Why is the Ethanol Futures Contract a Success?

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Motivation – Processing Hedges

- Cross hedging the cotton seed crush.
- Transaction frequency as a risk management strategy – applied to soybean crushing.
- CBOT Ethanol Futures - Corn Crush Reference Guide. (CBOT, 2005)
  - 1 bu corn → 2.6 gal ethanol, 17 lbs DDGS
  - How well does that work?
    - Absolute effectiveness
    - Relative to soybean crushing

Motivation

- Inventory and Transformation Hedging Effectiveness in Corn Crushing. (JARE 4/09).
  - Reviewer: "*If you are going to make a comparison* [between hedging ethanol in ethanol futures versus gasoline futures], *then you have to consider everything…including liquidity costs. The liquidity in ethanol futures is pretty poor. So, maybe gasoline is a cheaper choice for hedging. In fact, you should spend some more time talking about the practicality of doing hedges in the ethanol futures. As shown below, the trading is light and transaction costs are likely very high."*

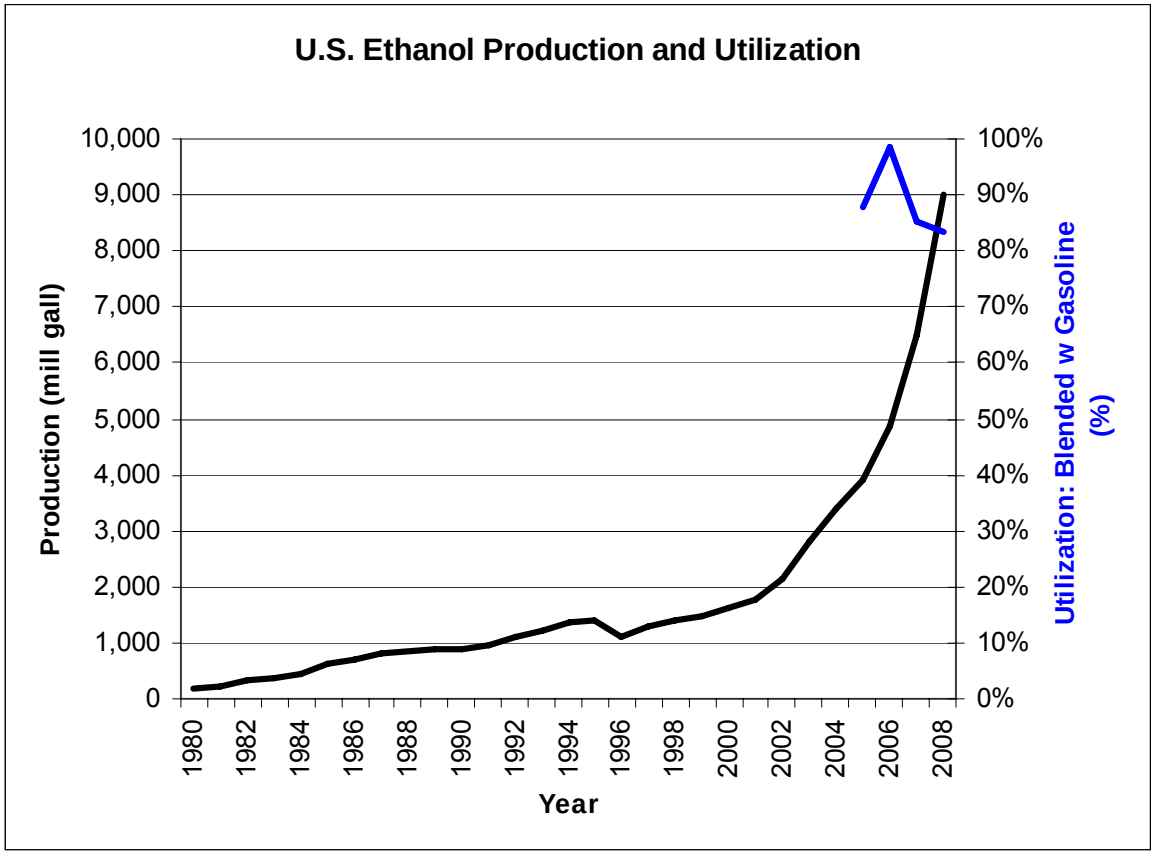
    Data … Jul-07 thru Jun-08 … volume: 0 …open interest: 915
  - Response:
    - Added some detail
    - Detailed response best left to another paper ….

