pricing commodities and other risks

Lately we've been running a series of stories and analyses on gas and power price indices, index formation, policy and compliance. We have received several requests from readers to present some more details on market risk and price formation in a broad sense, including essential terms and so on. Fortunately, we know a guy. Glenn Labhart, Dynegy's former chief risk officer and chairman of the Energy Oversight Committee of the GARP's Energy Risk Program (ERP), just happened to have a paper available covering everything you need to know on price formation and associated market risks.

Ironically, his concluding paragraph, actually works beautifully for our lead:

"To understand market risk properly, one must grasp the pricing components, risk aggregation and the proper structure of the underlying for adequate risk measurement. It is critical for all involved parties, including trading and risk management, to grasp these pricing concepts. Erroneous conclusions lead to an increase of the cost of risk by requiring incremental processes and procedures that detract from the overall strategy of the company and increase costs." Read on. –the editor

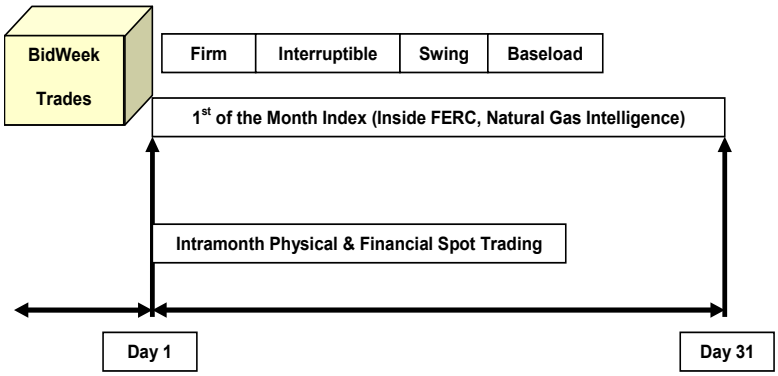
Risk Management Pricing Concepts of Underlying and Hedge Risk

By Glenn Labhart, Labhart Risk Advisors

To effectively manage risk, the pricing of commodities is dependent on many fundamental and financial trading variables. To manage risk effectively, the basic pricing concepts must be understood to ensure adequate oversight of fixed, basis, and index risk in an energy portfolio. This is applicable to all commodities, but for illustrative purposes we will focus on the US natural gas market.

At the numerous hubs or market centers located along the pipelines, large volumes of natural gas are delivered in physical or cash market transactions. The pricing structure for these transactions is a combination of a location–specific, fixed-price purchase or sale agreement or a floating price contract with the reference price derived from either a publication or an electronic exchange. As trading in natural gas is complex, understanding the underlying risks is crucial to effectively manage these risks.

The following diagram is a graphic of US spot market pricing for natural gas:



Historically, natural gas trading was primarily conducted during "bid week," generally the last three to five business days of each calendar month. The transactions during the bid week provide both end-users and producers the opportunity to assess the physical supply or demand requirements for the next month utilizing price discovery of the current spot market.

This process leads to forecasted volume that the supplier can deliver and the end-user is expected to consume, respectively. Based on these demand and supply forecast considerations, the physical transactions in natural gas are then executed. The actual transactions are governed by various delivery terms and prices.

During bid week, counterparties negotiate the pricing and delivery process and requirements for natural gas in the following month. Only spot transactions (described below) for delivery in the following month are typically considered. Delivery can take place on all or just a few select delivery days of the following month. Typically, the following spot physical transactions are executed:

- **Firm:** guaranteed delivery of the entire negotiated volume over the negotiated time period.
- **Interruptible:** delivery of the entire negotiated volume subject to potential interruptions, i.e., when the pipeline allocates capacity to firm, higher priority shipments and curtails interruptible supply.
- **Swing:** delivery of the entire negotiated volume is subject to interruptions. Delivery is usually set for a short time period: one to five days. It may also be scheduled for a full month. The inability to make or take delivery is expressly allowed as long as the parties contractually advise their intent to "swing" on the supply, leading to financial or physical responsibility for the shortfall.
- **Baseload:** delivery of the volume on a daily basis, with a daily flow of gas.

