

# MU Guide

## Hedging Ethanol in the NYMEX Unleaded Gas Futures

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Ethanol production has reached record levels, becoming a substantial source of corn demand with potential for further growth (Figure 1). As in any industry, the future price of ethanol at any given time is uncertain. Producers and purchasers of commodities commonly mitigate price uncertainty (i.e., lock in a price) by using futures markets to hedge against unexpected or unwanted price movements. Yet, little is known about ethanol price protection using futures contracts.

Futures prices for ethanol and unleaded gasoline are relatively volatile and appear to follow similar patterns at different levels, suggesting that a cash ethanol hedge with unleaded gasoline futures has potential to transfer price risk (or uncertainty) between the cash market and the futures market. This publication presents strategies for hedging ethanol. These techniques are applicable to both long hedgers wanting to reduce input price risk and short hedgers trying to set selling prices. They can be applied to marketing strategies involving either futures or options markets.

### Hedging issues

The New York Mercantile Exchange (NYMEX) futures contract for unleaded gasoline is used because ethanol prices follow the price of unleaded gasoline

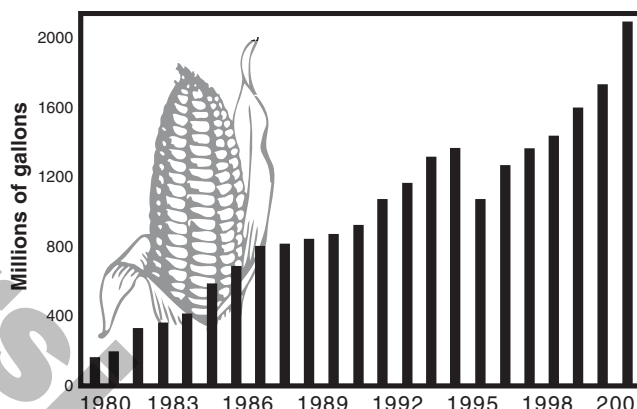


Figure 1. U.S. annual production of fuel ethanol.  
Source: Energy Information Administration and Renewable Fuels Association.

futures closely, as unleaded gasoline and ethanol are energy substitutes (Figure 2).

When hedging ethanol in unleaded gasoline futures markets, the convention is to use one 42,000-gallon contract for each 42,000 gallons of ethanol to be hedged. However, the one-to-one relationship may not be the appropriate futures-to-cash hedge ratio. It may be less risky to take a larger or smaller position in the futures market than in the cash market, depending on the price relationship between ethanol and unleaded gasoline.

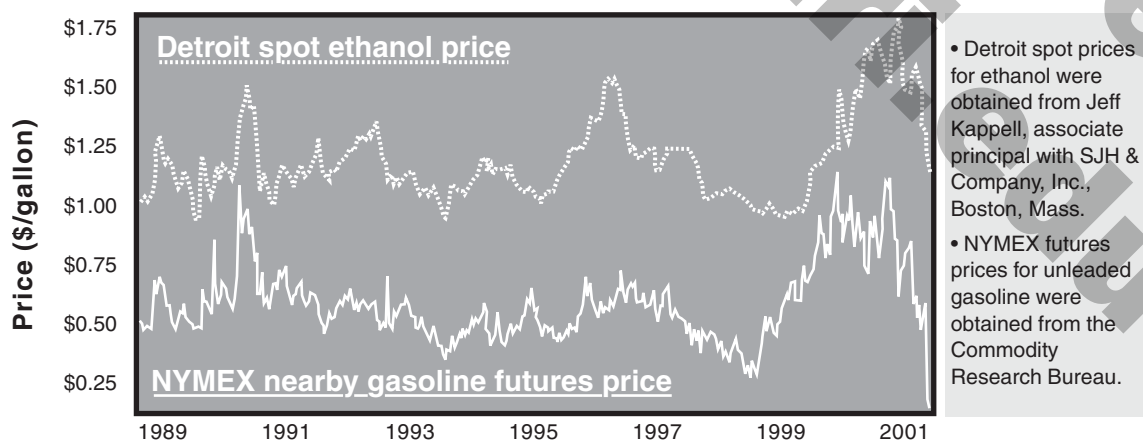


Figure 2. The futures price of unleaded gasoline follows the spot price of fuel ethanol.

- Detroit spot prices for ethanol were obtained from Jeff Kappell, associate principal with SJH & Company, Inc., Boston, Mass.
- NYMEX futures prices for unleaded gasoline were obtained from the Commodity Research Bureau.

