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About this Newsletter

*In this issue of **Energy** we demonstrate how comprehensive economic analysis can help to avoid expensive mistakes at arbitration and discuss four economic aspects of recent natural gas arbitrations: interpreting market value; using downstream prices to infer the value of gas; lack of robust statistical analysis; and defining the correct market.*

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Price Re-Openers in Natural Gas Supply Contracts:

Avoiding Costly Mistakes in Arbitration

By Paul R. Carpenter and Toby J.N. Brown

Introduction

In locations without liquid spot markets in natural gas, mostly outside North America and the UK, producers typically sell gas to large buyers under long-term contracts with a periodic "price re-opener" clause. The price re-opener allows the parties to renegotiate the price to take into account market movements, with the backstop of binding arbitration if they fail to agree to a price.

Natural gas contract price arbitrations are likely to become more prevalent and contentious in the near future, as the prices of competing fuels such as oil diverge from the prices for natural gas. The level and volatility of such divergence will put pressure on the economic viability of price re-opener clauses that are linked to oil prices.

Over the course of some dozen arbitrations in Europe and Australia, *Brattle* experts have seen claims for significant changes in price from both buyers and sellers. These changes have been founded on mistaken or inappropriate analyses and can be expensive because of the value resting on the outcome of the arbitration.

In this newsletter we demonstrate how comprehensive economic analysis can help to avoid expensive mistakes at arbitration. In current market conditions, where end-customer demand is falling below buyers' take-or-pay commitments and changes in oil prices have put significant price shifts on the table, parties contemplating price renegotiations must be even more confident in the quality of their economic analyses.

Economic theory explains why gas supply contracts contain re-openers, and understanding this theory can help to build a logical and credible case.

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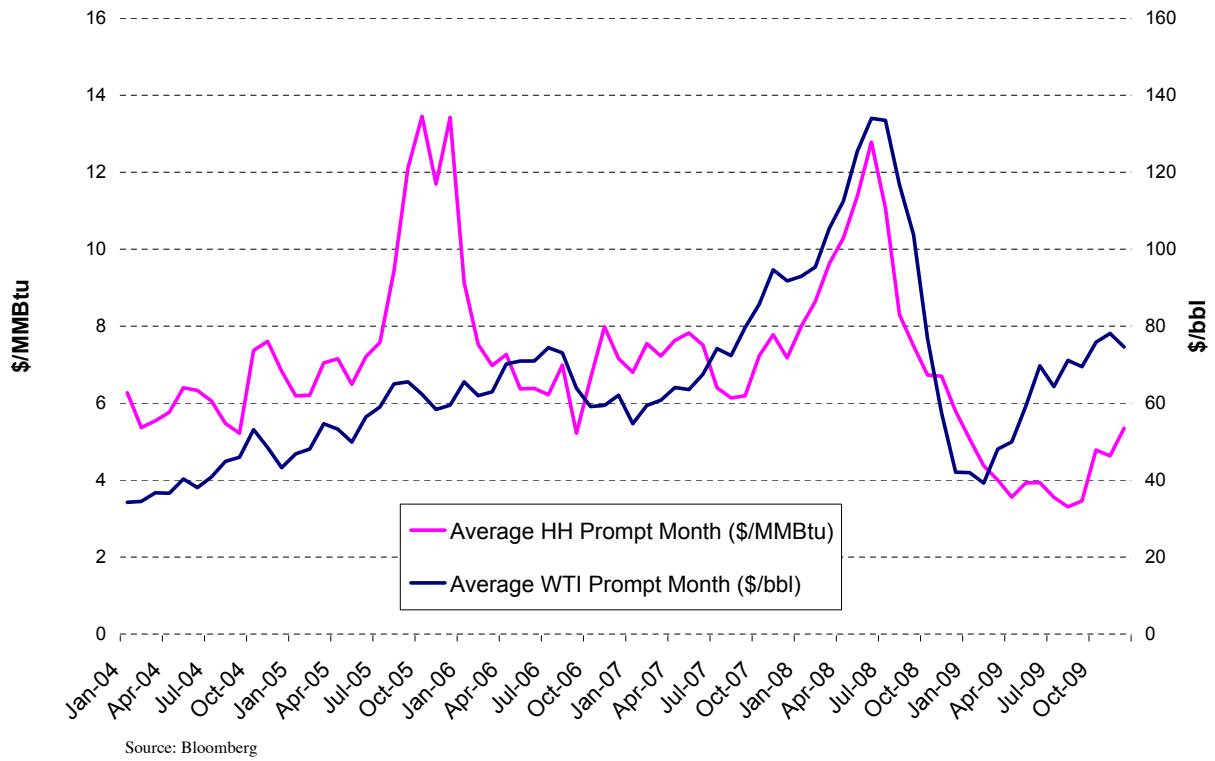
How Arbitrations Arise

