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Derivatives, Risk Management, and Policy in the Energy Markets

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Derivatives, Risk Management, and Policy in the Energy Markets

Summary

Risk management is important in the energy industries because of the volatility of oil and natural gas prices. Price volatility can reduce the profit of business strategies and hurt consumers. The use of financial derivatives, both traded and over-the-counter, has developed as a low cost method of hedging price risk. However, the use of derivatives has also been linked to major financial scandals and bankruptcies.

Risk management strategies can be undertaken without the use of derivatives. Vertical integration of the production process, inventory control and long-term, fixed price contracts can all compensate for the effects of price volatility. Whether one of these choices, or a derivative strategy, is chosen depends on the cost and flexibility of each alternative. Derivative use has expanded rapidly both in value and volume.

Market traded and over-the-counter derivatives have different characteristics with respect to their liquidity, safety, transparency and flexibility. The benefits and costs of using either instrument depends on the circumstances and goals of the firm setting up the strategy. A wide variety of derivative contracts exist, including forwards, futures, options and swaps which can be put together to achieve a wide variety of objectives.

Although market traded derivatives are self regulated with oversight by the Commodity Futures Trading Commission, over-the-counter derivatives are largely unregulated. Whether these transactions should be regulated might depend on their effect on commodity price volatility, their effect on the stability and integrity of U.S. capital markets, their ability to reduce the cost of capital, enhancing domestic real investment and the value of more open disclosure and price transparency.

Congress considered proposed derivative legislation in the 107th Congress. Senator Dianne Feinstein introduced legislation in the Senate, while Representative Peter DeFazio independently introduced a bill in the House. In the 108th Congress, Representative DeFazio has introduced a derivative regulation bill, (H.R m 1109), and there has been some speculation that Senator Feinstein may introduce legislation in the Senate. In the time since the collapse of Enron, many specific proposals to reform the industry have appeared. These include tying derivative trading more closely to the underlying business interests of the market traders, establishing a clearinghouse to manage transactions, establishing structured derivative trading companies and enhancing reporting and documentation requirements. Each proposal has merit, but each could also reduce the effectiveness of the derivative industry in managing risk, presenting a trade-off that would need to be balanced for an efficient outcome.

This report will be updated as events warrant.

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Derivatives, Risk Management. and Policy in the Energy Industries

The use of financial derivatives by American industry began in agriculture in the nineteenth century. Later, they were widely used in foreign exchange transactions, as well as in the bond markets. Their use in energy markets began in a modest way with the introduction of a heating oil futures contract in 1978 at the New York Mercantile Exchange (NYMEX). The NYMEX has since become the dominant market for traded energy derivatives in the United States.[1] This initial contract expanded over the next fifteen years to include contracts on unleaded gasoline, sweet crude oil, propane, natural gas, and sour crude oil. In 1986 the first option contract, on crude oil futures contracts, appeared. This was followed by a host of other contracts on a variety of energy products as well as margins between products and over time, called spreads. Use of these contracts expanded rapidly and they have become an important part of the financial and physical sides of the energy business. In 2001 the NYMEX traded and cleared contracts with a value of $2.9 trillion. Approximately half of this value represented contracts on crude oil, natural gas, gasoline and heating oil.[2]

Paralleling the growth of traded energy derivatives was the development of over-the-counter (OTC) derivative contracts. These contracts were originally arranged through an intermediary, generally a financial institution. The two parties to the agreement both had an interest in protecting themselves against future price movements as well as shifting risk, but needed more flexibility in the contract terms than standardized contracts on the NYMEX could provide. OTC contracts today are largely written on foreign exchange, interest rates, and equities, although commodity based contracts have also grown in importance. The Bank for International Settlements estimates that at the end of 2001 the value of outstanding OTC contracts worldwide was $111 trillion. Of this total, $598 billion were commodity based. By mid 2002 the value of commodity based contracts had increased to $777 billion.[3]

By 1993, problems related to the general use of financial derivatives began to surface. Derivatives were implicated in cases that resulted in huge financial losses. Orange County, California lost $1.7 billion trading derivatives and went bankrupt.

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[1] The International Petroleum Exchange was established in 1980 in the United Kingdom and trades products similar to those traded on the NYMEX, but with different underlying commodities.

[2] Historical as well as current trading data, contract specifications and other background information on NYMEX contracts can be found at [http://www.nymex.com].

[3] One of the problems in analyzing the OTC sector is that data is not routinely reported to regulatory agencies and hence may be an estimate. See Bank for International Settlements, Press Release, November 8, 2002, Table 1, p.5.