**Table 1. Gallons of ethanol hedged against one 42,000-gallon contract for unleaded gasoline.**

	4-week	8-week	12-week	16-week	20-week	24-week	28-week
Hedge ratio	0.867	1.0	1.0	1.0	0.831	0.712	0.632
Gallons of ethanol hedged per 42,000-gallon futures contract for unleaded gasoline	48,443	42,000	42,000	42,000	50,542	58,989	66,456
Hedging effectiveness ( $R^2$ )	0.786	0.884	0.923	0.945	0.947	0.955	0.961

**Note:** The closer  $R^2$  approaches 1, the more effective the hedge.

**Example:** Someone wishing to hedge ethanol production or purchases 20 weeks into the future would hedge 50,542 gallons of ethanol per 42,000-gallon futures contract for unleaded gasoline.

## Determining the quantity to hedge

Determining the size of the futures position to take requires calculating a hedge ratio. The hedge ratio is found by estimating the historical relationship between the futures price for unleaded gasoline and the cash price for ethanol. The hedge ratio estimates the relative price change between the futures market for unleaded gasoline and the cash market for ethanol, and can be used to establish the ethanol cash price that could be expected by hedging with unleaded gasoline futures. A hedge ratio of 1.0 implies a one-for-one hedge where for every \$0.10 per gallon change in the price of unleaded gasoline futures, the ethanol cash price changes by \$0.10 per gallon. A hedge ratio of 1.5 implies that for each \$0.10 per gallon change in the futures price of unleaded gasoline, the ethanol cash price changes by \$0.15 per gallon. A hedge ratio of 0.5 implies that for each \$0.10 per gallon change in the unleaded gasoline futures price, the ethanol cash price changes by \$0.05 per gallon.

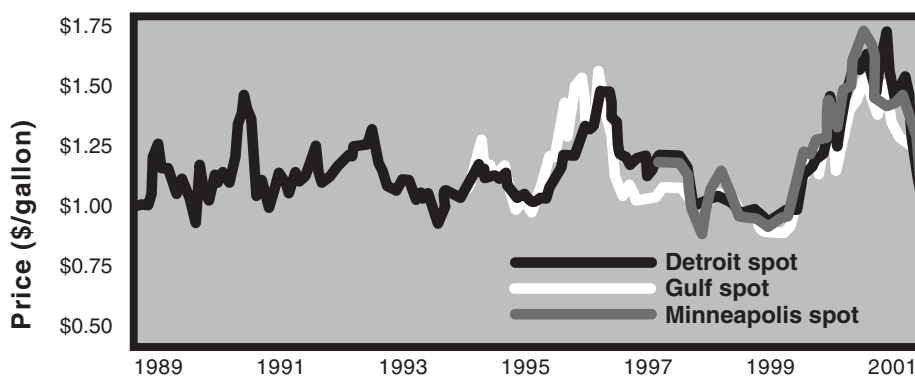
The hedge ratio equals the unleaded gasoline futures contract quantity of 42,000 gallons divided by the ethanol cash market quantity being hedged. Therefore, if the hedge ratio is estimated to be 0.80, then 52,500 gallons (42,000 ÷ 0.80) of ethanol would be hedged against one NYMEX futures contract for unleaded gasoline. Ethanol is often contracted as far as six months out. Thus, hedge ratios are determined for 4-, 8-, 12-, 16-, 20-, 24-, and 28-week periods. Table 1 shows the corresponding quantities of ethanol to hedge based on the hedge ratios. The ratios are generally less than one but not significantly different from one for the 8-, 12-, and 16-week periods. Thus, a one-to-one hedge ratio (42,000 gallons of ethanol per 42,000-gallon contract for unleaded gasoline) is used to calculate the appropriate quantity of ethanol to hedge for those periods.

## Hedging effectiveness

Several statistics help measure the potential risk of a proposed hedge. The R-squared ( $R^2$ ) value, which shows the strength of a trend or correlation, is one such measure. For purposes of this publication,  $R^2$  measures the proportion of total variability in the ethanol cash price explained by changes in the futures price of unleaded gasoline. An  $R^2$  value of 1.0 implies a perfect correlation between ethanol and unleaded gas prices, and an  $R^2$  value of 0 implies no correlation between the two prices. The higher the  $R^2$ , the stronger the relationship between the prices of the two energy sources and the less risk the hedge will involve.

## Data used

In this publication, weekly average price data from January 1, 1989, to November 29, 2001, were used for all analyses. The hedge ratios in Table 1 may be appropriate across multiple locations, as ethanol prices in Detroit, the Gulf of Mexico, and Minneapolis follow similar trends (Figure 3). However, the limited availability of ethanol price data at other locations prevents further statistical testing.



**Figure 3. Prices for fuel ethanol follow similar trends in various U.S. spot markets.**