This presentation: Why is the Ethanol Futures Contract a Success?

- Is the Ethanol Futures Contract a Success? Why?
  - Ethanol cash market
  - Ethanol futures market
  - Ethanol OTC swap market
  - SWAP transaction
  - That's why the ethanol futures contract is a success

Ethanol: U.S. Cash Market

- Ethanol producers
  - 170 operating plants
    12.5 bill gal/yr cap
  - Phoenix plant??
  - 24 plants under constr
    2 bill gal/yr cap
- Gasoline blenders
  - Use most ethanol as gasoline oxygenate
- Other industrial uses
- Change in inventories
- Transactions
  - Producers ↔ Brokers ↔ Blenders



Source: Renewable Fuels Association
Energy Information Administration

Ethanol Demand

- As a MTBE (gasoline additive) replacement
  - MTBE (methyl tertiary-butyl ether)
    - Octane enhancer
    - Reduced emissions of urban smog precursors
  - MTBE problems
    - Solubility
    - Migration into groundwater supplies
    - Absence of liability protection to petroleum companies for contamination
  - MTBE banned
    - California and New York beginning Jan 1, 2004
    - Subsequently in most other states as well
  - Standard auto fuel formulation now 10% ethanol
    - “Blending”

Ethanol Demand

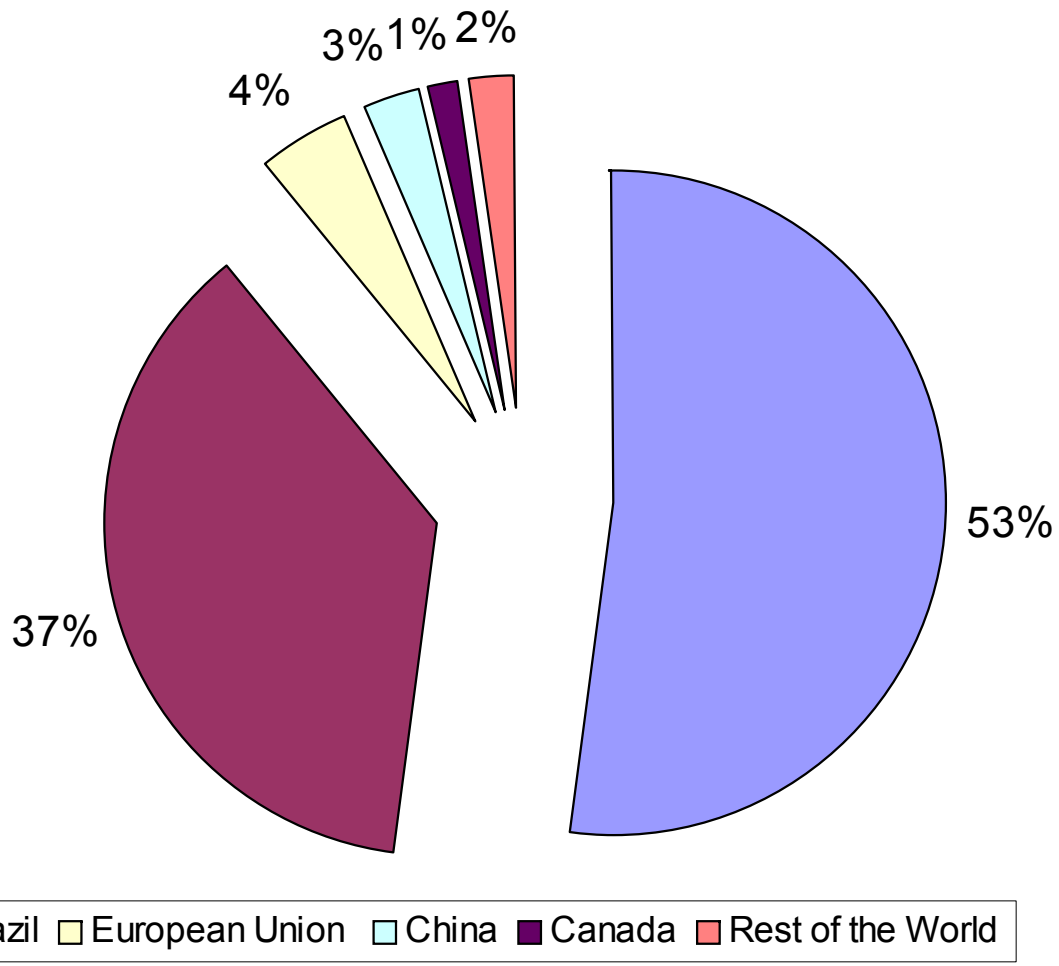
- As a gasoline substitute
  - "Twenty in ten" initiative: reduce U.S. gasoline usage by 20% over the next 10 years by "increasing the supply of renewable and alternative fuels by setting a mandatory fuels standard to require 35 billion gallons of renewable and alternative fuels in 2017 – nearly five times the 2012 target now in law. In 2017, this will displace 15% of projected annual gasoline use" (President Bush State of the Union Address, Jan 23, 2007)
  - Politically attractive
    - With consumers: avg retail gasoline price - $4.11/gal in July 2008
    - With farm state voters
  - Obama administration "renewable energy"
  - Policy goals
    - Energy security
    - Energy price stability

