



Energy Micropricing

Craig Pirrong

Commodity Transformations

- All commodities undergo transformations through the value chain
- Transformation in space (transportation)
- Transformation in time (storage)
- Transformation in form (processing)

Some Examples

- Power plants transform fuel into power
- Pipelines transform gas in one location to gas in another
- Storage terminals convert oil today to oil tomorrow

Complexity

- Most commodities go through numerous transformations of all 3 types
- Think of the process of transforming oil at the wellhead to gasoline at the pump
- Multiple spatial transformations (VLCC, pipeline, truck)
- Multiple physical transformations (at refinery)
- Storage at “break points”

Bottlenecks

- Every transformation process has bottlenecks
- Bottlenecks constrain the transformation process
- The tightness of these constraints can vary over time

Some Examples

- Pipeline capacity
- Transmission capacity (e.g., thermal, voltage limits)
- Refinery capacity
- Limits on rate of flow into and out of gas storage facilities (which can vary depending on type of facility)

Regulatory Bottlenecks

- Regulatory factors are an increasingly important source of bottlenecks.
- Gasoline formula regulations that vary by geographic region (e.g., Midwest)
- NOX or SOX limits (again may be geographic variation in these constraints)

Pricing

- Understanding energy pricing requires an understanding of the transformation process and the role of bottlenecks
- It also requires an understanding of the role of the price system

The Role of the Price System

- A competitive price system aggregates the information held by millions of economic actors
- Competitive prices adjust to direct resources to their highest value uses
- In particular, they adjust to reflect relative scarcity and the importance of constraints/bottlenecks

Pricing “Regimes”

- Prices may behave very differently over time, depending on how tightly constraints bind
- In general, prices are more volatile when constraints bind tightly than when they do not

The Economics of Pricing Regimes

- Very straightforward supply and demand economics explains this
- Supply is “inelastic” when constraints bind
- Binding constraints mean that it’s very costly to adjust production or consumption in response to demand and supply shocks
- In these circumstances, prices must bear the burden of adjustment

Example: Midwest Gas Pricing

- Midwest gas pricing has been very controversial recently (since late-1990s)
- Several FTC investigations
- Simple supply and demand analysis can shed light on why pricing behavior has changed
- Role of environmental regulations—supply less elastic

Example: NOX Permits

- CA enacted restrictions on NOX emissions from power plants
- Due to heavy operations in summer of 2000, many plants had come close to reaching their allowed emissions
- NOX permits became a bottleneck

Derived Demand

- Demand for products further back in the marketing chain “derived from” demand for final products—e.g., demand for oil is derived from demand for gasoline, heating oil, plastics, etc.
- Bottlenecks determine how shocks upstream and downstream impact prices along the chain

Implication of Derived Demand

- The same shock (e.g., an increase in the demand for gasoline) can have a different impact on the demand for (and hence pricing of) crude oil depending on the amount of slack in refining

Spreads Price Bottlenecks

- Transmission/congestion charges price transmission bottlenecks (example: PJM)
- Price of NG transportation and storage prices pipeline and storage bottlenecks
- Crack spread
- Spark spread
- Basis

Trading

- Spreads and pricing relationships are the essence of much commodity trading
- Trading and managing the risk of such price exposures requires an understanding of the value chain
- There is a big potential payoff to understanding the intricacies of the value chain

Suppression of Markets and Price Signals

- Sometimes (particularly in power markets, it seems) markets are missing (by accident or design) or price signals are suppressed
- Zonal pricing in power markets
- Price caps (electricity, gasoline in the bad old days)
- Absence of markets means that some bottlenecks are “free”
- People expend resources to get “free lunches”

Market Power

- The foregoing analysis has presumed that everybody is a price taker—competitive markets
- Some players may be “price makers”
- These players can influence prices—that is, they can exercise market power—by withholding output from the market

The Effects of Market Power

- Prices can spike in competitive markets
- Market power can lead to higher prices, but prices can be high without market power
- Market power sometimes hard to diagnose—not so hard at other times
- Policies that make no sense when there is no market power (e.g., price caps) may be sensible when market power exists

Market Power and Bottlenecks

- Bottlenecks can create or enhance market power
- Less competition behind bottleneck
- Midwestern gasoline redux
- Market power per se is not illegal
- Collusion
- Manipulation