

# **Analysis of NYMEX as a tool for Forecasting Prices of Crude Oil**

Prepared for

**Energy Security Partners, LLC**

Little Rock, Arkansas

[www.espgtl.com](http://www.espgtl.com)

by

**James L. Williams**

**WTRG Economics**

P.O. Box 250

London, Arkansas 72847

[www.wtrg.com](http://www.wtrg.com)

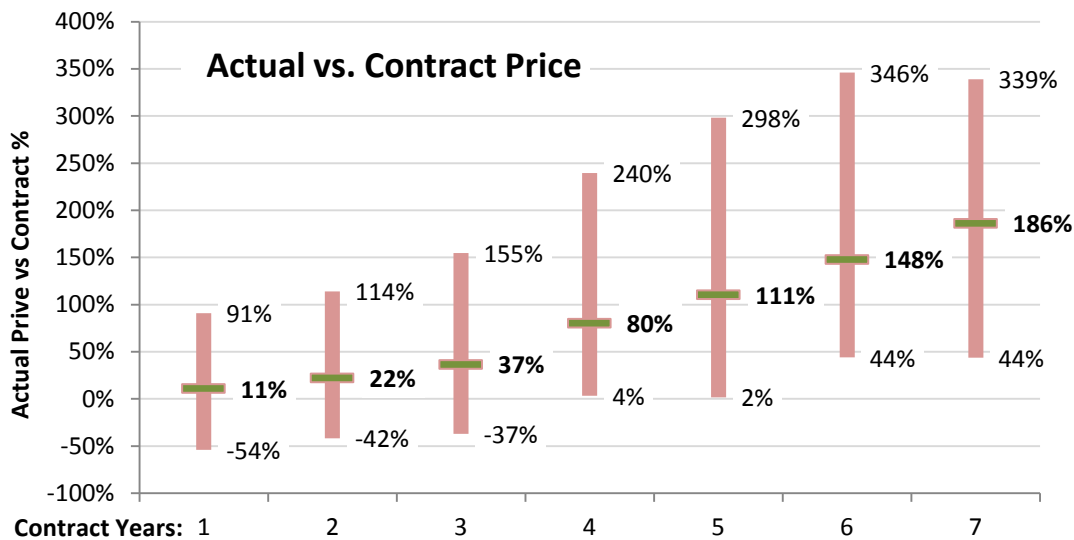


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## Executive Summary

This study examines the efficacy of NYMEX as a forecasting tool for crude oil prices. We assumed the purchase of one December contract for all years for which one was listed on each trading day in January. We then compared the average price paid for those contracts with the actual price of crude in the contract month. We repeated this each January from 1991 through January 2012. We then examined the results for NYMEX as a predictor for up to seven years out.

We found that, on average, NYMEX under-predicted the price and that the size of the error increased with time. In the most extreme case, seven years out, the actual price was over 180% higher than the average contract for the same month. We conclude that NYMEX is a poor indicator of future price and that for the last 20 years the bias was toward under forecasting the actual price.



## **Analysis and Discussion**

This analysis examines the reliability of the NYMEX futures market as a tool for forecasting long term oil prices. We use December contracts because they are the first contracts traded for any given year. This allows the longest possible time horizon. It also has additional benefit of higher volumes and open interest over the course of trading of the contract.

A NYMEX light sweet crude oil futures contract is a contract to physically deliver 1,000 barrels of crude oil at Cushing, Oklahoma over the course of the contract month. Contracts are traded until about the 30<sup>th</sup> of the month preceding the contract month. This oil must meet certain quality standards -- its sulfur content must be 0.42% or less by weight and have an API gravity between 37° and 42° inclusive. This oil is commonly referred to as West Texas Intermediate, but many other crude streams meet the specifications.

Open interest is the number of contracts outstanding for a given contract month. Total open interest is the sum of the open interest for all contract months. The volume is the number of contracts traded on a given day and total volume is the sum of the volumes over all contract months.