The Importance of Arbitrations in an Uncertain World

Given the recent movements in world energy prices over a short period of time, considerable sums ride on the outcomes of gas arbitrations. For example, increasing the price of a 5 bcm/year contract from $3/GJ to $5/GJ shifts approximately $400 million per year from buyer to seller. Long-term contracts in some markets are coming under increasing pressure as the economic downturn reduces gas demand and as excess short-term gas makes contracts linked to the oil price look very expensive in relation to sales linked to a gas index.

As a result, we expect to see an increasing amount of price arbitrations in the future as sellers seek to gain from relatively high oil prices and buyers seek the benefits of lower gas prices. Figure 1 shows that a gap has opened up between oil and gas prices during 2009, and illustrates the pressure that oil-linked contracts are coming under.

Figure 1 - Average NYMEX Prompt Month Settlement Price for Crude Oil and Natural Gas



Source: Bloomberg

TRANSACTION COST THEORY

A well-established economic theory explains why, in some situations, long-term contracts (rather than short contracts, spot market transactions, or vertical integration) are in the best interests of both buyers and sellers and are thus the dominant kind of transaction. The theory of transaction costs holds that a transaction will take whatever form minimizes the associated costs. Ronald Coase was awarded the 1991 Nobel Prize for introducing this theory (in 1937). More recently, Oliver Williamson was awarded the 2009 Nobel Prize for related work on governance and the boundaries of a firm.[1]

Contracts are costly to write and to enforce. Therefore, when they are used in place of spot markets there must be benefits associated with choosing contracts that outweigh the writing and enforcing costs. When a particular supply relationship relies on an investment that once made cannot be redeployed to support an alternative supply relationship, the party sinking the investment is potentially subject to hold-up (see *Case Study of Hold-Ups* on page 4). A long-term contract is designed to reduce the likelihood that the counterparty will attempt a hold-up by committing each side for a long period.

Furthermore, the theory explains why long-term contracts include price re-openers. Despite the uncertainty and expense of price re-openers and arbitration, it is preferable to the risk that over time a fixed-price or indexed contract will become so out of line with market fundamentals that one side or the other will be unwilling or unable to continue with the contract. Of course, if there is a reliable liquid spot market, parties can achieve certainty by linking the price of the contract directly to the spot market, and there is no need for re-openers. Without a reliable spot market, the uncertainty of price re-openers is better for both sides than the certainty that a fixed-price or indexed price will become significantly "out of the money" at some point over the life of a 20-year contract.

In the natural gas industry, investment in production infrastructure may well be specific to a particular supply relationship, especially if the producer delivers the gas by pipeline to the downstream utility's distribution system. The lumpiness of natural gas investments also contributes to the risk of hold-up since spot markets, outside North America and Northwest Europe, are relatively illiquid. ■

Typical Re-Opener Arrangements

A long-term contract with gas production and take-or-pay commitments gives parties in an arbitration the contract stability and certainty of supply, which is desirable in the context of sunk investments in assets such as pipelines and production fields. However, a long-term contract may bring the risk that, over time, the contract price might become significantly "out of the money" as market circumstances change, leaving one of the contracting parties under strong pressure to break the contract.

While at first sight it may appear strange that parties should expose themselves to the uncertainties of a price re-opener and related arbitration, it is evident from the prevalence of such arrangements that this is preferable to other possibilities (such as fixed prices or prices linked to a cost-based index such as production cost inflation). We explore above (see *Transaction Cost Theory*) the economic theory that explains why these arrangements are common in the natural gas industry outside of the U.S. and UK.

