METRIC OF THE MONTH: MAY 2012

A DEEPER LOOK INTO INTERESTING TRENDS IN ENERGY SECURITY DATA

CRUDE OIL PRICE VOLATILITY

With crude oil prices in news, this month we thought we would take a look at Crude Oil Price Volatility. It is one of the four price and market volatility metrics used in the Index of U.S. Energy Security Risk.[1]

"Price volatility" refers to the degree to which prices rise or fall over a period of time. In an efficient market, prices reflect known existing and anticipated future circumstances of supply and demand and factors that could affect them. Changes in market prices tend to reflect changes in what markets collectively know or anticipate.

When market prices tend to change a lot over relatively a short time, the market is said to have high volatility. When relatively stable prices prevail, the market is id to have low volatility. In energy markets, assets represent huge investments, typically hundreds of millions if not billions of dollars. The ability of those investments to earn a return depends upon the ability to produce fuels or power and sell it at a viable price.

Some amount of price volatility is an inevitable consequence of a market-based economy. Since companies invest based on expectations about prices, high price volatility creates uncertainty and risk, and risk premiums rise to compensate. Volatile prices can also affect labor markets, increasing temporary layoffs or prompting surge hiring.

Energy costs are a significant portion of our overall economy. In 2006, over 1.1 trillion dollars was spent for end-use energy in the residential, commercial, industrial, and transportation sectors. This energy cost amounted to about 8.8 percent of 2006's GDP of $13.2 trillion.

When energy markets are volatile, which is frequently the case with petroleum and natural gas, the year-to-year changes in the total costs can themselves pose a significant jolt to the economy. When households have to suddenly pay more for energy costs, there is less money available in household budgets for other competing demands. And with a large part of our energy use consisting of fuel imports, volatility in the markets amounts to sudden and large shifts

[1] The others are Energy Expenditure Volatility, World Oil Refinery Utilization, and Petroleum Stock Levels.

in international trade.

Energy price volatility can also hurt economic growth. In 2001, the Energy Information Administration (EIA) undertook an analysis of the effect of energy price volatility vis-à-vis steady energy prices.[2] This analysis was undertaken in response to the two years of rapidly falling oil prices in 1997 and 1998, followed by two years of rapidly rising prices in 1999 and 2000.

EIA's analysis examined what the impact would be on the growth of the economy if energy prices had remained steady throughout the four-year period. It found that over the entire four-year period, a steady energy price path could have potentially boosted GDP growth by 0.2 percentage points compared to the volatile price path. EIA concluded that all other things equal, the economy would most likely perform better with stable or predictable energy prices than when the price of energy fluctuates greatly.

The Crude Oil Price Volatility metric uses measures of the annual change in crude oil price measured in terms of the real cost per barrel (in real 2000 dollars) of crude oil landed in the U.S. The measure of price volatility for any given year is arrived at by averaging the change in that year and the changes in the previous two years. So the measure of volatility in 2000, for example, is the measure of the average annual change in the years 1998, 1999, and 2000.

For 1973-2009, the historical data on imported costs of crude oil were developed from EIA's *Annual Energy Review*. For the costs for 1970-1972, we calculated estimates using crude oil refiner acquisition costs as a proxy.[3]

For forecast years, we do not have comparable data indicating price volatility. Forecasting models generally assume a market in balance, and typically do not show volatility, especially over the long term.