That same year, Metallgesellschaft lost over $1 billion in energy trading in the United States. The year 1998 brought the crisis at Long Term Capital Management, a leveraged hedge fund, that required intervention by the Federal Reserve Bank of New York which arranged a rescue operation by major financial institutions. In 2001 Enron Corp., a company known for its promotion and use of derivatives through its trading arm, Enron Online, went bankrupt amidst major financial scandal.

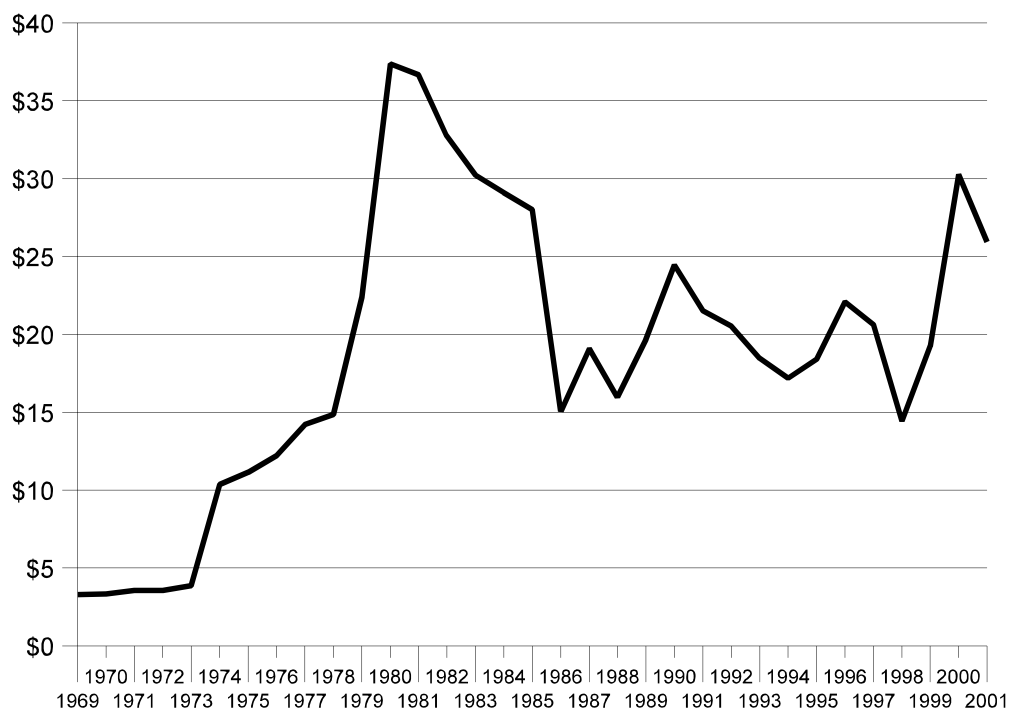
As a result of this association with bankruptcy and financial scandal over the past decade, questions have arisen as to whether derivative contracts are a legitimate requirement for functioning energy markets and companies, or are they merely a dangerous financial game where the stakes are high and the potential for financial ruin very real? Are the potential effects on the physical energy supply, the financial condition of energy companies, the financial markets, and the economy as a whole significant enough to warrant a public policy response, and, if so, what factors might be important in developing appropriate policy?

This report provides a systematic guide to understanding the use of financial derivative contracts in the energy industry, focusing specifically on the petroleum and natural gas sectors.

Risk Management

There was little need for the use of derivatives in risk management in the energy industry before 1973. The domestic price of oil was stabilized through production

Figure 1: West Texas Intermediate Crude Oil Prices 1969-2001



Source: IEA and EIA data.

restrictions and the international price of oil was managed by the large international oil companies. In this environment, price volatility, which could upset operational plans as well as profit forecasts, was not of major concern. Short run price volatility became a factor in the U.S. oil market following the first oil price shock of 1973/74. By 1981, when oil price regulation ended in the U.S., the effects of price volatility were of major concern to producers as well as consumers of energy. Figure 1 clearly demonstrates the volatile nature of oil prices as they reacted to OPEC actions as well as changing economic and political circumstances. As the figure shows, in relatively short periods of time the price of oil could rise more than two-fold, only to decline by almost two-thirds later on. This volatility in oil prices naturally spilled over into the product markets for gasoline, heating oil, jet fuel, and other refined products, directly affecting consumers and firms.

Price volatility, on the scale represented in Figure 1, gives rise to risk. Risk is defined as a situation in which a variable, in this case the price of oil, is likely to take on a value differing from that which was expected. Economists, and other analysts use a statistical tool, the standard deviation, to measure risk. The standard deviation measures the spread of possible outcomes around the average, or expected, value of the variable in question. Larger values of the standard deviation imply more risk. Risk management encompasses a range of activities designed to re-allocate risk to other parties more willing to bear it and to mitigate the effects of remaining risk exposure.