A typical price re-opener clause might provide for a regular schedule of renegotiations and/or the option for either side to call for a price renegotiation more or less at any time, provided that a certain period of time has elapsed since the previous renegotiation.[2] The contract should specify the details of how the negotiations are to proceed, and, if they are unsuccessful, the exact nature of the question to be decided at arbitration. The arbitrator might be tasked with determining the market value of the gas supplied under the contract as of the date that the re-opener clause was invoked.

The contract may go on to specify in detail how the phrase "market value of the gas supplied under the contract" is to be interpreted, and may also specify factors that the arbitrator should consider in arriving at the market value. The parties will typically bring expert evidence to arbitration, both in relation to factual matters (data from which market value may be estimated) and methodological issues (how to treat the data, and in particular which data are relevant and which are not).

Economic Issues in Arbitrations

Interpreting "Market Value" Correctly

We have seen a considerable gap between the two sides at arbitration based on alternative interpretations of "market value." For example, one seller may assert that, absent the long-term contract subject to arbitration, it would be able to export its gas as liquefied natural gas (LNG) to high-priced markets overseas, or sell smaller volumes short term to particular domestic end-users, and that these higher prices indicated the "market value." The buyer may counter that its end-users would only be willing and able to pay much lower prices.

The economic literature provides a clear guide to how the contract might be interpreted: parties use long-term contracts to protect sunk investments against "hold-up" (see below, *Case Study of Hold-Ups*). Provided that it is enforced, a long-term contract allows investors to earn a return on investment in situations where, absent the contract, they might only be able to recover operating costs. In the context of a natural gas supply agreement, the contract will contain a purchasing obligation, such as a minimum volume take-or-pay clause (without this obligation the contract is merely an option for the buyer).

However, in order for the contract to be robust, the buyer has to be able to afford to purchase the take-or-pay quantity — which means that the price must relate to the value of gas in the downstream market, net of the buyer's operating costs. If the contract price were to track the export market, or the price of short-term transactions for small volumes, the buyer might be bankrupted and the seller would lose the protection of the contract as a result.

CASE STUDY OF HOLD-UPS

The risk of hold-ups explains some features of the structure of the U.S. coal industry.

Suppose, for example, that a developer considers building a power plant adjacent to a coal mine in order to minimize fuel transport costs. The mine operator agrees to supply the power plant at $1.50/GJ, at which price the generator will just be able to sell electricity into the local power pool and make a sufficient margin to cover operating costs and earn a return on capital sunk in the plant. $1.50/GJ is the plant's maximum willingness to pay — if coal were more expensive, the plant would expect to lose money and so would not be built. After the power plant is built, however, the capital cost of the plant is sunk and the next cheapest source of supply is trucked-in coal at $2/GJ.

