



# Economic Letter

## U.S. Gasoline Imports Rise Following Temporary Easing of Fuel Standards

by Adriana Z. Fernández and Robert W. Gilmer

**ABSTRACT:** EPA fuel standards were temporarily waived following major Gulf Coast hurricanes in 2005 and 2008, including Katrina. The results suggest that more uniform environmental standards could help foreign refiners meet extraordinary U.S. gasoline demand.

**A**mendments in 1990 to the Clean Air Act complicated the U.S. gasoline market, with different kinds of fuel sold in at least 15 states. This market segmentation is largely responsible for increasing refining costs and gasoline prices.<sup>1</sup>

The Environmental Protection Agency (EPA) regularly designates counties that are in “nonattainment” or “maintenance” of environmental standards based on the presence of National Ambient Air Quality Standards pollutants in the atmosphere. The EPA’s most recent depiction indicates an intensely fragmented gasoline market (*Chart 1*).

The EPA issued pollution-control waivers in response to hurricanes Rita and Katrina in 2005 and Gustav and Ike in 2008 when the storms disrupted refinery operations along the Gulf of Mexico. The regulator’s actions allow researchers to assess the impact of environmental restrictions on U.S. imports of finished gasoline. Katrina made landfall on Aug. 29, 2005, and Rita followed on Sept. 22; Gustav reached the coast on Sept. 1, 2008, followed by Ike on Sept. 13.

EPA waivers ran from Aug. 25 to Oct. 28, 2005, and from Aug. 29 to Oct. 31, 2008. They were designed to help make up for lost production in the affected areas. During the waiver periods, foreign refiners supplied significant amounts of

extra fuel, responding to more uniform fuel standards across the country and to rising U.S. prices.<sup>2</sup>

### Market Segmentation

A large number of studies suggest that the fuel diversity and market segmentation associated with the 1990 Clean Air Act amendments result in higher fixed and variable costs of refining. Although the high numbers of nonsubstitutable fuels create business and logistic impediments for both domestic and foreign refiners, the impact falls disproportionately on the foreign ones.

Few foreign refiners have the technology to produce gasoline meeting the minimum U.S. standards. And these refiners face a market where requirements for localized blends spread total gasoline demand among various formulations, creating many small markets instead of a single large one.<sup>3</sup>

Sometimes, one type of gasoline cannot be sold in an adjacent county. Neighboring major metropolitan areas frequently use different formulations, which also vary by season as air quality changes. Additionally, the properties of fuel blends that include ethanol—a byproduct of plant materials used to oxygenate fuel to make it burn more cleanly—represent a major impediment for foreign producers.<sup>4</sup>

## Gasoline in 2005, 2008

The impact of the 2005 and 2008 hurricane emergencies and waivers can be assessed by examining short-run movements in the gasoline market during the two periods. The short-run movements are estimated using the statistical process of “detrending,” which allows researchers to concentrate on such fluctuations rather than longer-term trends. For purposes of assessing the market in the 10-week periods following the 2005 and 2008 hurricanes, finished gasoline import and domestic production data from 1995 to mid-2013 were reviewed.<sup>5</sup> The 10-week windows before and after the emergency waivers were also studied.

Refinery production decreased to around 300,000 barrels a day below trend during the emergency period in 2005 (Table 1) and by close to 130,000 below trend in 2008 (Table 2). In both cases, a good portion of the decrease was offset by imports. They rose from an average of slightly more than 3,000 barrels a day above trend immediately before Katrina to 120,000 barrels above trend during the emergency, making up 40 percent of lost production.

In 2008, imports made up a more modest 16 percent of lost production, but increased from more than 33,000 barrels per day below trend in the 10 weeks leading up to the waiver to 20,600 above trend during the waiver period, before drastically decreasing afterward. After the waiver expired, much of the increase in production was offset by finished gasoline inventory buildups and significant drops in imports.

The finished gasoline supply patterns in Tables 1 and 2 suggest that imports rose significantly in response to the temporary simplification of the U.S. gasoline markets that the waivers allowed. The waiver-driven imports also accompanied higher prices resulting from Gulf Coast refinery outages. The transatlantic price differential, about 60 cents per barrel in the 10 weeks prior to the waiver, spiked during the waiver periods—peaking at \$25 per barrel in 2005 and \$31 in 2008.<sup>6</sup>

## Waiver Price Differential Impacts

The data as well as economic theory suggest that the environmental waivers stimulated gasoline imports by temporar-

