

Price Volatility in Natural Gas Markets

Presented to:
Energy Information Administration's
2008 Energy Conference

April 8, 2008

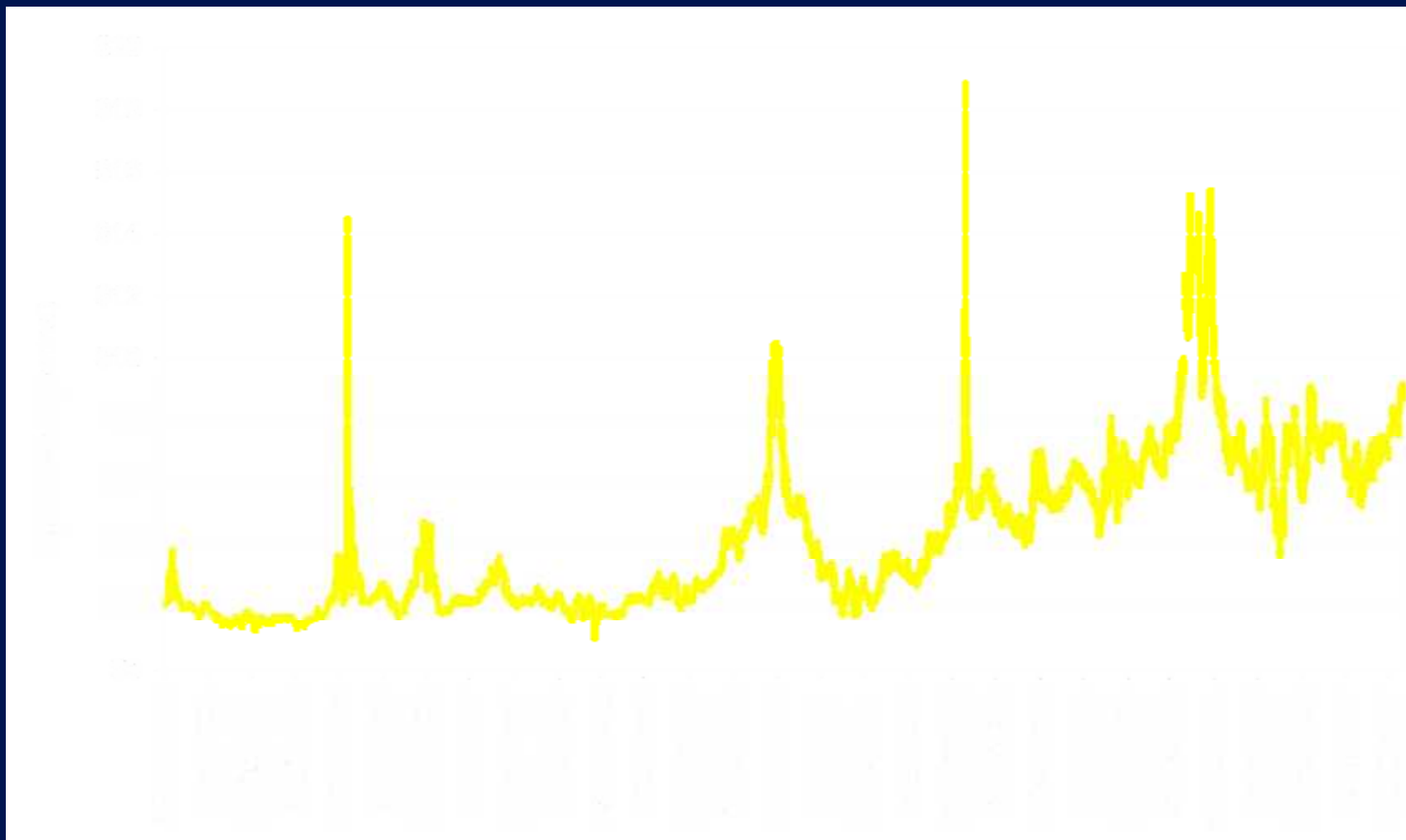
Presented by:
Erin Mastrangelo
(Former EIA Industry Economist)

ekmastrangelo@gmail.com

Agenda

- **Overview of prices and volatility**
 - **What is volatility?**
 - **Trends**
- **Drivers of volatility**
- **Some empirical results**
- **Implications and Conclusions**

Henry Hub Spot Price: 1994 - 2007



Source: *NGI's Daily Gas Price Index*, Intelligence Press

What is Price Volatility?