Although managing price risk has become a major consideration for energy companies, this doesn't necessarily mean using financial derivatives. Several alternatives to derivatives exist that might accomplish similar results. Vertical integration, the incorporation of the various stages of the production process, from exploration and production to final retail distribution, into one entity, allows the firm to control price risk. Vertically integrated firms are able to manage how a change in the price of a primary factor of production is incorporated into the cost structure of the firm. This strategy, to be fully implemented, requires the firm to own its oil or gas reserve base, an increasingly unlikely circumstance. Also, although the oil industry is characterized by integrated firms, it is also characterized by firms that operate in only one, or a limited number, of sectors of the industry. Even if the capital were available to form more vertically integrated firms, the most likely way this would be achieved in the oil industry would be through mergers and acquisitions, which have the potential of reducing competition.

Price risk may also be managed through inventory control. If firms maintain substantial stocks of natural gas or oil in inventory it is possible to use these stocks to effectively smooth out price movements. Draw down in periods of high market prices could be compensated by spot market purchases when the price is low. The problem here is cost. Storing oil and natural gas is expensive, making this strategy unattractive if cheaper alternatives are available.

Long term contracting at fixed prices might also reduce the firm's exposure to price volatility. However, this strategy creates risks of its own. If the agreed upon contract price turns out to be higher than the actual market price in the future, the buyer of the product might find itself at a competitive disadvantage. For example, if a refinery agreed to purchase crude oil at $30 per barrel from an oil trader, and the price of crude oil then fell substantially, the refinery might not be able to produce competitively priced gasoline and might be forced to close or might possibly default on the contract. Similarly, if the price of oil turned out to be above $30 per barrel, the seller of the oil would have an incentive, at least in theory, to default on the contract and sell the oil on the higher value spot market leaving the refiner exposed to the higher price. The long term contract, which was designed to reduce price risk, accomplishes that goal by increasing default risk. To mitigate default risk, parties to the contract might diversify their purchases, buy insurance, require collateral, or only deal with well established firms.

Managing price risk has become a necessity in the oil and natural gas industries to maintain profitability and to avoid being at a competitive disadvantage. A recent report by the Energy Information Administration studied financial derivative use in the marketing, producing and refining sectors of the oil and natural gas industries. The study used company data and Securities and Exchange Commission filings and determined that virtually all of the largest energy firms use derivatives to hedge risk. However, the value of contracts held by companies varied widely.[4] The NYMEX reports that the annual contract volume in 2001 for natural gas was 16,468,355 and for light, sweet crude oil was 37,530,568. Since volatile energy prices are not likely to stabilize in the future, firms must undertake a strategy to protect themselves from price volatility. The strategy chosen must be cost effective, flexible, and reliable. Financial derivatives fit these requirements for many firms in the energy industries.

Derivative Basics

Derivatives are financial contracts whose value is based on another, underlying asset. For example, a futures contract on 1000 barrels of light, sweet, crude oil dated July, 2003 at a price of $30 obligates the owner of that contract to purchase oil at that time, at those terms. In what sense does the futures contract have value? If, near the settlement date in July, 2003, light, sweet crude is selling for $40 per barrel on the spot market, holding a legally enforceable right to buy the oil at $30 per barrel creates a value of $10 per barrel for the owner of the futures contract. Conversely, if oil is available on the spot market for $20 per barrel on the July, 2003 settlement date, the futures contract is a liability for the contract holder in that it requires the oil buyer to pay $10 more for oil than the market price. In practice, very few futures contracts traded on markets like the NYMEX are ever settled through physical delivery of the product. The NYMEX contracts allow for cash settlement. Physical purchases can then be made on the spot market at then current market prices. While cash settlement expands the spectrum of participants in the market and is far more efficient than physical delivery for most contract holders, it can create the perception that the motivation and focus of the contracts are a purely financial bet on the future price of oil rather than a business strategy designed to reduce risk.

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[4] Energy Information Administration, *Derivatives and Risk Management in the Petroleum, Natural Gas, and Electricity Industries.* October, 2002, pp.27-28. This report can be found at:[http://www.eia.gov/emeu/finance/pubs.html]

An important distinction between derivatives is whether they are traded on an organized exchange like the NYMEX or whether they are traded on the OTC market. Energy derivatives traded on the NYMEX are standardized contracts for a fixed amount of underlying product, delivered at a specified date, with a specified price, at a particular location. For example, the light, sweet crude oil futures contract discussed above is for 1000 barrels of West Texas Intermediate, on one of a set of pre-specified dates, for delivery at Cushing, OK. The "same" oil delivered at a different location at a different time might well have a different value. The specificity of traded NYMEX contracts stimulates the need for OTC derivatives by creating basis risk. Basis risk arises from the fact that a physical good's location, delivery time, quality, and other product characteristics might cause its price to differ from a similar good with different characteristics. The implication of basis risk is that it is not generally possible to establish a perfect hedge using only traded derivatives.