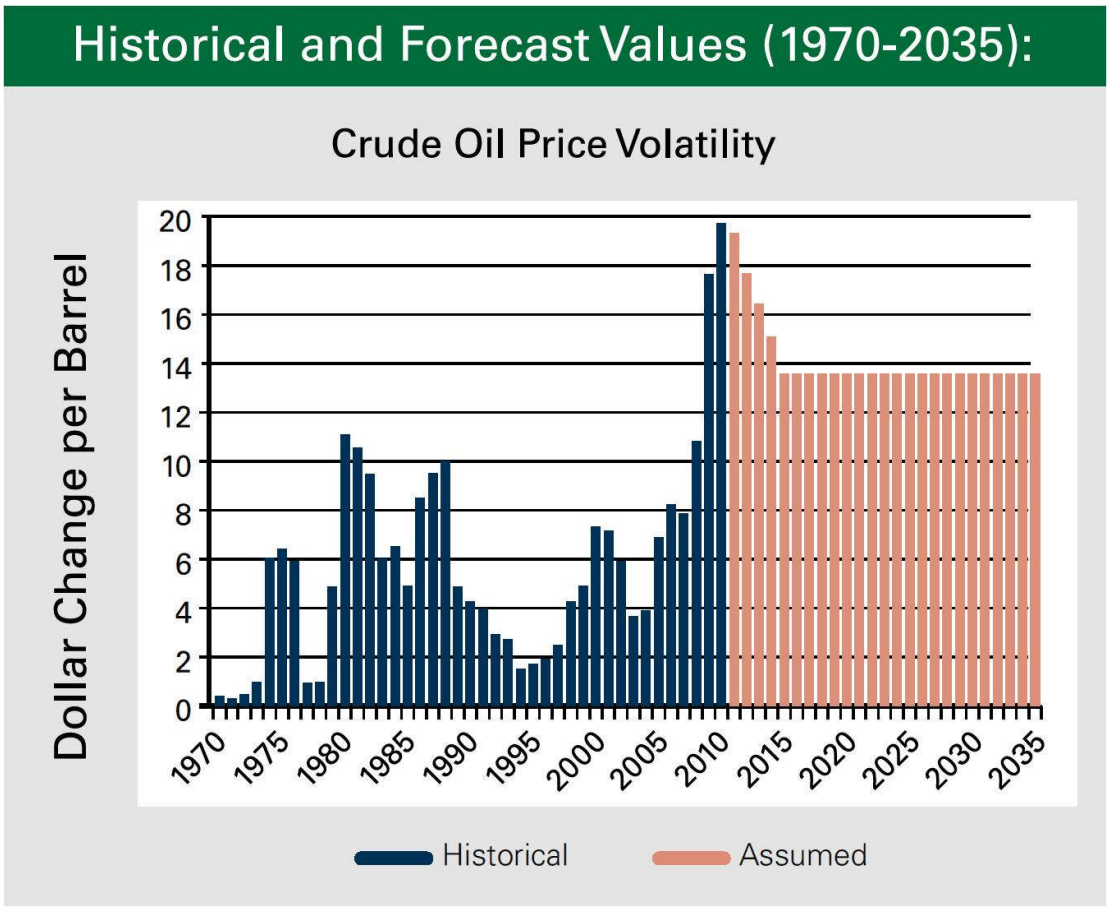
Accordingly, for our forecast time horizon, we first estimate the average price volatility, as a percent of the price, over the 40-year period 1970-2009. We then ramp up or down, as appropriate, the volatility over the first five forecast to the 1970-2009 historical average, expressed as a percentage of price. After that five-year transition, volatility is held constant as a percent of price.

Over the period 1970-2035, the Crude Oil Price Volatility estimates are as shown in Figure 1. The historical trend vividly shows the high volatility seen in the oil market in recent decades. The two oil price shocks in the 1970s and early-1980s show up as periods of high volatility, as does the plunge in oil price in the mid-1980s. More recently, the oil market turmoil—both up and down—has raised volatility to record levels.

[2] EIA, *Energy Price Impacts on the U.S. Economy,* April 2001. Available at: <http://www.eia.doe.gov/oiaf/economy/energy_price.pdf>.

[3] For the 1970 estimate, we needed average crude oil prices for 1967-1969. These were estimated by measuring the change in Crude Oil Domestic First Purchase Price, as presented in EIA's longer time series in its *Annual Energy Review*. This percentage change was applied to the 1968 refiner acquisition costs to estimate 1967 costs.