- A measure of the degree of price variation in a market.
- Increasing prices do not necessarily indicate that the market is undergoing a particularly volatile period.
- When prices increase, volatility increases only if accompanied by a disproportionately large increase in the absolute daily price change.

Price Volatility Defined

A common measure of risk or uncertainty in the market is to define price volatility as the standard deviation of daily relative changes in price

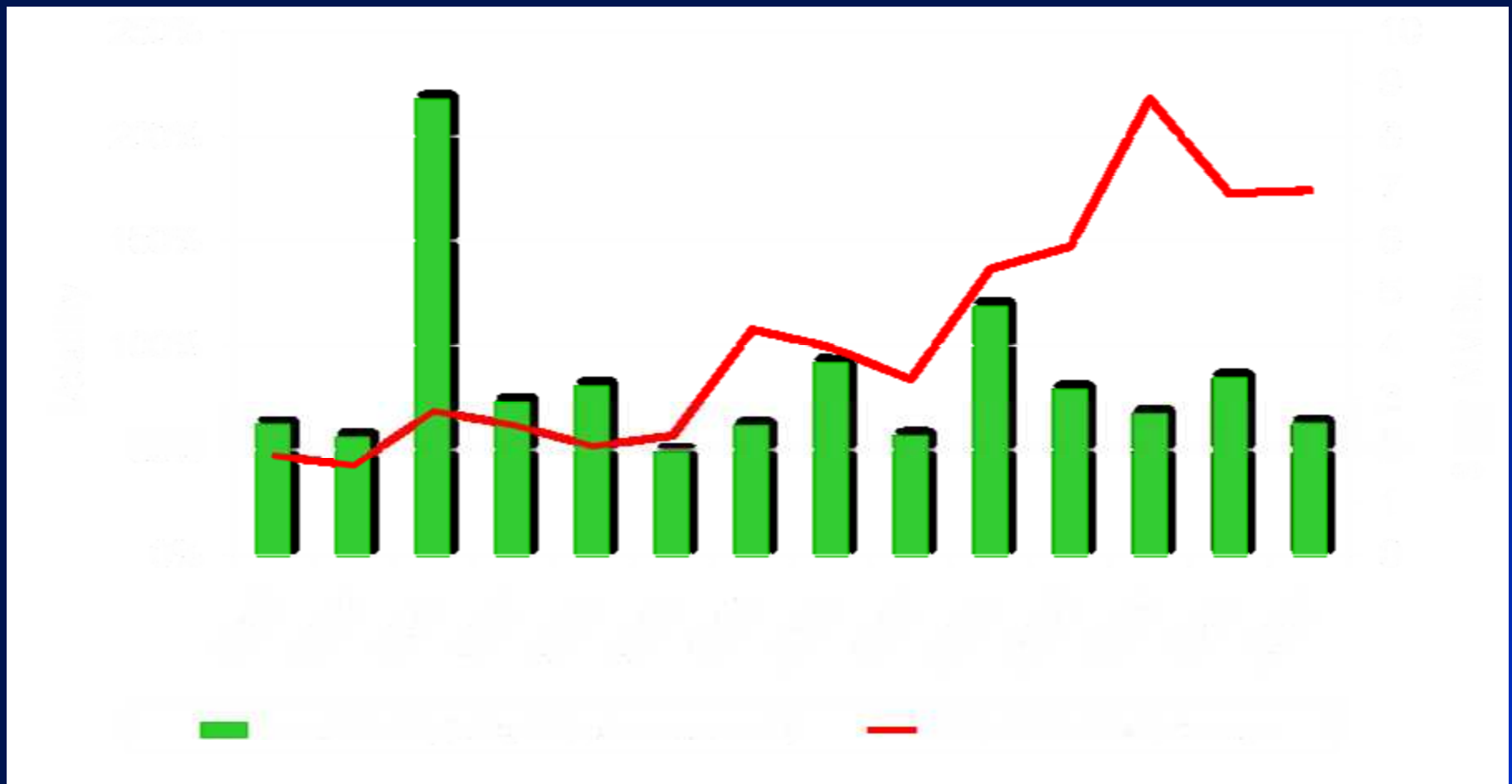
$$Volatility_T = \sqrt{\frac{\sum_{i=1}^N (\Delta p - \Delta \bar{p})^2}{N-1}} * \sqrt{N_T}$$