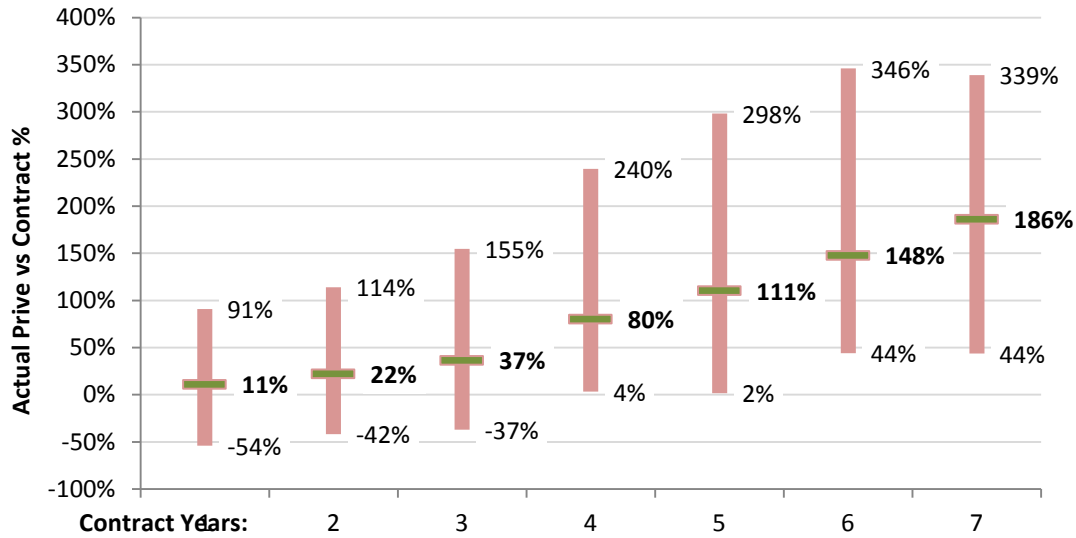
In order to have the maximum number of years available for this study we will examine all December contracts available. To minimize the potential of a single day anomaly, we will assume the purchase of a December contract of all available contract years for each day in January each year beginning in 1991. Our prices, volumes and open interest will be the average of those January purchases in each year from 1990 forward. While NYMEX now offers contracts out nine years, that has not always been the case. Therefore we use the maximum number of years available in each transaction month. From 1991-1997 the farthest contract month was three years out. For example, in January of 1991 we could purchase up to a December 1993 contract. By 1998, you could purchase a December 2005 contract, i.e., out seven years. Since 2009 contracts have been listed up to nine years out. For our purposes this is academic as the only contracts we can compare are those which expired.

We compare the price we paid for a December contract to the actual price and compute the percent difference. We then look at the data in terms of the number of years since it was purchased. In other words, how accurately did the contract purchased predict the actual price of crude oil at the time of contract maturity (i.e., at 1 - 7 years out)?

Exhibit 1 illustrates our findings in terms of actual vs. contract prices. For all years, the average of the actual vs. contract price demonstrates that the contract prices underestimated the actual price. For contracts dated one year out the actual price was 11% higher than the contract. For seven year contracts the actual price averaged 186% higher than the contract purchase price.

