The Effects of an E10 Ethanol-Blend Policy on California

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National attention has emerged in support of biofuel development and use. The motivating factors include high oil prices, security concerns from relying on foreign energy sources, support for economic growth in the United States' agricultural community, and environmental goals related to criteria pollutants and climate change emissions. Given the existing production infrastructure and experience with fuel blending, the biofuel of choice is currently ethanol. Currently, gasoline fuel in California includes approximately 5.7% ethanol (E5.7).

Another mixture, E10, combines10% ethanol and 90% gasoline for use in internal combustion engines of most modern automobiles and light-duty vehicles. E10 blends are mandated in some areas for emissions and other reasons.

The potential effects of an E10 ethanol-blend policy in California are uncertain. In California, ethanol fuel or corn feedstock is largely imported from midwest states creating interstate transport challenges. Ethanol fuel cannot be transported in the fuel pipeline system and needs to be blended with gasoline near the end-market locations.

Additionally, certain blend fractions of ethanol in gasoline can increase evaporative emissions and permeation, resulting in larger air quality concerns. Moreover, especially in California, E10 from corn is supported largely because it facilitates the transition away from petroleum and toward biofuels. But this issue has not been thought through, and is subject to a variety of uncertain assumptions.

How much ethanol would be consumed in CA each year for the next ten years if there were a mandatory E10 policy? In recent research with graduate students Wei Zhang, Omid Rouhani and Lea Prince, I estimate ethanol consumption based on projections of fuel demand as a base case, and then analyze different scenarios.

In order to estimate the required ethanol quantities under an E10 mandate, we first estimate future gasoline fuel demand. The estimation of demand models for gasoline has produced varying results over the past few decades and continues to be a subject of great interest. Estimates drawn from analysis that includes recent data and California-specific data are scarce, however.

A key parameter in the estimation of gasoline

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demand is the price elasticity of demand, which measures the percent change in gasoline demand for a percent change in gasoline price. It is a measure of how responsive consumers are to changes in the price of gasoline. The higher the elasticity in magnitude, the more consumers will decrease gasoline consumption in response to an increase in gasoline price. According to previous

studies estimating the elasticity of demand for gasoline using data spread over the years 1929 to 2000, the mean short-run elasticity ranged from -0.25 to -0.28. Short-run elasiticities measure the responsiveness over a time span of several months. One recent study, Hughes et al. (2008), shows that demand has become more inelastic over the recent years. In particular, they find that short-run elasticities have decreased by up to an order of magnitude from a range of -0.21 to -0.34 for the years 1975 to 1980, to a range of -0.034 to -0.077 for the recent years 2001 to 2006.

To determine how much ethanol would need to be supplied in California each year from 2010 to 2020 if there were a mandatory national E10 policy that required 10% of the fuel blend to be ethanol, we start with a model of fuel demand for California. Under an E10 policy, 10% of this fuel demand would have to be ethanol.

According to our model, we find the intermediate-run price elasticity of demand for gasoline in California to be -0.221. Unlike the previous estimates of the elasticity of demand, our estimate is specific to California and the data used in its estimation include data from recent years. In alternate specifications, we also use a range for the elasticity, from -0.101 to -0.28, which encompasses the range of mean elasticities found in the literature.

If implemented, an E10 policy in California would have impacts on ethanol consumption and greenhouse gas emissions, among other effects. Under an E10 policy in California, the ethanol consumption in 2020 will range from 1.56 billion to 2.40 billion gallons, with a base case value of 1.68 billion gallons. The average greenhouse gas emission reduction in 2020 using an E10 policy for the present combination of feedstock will be 1.37% compared to the current E5.7 blend, with a range of -0.94% to 3.87%.