Δp = the log change in daily spot price,
 $\ln(p_t/p_{t-1})$

N = number of days within time interval, T

Annual Price Volatility: Henry Hub

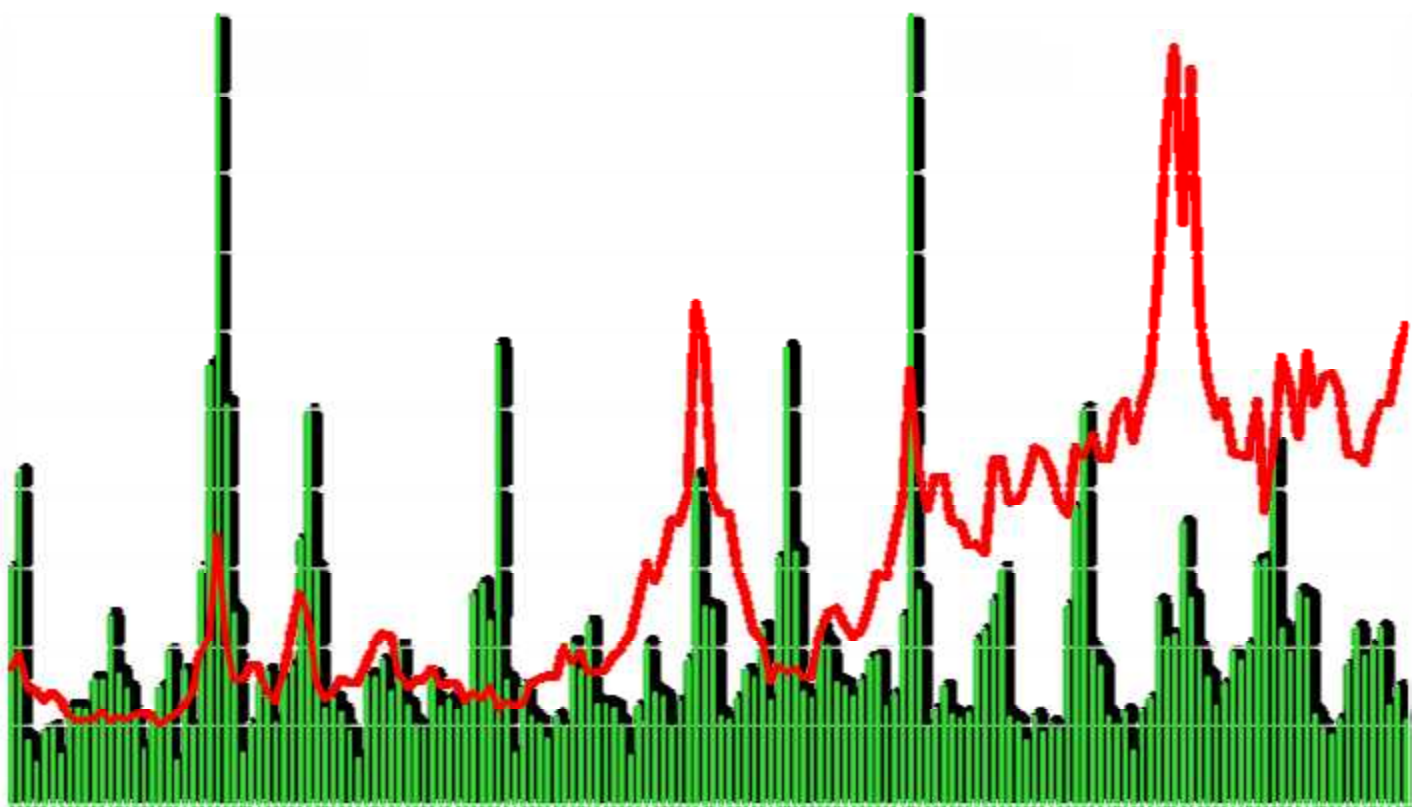
Consistently High; No Increasing or Decreasing Trend