In contrast to NYMEX traded contracts, OTC contracts are custom designed to reflect the specific needs of the contracting parties. These contracts are typically one-on-one arrangements, traditionally with a financial institution acting as a fee-earning middleman, broker and manager. During the 1990s, a number of energy trading companies, of which Enron Online was perhaps the best known, became active participants in the OTC derivative market. Not only did these trading firms broker contracts, they also expanded their role to become the counterparty to the contracts.[5] Since the terms and specifications of the contracts can literally be anything the parties agree upon, the degree and scope of risk faced by the counterparty trading firms increased substantially. The ability to customize contracts to provide a unique risk management profile brings distinct advantages which must be balanced against the disadvantages of OTC contracts.

Derivatives traded on the NYMEX are liquid, while OTC contracts generally are not. A party on either side of a NYMEX contract can cancel its position at any time by buying or selling a contract that is opposite its original contract. For example, if a firm had purchased a futures contract on 1000 barrels of crude oil it could sell a contract with identical terms which would effectively cancel the firm's obligation. From the point of view of the exchange, the firm would have netted out its position, having bought and sold contracts obligating it to 1000 barrels of oil, leaving it, in effect, out of the market. This type of transaction can be undertaken at any time because all contracts are standardized and have the central clearinghouse, which is owned by the market, as counterparty to the contracts. If the contract were OTC, the only way the contract could be terminated or modified would be through mutual negotiation and agreement between the principals. A firm that chose to abrogate an OTC contract it found financially disadvantageous would likely have to pay penalties to the counterparty, who would suffer damages.

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[5] A counterparty takes a position opposite that of the original contract. For example, if you buy a derivative contract which entitles you to purchase oil, someone must take the responsibility to sell you the oil at the contract terms, that person is the counterparty to the contract.

Financial performance of an exchange traded derivative is guaranteed while the holder of an OTC contract is exposed to default risk. Exchanges guarantee performance by rigorously evaluating the credit worthiness of traders on the market. Additionally, margin accounts, which act as deposits, or reserves, against losses are marked to market on a daily basis. Marking to market is a cash flow system which calculates the gains or losses of every derivative contract position on a daily basis. The contract holder's margin accounts are then debited or credited to maintain minimal levels of margin equity in the derivative position. This process assures traders that every contract has sufficient capital backing to guarantee performance. Finally, as a final safeguard, the exchange itself guarantees the financial performance of the contracts traded on its market. In the OTC case there is no equivalent to the marking to market process which can allow losses, backed by little collateral, to accumulate. If the terms of an OTC contract are such that one of the principals to the agreement is suffering large losses, that party might not be able to meet the terms of the agreement, raising the possibility of default. The costs of default can be substantial and are very real since OTC contracts are legally enforceable contracts.

Trades on organized exchanges are anonymously, cost efficiently, and competitively implemented with instantaneous price transparency. This is helpful to traders who might want to put a business strategy in place cheaply, quickly, and without revealing their strategy to other market participants. OTC contracts are, in effect, the opposite. Since they are one-on-one arrangements, the principals to the agreement are closely related to one another. The contract may require substantial fees paid to the manager or broker, and, since they are privately negotiated, they are not the result of a competitive process.

Set against these limitations is the important benefit of flexibility. A market traded derivative contract can, at best, implement only a portion of the firm's risk management strategy. For example, a California firm interested in purchasing natural gas might try to hedge its price risk by purchasing NYMEX futures contracts. However, the reference price for these contracts is at Henry Hub in Louisiana. The price of natural gas in California is different than the price at Henry Hub and therefore the firm can only cover a portion of the price risk it faces. Through the use of OTC derivatives, the firm may be able to eliminate basis risk and more effectively hedge the effects of price risk. In more extreme cases, the firm may have a strategy which is incompatible with exchange traded derivatives, leaving only a choice between doing nothing or entering into OTC contracts.

Derivative Contract Types

The most basic type of derivative contract is a *forward contract.* In a forward contract the terms are very similar to a cash-and-carry agreement, except that delivery and transfer of ownership of the underlying commodity is in the future. If an oil refiner enters into a forward contract for crude oil delivery, the refinery avoids price risk by locking in a price now, or avoids storage costs if current purchase and storage are an option. The refiner faces the potential of default risk if the price of oil changes substantially, tempting the contracts counterparty not to perform. Also, in these arrangements the credit worthiness of both parties is critical to performance of the contract. Finally, the liquidity of these contracts is low because they are one-on-one relationships that can only be changed by mutual consent.

