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# Clean Air regulation and heterogeneity in US gasoline prices ☆

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**Abstract**

In order to improve public health in areas with air quality problems, the US Clean Air Act imposes a variety of federal regulations on gasoline, which have led to a proliferation of fuel blends known as "boutique fuels." More than 45 fuel blends are sold nationwide. We examine the effects of this program on wholesale gasoline prices. The methodological innovation in this study is the use of a regulatory distance measure as a proxy for measuring market power that arises from product differentiation. We find that Clean Air regulation increases gasoline prices by increasing the cost of refining, but more importantly, by creating regulatory "islands," it segments the market and increases the market power of firms. Our estimation controls for the potential endogeneity of the regulatory variables. We find that OLS techniques systematically underestimate the effect of regulation on gasoline prices.


*JEL classification:* L51; L71; D43

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## 1. Introduction

In order to improve public health in areas with air quality problems, the US Clean Air Act of 1990 led to a variety of federal regulations that aim to reduce emissions from motor vehicles. The Act allows individual states to implement their own clean fuel programs for gasoline to address local or regional air quality concerns. These federal and state regulations have not only led to a significant improvement in air quality but also to a proliferation of clean fuel blends. Differential gasoline standards include the Reformulated Gasoline (RFG) program, the Oxygenated Gasoline (OXY) program, and federal or state programs that impose lower volatility requirements, caps on sulfur content, the use of fuel additives such as methyl tertiary butyl ether (MTBE) and ethanol, as well as requirements for minimum oxygen content.

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At least 15 different types of fuel specifications are currently in use. Combined with the three octane grades of gasoline available at pumps—regular, mid-grade and premium[1]—over 45 different blends are used nationwide [29]. A new ozone rule proposed by the EPA is expected to add another 24 new blends into the mix in the near future.[2] These fuels are often called ''boutique fuels.''

An investigative committee of the United States Senate concluded that ''the mix of state and federal standards in effect today has resulted in a situation where adjacent areas may be using gasoline with significantly different properties'' [32, p. 74]. Because requirements vary between and within states, refiners find it difficult to move product quickly from one area to another. Critics have suggested that the multiplicity of fuels in use have caused price volatility especially during periods of supply disruption, such as winter–summer transitions, periods of high demand and refinery and pipeline breakdowns, since refiners mostly specialize in producing certain fuel specifications and cannot switch between them immediately. They have also resulted in supply bottlenecks and pipeline congestion because various types of fuels must often use the same pipeline system.[3]

Boutique fuel programs have ''fewer fuel producers, are less fungible and have fewer distribution system supply options'' [19]. The magnitude of the problem varies with volumes, distance from supply sources and their number, which in turn depends on the degree of product differentiation. For example, in the summer, fuel produced for the Charlotte, North Carolina area cannot be used in Norfolk, Virginia (which must use RFG) or Atlanta, Georgia (which requires a lower Reid Vapor Pressure (RVP) and sulfur cap). However, Atlanta and Norfolk fuels can be moved to Charlotte [34]. The United States Congress is considering enacting legislation to prevent further proliferation of boutique fuel islands through the Boutique Fuels Reduction Act of 2006 [22]. The bill proposes to establish a mechanism to start reducing the number of boutique fuels and broadens the authority of the EPA to waive boutique fuel mandates when supply shortages and price spikes occur.

This paper uses panel data techniques to explain heterogeneity in wholesale gasoline prices[4] due to federal and state Clean Air regulation during the period 1995–2002. We consider two major types of clean fuels, the RFG and OXY programs, which aim to reduce local ozone and carbon monoxide pollution, respectively. We show that Clean Air regulation of gasoline affects prices in two ways: the ''direct cost'' effect: clean gasoline is more costly to produce so the larger the regulated area within a state, the higher the average price in that state, and the ''market segmentation'' effect: the greater the regulatory distance between a state and its neighbors, i.e., the difference in relative size between the clean gasoline markets, the higher the price in that state. The methodological innovation in this study is the use of a regulatory distance measure as a proxy for measuring market power that arises from product differentiation. Compared to an unregulated market, the number of refineries supplying a particular clean fuel may decline, leading to a potential increase in their market power in the regulated market.

Other papers have examined the issue of boutique fuels.[5] Muehlegger [27] uses a structural model to isolate the effect of differential regulation on the price of gasoline during refinery outages in the states of California, Illinois and Wisconsin. These states were chosen because they exhibited significant price spikes in recent years. He finds that during supply shocks these regulations increase refining costs by 3–4.5 cents/gallon. He concludes that during refinery outages, the incompatibility between state and federal regulation may contribute about 5–7 cents/gallon to the price of gasoline, numbers that are higher than our average estimates for the country as a whole.[6] Chouinard and Perloff [9] estimate a reduced-form model of gasoline price

[1]Price levels vary by grade, but the price differential between grades is generally constant [17].

[2]The number of fuels may increase further because of a ban on the use of MTBE (suspected of contaminating groundwater supplies) by some states, introduction of a renewable fuel standard and use of low sulfur fuels [16].

[3]Several pipelines put refiners into an allocation system during peak periods that delays fuel transportation and increases costs [19]. Often the same pipeline has to be washed before carrying a different fuel blend.

[4]Unless stated otherwise, ''price'' will mean the wholesale price of gasoline.

[5]The dynamics of gasoline prices as well as the transmission of price changes from crude to wholesale and from wholesale to retail markets has been studied by Borenstein and Shepard [5] and Borenstein et al. [7]. Borenstein and Shepard [6] examine market power in wholesale gasoline markets through the concentration of refiners supplying products at gasoline terminals.

[6]His higher estimates may at least be partly due to the choice of states with significant gasoline price spikes while our numbers are national averages.