

## Natural Gas Prices in a Recession

Christopher Gulick

**O**n October 21, 2008, the Federal Reserve Bank of Chicago released its latest monthly calculation of the National Activity Index (CFNAI), an index that measures the change in activity across 85 economic indicators in the United States.<sup>1</sup> When the three-month moving average of this index falls below  $-0.70$ , it typically indicates the start of a recession. By this metric, the U.S. economy entered a recession at the end of 2007, and the CFNAI has been negative since then.

At the same time, natural gas and oil prices increased substantially, as did the development of natural gas production in the United States. We are now in a situation where natural gas production capacity has grown quickly and interstate pipeline capacity has been expanded to handle some of this additional production capacity. But economic activity has declined sharply, and demand for natural gas could become suppressed for some time before turning around. Putting aside the question of whether energy prices have been affected by, or have contributed to, this economic downturn, the reality is that oil and natural gas prices in the United States are decreasing and will likely remain lower before moving up again. This article explores some of the general interactions between economic ac-

tivity and natural gas prices and closes with a discussion of some likely scenarios for natural gas prices as we traverse the recession.

### DIVING DOLLAR AIDED IN INCREASING NATURAL GAS PRICES

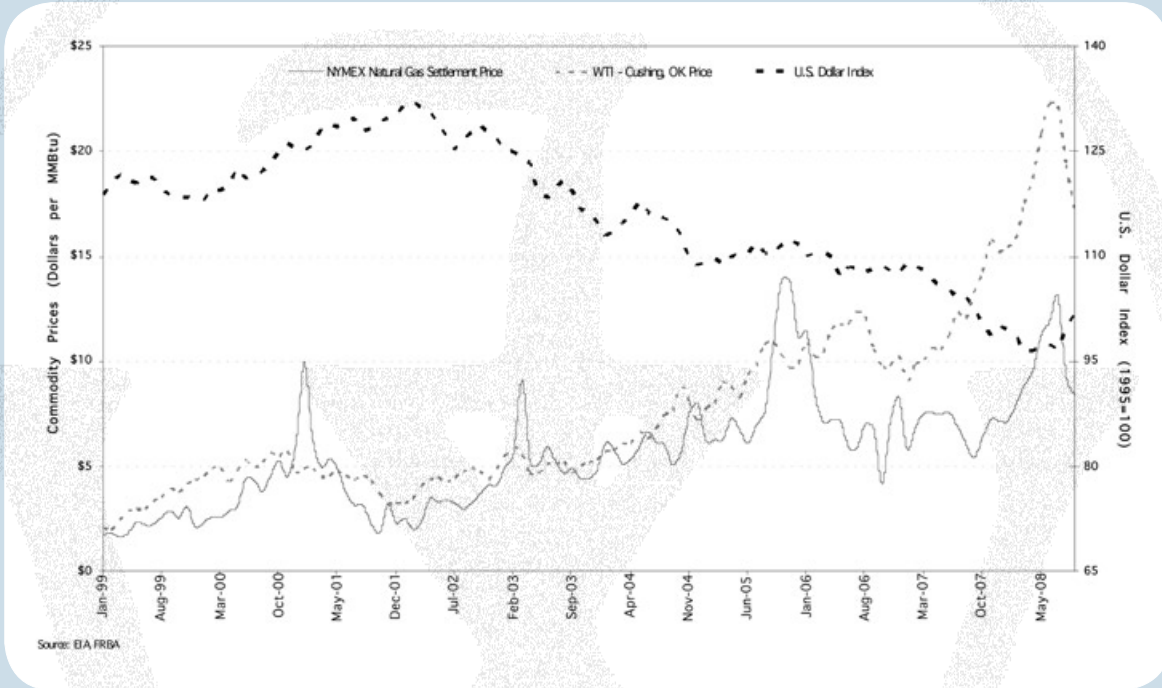
Recent research has demonstrated that there is likely a long-term link between natural gas prices and crude oil prices.<sup>2</sup> This link arises from, among other things, common production, substitutable markets, and competition for infrastructure and resources.

In addition, oil prices interact with the value of the U.S. dollar since all oil market activity is denominated in the U.S. currency. As the value of the U.S. dollar fell relative to other currencies, upward pressure was placed on the price of oil to maintain the economic parity of foreign oil production. In 2008, the value of the dollar fell to low levels as crude oil prices at Cushing, Oklahoma, rocketed to over \$140 a barrel before reversing course; natural gas prices followed a similar trajectory. **Exhibit 1** illustrates the historical relationship between U.S. oil and natural gas prices against the backdrop of the value of the U.S. dollar.