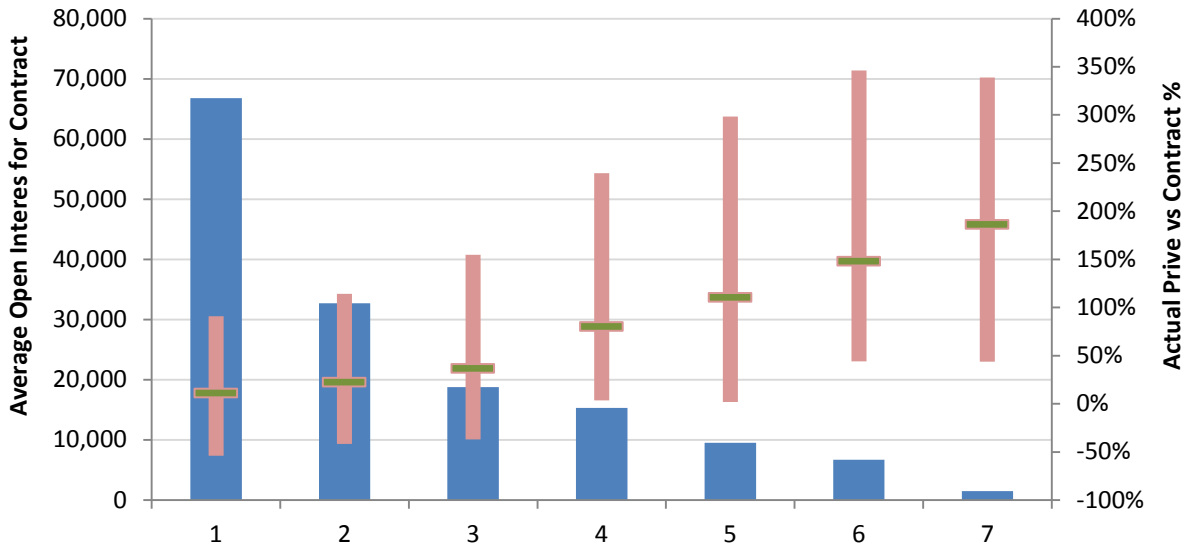
In the best case for seven years out the actual price was only 44% higher than the contract price. In the worst it was 339% higher. Whether you examine the average or the range, the difference between actual vs. contract increases with time, and for years 4 – 7 contract prices underestimate actual prices for all trades.

**Exhibit 1: Actual vs. Contract Price**  
(depicting maximum, minimum, and average values)



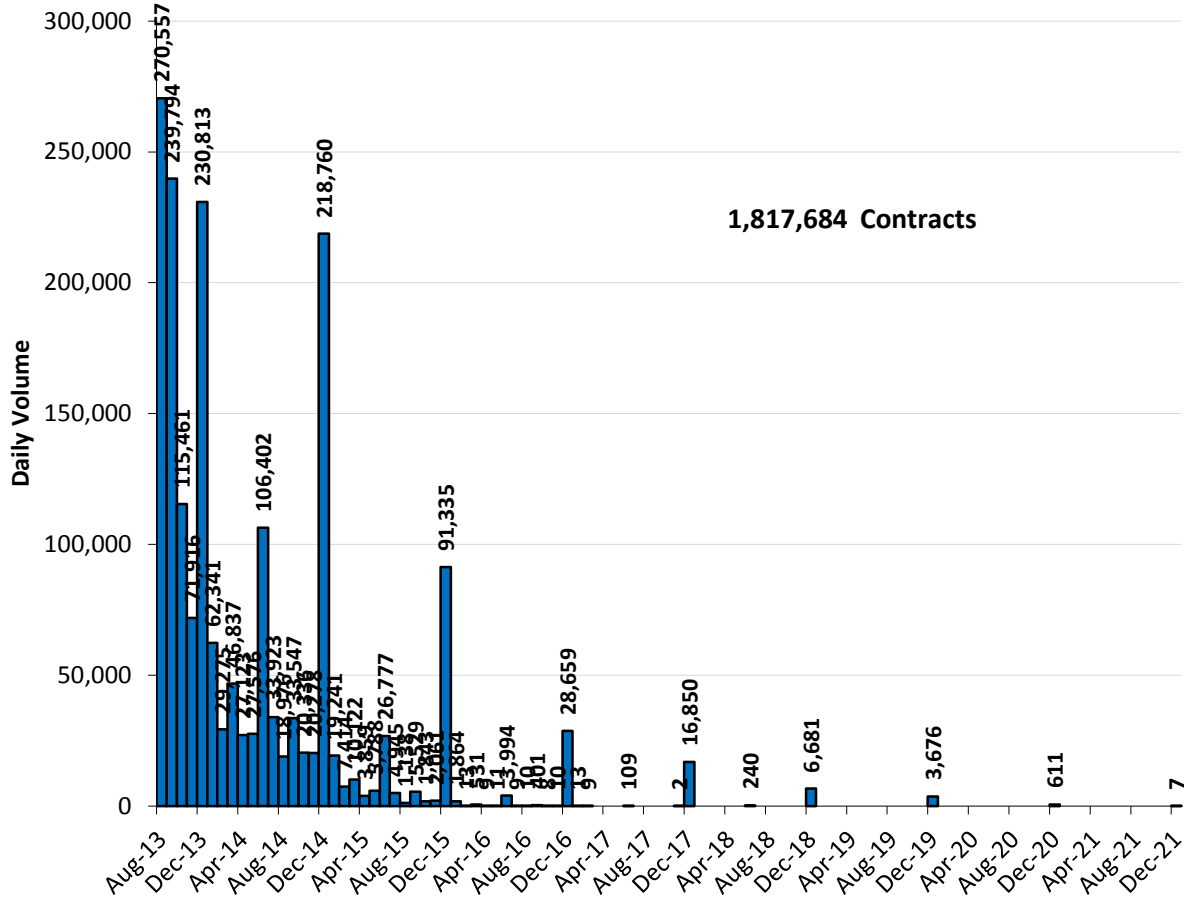
In Exhibit 2 we add the average number of contracts outstanding for the contract month when the January transaction was made. One year out open interest averaged over 66,000 contracts compared to only 1500 in year seven. If compared to the total number of contracts—which averaged 715,000—the average open interest seven years forward was only 0.2%. Very few traders express an opinion on crude price seven years out by the purchase or sale of a contract. Rather than expressing the collective wisdom of the market the far contracts reflect the opinion of only a few.