Typically, all of the trade types mentioned

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above comprise the energy portfolio that a company will manage largely due to:

- Term agreements in place as required for financing.
- Management's desire to have a stable source or supply at an index or fixed price.
- Requirements to manage the energy portfolio that coincide with the scheduling requirements of the pipeline/storage facility/transport agreement.
- Loss of supply/demand that results in imbalances that are prior period adjustments as required by the contract between counterparties.

Trades during bid week are executed through electronic exchanges, cash brokers, or directly between the parties. When trades are based on index prices, then the price is floating reflecting the prevailing prices at the index locations.

Index locations represent prices at hubs which are major trade locations. To calculate the index value, the information is self-reported by both the buyers and sellers of physical gas to publishers, who produce subscription-based industry newsletters that summarize the price reports they receive.

Index prices reported by publications differ due to differing methodologies that are transparent and change periodically. There are indices that focus on the price of gas for delivery during the next month and there are other indices that focus on transactions for the next day or balance-of month delivery.

The publishers publish the prices on or about the first day of the month to reflect prices effective on the first day of the month for the daily and monthly prices. Once the index values are published, transactions continue throughout the month using the index prices as a reference.

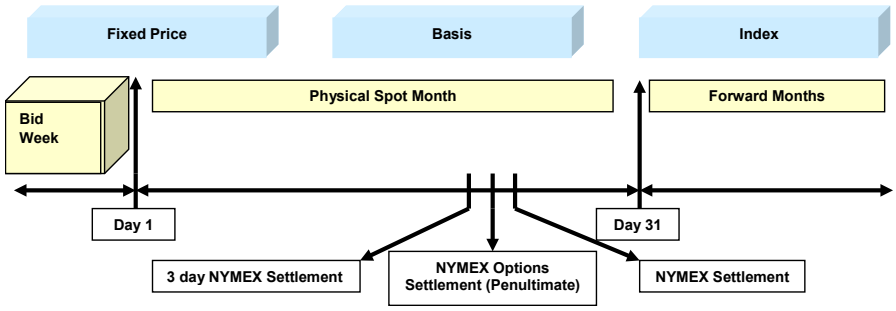
During bid week, however, the index values are typically limited to the daily values. Prices at each index location vary each day and reflect supply and demand for that specific region determined by the weather, the availability of gas, the storage levels and the availability of transportation. These daily prices represent the current market value to provide price discovery during bid week for the following month prices.

While the description of gas trading reflects US practices, the structure of natural gas trading in the physical markets are typically quite similar in other places around the world. There are differences, however, among marketplaces. Differences reflect the regulatory environment, the physical infrastructure and the structure of the market place where gas is traded in different countries.

At each market place, transportation and scheduling costs are integral parts of the daily activities and pricing decisions.

Forward Physical and Financial Trading and Risk-Based Pricing

Transactions executed prior and during bid week for forward month delivery require a similar daily market and operational risk assessment and management as those transactions executed during bid week. While physical bid week transactions are executed and managed on an intra-month basis, forward transactions, or those transactions done for periods beyond bid week, are different as illustrated in the above diagram.



Forward physical trading involves three components: ***fixed price, basis and index.*** These three components have risk management implications.

- **Fixed-price trading has probably the simplest structure:** The price is agreed upon at the onset of the transaction. The pricing point is the Henry Hub in Louisiana. Fixed-price transactions are executed at other locations and have the embedded risk components within the fixed price.

- **Basis is the location differential between two physical markets.** The basis price represents the price or value differential between two locations. Since delivery can occur at various future dates, from the next day to several years in the future, multiple basis values may exist for each location pair. Publications typically publish basis values for a variety of forward delivery dates. Most commonly, forward basis values are reported for delivery in the next month (the "prompt" month), and the following months (the "forward" months). There are also seasonal quotes (Winter and Summer). Winter is referred to as November-March; Summer as April-October. Most reported quotes are based on Henry Hub pricing.

- **Index reflects the transaction price of gas delivery at a particular location during a specific month, and the index price is reported by published price reports.** Index risk is intended to mirror the physical price locations that are used in natural gas physical trading as reflected in the monthly and daily index publications.