Ethanol Demand

- As a gasoline substitute (continued)
  - Energy balance
    - 1.3 corn-based ethanol
    - 3.2 soy diesel
    - 8.3 sugar-based ethanol
  - Economic viability
    - 51¢/gal tax credit for blending ethanol
    - 54¢/gal import tariff
  - Environmental externalities
    - Carbon monoxide↓, carbon dioxide↓
    - Nitrous oxide↑, methane↑
    - Carcinogens: Aldehydes and alcohol
    - Pollution from increased intensity of agricultural production
    - Deforestation in LDCs as land is brought into production

World Ethanol Production - 2008

- Income transfers
  - Between agricultural sectors
  - Between less developed nations and those with automobiles



Source: Renewable Fuels Association

Ethanol: U.S. Cash Market

- Market for fuel additive
- Continuous processing
  - Production
  - Utilization
- Brokered transactions
  - Match buyers and sellers
  - Forward contracts
  - Strips: 3-6 mo contracted flows

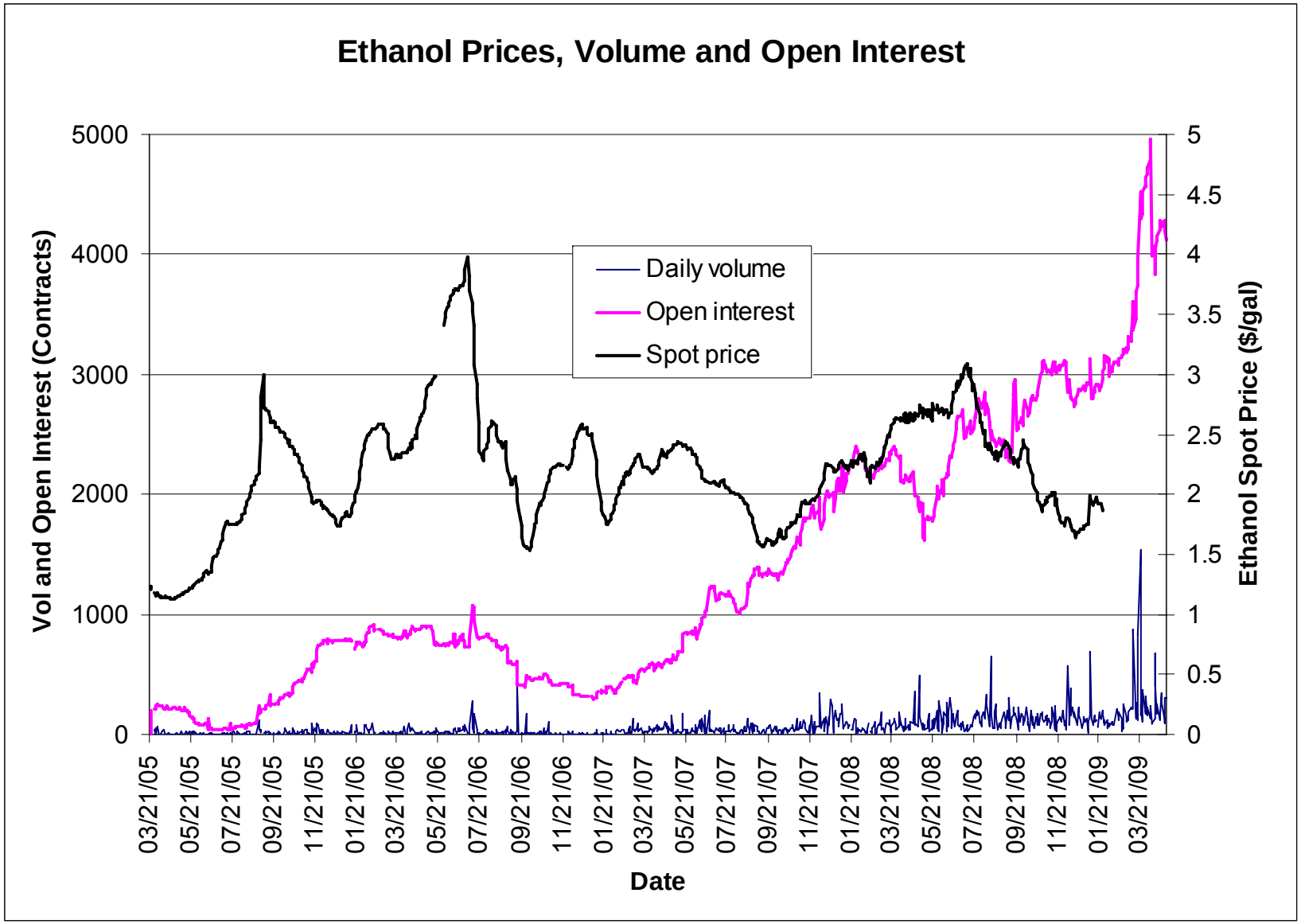
Ethanol Futures Market
(trading began Mar 23, 2005)

- **Contract Size:** 29,000 U.S. gallons (approx one rail car)
- **Deliverable Grades:** Denatured fuel ethanol, specified in The American Society for Testing and Materials standard D4806 for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel plus California standards.
- **Tick Size:** $0.001 per gallon = $29 per contract
- **Daily Price Limit:** $0.30 per gallon = $8,700 per contract. No limit in spot month.
- **Trading Hours: (Chicago Time)**

Open Auction:		9:30 a.m. to 1:15 p.m.
Electronic Platform:	6:36 p.m. - 6:00 a.m. &	9:30 a.m. to 1:15 p.m.