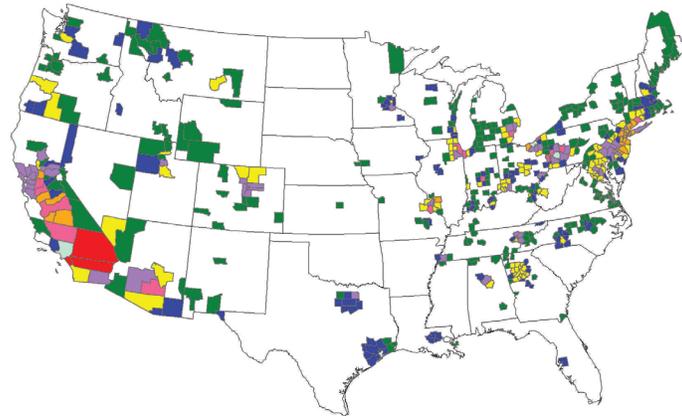
ily decreasing the barriers that foreign producers faced in the highly restrictive and segmented U.S. market. The waivers also allowed price arbitrage to occur.

Based on this interpretation, an

econometric model can be constructed that captures the effects of the waivers and transatlantic price differentials on finished gasoline imports. It incorporates finished gasoline imports and the

Chart  
1

Large Variation in Fuel Standards by County



NOTE: Each color represents a different fuel specification for identified pollutants and is based on Environmental Protection Agency air quality standards as of July 2, 2014.

SOURCE: Environmental Protection Agency, [www.epa.gov/airquality/greenbook/mapnmpoll.html](http://www.epa.gov/airquality/greenbook/mapnmpoll.html).

Table  
1

Finished Gasoline Supply in 2005

	Hurricanes Katrina and Rita in 2005		
	10 weeks before	10-week waiver period	10 weeks after
Production	100.5	-299.8	82.9
Imports	3.0	119.9	1.7
- Exports	11.7	-14.7	-3.6
- Change in stocks	51.6	-4.8	39.5
= Supply	40.2	-160.5	48.7

NOTE: Table shows estimated deviations from long-term trend, in thousands of barrels.

SOURCES: Energy Information Administration; authors' calculations.

Table  
2

Finished Gasoline Supply in 2008

	Hurricanes Gustav and Ike in 2008		
	10 weeks before	10-week waiver period	10 weeks after
Production	125.2	-127.8	59.2
Imports	-33.1	20.6	-125.3
- Exports	5.8	-14.2	-8.3
- Change in stocks	38.7	-30.3	28.3
= Supply	47.6	-62.6	-86.1

NOTE: Table shows estimated deviations from long-term trend, in thousands of barrels.

SOURCES: Energy Information Administration; authors' calculations.

**Table 3** | Estimated Effects on Gasoline Imports  
(Thousands of barrels per day)

Variable	Estimated effect	95 percent confidence interval
Waiver	58,810	10,020–107,590
\$1 price differential	5,150	2,350–7,950

NOTE: There is 95 percent probability that the effects of the waivers and price differentials on gasoline imports are within the confidence intervals shown.

SOURCES: Energy Information Administration; Bloomberg; Environmental Protection Agency; authors' calculations.

transatlantic price differential over waiver periods.<sup>7</sup>

The waivers likely generated almost 59,000 additional barrels a day of finished gasoline imports (Table 3). The high price differentials added close to another 23,000 barrels in 2005 and 20,000 barrels during 2008.<sup>8</sup> The model explains 68 percent of the short-run movements in finished gasoline imports during the period.

The results are economically and statistically significant and appear reasonable. However, the estimated effect of the waivers is large and comes from a model of oil imports that does not explicitly take account of disruptions in domestic oil production. Instead, the hurricanes' extraordinary supply disruptions are indirectly captured by the waiver and price movements.

### A Robustness Check

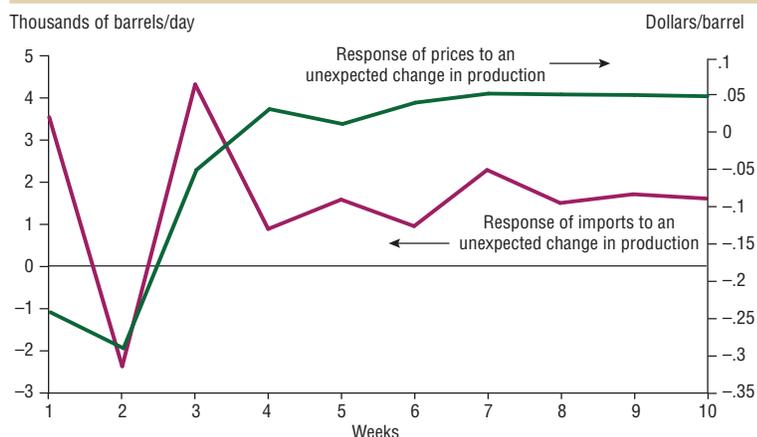
The response of gasoline imports to domestic supply disruptions as well as to waivers and price fluctuations may be fur-

ther tested using a vector autoregressive (VAR) model—a widely used time series technique that captures the interactions over time between related economic variables. This kind of modeling can generate forecasts, given the potential future direction of specified variables. Three variables were studied: domestic finished gasoline production, the transatlantic spot price differential and U.S. gasoline imports.<sup>9</sup> If the response to supply disruptions is weak, one may conclude that the strong response of gasoline imports observed around the emergencies in 2005 and 2008 was related to the waivers.