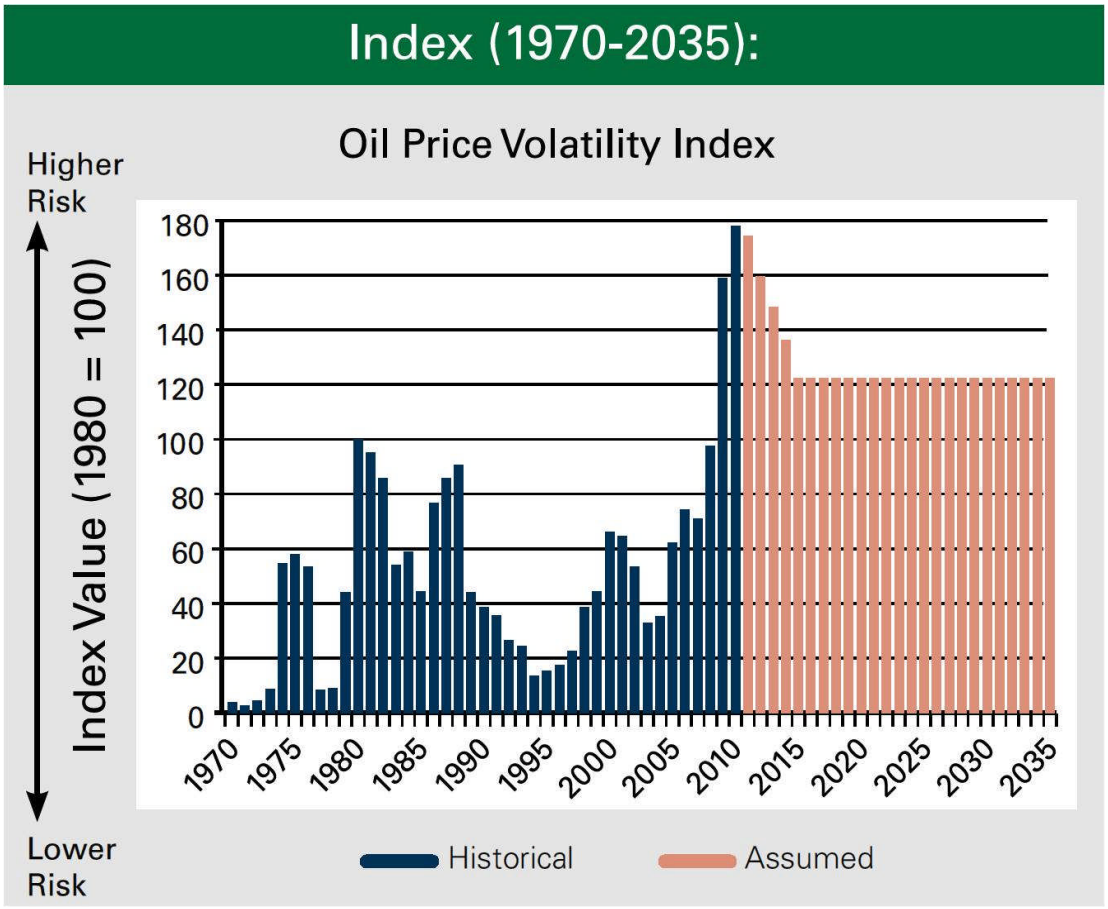
Figure 1.



Much of this volatility can be related to unrest in the Middle East related to the Arab Spring. The political and in some cases military upheavals in Libya, Egypt, Syria, and other countries, the boycott of Iranian crude oil in response to its nuclear weapons program, and the risk of terrorist attacks all have conspired to make oil markets more volatile. Thus far, these events have not seriously disrupted oil supplies, but it is conceivable that they could. Greater oil production from the United States, Canada, and other politically stable countries, therefore, provides a critical hedge against price volatility, and it is one of the reasons the Keystone XL pipeline project is needed to enhance energy security.

The risks described by Crude Oil Price Volatility move in the same direction as the metric, namely that higher values indicate higher risk. Accordingly, for using this metric Index, we only need to normalize the time series to an indexed value, where the year 1980 is set at 100. This produces the values graphed in Figure 2.

Figure 2.


Index (1970-2035):
Oil Price Volatility Index
Higher Risk
Lower Risk
Index Value (1980 = 100)
180
160
140
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
Historical
Assumed