**Exhibit 2: Actual vs. Contract Price, & Open Interest vs. Years Out**



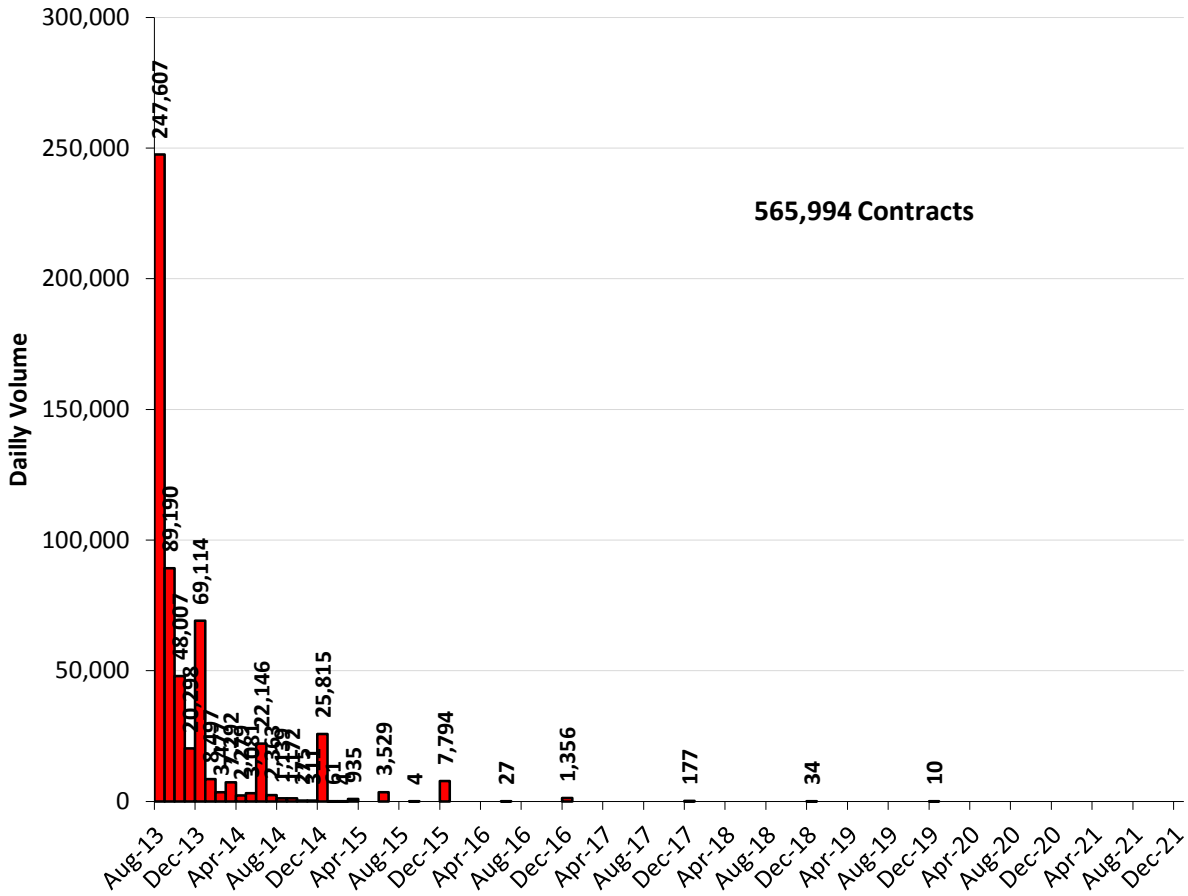
Exhibits 3 and 4 further illustrate the point. They show the total contracts outstanding and volume traded for June 28, 2010. Almost nine years forward in December 2021 there are only 7 contracts.

