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An Analysis of the Impact of the Increase in Excise Tax on Gas in California

Introduction

On April 6, 2017, Legislative leaders and Gov. Jerry Brown of California approved and signed into law the "Road Repair Accountability Act", also known as Senate Bill 1. This bill proposes to raise base excise taxes and price-based excise taxes by November 1, 2017 and July 1, 2019 respectively. $2.4 billion is estimated to be raised through the excise tax increase on gasoline (Jim Miller, 2017).

This paper analyzes the possible impact this increase in gasoline excise tax will have on the total gasoline consumption in the state of California. It is expected that base-price for gasoline will rise due to the tax increase, which in turn is expected to reduce total gasoline consumption by some amount. However, considering that the demand for gasoline is historically rather inelastic in nature and the fact that there are almost no close substitutes for the average gasoline consumer, the said decrease in consumption level should be relatively minimal. Ergo, this policy is highly likely to raise a considerable amount of the intended revenue, if not more, by the end of 2027.

Policy Background

As of October 23, 2017, the state of California has both a base excise tax and a price-based excise tax on gasoline in place at 18 cents a gallon and 9.8 cents a gallon respectively; a combined tax rate of 27.8 cents a gallon (Jim Miller, 2017, Rob Nikolewski, 2017). However, California authorities plan to raise a total of $52.4 billion by the end of 2027 for the repair of old and damaged roads and bridges and Senate Bill 1 was, therefore, signed into law. It proposes a base excise tax increase to 30 cents a gallon by November 1, 2017 a price-based excise tax reset to 17.3 cents a gallon by July 1, 2019. That makes for a total tax of 47.3 cents a gallon by July 2019, representing a combined excise tax increase of 19.5 cent a gallon (Rob Nikolewski, 2017).

Proponents of this bill suggest that this excise tax increase will generate an annual average of $2.4 billion for 10 years. To predict whether this estimate is feasible, the overall effect of the gasoline excise tax increase on the total consumption must be determined first. For the purposes of this paper, short (one year) and long-term estimates of all necessary parameters will be discussed to provide a clearer understanding of the potential magnitude of this change.

Methodology

In order to remain within the page requirement of this paper, the impact of the partial tax incident (the 12 cents a gallon increase in base excise tax alone) between November 2017 to July 2019 will not be included. This study will instead focus on determining what the impact of the combined tax increase on annual consumption level would be once it takes effect on July 2019 before predicting whether the expected revenue of $2.4 billion is feasible at all.

It is worth acknowledging that gasoline sellers are the ones that pay excises taxes directly to the government since they bear the statutory incidence of that tax. Figure 1 explains what is happening to the supply curve and the quantity demanded as a result of the tax. There will be a shift in the entire supply of gasoline in the market without shifting demand. This is because this tax is perceived as an additional cost of production to sellers alone. Consumers, on the other hand, are expected to experience this tax merely as a hike in price, decreasing only the quantity of gasoline demanded. It is important, however, to remember that the magnitude of the price change, and hence, that actual quantity of gasoline consumption, depends on how the burden of the tax is shared among consumers and producers. That is because price elasticities of demand and supply prevent the change in price from being necessarily identical to the tax increment. Therefore, to find out what the share of each tax burden is, it is essential to understand the proportionate ratios of the price elasticities of demand and supply for gasoline given the tax incidence.

According to "Gasoline price volatility and the elasticity of demand for gasoline" (C.-Y. Cynthia Lin, 2013), a mean estimate of -0.21 for short-run (one year) demand elasticity for gasoline can be derived whereas a mean estimate of -0.54 can be derived for long-run demand elasticity. The average short-run price elasticity of U.S. oil supply was found to be 0.052 while long-run supply elasticity estimates average to 0.394. Considering only the absolute values of every elasticity estimate, the respective tax share can be found in the following way:

Fraction of tax borne by demander = Es/(Ed+Es)

Fraction of tax borne by supplier = Ed/(Ed+Es)

Where Es = Price Elasticity of Supply and Ed = Price Elasticity of Demand

Table 1 provides the final estimates for each tax burden share. Once short and long-run prices due to tax have been properly determined using given elasticities, the total effect on consumption can be defined as:

$$E^D = \frac{\frac{Q_n - Q_O}{Q_O}}{\frac{P_n - P_O}{P_O}}$$

As seen in Table 1, 79% of the tax incident is borne by the consumer in the short-run and 58% in the long-run. That translates into 15.4 cents and 11.31 cents per gallon of the burden respectively, representing the "true" increase in price that consumers of gasoline perceive.