Ethanol Futures Market
(trading began Mar 23, 2005)

- **Contract Months:** 12 per year, 3 years forward
- **Last Trading Day:** 3rd business day of the delivery month.
- **Last Delivery Day:** 2nd business day following the last trading day.
- **Physical delivery, exchange for physicals, or exchange for risk:**
  - No cash settlement.
  - "Physical delivery by tank car, on track, at shipping origin with seller responsible for transporting product to buyer's destination. … the delivery instrument … is a shipping certificate which gives the buyer the right, but not the obligation to demand load-out of physical ethanol from the firm that issued the certificate" (CBOT, 2008).



Source: BarChart.com for volume, open interest
Bloomberg average US rack ethanol for spot price

Final Prices: 06/04/09 07:00 PM (CST)

MTH/		DAILY				PT		PRIOR DAY		
STRIKE	OPEN	HIGH	LOW	LAST	SETT	CHGE	EST.VOL	SETT	VOL	INT
ACF Ethanol Futures										
JLY09	1.770	1.795	1.770	----	1.791	+.043	14	1.748	54	940
AUG09	1.789	1.789	1.789	----	1.789	+.039	5	1.750	10	413
SEP09	1.785	1.800	1.785	----	1.792	+.022	15	1.770	5	265
OCT09	1.795	1.795	1.795	----	1.795	+.035	5	1.760	10	222
NOV09	1.780	1.780	1.780	----	1.780	+.035	5	1.745	5	356
DEC09	1.810	1.810	1.785	----	1.802	+.052	15	1.750	15	405
JAN10	1.800	1.800	1.800	----	1.800	+.035	5	1.765	4	440
FEB10	1.810	1.840	1.810	----	1.822	+.047	12	1.775	5	348
MAR10	1.810	1.850	1.810	----	1.819	+.044	12	1.775	5	370
APR10	1.815	1.850B	1.815	----	1.815	+.035	6	1.780	5	302
MAY10	----	----	----	----	1.835	+.035		1.800		5
JUN10	----	----	----	----	1.845	+.035		1.810		1
JLY10	----	----	----	----	1.855	+.035		1.820		
AUG10	----	----	----	----	1.855	+.035		1.820		
SEP10	----	----	----	----	1.855	+.035		1.820		
OCT10	----	----	----	----	1.855	+.035		1.820		
NOV10	----	----	----	----	1.855	+.035		1.820		
DEC10	----	----	----	----	1.855	+.035		1.820		35
JAN11	----	----	----	----	1.855	+.035		1.820		
FEB11	----	----	----	----	1.865	+.035		1.830		
MAR11	----	----	----	----	1.865	+.035		1.830		
APR11	----	----	----	----	1.865	+.035		1.830		
MAY11	----	----	----	----	1.865	+.035		1.830		
JUN11	----	----	----	----	1.865	+.035		1.830		
JLY11	----	----	----	----	1.865	+.035		1.830		
AUG11	----	----	----	----	1.865	+.035		1.830		
SEP11	----	----	----	----	1.865	+.035		1.830		
OCT11	----	----	----	----	1.865	+.035		1.830		
NOV11	----	----	----	----	1.865	+.035		1.830		
DEC11	----	----	----	----	1.865	+.035		1.830		
JAN12	----	----	----	----	1.865	+.035		1.830		
FEB12	----	----	----	----	1.875	+.035		1.840		
MAR12	----	----	----	----	1.875	+.035		1.840		
APR12	----	----	----	----	1.875	+.035		1.840		
MAY12	----	----	----	----	1.875	+.035		1.840		
JUN12	----	----	----	----	1.875	UNCH		----		
TOTAL							EST.VOL		VOLUME	OPEN INT
TOTAL							94		118	4102

Ethanol Futures – Daily Volume Pit and Electronically Traded

	2005 (Beg 3/23)	2006	2007	2008	2009 (thru 4/30)
Avg daily volume	13	21	46	114	205
Maturities (avg)	9	15	28	31	36
Trading volume by maturity and day					
0	79%	80%	78%	67%	69%
1	3%	3%	4%	4%	1%
2-5	10%	9%	9%	12%	10%
6-10	4%	4%	4%	6%	7%
11-20	3%	2%	3%	6%	6%
21+	1%	1%	2%	5%	7%

Source: BarChart.com

Are Ethanol Futures Markets too illiquid for hedging?