**Exhibit 3: NYMEX Crude Oil Open Interest, 6/28/2013**



For example: if we look at the volume traded June 28, 2013, a total of 564,994 contracts were traded; none of the 7 outstanding contracts for 2021 were traded nor were any of the 611 in 2020. The farthest out we find a trade is for 2019, where only 10 of 3,676 contracts were traded.

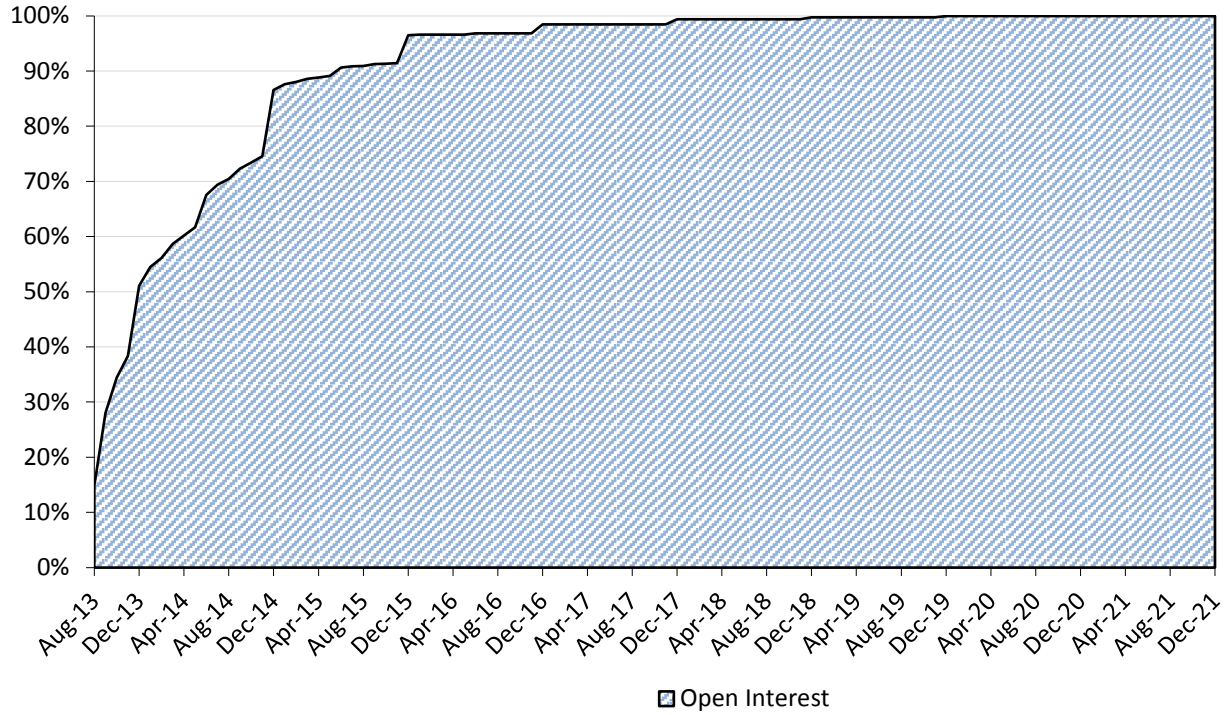
**Exhibit 4: NYMEX Crude Volume Traded, 6/28/2013**