Monthly Price Volatility: Henry

Hub

Strong Seasonal Pattern



Market Factors That Impact Natural Gas Price Volatility

Demand Side:

- Weather (heating and non-heating season)
- Market for Related Fuels
- Additional Natural Gas-Fired Infrastructure
- Economic Activity

Supply Side:

- Variation in Storage
- Production
- Imports
- Delivery Constraints

-
- Both consumers and producers have limited choices in responding to high prices
 - Inelasticity of demand and supply in natural gas markets leads to high levels of volatility, relative to other commodities

Seasonality in Volatility

- Seasonal variation reflects weather related demand.
- Data suggests that storage dynamics may also be affecting volatility levels.

Month	Average Monthly Volatility	Coefficient of Variation
January	25.38%	52.98%
February*	27.45%	99.06%
March	16.49%	70.37%
April	12.63%	42.30%
May	11.38%	31.47%
June	12.87%	30.06%
July	12.67%	30.72%
August	16.32%	35.42%
September	17.05%	43.89%
October	22.79%	43.76%
November	24.75%	58.43%
December	26.74%	47.29%

* The calculated February value excludes the first two weeks of February 1996.

Econometric Results

- Results of a time-series regression analysis of *weekly* volatility show there is seasonality in the markets, but also indicate that storage dynamics have a strong influence on volatility
 - Weekly volatility in March and April, the months surrounding the end of the heating season, is 30 and 34 percent lower than in January.
 - Weekly volatility in October and November, the months surrounding the start of the heating season, is 46 and 47 percent higher than in January.
 - As storage levels move away from the 5-year average (above or below), the weekly volatility increases.

Consequences of High Volatility

- Real-time supply and demand data are unavailable so market participants look to prices as a barometer for current market conditions.
- Individuals and companies may react to sharp price changes by requiring larger expected returns, or delaying or declining investments.
- Overall effect is increased **uncertainty** and **risk**, which affects decision making for both suppliers and consumers of natural gas.