- Ethanol trading volume - lots of zeros, small numbers.
- 2005-2009
  - Average daily volume by maturity 2.8 contracts.
  - 74% of the time no trades for a given contract.
- 2008-2009
  - Average daily volume by maturity 4.2 contracts.
  - 68% of the time no trades for a given contract.

Ethanol and gasoline hedging effectiveness

	Hedge Horizon			
Hedge ethanol with:	**1 wk**	**2 wks**	**4 wks**	**8 wks**
Ethanol Futures 2005-08	0.005	0.319**	0.658**	0.795**
Unl Gas Futures 2005-06	0.019	0.016	0.083	0.117
Ethanol Futures 2005-06	0.000	0.417**	0.640**+	0.800**+
RBOB Futures 2006-08	0.094	0.186	0.280**	0.384*
Ethanol Futures 2006-08	0.002	0.286	0.655**++	0.846**++

Source: Dahlgran, JARE, 4/09

Ethanol OTC Standardized Contracts

- Calendar swaps
  - Launched Dec 4, 2006 (Reuters.com, 2009)
  - Settled at monthly average ethanol futures price
- October 2007 CME Group introduced
  - Basis swaps – settled at ethanol monthly average basis
    - New York Harbor
    - Los Angeles
    - Gulf Coast
  - Options on ethanol calendar swaps
  - Cash-settled options on ethanol futures
- "In 2008, more than 291,000 ethanol swaps were cleared through CME Clearing with a notional value of more than $16 billion." (Reuters.com, 2009)

Standardized Ethanol OTC Contracts

- Swap brokers bring counterparties together off exchange
- Centrally cleared through CME ClearPort©
  - Standardized margin requirements
  - Marked to market daily using ethanol futures
  - Margin calls
  - Volume and open interest are available
  - Prices not reported
- 14,500 gal contracts
- Up to 24 mos forward

Ethanol Futures Margin Requirements

Contract	Vol 6/3/09	Op Int 6/3/09	Speculator		Hedger/Member	
			Initial	Maint	Initial	Maint
Ethanol futures	118	4,102	$4,725	$3,500	$3,500	$3,500
OTC forward month swap	350	21,998	$2,700	$2,000	$2,000	$2,000
OTC options on fwd swaps	0	5,282				
OTC previous month swap			$1,688	$1,250	$1,250	$1,250
Cash settled options			$4,725	$3,500	$3,500	$3,500
Gulf coast basis swap	0	0	$2,700	$2,000	$2,000	$2,000
LA basis swap	0	14	$2,700	$2,000	$2,000	$2,000
NY harbor basis swap	0	0	$2,970	$2,200	$2,200	$2,200

Cash-Settled Options on Ethanol Futures

- Contract Size: One futures contract
- Tick Size: $0.001 per gallon = $29.00 per contract
- Contract Months: All calendar months
- Trading Venue: OTC (clearing only)
- Clearing Hours: Sunday - Friday: 6:36 p.m. - 3:00 p.m. CT next day
- Last Clearing Date: Last trading day of underlying futures
- Strike Price Increments: $0.05 per gallon. 21 strikes listed initially.
- Non exercisable: Cash-settled on the last clearing day.
- Final Settlement:
  - At 1:15 p.m. CT on the last day of clearing
  - Final settlement price is option's intrinsic value
    - Calls: greater of futures settlement price - strike price, or zero.
    - Puts: greater of strike price - futures settlement price, or zero.