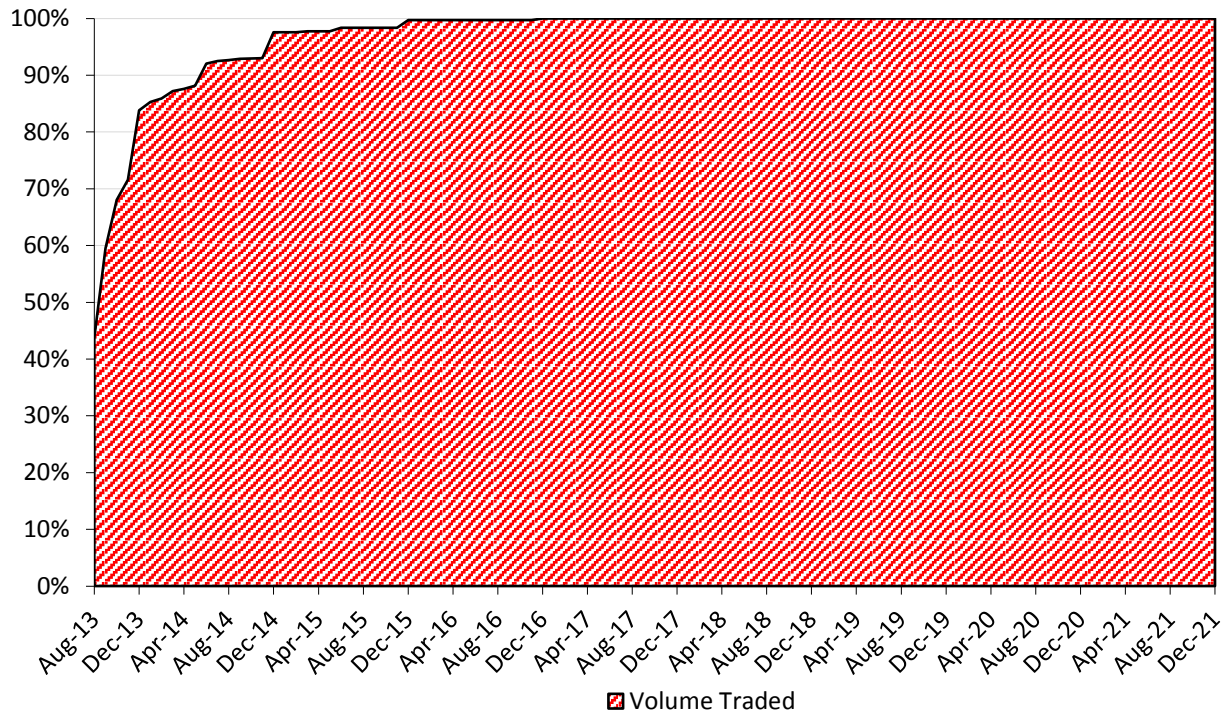
Exhibits 5 and 6 illustrate the open interest and volume traded by the cumulative number of contracts from the front month of August 2013 forward. It is easy to see that all of the trading action is in the first few years. In Exhibit 5 over 90 percent of all contracts (open interest) are in the first 24 trading months. Contracts dated more than two years forward represent less than 10 percent.