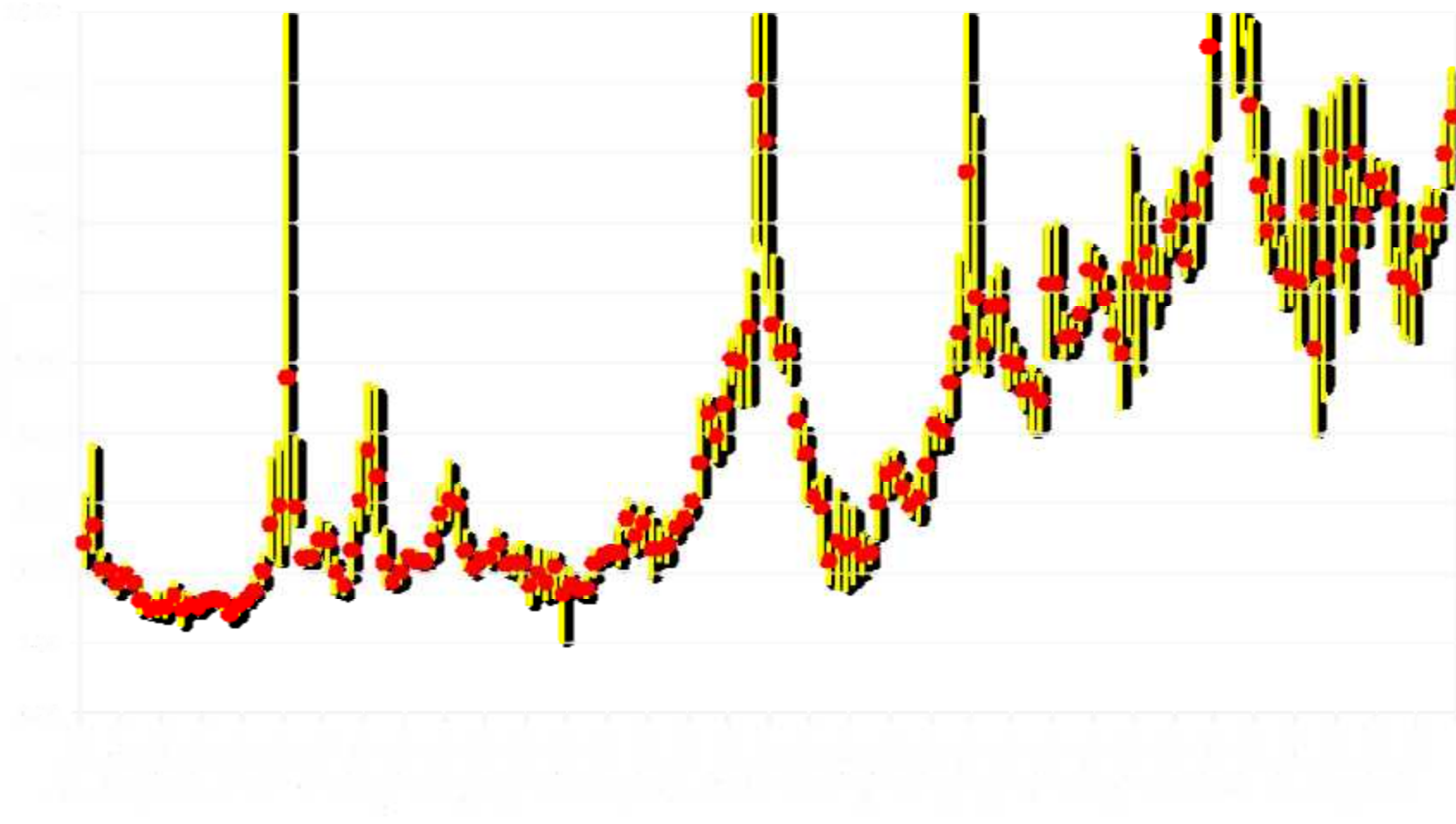
Mean Absolute Price Changes

- Even under constant or low volatility levels, price risk may increase as the price of natural gas increases.
- The range of potential costs to buyers and sellers depends on the range of possible price changes, not necessarily on the *percent* change in price. *For example:*

Scenario	Absolute Price Increase	Percent Increase in Price	Economic Impact
Price increases from \$2.50 to \$3.00	50 cents	20 percent	LOWER
Price increases from \$10 to \$11	\$1.00	10 percent	HIGHER

\$11

Henry Hub Monthly Spot Prices: Average, Min and Max, 1994 – 2007



Source: NGI's Daily Gas Price Index, Intelligence Press

Note: Dots represent averages and vertical lines indicate the high and low range

Conclusions

- A high degree of price volatility seems inherent in natural gas markets, but volatility and high prices are different aspects of market pricing
- Volatility exhibits seasonal patterns based on weather and storage dynamics
- Price volatility increases as storage levels move away from the 5-year average storage inventory level
- Financial risk can be large even under relatively low volatility levels, if daily price movements are large