When these three components are viewed in aggregate at the trading level, the strategy is to manage these three risks:

- **Commodity price risk** *(Fixed Price)*
- **Location differences** *(Basis)*
- **Prevailing index prices** *(Index)*

When analyzing the profit of the transaction, the profits are based on the reported index values and positive or negative differentials are profits captured by the transaction.

This three-component risk methodology is used in natural gas trading because it mirrors existing financial instruments and pricing practices. All these instruments can be executed to offset the respective fixed price or basis risk.

Differences in the basis, or basis spreads, are closely related to the cost of moving natural gas between two different

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locations. Historically, gas trading locations in the US Northeast tend to experience greater price volatility than in North American regions. This greater volatility reflects:

- longer distance and the limited alternative ways gas must be shipped to reach this market.
- large demand volatility caused by seasonal weather effects and limited local gas storage capacity.

As the shale production in certain geographic areas has prompted the development of new transport capacity, reallocation of pipeline flows, and LNG export requirements, the basis market will continually be tested as these new fundamentals are embedded fully into the US and global markets.

To better explain how the risk components are embedded within a transaction, this table identifies each component for the trade type.

Trade Type	Fixed Price	Basis	Index
Fixed Price Physical	X	X	X
Basis Financial Swap		X	
Fixed Floating Henry Hub Swap	X		
NYMEX Henry Hub Futures	X		
NYMEX Exchange for Physical		X	X
Purchase/Sale at Index			X
Gas Transportation		X	X
Physical Gas Storage	X	X	X

Each transaction contains three different types of risk that must be managed both individually and collectively and are referred to as "legs" of risk.

Organizations tend to manage risk on a regional basis since there are many hubs and multiple index pricing locations. Within the region, organizations tend to have risk separated into categories by business type. These categories are sometimes referred to as "books." Within the organization the information system is organized, not only to manage risk, but also to monitor profitability. Typical categories or books and transaction types are listed here:

Books		Transaction Types
Locational Fixed price Cash	Fixed Price	Financial Basis Swaps
Intramonth Cash		Financial Swing Swaps
Storage		Physical Fixed Baseload
Basis	Basis	Physical FOM Index Baseload
Transportation		Physical NYMEX Baseload
Fixed Price Financial		Physical Daily Index Baseload
	Index	Financial Options
		Storage Injections/Withdrawals
		Pipeline Imbalances

An organization active in several regions, will typically have separate desks that exclusively handle the financial trades and financial risk, or the physical trades and the physical risks.

In controlling fixed-price risk, a key consideration is to have a manager within the company's fixed-price desk to manage futures and derivatives risk separately from the desks which manage physical assets or transactions. The fixed-price desk generally only trades on the financial markets, with limited, if any, trading activity in the physical markets. The fixed-price desk manages only its specific type of risk, which is either executed as open risk or is transacted internally with the other regions or desks within the organization.

When trading desks execute transactions, they are responsible for the aggregate risks (fixed price, basis and index) within their respective portfolios. The complexity of the risk management process lies in understanding and distinguishing relationships of physical and financial trades that are separate or jointly related between the physical and financial marketplace.

Most companies coordinate credit risk information within the decision-making framework. In effect, the risk management structure becomes an integral part of the business function for market risk.

Simply focusing on the potential default, operational and liquidity risks does not completely capture the interrelationships among various risks. Additional risks, such as headline and performance or operational risk are similarly material risks. It is prudent to assess the underlying risk portfolio relative to the market size and growth projections, to establish risk analytics that can more accurately measure potential risk, as well as opportunities.

To understand market risk properly, one must grasp the pricing components, risk aggregation, and the proper structure of the underlying and hedge risk for adequate risk measurement. It is critical for all involved parties including trading and risk management to grasp these pricing concepts. Erroneous conclusions lead to an increase of the cost of risk by requiring incremental processes and procedures that detract from the overall strategy of the company and increase costs.

Labhart can be reached at glenn@labhartriskadvisors.com or go to http://www.labhartriskadvisors.com/

labhart
RISK ADVISORS