A *futures contract* is similar in intent to a forward contract, but has some important differences. A futures contract has standard terms and is traded on organized exchanges. It specifies trades of a particular quantity of the underlying commodity at a particular price, at a particular time. For example, NYMEX natural gas futures contracts are for gas equivalent to 10,000 million British thermal units, at Henry Hub, LA, for any one of seventy two consecutive months into the future, at a dollars and cents price for 10,000 million British thermal units of gas equivalent. Although the contract can be settled at expiration in the physical commodity, it is more normally settled in cash through the exchange.

An *options contract* gives the owner the right, but not the obligation, to buy or sell quantities of the underlying asset at a fixed price known as the strike price. The two basic options are calls and puts. A call gives the owner the right to buy the underlying asset at the contract terms, while a put gives the owner the right to sell the underlying asset at the contract terms. For example, on the NYMEX, a call option on crude oil gives the owner the right to buy oil futures contracts at a fixed price, while the owner of a put has the right to sell oil futures contracts at a fixed price. An options contract will only be exercised if it is in the financial interest of the owner, and is allowed to expire if it is not. As a result, option based strategies allow the owner to participate in favorable outcomes while minimizing the effect of negative outcomes. Offsetting this favorable result, an options based strategy is more expensive than futures based strategies.

Not only are options available on futures contracts directly linked to the underlying physical commodity, but they are also available on critical spreads or differences that affect profit. A *crack spread option* protects against an expansion or contraction in the difference between prices. A user of refined products might want protection against price increases when refinery margins grow even if the price of crude oil is constant. A *calendar spread option* is used to lock in profits over time. For example, a storage facility can lock in a profit on the storage of natural gas by using a calendar spread.

A *swap contract* allows the two parties to the agreement to exchange streams of returns derived from underlying assets. Ownership rights, if any, remain intact and the physical asset is not exchanged. Settlement payments are made in cash at pre-determined points during the life of the agreement to balance out differences in the value of the swapped return streams. For example, a refiner and an oil producer might agree to a five year agreement which has scheduled, periodic payments over its life. The payment, which might either be paid out or received by the firm, is equal to the difference between a negotiated fixed price and the currently prevailing spot price for a given amount of oil. If the spot price is above the fixed price, the producer pays the refiner, if the spot price is below the fixed price, the refiner pays the producer the difference. The intent is to insure that both parties to the agreement have predictable, stable costs and revenues, respectively. Swaps represent some of the best, and most common, examples of OTC contracts.

In many strategies, options are put together in combination to achieve the risk management goals of the company. The simple building blocks of calls, puts, and future contracts combined with positions in the underlying assets can achieve a wide variety of final outcomes. Many of these outcomes are desirable and perform well in controlling risk and stabilizing profit. However, it is also possible to use the same tools to conceal debt, inflate profit, and render the financial reports of the company opaque.

Workings of Derivative Contracts

This section will examine in more detail how derivative contracts manage price risk and at what cost.

The first example is concerned with natural gas transactions. A variety of participants in the natural gas markets might find it useful to use derivative contracts. Marketers can use futures contracts to offer their suppliers and customers futures-based pricing arrangements. They can use options contracts to provide price floors for natural gas sellers, price ceilings for buyers, and combinations thereof, without their customers' direct participation in the market. Producers can use options to establish a floor selling price for their future production while staying in position to reap the benefits of favorable price movements. Pipelines, to the extent that they remain merchant sellers of gas in competition with producers, might find it necessary to provide their customers with futures and options based pricing to remain competitive. Local distribution companies can use options to hedge storage costs as well as providing a ceiling on consumer costs. End users can purchase derivatives to lock in prices for their future requirements. They can proactively manage their gas purchase costs whether they feel future market conditions will yield rising, stable, or falling prices.

Consider a manufacturer who uses natural gas in a production process and is concerned about a weather induced price spike during the winter months. The firm also believes that the underlying demand and supply fundamentals are strong so that it is very unlikely that the price of natural gas will fall from its current value. What can the firm do to protect itself from rising gas prices? Several strategies are available. First, the firm might buy futures contracts on natural gas. In this case, if the price of natural gas does rise in the winter there would be a corresponding rise in the value of the futures contract. At the expiration of the futures contract, the firm could buy the required natural gas on the spot market using the profits made on the futures contract to offset the higher spot market price. In this way the manufacturer would have successfully hedged his needs for natural gas against price risk. Of course, if the price of gas actually declines, the manufacturer will lose on the futures contract. The amount lost is equal to the difference between the gas price specified in the futures contract and the market price. However, the manufacturer gains an equivalent value by purchasing gas at the lower spot market price. On a net basis, this leaves the manufacturer purchasing gas at the futures contract price, exactly as in the first part of the example.