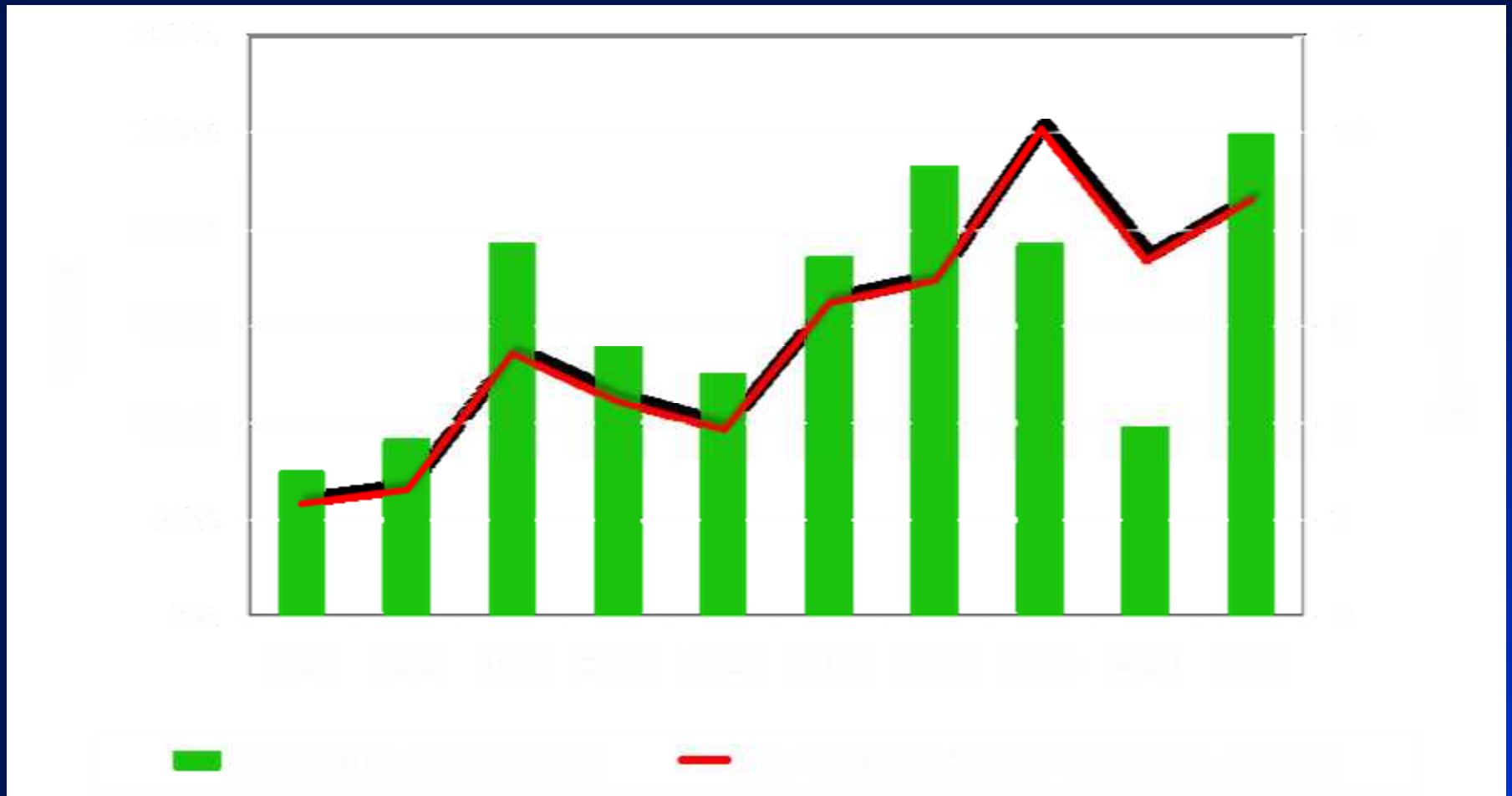
Additional Information...

www.eia.doe.gov : Click on "Natural Gas"

- *"An Analysis of Price Volatility in Natural Gas Markets"*, August 2007
- Reports and analyses on natural gas markets and infrastructure.

New York City Transco Zone 6

Significantly higher volatility relative to Henry Hub may reflect population and capacity constraints



Chicago City Gates

Volatility Patterns Are Similar to the Henry Hub