As of October 24, 2017, the American Automobile Association (AAA) estimated the state of California's average price for gasoline to be $3.03 at equilibrium (American Automobile Association, 2017). The future price after tax is, therefore, expected to rise to $3.18 in the short-run and $3.14 in the long-run, providing values for P_o and P_n. Current levels of gasoline consumption were measured in British Thermal Units (Btu). A Btu is "*the quantity of heat required to raise the temperature of one pound of liquid water by 1 degree Fahrenheit at the temperature that water has its greatest density (approximately 39 degrees Fahrenheit)*" (EIA 2017). It converts at the rate 1 gallon = 120,476 Btu. The US Energy Information Administration (EIA) has depicted gasoline consumption for the state of California to be 1,684.7 Trillion Btu in 2015. This translates into 13,983,697,998 gallons which can be plugged in for Q_o. Finally, this paper utilizes only estimates for demand elasticity for its analysis since it aims to evaluate overall impact of the increased tax on consumption level of gasoline and not its supply. Table 2 summarizes available parameters for the predictive calculations. Q_n and P_n for short-run estimates becomes Q_o and P_o respectively for long-run analysis.

Calculations and Results

The effect on consumption can be found by making Q_n the subject:

$$Q_n = Q_o \times [\left(\frac{P_n - P_o}{P_o}\right) + 1]$$

Short-term impact: $Q_n = 13{,}983{,}697{,}998 \times [\left(\frac{3.18-3.03}{3.03}\right) + 1]$ = **14,675,960,275.1** gallons a year

Long-run impact: $Q_n = 14{,}675{,}960{,}275.1 \times [\left(\frac{3.14-3.18}{3.18}\right) + 1]$ = **14,491,357,001.2** gallons a year

Impact of tax on government revenue: Total revenue raised through tax = Tax Incidence $\times Q_n$

Short-run revenue: 0.195 dollars $\times$ 14,675,960,275.1 gallons= **2,861,812,253.64** dollars a year

Long-run revenue: 0.195 dollars $\times$ 14,491,357,001.2 gallons = **2,825,814,615.23** dollars a year

Limitations of Analysis

Due to the lack of available literature on price elasticity of demand and supply for the state of California, national average elasticity estimates were instead drawn to represent California estimates. Also, estimates for elasticity, before-tax consumption level and prices may not be perfectly current or accurate as estimates from studies of previous years were used. The partial tax (12 cents a gallon) during the first two years was not included in this analysis and, hence, necessary adjustments should be made to account for it.

Conclusion

Given the estimates that were used for this study, as well as accounting for their limitations, Senate Bill 1 appears to be feasibly capable to reach its intended goal. This analysis predicts that at the estimates used for this purpose, a short and long-run annual average of $2,861,812,253.64 and $2,825,814,615.23 respectively will be raised through the tax increase. Proponents of this bill suggested that an annual average of about $2.4 billion will be raised and this appears to be reasonably consistent with this study compared to estimates proposed by opponents of this bill such as Travis Allen. They estimate this policy to raise $5.2 billion annually from the 12 cents per gallon increase in base tax alone. There appears to be no reasonable consistency to the results of this study as it amounts to nearly twice as much revenue raised than this paper predicts.

Appendix

Tables

Table 1: Short and Long-Term Elasticity Estimates And Share of Tax Incident

	Short Term Elasticity Estimate	***Long Term Elasticity Estimate***	***Short Term Tax Share***	***Long Term Tax Share***	***Short Term Tax Incident (in cents)***	***Long Term Tax Incident (in cents)***
Demand	**0.21**	**0.54**	0.2/(0.2+0.052) = **0.79**	0.54/(0.54+0.394) = **0.58**	0.79 x 19.5 = **15.41**	0.58 x 19.5 = **11.31**
Supply	**0.052**	**0.394**	0.052/(-0.2+0.052) = **0.21**	0.394/(0.54+0.394) = **0.42**	0.21 x 19.5 = **$4.09**	0.42 x 19.5 = **$8.19**

Fraction of tax borne by demander = Es/(Ed+Es), Fraction of tax borne by supplier = Ed/(Ed+Es), where Es = Price Elasticity of Supply and Ed = Price Elasticity of Demand. Absolute values of every estimate were used for calculations.