While foreign oil producers might have been somewhat indifferent from an economic perspective to the initial increase in oil prices, the increase in domestic natural gas prices supported the expanded development in U.S. natural gas that had started in 2002, as more costly reserves were able to be developed. Expansion of coalbed methane production and developments in producing natural gas from shale formations promised ample natural gas for the future, boosting domestic natural gas production and development of interstate pipeline facilities. Over this period, net imports to the United States also dropped off as higher, oil-based prices in the Far

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**Exhibit 1.** U. S. Monthly Natural Gas and Oil Prices vs. U. S. Dollar Index, January 1, 1999–October 1, 2008



East and Europe pulled available liquefied natural gas (LNG) supplies into those markets and Canadian natural gas production was increasingly diverted into producing oil from Alberta’s tar sands.

### QUICK OVERVIEW OF ECONOMIC ACTIVITY AND NATURAL GAS CONSUMPTION

While the CFNAI provides a broad metric of economic activity, underlying the index lie specific changes in economic activity—changes that have, and will have, a real impact on U.S. gas consumption. **Exhibit 2** illustrates annualized U.S. consumption of natural gas by end-use sectors over the last seven-and-a-half years.

This exhibit shows that natural gas consumption in the residential and commercial sectors is essentially flat, industrial consumption has been in a steady decline, and the use of natural gas in the electricity generating sector has been steadily increasing. The impact of a recession on the industrial and power generation sectors and the potential effect on their respective demands for natural gas are also areas of concern. The industrial

sector tends to be capital-intensive and can only adapt, in the short term, to economic dislocations by changing production on the margin, such as the number of shifts, employees, closing plants, and, by extension, the amount of energy consumed. This sector consumes natural gas directly and indirectly through electricity usage. Demand for natural gas by the industrial sector has generally been declining over the past eight years, and a recession would only worsen this trend.

A recession could affect the amount of natural gas consumed by the power generation sector by reducing the demand for electricity in other sectors. In many areas of the country, natural gas tends to be the marginal generation source and, therefore, the generation segment most likely to see the immediate effects of a demand reduction.<sup>3</sup> However, this potential demand effect is offset by a growing reliance on natural gas-fired electric generation capacity, reflecting the ability to quickly (relatively) site facilities and also reflecting growing concerns regarding greenhouse gas and carbon emissions. Also, while electricity consumption does tend to track gross domestic product (GDP), the power generation market

**Exhibit 2. Annual U.S. Natural Gas Demand, by Selected Segments (Quadrillion Btu's)**

|                             | <b>Residential</b> | <b>Commercial</b> | <b>Industrial</b> | <b>Generation</b> | <b>Total</b> |
|-----------------------------|--------------------|-------------------|-------------------|-------------------|--------------|
| 2001                        | 4.77               | 3.02              | 7.34              | 5.34              | 20.48        |
| 2002                        | 4.89               | 3.14              | 7.51              | 5.67              | 21.21        |
| 2003                        | 5.08               | 3.18              | 7.15              | 5.14              | 20.54        |
| 2004                        | 4.87               | 3.13              | 7.24              | 5.46              | 20.70        |
| 2005                        | 4.83               | 3.00              | 6.60              | 5.87              | 20.29        |
| 2006                        | 4.37               | 2.83              | 6.49              | 6.22              | 19.92        |
| 2007                        | 4.72               | 3.00              | 6.63              | 6.87              | 21.24        |
| 12 mos. ending 7/08         | 4.78               | 3.06              | 6.79              | 7.08              | 21.71        |
| Compound Annual Growth Rate | 0.01%              | 0.18%             | -1.12%            | 4.11%             | 0.83%        |

Source: EIA (Not weather normalized).

is not known for being particularly price-elastic when it comes to buying fuel.

Over the past couple of years, these two sectors of the U.S. economy accounted for about 64 percent of the annual demand for natural gas in the United States, or about 38 billion cubic feet a day. To create a simple perspective, a 10 percent decline in natural gas demand by these two market segments would be approximately 3.8 billion cubic feet a day. The overall demand for natural gas is sensitive to the demand in these two market sectors, and until these sectors recover, demand for natural gas will be dampened. As the U.S. economy continues through the recession that appears to have started in late 2007, we face the prospect of reconciling an expanded natural gas production capability with a market likely to be characterized by slowing demand.