Ethanol Calendar Swaps

- Clearing unit: 14,500 gallons / contract
- Daily Settlement:
  - Settled to the Ethanol futures contract that follows the Calendar Swap contract month.
  - During final month of listing, daily settlement is running cumulative average of the settlement prices for the Ethanol futures contract that follows the Ethanol Calendar Swap.
- Final Settlement:
  - Cash-settled to the average of the settlement prices for the Ethanol futures contract that follows the Ethanol Calendar Swap contract for each business day in the Ethanol Calendar Swap contract month.
- Example:
  - Final settlement for May Ethanol Calendar Swap is average of daily settlement prices for the June Ethanol futures contract during the month of May.
  - Settlement date – last business day in May.

Forward Month/Previous Month Swaps

- January Forward Month Ethanol Swap
  - Settlement prices based on running average of the February Ethanol futures contract during the month of January
  - Settled last business day of January
- February Previous Month Ethanol Swap
  - Settlement prices based on running average of the February Ethanol futures contract during the month of January
  - Settled last business day of January
- January forward month same as February previous month

Ethanol Basis Swaps

- Clearing unit: 14,500 gallons / contract
- Daily Settlement:
  - Basis = cash – futures
    - Cash: daily OPIS (Oil Price Information Service) NYH, LA and GC prices
    - Futures: settlement price for contract following Basis Swap contract month
  - During last month of listing, use running cumulative average of above basis
- Final Settlement:
  - Cash settled to the monthly average basis for NYH, LA and GC.
  - $0.0001/gal increments.
  - Takes place in the morning of the business day following the last business day of the swap contract month.
- Example: final settlement for a Nov 2007 Ethanol Basis Swap
  - Settlement price: average of the daily settlement prices for the NYH Basis Swap (or LA or GC Basis Swaps) during the month of November 2007.
  - Settlement date: Morning of business day following last business day of Nov

Options on Ethanol Calendar Swaps

- Clearing unit: One ethanol calendar swap
- Strike price intervals: $0.05 per gallon. At the commencement of trading 10 strikes above and 10 strikes below the at-the-money strike will be listed.
- Final Settlement at intrinsic value:
  - For calls: greater of settlement price for underlying Ethanol Calendar Swap contract - option strike price, or zero.
  - For puts: greater of strike price - underlying Ethanol Calendar Swap contract settlement price, or zero.

Example Calendar Swap Transaction

- Ethanol refiner with 100 car / mo cap
  = 100 contracts of each maturity for next year
- Dec 09 ethanol futures: $1.85 / gal (objective)
- Counterparty: gasoline blender
- Swap broker submits offsetting contracts to CME Clearport for clearing by CME Clearing
  - Refiner assigned short swap position at $1.85
  - Blender assigned long swap position at $1.85

Example Calendar Swap Transaction

- Settlement, mark to market, margin calls based on $1.85 versus daily Dec ethanol futures settlement
- In Nov Settlement, mark to market, margin calls based on $1.85 versus cumulative Nov avg of Dec ethanol futures settlement
- Final settlement – average Nov price of Dec ethanol was $1.95.
  - Refiner receives margin account balance less 10¢ / gal
  - Blender receives margin account balance plus 10¢ / gal

Example Calendar Swap Transaction

- Works like hedge except final settlement is Nov average Dec futures price
- Counterparties don't have same objective
  - Refiner wants short at $1.87
  - Blender wants long at $1.83
  - Broker long at $1.87 and short at $1.83

Why is the Ethanol Futures Contract a Success?

- Ethanol as a gasoline additive rather than substitute
  - Processing price risk
  - Reliable hedging demand
- OTC contracts marked to futures prices
  - OTC open interest 27,000 contracts
  - Futures open interest 4,000 contracts
  - Futures markets required for risk management

Why is the Ethanol Futures Contract a Success?

- Exchange for risk feature
  - Futures position exchanged for OTC position
  - Unwind existing or initiate new OTC positions
  - Transacted any time from inception through expiration of OTC position
  - Integrates futures and OTC markets
- Monthly average pricing on OTC contracts
  - Reduces price risk to monthly average
  - Pricing representative of continuous production
  - Efficiency of contracting – one transaction