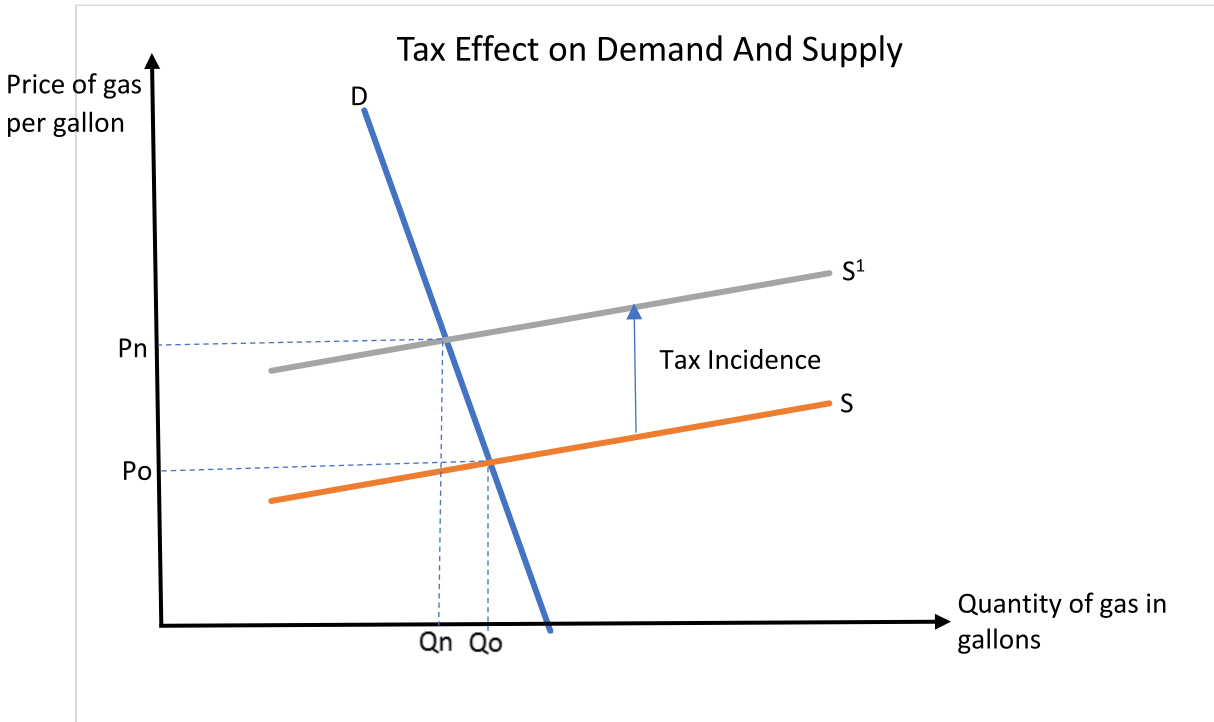
Table 2: Summary of Results

	Estimates before tax increase	***Expected short-run estimates after tax (at Ed = -0.21)***	***Expected long-run estimates after tax (at Ed = -0.54)***
Price (dollars)	3.03	3.18	3.14
Quantity consumed (million gallons)	13,983,697,998	14,675,960,275.1	14,491,357,001.2
Extra Revenue from Tax increase ($) (Tax increment × Q_n)	n/a	2,861,812,253.64	2,825,814,615.23

Ed = price elasticity of demand, Q_n = New quantity consumed due to tax, Tax increment = 19.5 cents a gallon

Figures

Figure 1: Market Supply Shift due to Tax



Po = Old Market Price, Pn = New Market Price due to tax, Qo = Old Market Quantity, Qn = New Market Quantity due to tax

D = Market Demand, S = Market Supply, S^1 = Market Supply due to Statutory Tax Incidence

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