

# Reformulating competition? Gasoline content regulation and wholesale gasoline prices

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## Abstract

The 1990 Clean Air Act Amendments stipulated gasoline content requirements for metropolitan areas with air pollution levels above predetermined federal thresholds. The legislation led to exogenous changes in the type of gasoline required for sale across US metropolitan areas. This paper uses a panel of detailed wholesale gasoline price data to estimate the effect of gasoline content regulation on wholesale prices and price volatility. We investigate the extent to which the estimated price effects are driven by changes in the number of suppliers versus geographic segmentation resulting from regulation. We find that prices in regulated metropolitan areas increase significantly, relative to a control group, by an average of 3 cents/gal. The price effect, however, varies by 8 cents/gal across regulated markets and the heterogeneity across markets is correlated with the degree of geographic isolation generated by the discontinuous regulatory requirements.

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## 1. Introduction

The theory of environmental policy suggests that when setting environmental standards, the government regulator will optimize social welfare by equating marginal external damages and marginal abatement costs. When damages and costs vary spatially, the theory suggests that spatially differentiated standards are appropriate [15,5]. However, spatially differentiated standards have the potential to segment markets that might be integrated under a uniform standard. Segmentation, in turn, may give firms that supply isolated markets the ability to exercise market power. Such secondary effects of spatially differentiated standards on market competition and efficiency may counteract potential benefits of moving from a system with uniform standards to one with spatially differentiated standards. The literature on fiscal federalism discusses the

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optimal geographic size and scope of government policies given the market forces that can lead to efficiency gains or losses as a function of federal versus local policy implementation (e.g. [17,14]).

Historically, US transportation policies have used command-and-control standards to limit emissions rates, gasoline additives, and vehicle fuel economy, primarily at the national level. More recently, the US Environmental Protection Agency (EPA) introduced gasoline content regulations aimed at specific cities with poor air quality, and allowed flexibility in how different areas met those requirements. The policies segmented once contiguous fuel markets and therefore may have had a secondary impact on market structure. This paper examines whether environmental policies aiming to improve environmental quality by reformulating gasoline may have significantly altered competition as well.

The 1990 Clean Air Act Amendments (CAAA) stipulated minimum motor fuel content requirements in order to decrease air pollution in excessively polluted areas. Under the regulation, gasoline marketed in “non-attainment” areas must meet different emissions and formulation requirements depending on the type of air pollution violation.<sup>1</sup> Hence, the implementation of the CAAA resulted in discrete changes in the required formulation of gasoline across metropolitan areas and geographically segmented once contiguous wholesale gasoline markets. By 2004, industry analysts estimated that the number of fuels in the United States proliferated from one type to over 17 types as a result of the regulation [23].

Commensurate with the implementation of the gasoline content regulations, many metropolitan areas seemed to experience higher wholesale gasoline prices and greater price volatility. The timing and geographic location of apparently higher and more volatile prices often coincided with gasoline content regulation. This coincidence prompted several state and federal investigations into the link between gasoline content regulation and wholesale gasoline prices [19,22]. Economists and policy makers hypothesize that, in addition to potentially increasing marginal costs, gasoline content regulations may increase prices for two reasons. First, wholesale prices and volatility may increase due to the segmentation of once integrated geographic markets. The patchwork gasoline requirements based on pollution thresholds create isolated metropolitan supply areas. This may increase the market power of suppliers by limiting arbitrage across markets. Increased market power may lead to higher price levels and higher volatility if limited arbitrage increases the market power of incumbent suppliers in periods of relatively tight supply [21]. Second, producing reformulated fuel often involved large fixed cost investments [18]. Hence, many producers may have opted to exit the regulated markets, leading to a decrease in the number of competitors supplying those markets. Increases in market concentration through increased entry barriers to production may separately contribute to higher and more volatile gasoline prices in the regulated markets.<sup>2</sup>

We use weekly wholesale prices for unbranded gasoline for selected distribution racks in the United States to estimate a reduced-form relationship between prices and gasoline content regulation. We examine how this price effect varies with changes in the number of competitors versus geographic market segmentation induced by regulation. Our reduced-form analysis compares regulated metropolitan areas with unregulated metropolitan areas in close geographic proximity in order to estimate the price effect of gasoline content regulation within the regional gasoline supply chain. In addition, we compare the variance of price series across treated and untreated cities in order to examine the effect of content regulation on price volatility.

Our evidence shows that prices in regulated metropolitan areas increase significantly relative to the unregulated comparison markets. While the price effect of regulation is on average 3 cents/gal, the point estimate for the price effect of content regulation varies across regulated cities by approximately 8 cents/gal. We use the variation in the change in the number of competitors and the change in geographic isolation across the treated metropolitan areas to examine the extent to which each factor contributes to the city-specific increase in wholesale gasoline prices resulting from content regulation. The average effect of reduced competition is estimated at 1.24 cents/gal. This implies that changes in the number of suppliers do not absorb all variation in price effect of regulation across cities, but do have some effect and in the expected direction.

<sup>1</sup>EPA classifies counties as “non-attainment” if air pollution levels exceed criteria limits. The three main types of regulation are Federal Reformulated Gasoline, which was required for metropolitan areas with highest levels of ozone non-attainment, Reid vapor pressure, and oxygenate requirements, for non-attainment areas for ozone and CO, respectively.

<sup>2</sup>A related literature examines how environmental regulations deter entry. For example, a study of the Portland cement industry finds that Title V of the CAAA increased the sunk costs of entry [16]. This exacerbated industry concentration and firms’ ability to exercise market power.

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