticity of demand for gasoline." *Energy Economics*. 38, 111-117.

average the long-run price elasticity of demand for gasoline ranged from -0.10 to -0.86, meaning that a 10-percent fall in the price of gasoline produced an increase in sales of between 1.0 and 8.6 percent.

Devereux, Lockwood, and Redoano (2006)[3] found that a home state's gasoline tax rate is not affected by the neighboring states' gasoline tax rates. They conclude that this suggests that the role of crossing the border to shop for gasoline is not a significant factor in consumers' responses to gasoline price changes.

Table 1: Long-run Price Elasticity of Demand for Gasoline in the United States

Study	Date Range	Mean of Long-Run Price Elasticity
Dahl and Sterner (1991)	pre 1989	−0.86
Espey (1998)	1929 – 1993	−0.58
Goodwin (1992)		
Time series	pre 1987	−0.71
Cross section	pre 1987	−0.84
Goodwin et al. (2004)	1929 – 1991	−0.64
Graham and Glaister (2002)	pre 1994	−0.23 to −0.80
Graham and Glaister (2004)	pre 1994	−0.77
Hanly et al. (2002)	1929 – 1991	−0.64
Waduh et al. (2009)	1978 – 2004	−0.102 to −0.118
Small and Van Dender (2007)	1966 – 2001	−0.16
	1997 – 2001	−0.16

Source: excerpted from Lin, Y.C. and Lea Prince (2013), Table 1, page 112.

Conclusion

Given the relatively low estimates of the price elasticity of demand for gasoline found in the economics literature, it appears unlikely that a reduction in West Virginia's gasoline tax will induce consumers to purchase enough additional gasoline to offset the revenue losses from the tax reduction.

For illustration, a relatively small reduction of 10 cents in West Virginia's gasoline tax rate would require a price elasticity of demand at current prices of nearly 7.3 to offset the revenue losses from the tax cut. This elasticity is several orders of magnitude larger than we would expect to observe in the marketplace based on our review of the literature. Further, this required elasticity would rise with higher gas prices.

[3] Devereux, M.P., B. Lockwood, M. Redoano. 2007. "Horizontal and vertical indirect tax competition: Theory and some evidence from the USA." *Journal of Public Economics* 91, 451-479.

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