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### **WHAT'S NEXT?**

Given the current economic conditions in the United States and the potential ripple effects on the global economic climate, the short-term outlook is likely to be a continued contraction in economic activity resulting in continued downward pressure on crude oil prices and seasonally adjusted prices of petroleum derivative products.

The new equilibrium crude oil price will depend, in part, on the value of the dollar, the success of OPEC production cuts and whether nonmembers follow suit, and the severity and duration of the economic downturn. In turn, these factors will also have an effect on natural gas prices.

Typically, natural gas production increases and prices lag the direction of economic activity. As was shown in Exhibit 1, natural gas prices tend to follow price trends in crude oil, and this relationship is expected to continue. However, the relationship can be disrupted by more local events, such as weather conditions and heating demand, that can affect production-area and market-area prices for natural gas and result in higher volatility for wholesale natural gas prices.

Supported by the higher prices of natural gas over the recent past, development of natural gas reserves and production has been fairly strong, as both the number of wells and amount of domestically produced natural gas have steadily increased. But this level of development is not likely to continue as natural gas prices fall back to the \$6–\$7 a million Btu's, or perhaps even lower.<sup>4</sup> A continued decline in crude oil prices, even in the face of OPEC-approved production cuts, would also contribute to downward price pressure on natural gas.

One of the characteristics of capital-intensive industries, such as natural gas, is that increments of new productive capacity come in discreet chunks, while changes in demand tend to occur

gradually. As a result, the supply response in the natural gas industry to falling prices will likely be a reduction in capacity additions, and perhaps production, until the market comes back into balance and prices can support continued development. In fact, some producers have already announced cutbacks in capital expenditures and drilling programs in order to better balance expected cash flows over time.

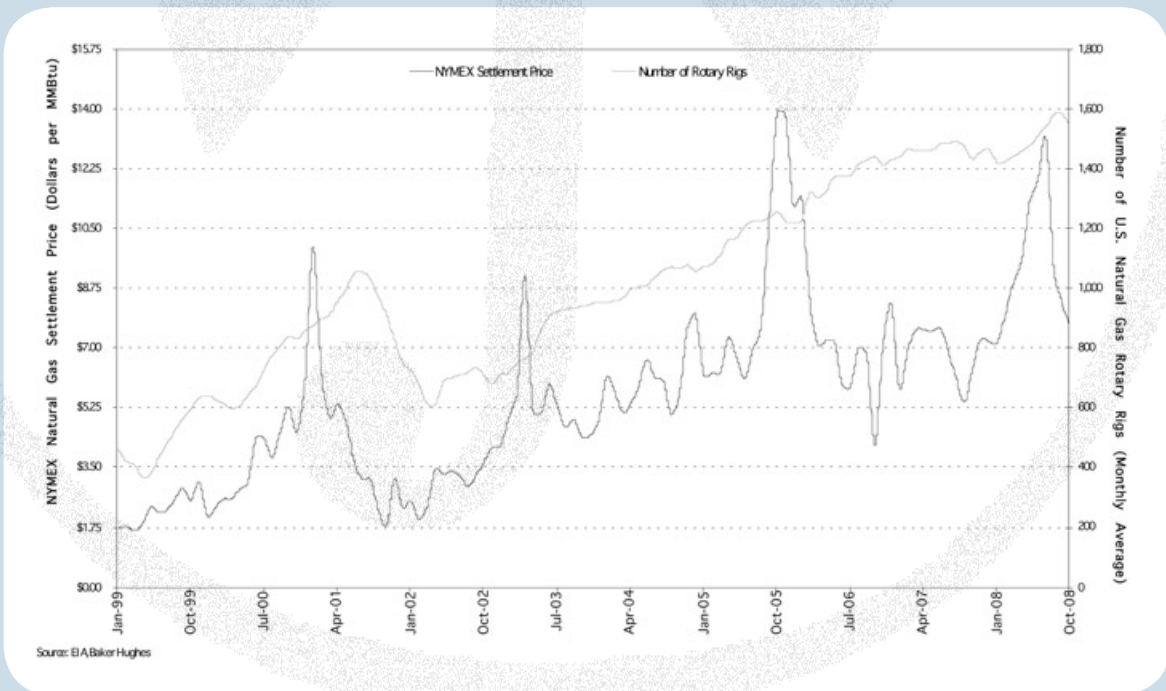
A typical example of this response can be seen by tracking the number of drilling rigs in operation as the natural gas–price changes. There typically is a lag as producers either increase or decrease the number of operating drilling rigs in response to expected natural gas prices. As can be seen in **Exhibit 3**, the number of drilling rigs increased in the late 1990s as natural gas prices headed toward their first \$10-a-million-Btu’s close. This run-up in operating rigs increased natural gas production and resulted in too much gas chasing too little a market. Not surprisingly, producers scaled back their capital expenditures as prices returned to their previous lows. Then, as prices started trending up again, the number of drilling rigs increased, as did the amount spent on drilling. This trend

has continued even though prices dipped sharply in early 2006, ostensibly because the price levels were not low enough to make investing in producing additional natural gas unattractive.