The results suggest that unexpected domestic oil production disruptions (that is, closures, maintenance or natural disasters) generally have a limited impact on oil imports and the transatlantic price differential (Chart 2). The impact on imports is negligible; an immediate increase of 3,500 barrels per day is quickly reversed after two weeks. The impact on the price differential is also small. If gasoline pro-

▶ The data as well as economic theory suggest that the environmental waivers stimulated gasoline imports by temporarily decreasing the barriers that foreign producers faced in the highly restrictive and segmented U.S. market.

**Chart 2** | Imports and Prices Respond Little to Typical Gasoline Production Shock



SOURCES: Energy Information Administration; Bloomberg; authors' calculations.

duction unexpectedly increases (the result of a typical shock), the price differential initially falls by about 25 cents per barrel. However, the differential reverts to its original level after about the third week.

Price shocks seem to have a slightly greater effect on imports. Overall, the results suggest a low response of imports to sudden, unexpected changes in production and prices. The results also imply that unexpected changes in domestic oil production account for an extremely small percentage of the observed variation in oil imports (0.3 percent) and a small percentage of the observed variation in the oil price differential (2 percent to 3 percent) during the estimation period, January 1995 to May 2013.

Overall, the responses of prices and imports suggest that the extraordinary supply disruptions during the hurricanes in 2005 and 2008 could not be the sole source of the significant increases in prices and imports observed during these emergencies. These results support the idea that the waivers played an important role in attracting imports and allowing price arbitrage conditions to be exploited.<sup>10</sup>

### Meeting Fuel Standards

EPA-issued environmental waivers following Gulf Coast hurricanes in 2005 and 2008 simplified short-term U.S. fuel standards. Foreign refiners supplied more finished gasoline to the U.S., both in response to the waiver and to the spike in prices.

More uniform fuel standards, perhaps combined with more certainty about the long-term content requirements for U.S. gasoline, could allow significant additions to U.S. supplies through imports, especially during short-term, emergency periods of disruption.

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### Notes

<sup>1</sup> See “Boutique Fuels’ and Reformulated Gasoline: Harmonization of Fuel Standards,” by Brent D. Yacobucci, Congressional Research Service Report for Congress, Order Code RL31361, Washington, D.C., Dec. 17, 2004.

<sup>2</sup> While there may be costs associated with degradation of air quality that a more uniform fuel standard would bring, such costs are difficult to estimate. They are not included in the current analysis.

<sup>3</sup> See “Gasoline Supply: The Role of Imports,” by Lawrence C. Kumins, Congressional Research Service Report for Congress, Order Code RL32583, Washington, D.C., Sept. 14, 2004.

<sup>4</sup> Ethanol cannot be stored or transported by pipeline because it does not mix well with gasoline and can separate. Ethanol blends thus have to be mixed near the point of final consumption, giving an edge to local refiners.

<sup>5</sup> We separated the “long term” trend of the data and the “short term” ups and downs around that trend using a technique called the Hodrick–Prescott filter. Energy Information Administration data are weekly, seasonally adjusted and run from January 1994 to June 2013.

<sup>6</sup> The Gulf Coast–New York transatlantic spot price differential equals the difference between Gulf Coast–Rotterdam and the New York–Rotterdam spot prices. The spot price data, which are for Mogas 95RON FOB Barges 10ppm gasoline, are from Bloomberg.

<sup>7</sup> Specifically, the model holds that finished gasoline imports today depend on the level of gasoline imports in each of the last four weeks, the transatlantic price differential and whether waivers were in place. Weekly data from Feb. 2, 1995, to May 24, 2013, were used to estimate the model. A relatively strong explanatory power is present—as indicated by a coefficient of determination (R-squared) of 68 percent.

<sup>8</sup> The estimated effect of the higher price differential on gasoline imports during the 10-week emergency period equals the estimated price coefficient (5.15) times the average price differential in the waiver period.

<sup>9</sup> In the three-variable VAR model, the current values of domestic oil production, the transatlantic oil price differential and oil imports depend on the values of each of these variables in the last five weeks. The data are weekly and the estimation sample is the end of January 1995 to the end of May 2013.

<sup>10</sup> This conclusion is supported by the interaction of the waiver variable with the price differential variable in the model. The interaction effect is positive and significant. The waiver and price differential effects are also positive and significant, although the size of the price effect is smaller than before.

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