If the manufacturer's forecast about the unlikely nature of a price decline is less certain, then a different strategy might be appropriate. The firm might wish to protect itself from a dramatic price increase, but at the same time be able to participate in the benefits of possible price reductions. Purchase of a call option might be a way to achieve both objectives, but at a cost. The numbers used in the following example are for illustration only. Suppose natural gas futures contracts for three months in the future are currently at $2.20 per million British thermal units. The firm might consider an at-the-money call option which might sell at 15 cents per million British thermal units.[6] If the price of gas fell significantly, the firm would let the option expire and purchase the gas on the spot market at the then current price. The 15 cents the firm paid for the option would be added to the spot price of the gas to get the true total cost of the gas purchased by the firm. If the price of gas instead goes up, the firm could exercise its option contract and buy the gas for $2.20, plus the 15 cents paid for the option.

If the firm feels that the premium of 15 cents for the call is too much to add to the cost of the gas and still remain competitive, it might purchase an out-of-the-money call. An out-of-the-money call has a strike price which is higher than the current market price and, hence, offers less upward price protection, but at a lower cost. The firm might decide to buy a $2.45 call for 7 cents. With this strategy the firm has purchased an insurance policy against a severe price increase, while leaving open the possibility of participating in price declines. By buying the out-of-the-money call, the firm reduces the cost of this insurance from 15 cents to 7 cents. However, the reduction in cost is accompanied by greater upward price exposure ($2.45 strike price compared to $2.20 strike price).

Had the firm not hedged, the net purchase cost of gas would vary with the market price on a cent per cent basis. Had the firm purchased the at-the-money call, the purchase price would be higher by the cost of the call up to the strike price. At a futures price of $2.35 (strike price plus the 15 cent price of the call) the firm would break even. At prices above $2.35 the firm would be cent for cent better off as a result of the hedge. If the firm had purchased the out-of-the-money call at prices up to $2.52 (strike price plus the 7 cent price of the call) the firm pays more than if there had been no hedge. However, compared to the at-the-money call the firm is better off at prices below $2.28. The breakeven point between the two alternative strike prices is the lower strike price plus the difference in prices of the calls, in this case $2.20 plus 8 cents or $2.28. If the firm believes that prices are likely to be below $2.28, but still wants protection against sharply higher prices, the likely choice is the $2.45 call.

The two examples described above, as well as more complicated variants of them, have several characteristics in common. First, the strategies were carried out

[6] The strike price is the price written into the options contract at which the owner of the option may buy, in the case of a call, or sell, in the case of a put, the underlying commodity, in this case natural gas. An option is said to be at-the-money when the strike price equals the current market price. For a call, when the strike price is higher than the market price the call is said to be out-of-the-money. If the strike price is lower than the market price the call option is said to be in-the-money.

using market traded contracts. The value of these contracts are transparent due to the real time availability of prices on the market. Their value to the firm is well understood and can be disclosed on all appropriate financial statements of the firm. If the firm chose to close out its derivative positions for any reason, that could be easily accomplished at predictable cost because of the depth and liquidity of the market. Second, the focus of the strategies was on the underlying natural gas. While the transactions were financial, the motivation for making them was to protect and facilitate the underlying energy business. Purchasing the same derivative contracts with no gas holdings, or business interest in the physical gas market, is far more speculative. Third, even though these transactions were clearly hedges designed to reduce the firms exposure to price risk, it is likely that speculators were part of the transactions. A speculator could have been the purchaser, or seller of a contract opposite almost any of the transactions discussed. In fact, without a counterparty taking an "opposite", speculative, view of how market forces would affect price, it is not clear that a liquid market for derivatives could function effectively.

As the focus of the derivative trader shifts from managing the underlying business assets to managing the financial assets themselves, problems can emerge. Consider the case of a natural gas company which has just signed a prepaid forward contract to supply natural gas one year in the future. The firm received $1 million as a pre-payment for delivery. Next, the same company signs a cash-settlement forward contract with another firm to purchase an equal amount of gas for delivery in one year for a price of $1.06 million. Each of these transactions, as well as both taken together could be legitimate hedging transactions. However, add in that the counterparty to both forward contracts is the same company. In this case, the gas obligations effectively cancel each other out and we are left with what seems to be a $1 million loan at an interest rate of 6% for one year. This liability can easily be obscured on the company's financial statements, concealing the increased leverage of the firm. Financial engineering of this type, as well as managing earnings and other deceptive practices, serve to mislead investors and create inefficiencies in capital markets.