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The supply response in the natural gas industry to falling prices will likely be a reduction in capacity additions, and perhaps production. Continued capital expenditures on natural gas resource development are less likely to be repeated in the face of recent falling natural gas prices for a few reasons. First, the average cost of drilling a well has increased sharply in the past few years, requiring an even higher price of natural gas to justify the capital expenditures. As evidenced in **Exhibit 4**, between 1994 and 2007, the average cost in real dollars of drilling a natural gas well more than tripled from \$535,000 to \$1.9 million.<sup>5</sup> Second, the recession will likely lead to a decrease in natural gas

**Exhibit 3.** NYMEX Natural Gas Settlement Price vs. U. S. Natural Gas Rotary Rig Count, January 1999–October 2008



consumption, particularly in the industrial sector and less so in the electric generation sector. In a recession scenario with reduced demand, putting more natural gas into the market would likely further suppress prices. Third, as discussed in more detail below, consolidating exploration and production (E&P) firms with good reserve positions may be more cost-effective than developing new natural gas production.

Against this backdrop of increased drilling costs and declining natural gas prices, reducing capital expenditures is a rational response, but not the only one. Another potential development could be the consolidation of natural gas firms with a strong position in recently developed reserves proximate to adequate pipeline capacity to market. As oil and natural gas prices have fallen, so have the share prices of E&P companies. On a year-to-date basis, there have been declines in the neighborhood of 40–50 percent in the share prices of some oil and gas production companies. While the effect on shareholders is painful, these price declines might also provide opportunities to acquire natural gas and oil reserves by purchasing the companies that own the reserves rather than independently devel-

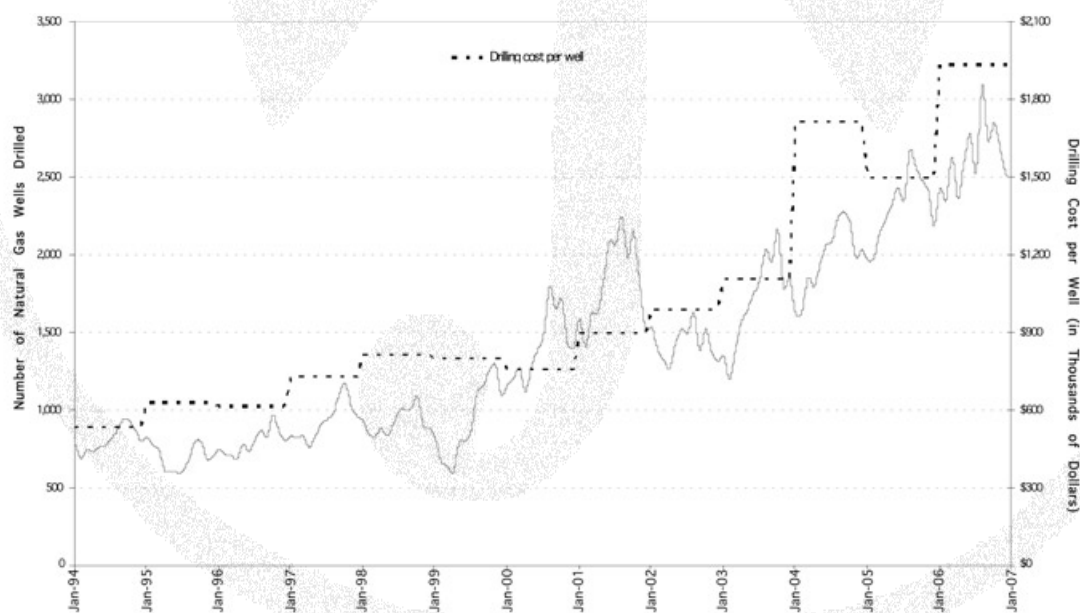
oping reserves. Should oil and natural gas prices continue to decline, there could be an increase in the level of consolidation, particularly of the remaining independent producers.