In Exhibit 6 we see that 98 percent of the contracts traded on June 28, 2013 were for the first 24 contract months. It is clear that the price of contracts traded more than two years out is determined by relatively few market participants.

**Exhibit 5: Cumulative Open Interest, 6/28/2013**



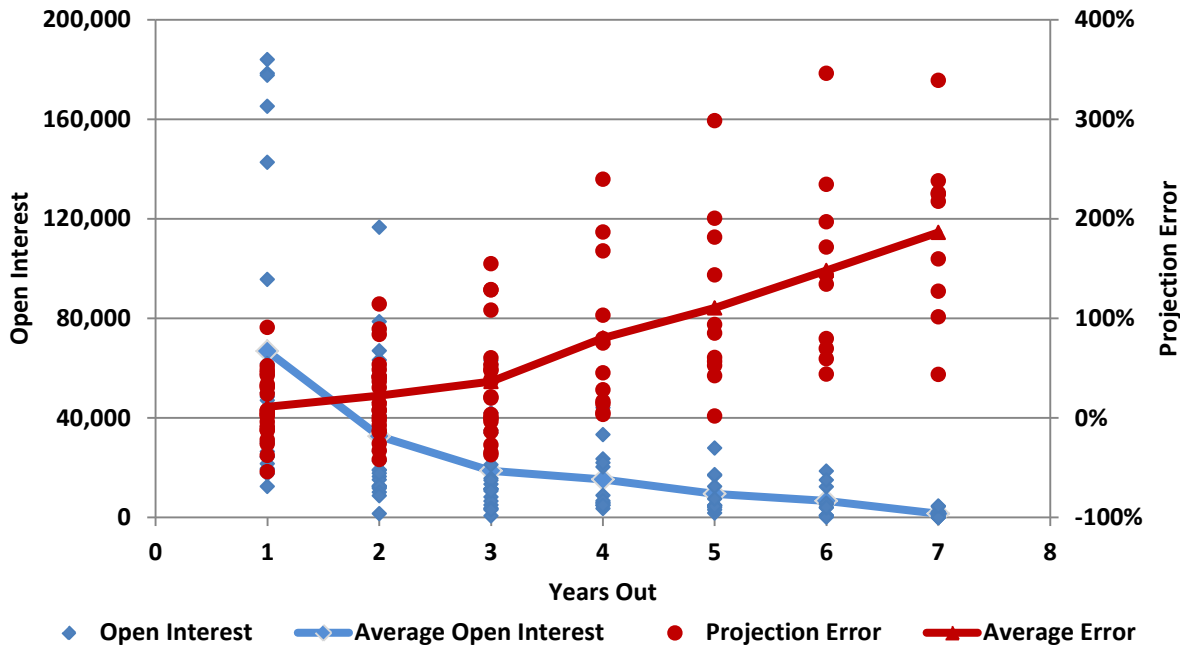
**Exhibit 6: Cumulative Volume Traded, 6/28/2013**



In Exhibit 7 we summarize our observations. The red dots represent the percent difference between the actual price in the contract month and the price of the futures contract. The red line shows the average difference or error. The blue dots represent the open interest in the contracts at the time of purchase and the blue line is the average of the open interest for each of our December trades. The fewer the average number of contracts the greater the average error. The dispersion also shows a tendency to increase that farther out we go. There is no instance where the average error was negative. For all months traded out 1 – 7 years on average the contract price under estimated the actual price in the contract delivery month.

Therefore, the farther the trade is out, the greater the error, and the greater the tendency for the contract to underestimate the actual value. From 4 – 7 years out the contract price was always less than the actual. Seven year trades severely under estimated the price--on average the actual price was 183% higher than the cost of the contract.

**Exhibit 7: Open Interest & Percent Error**



While long dated contracts in the future may not always under estimate price we can reasonably expect that the NYMEX futures strip will continue to be a poor estimate of future prices. This conclusion is based on comparisons of actual prices vs. contract prices and the fact that there are relatively few participants in the market for contracts more the 3 years into the future.