Although relatively simple derivative transactions were used in all of the examples considered, the motivation and outcomes of the transactions were quite different. Each of the derivative instruments used was legitimate, in the sense that it could have been part of a normal hedging activity, and yet the last example shows that hedging had little to do with the underlying motivation for the transaction. Also, notice the time frame. The de facto loan arrangement of the last example might not have been attractive, or even feasible, if the forward contracts had been for a significantly shorter time than one year. What these examples show is that the derivative contract itself is neither inherently good nor bad, it is just a tool that helps a firm or other trader achieve its business objectives.

Policy Issues

How valuable is the use of derivatives to the energy industries, the financial markets, even the U.S. economy as a whole?[7] This question has been answered for the traded derivative sector. When Congress established the Commodity Futures Trading Commission, it recognized the importance to the nation of orderly, fair, market determined prices on the futures exchanges.[8] As a result, the organized markets, including the NYMEX, self regulate with oversight by the Commission. The question really is addressed to the OTC transactions some associate with the Enron, Long Term Capital Management, etc. type of financial debacles. Is there a case for regulating these contracts at the national level? While the lack of any dis-aggregated OTC data makes empirical statements impossible, the factors that might enter into a determination can be evaluated.

One factor in determining the value of derivative transactions is the extent to which they can be expected to reduce the price volatility of the underlying energy commodity market. First, note that the very existence of derivatives is predicated on the fact that there is significant price volatility in the underlying market. If the price were regulated, or the underlying demand and supply fundamentals were predictable and slow moving, there would be little likelihood of derivative contracts being written. As a result, if derivative contracts significantly reduced underlying volatility, they would set in motion forces that would lead to their own irrelevance. Given the growth in over the counter derivatives, there seems to be little evidence of a decline in use of these contracts. According to the Bank for International Settlement, by June of 2002 the notional value of OTC contracts stood at $128 trillion, a growth of 15% over year-end 2001[9]. Commodity based contracts accounted for only 0.7% of the total, but grew by almost 30% over the period. Interest rate swaps accounted for the vast majority of the contracts (81%). Second, as Figure 1 showed, there is little evidence that key energy prices have become more stable during the last decade as they continue to be driven by exogenous, geo-political events.

Economists have long theorized on the effects of speculation on market prices. Their conclusions are mixed. Writers, from Adam Smith through Milton Friedman, suggest that speculative activities tend to reduce price volatility because speculators can be expected to buy low and sell high providing a kind of "automatic stabilizer" effect to the market. Other writers, notably William Baumol, take the position that speculative activities tend to increase price movements. This occurs because speculators tend to buy as prices are increasing and high and sell as prices have already begun to fall, or are low. This behavior makes price volatility even greater

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[7] This section draws on the report, Energy Information Administration, *Derivatives and Risk Management in the Petroleum, Natural Gas, and Electricity Industries.* October, 2002.

[8] Section 3 of the Commodity Exchange Act, 7 U.S.C. Section 5.

[9] Bank for International Settlements, data is available at: [http://www.bis.org/publ/otc-hy0]. Measurement of contracts at notional value is essentially a measure at the "face value" upon which the derivative contract is written, adjusted for double counting. This value may bear little relationship to the market value of the contract.

by reinforcing the underlying price dynamic. In either case, it is clear that the availability of derivative trading makes carrying out speculative strategies cheaper and more feasible, and because they are highly leveraged instruments, make the potential payoffs higher creating greater incentive to speculate.

Second, efficient capital markets allow firms to raise capital for investment and technological improvement that leads to economic growth. The strength and integrity of these markets also attract capital from around the world. Damage to these markets would have major implications for the domestic and international economies. Could problems in the derivative markets precipitate more general damage to the U.S. capital markets? More specifically, could problems in the energy related OTC trading sector damage the reputation of U.S. capital markets? The logical chain for such an event might start with the failure of a large firm active in derivative trading and perhaps other financial transactions. The result then might be a melt-down of the derivative markets spreading to equity and debt markets. Some point out that the problem with this logic is that it has already happened with only isolated effects on U.S. financial markets. The failures of Enron, Long Term Capital Management, Barings, PLC, the losses sustained by Metallgesellschaft and Orange County have not paralyzed the U.S. financial system. However, the collapse of Enron's trading operations did put a chill on OTC energy trading and led to calls for a variety of specific reforms which are discussed later in this report. While the integrity, safety, liquidity and efficiency of U.S. markets attract capital, so does their ability to innovate and embrace strategies that offer new profiles of risk and return. These factors might ultimately represent a trade-off. While protecting against this broad risk to the market system, called systemic risk, is valuable, if it comes at the expense of reducing the ability of individuals to take on, or transfer, financial risk for an appropriate rate of return, this too might damage the functioning of the financial markets.