### WHAT ABOUT IMPORTED LNG?

The current role of imported LNG in the U.S. markets is to fill the marginal demand for natural gas. LNG is typically a price-taker in U.S. markets, with prices often tied to regional natural gas prices at the point of vaporization. In European and Far East markets, LNG is typically sold at prices tied to a basket of regional oil products, weighted by various factors. The underlying LNG cost structure tends to be tied to oil-price indices, and because LNG is transported on ocean-going tankers, LNG cargoes have some flexibility to go to the market that will yield the highest margin.

When natural gas prices were spiking in the United States, LNG cargoes were diverted to eastern U.S. markets. In fact, gas companies in some importing European countries had to seek approval from their regulators to buy LNG priced against NYMEX in order to bid needed supplies away from U.S. markets. More recently,

**Exhibit 4.** Number of Natural Gas Wells Drilled vs. Nominal Drilling Cost per Well, January 1994–January 2007



Source: EIA

higher oil prices resulted in better LNG prices in Europe and the Far East, and more of the available LNG went into those markets. Oil product and related LNG prices are coming down, as are natural gas prices. But at an assumed 6.1 parity (million Btu's per barrel of oil), natural gas at \$7.00 a million Btu's is still trading well under oil at \$65 a barrel, and available LNG cargoes likely will continue to be delivered into European and Far East markets for the near term.

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The dynamic between natural gas and oil prices raises some interesting possibilities for LNG imports, particularly when considered in light of the price needed to support development of additional domestic natural gas resources when LNG tends to be the marginal natural gas supply. The cost structure of existing LNG supplies allows LNG costs to fall relatively low. Past estimates put the break-even price of LNG from Trinidad and Tobago into the U.S. Gulf Coast at under \$3.00 a million Btu's, while deliveries into the Costa Azul terminal in North Baja, Mexico, were estimated to break even at \$4.00 a million Btu's. With break-even prices lower than the replacement cost of domestic natural gas in the face of reduced domestic demand, increased LNG imports could potentially dampen domestic production if natural gas prices remain higher in the United States than in other markets.

### GOING FORWARD

Based on historical experience, initial market responses, and the actions of some producers, the natural gas market in North America will adjust to the recession scenario:

- The value of the U.S. dollar stabilizes and perhaps even strengthens.
- The credit market remains tight and takes a year or more to recover.
- Oil prices continue to decline, but stabilize—that price point might be close—natural gas prices also trend lower.
- Industrial demand for natural gas continues to decline, but more sharply than at histori-

cal rates; natural gas demand in residential and commercial market segments is flat or may slightly decline.

- Growth in the demand rate for natural gas by the electric generation sector slows but continues to increase as incremental generation capacity is likely to be natural gas-fired.
- Natural gas drilling activity contracts in response to lower natural gas prices and reduced demand.
- Pipeline expansion projects associated with more recent natural gas developments are postponed.

Moving out of a recession, the demand for natural gas will likely lead the available productive capacity:

- As the economy expands, demand for natural gas picks up, oil and natural gas prices start to increase, drilling activity lags, and the potential for price spikes increases.
- Credit is increasingly available but with tighter controls.
- LNG imports increase to fill the short-term demand gap.
- Previously shelved natural gas development and pipeline projects are dusted off.
- Natural gas productive capacity catches up with, and probably again surpasses, demand, which mitigates price increases.
- Industrial demand for natural gas rebounds but continues to slowly decline.
- Demand for natural gas by the electric generation sector jumps quickly as electricity demand paces a turnaround in GDP.
- Natural gas demand in the commercial and residential sectors remains constant. □

### NOTES

1. The CFNAI is designed to have an average value of zero and a standard deviation of one.
2. Villar, J. A. (2006, October). The relationship between crude oil and natural gas prices. <http://tonto.eia.doe.gov/ft-proot/features/reoilgaspri.pdf>.
3. Over 50 percent of the electricity generated in the United States comes from coal and nuclear fuel sources using technology that cannot easily follow hourly load changes.
4. Anecdotal evidence suggests that the marginal natural gas production requires prices higher than about \$5.50–\$6.00 a million Btu's.
5. Energy Information Administration. (2008). Costs of crude oil and natural gas wells drilled. [http://tonto.eia.doe.gov/dnav/ng/ng\\_enr\\_wellcost\\_s1\\_a.htm](http://tonto.eia.doe.gov/dnav/ng/ng_enr_wellcost_s1_a.htm).