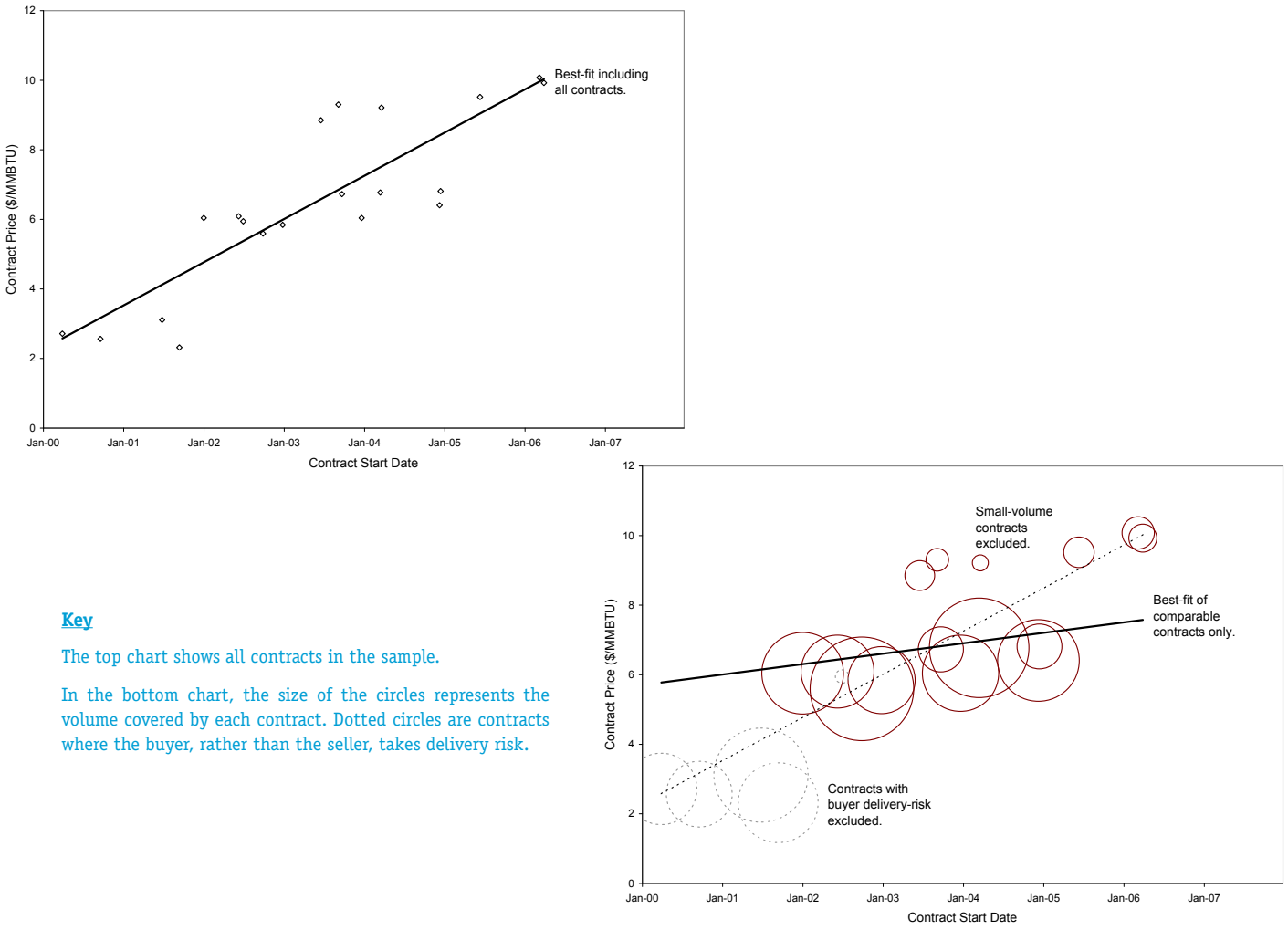
Without a long-term contract, the mine operator could "hold-up" the power plant and demand $1.95/GJ. Knowing this risk, the power plant would not be built unless the mine first signed a long-term contract to fix the price of coal at $1.50/GJ.[4] ■

Using Downstream Prices to Infer the Value of Gas

In another case, an import contract called for prices to be reset with reference to the value in the market in the destination country. One of the end-uses for gas in this market was electricity generation, and the producer argued that the electricity price (which, unlike the gas price, was readily observable in a liquid spot market) could be used to infer the value of gas. This argument is equivalent to assuming that the "spark spread"[3] is constant.

We know from experience in markets where both gas and electricity prices are easy to observe that the spark spread often is not constant over time. For example, when coal is relatively expensive we expect to see that the marginal (price-setting) generator is coal-fired, and the gas spark spread will be high. If coal becomes cheaper, the marginal generator is more likely to be gas-fired, and the spark spread will fall. In general, because power station assets are long-lived and it takes a number of years to plan and construct a power plant, the stock of power stations does not adjust to short-run changes in fuel prices. An argument based on constant

Figure 2 - Trend in Contract Prices Over Time



Key

The top chart shows all contracts in the sample.

In the bottom chart, the size of the circles represents the volume covered by each contract. Dotted circles are contracts where the buyer, rather than the seller, takes delivery risk.

spark spreads is therefore flawed. In fact, the observed run-up in electricity prices is caused in large part by a lack of rain restricting availability of hydro-electric generation. The price increase does not indicate that a shortage of gas makes gas more valuable, but rather that a shortage of power stations makes them more valuable.

Ensuring Statistical Analyses are Robust

Experts are typically brought in by each side in an arbitration to analyze and interpret data pertaining to market value. For example, the expert may use information from subpoenaed third-party gas supply contracts in the relevant market, signed in the period leading up to the arbitration, to examine whether the market value of gas changed over time. We have seen expert evidence based on ill-specified regression models that ignore key non-price features of the contracts, such as firmness or local market characteristics, in an attempt to predict the prevailing market price and changes over time. We have also seen models that have confused contract negotiation dates and contract start dates (when gas starts flowing). These dates can sometimes be several years apart and if not appropriately considered can lead to incorrect conclusions about price changes over specific periods of time.

We have also seen an expert attempting to infer market value from contracts pertaining only to a subset of customers with contracts that look nothing like the contract subject to the arbitration in volume commitment or duration. Since the subset of contracts was not representative, the market

value inference was biased. This is illustrated in the charts above on Page 5.[5] The first chart shows an upward trend of contract prices over time, suggesting a 2007 "market price" of around $10/MMBTU. The second chart shows the same data, but plotted to indicate the volume of each transaction and whether the buyer or seller takes the volume risk, suggesting a 2007 "market price" for large volumes where the seller takes volume risk of about $7/MMBTU. A significant error was introduced by failing to account for these two factors.

In other instances, we have seen errors by experts who included interruptible or best endeavors contracts in their subsets (and even contracts for other products, such as ethane) even though the arbitration involved the value of natural gas under a long-term *firm* contract. This resulted in a poor subset of contracts that was not representative of the value of the contract in question. Finally, we have also seen experts ignore price re-opener clauses or amendments in their contract subset that resulted in prices being re-established at certain points in time, again leading to faulty model results.

Ensuring Data Relates to the Correct Market

Determining the correct market definition is often a key part of an arbitration, and this can depend on proper economic and legal analysis of the contract. For example, an importer had a long-term contract with an LNG exporter, with the price under the contract to be determined in relation to the value of gas in the importer's market. For a period of time the market in which the importer resold gas was oversupplied and prices were low.

At arbitration, the importer used evidence on prices paid by end-consumers located in its home market to argue that its import contract price should be low. However, the importer had been able to redirect LNG cargoes to markets overseas where prices were higher. Thus, the value of the gas to the importer included higher-priced overseas sales, which therefore had to be reflected in the renegotiated contract price.

CONCLUSION

Arbitration results are often perceived as arbitrary compromises between the positions of parties, unsupported by clear economic reasoning. However, in many cases the economic theory that leads parties to sign long-term contracts with arbitration clauses in the first place also produces a logic that can guide the arbitration to a correct answer.

If this logic is applied correctly, parties can avoid some of the expensive mistakes seen in recent arbitrations. Evidence from downstream product markets, such as gas-fired electricity generation, must be properly factored into the analysis because faulty logic will give incorrect results. Where market transaction data is available, the expert analysis must be statistically robust. Finally, the assessment of market value must relate to the market in which the gas is actually sold.

ENDNOTES

[1] See, for example, Williamson, *The Economic Institutions of Capitalism*, New York: Free Press, 1985.

[2] Perhaps in response to the volatility of energy prices in recent years, we have seen some contracts that allow re-openers every year.

[3] The spark spread is usually defined as the difference between the price of electricity and the price of gas, on an energy-equivalent basis, taking into account the thermal efficiency of electricity generation. Thus, the operating margin available to a gas plant to support fixed costs.

[4] In Professor Paul Joskow's seminal study of the relationship between power plants and coal mines, plants close to coal mines were more likely to be owned by the mine, in order to avoid the hold-up problem associated with locating the power plant at the mine mouth (see, for example, Joskow, *Massachusetts Institute of Technology, Department of Economics Working Paper no. 444*, 1987).

[5] These charts are illustrative only and are not based on actual market data.

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