Third, the use of derivatives might reduce the cost of capital for firms, enhance their real capital investment and increase their value. This result might occur because using derivatives to hedge risk reduces the riskiness of the firm's cash flow stream. Again, economists' views on this issue are mixed. Traditional theory took the position that any reduction in risk the firm faced would enhance the value of the firm. In 1958 Franco Modigliani and Merton Miller changed traditional perceptions by demonstrating that any change in the financial capital structure of the firm, in their case, specifically, the mixture of equity and debt financing, in an economic setting with no imperfections, would have no effect on the value of the firm. Later writers have demonstrated that if any of a variety of market imperfections exist, then the value of the firm may very well be affected by the choice of financial structure. This line of reasoning usually posits that although the firm's actions, e.g. implementing a program of futures contracts, do reduce risk, these actions come at a cost. Either the payment to achieve the reduction in risk is just equal in value to the risk reduction, in which case the value of the firm is unchanged, or the owners of the firm could achieve the same risk and return profile through lower cost personal transactions, making them unwilling to admit an increase in the value of the firm due to managerial action.

The limited empirical information available suggests that the use of derivatives is extensive. The Energy Information Administration's analysis of Securities and

Exchange Commission 10K filings for 2002 shows that the use of derivatives was virtually universal, but the value of derivative holdings varied widely.[10] From this study it also appeared that firms on the marketing level used derivatives far more than producers or refiners, perhaps because producers can control production and refiners have storage and inventory management capabilities. It also appeared that vertically integrated oil companies found less need for derivative use, which again fits in with the earlier explanations of how firms might carry out risk management. Although there is little direct evidence that the use of derivatives increases the value of the firm, the near universality of use by energy firms, as shown by the Energy Information Administration, suggests that a wide spectrum of energy managers see value in using derivatives to manage risk. If these firms are efficiently managed, it would be unlikely that they would consistently engage in inefficient activities.

Although little in the way of theory or empirical evidence exists to tie derivatives to either beneficial or injurious market effects, the very size of both the traded market and OTC contracts suggests the possibility of important consequences should problems occur. The openness and innovation in the market suggests that while great success might be registered, large errors might also be made. Also, the critical nature of the underlying commodities suggests the potential for major disruption of both the consumer and producer sectors of the economy if a derivative related financial crisis led to disruption in the physical markets.

Specific Reform Proposals

In the wake of Enron, there have been legislative proposals to increase the regulation of OTC energy contracts.[11] In the 107th Congress, proposed legislation concerning OTC trading was considered. Senator Dianne Feinstein proposed derivatives legislation, (S. 1951), in the Senate, while, independently, Representative Peter DeFazio introduced a bill, (H.R. 4038), in the House of Representatives. The issue of OTC derivative reform is likely to be addressed again by the 108th Congress. Representative DeFazio has re-introduced his bill on "Market Oversight Consolidation and OTC Derivatives Regulation Act", (H.R. 1109) in the House, and the Bureau of National Affairs reports that Senator Feinstein may introduce derivatives legislation again in the Senate.[12] In addition, since the 107th Congress considered OTC derivative reform, a number of specific reform proposals have appeared in the literature.

In principle, an OTC contract is between two parties who interact one-on-one because of differing needs, perhaps with a financial institution managing the terms

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[10] Energy Information Administration, *Derivatives and Risk Management in the Petroleum, Natural Gas, and Electricity Industries*, October, 2002, pp.27-28.

[11] For an analysis of the history of derivative regulation as well as an analysis of policy proposals, see Mark Jickling,"*Regulation of Energy Derivatives*", CRS Report for Congress, RS21401.

[12] Securities Regulation & Law Report, Volume 35, Number 9, The Bureau of National Affairs, March 3,3003, p. 361.

of the agreement. In practice, the market has evolved into a dealer driven market where the dealers are "energy trading" firms. These companies generally have experience in the physical energy market, either because they began their businesses in the field or because they were set up by energy companies specifically to trade energy derivatives. Energy trading firms serve as a counterparty to firms who want to set up an OTC contract. They then hedge the risk that they took on by purchasing market traded derivative contracts with an offsetting risk profile. As a result, they are heavily leveraged relative to their capital base. Both parties in the OTC transaction are then subject to each others' substantial credit risk.

One suggestion that has been discussed to address the OTC market proposes that energy trading firms be more related to the core, physical side of the energy market. The theory is that the asset positions and cash flows from the physical side of the business can act as a stabilizing factor for the OTC side of the business. Additionally, if the company's business focus is on the physical market it might be less likely to make the purely speculative financial bets that are possible with highly leveraged derivative positions. Critics contend that firms have moved away from the physical side of the business and into energy trading because that is where they perceive the greater return to be. As a result, requiring firms to participate more heavily in the physical business would require them to participate in what they see as a less profitable activity. In any case, if the cash flow from the physical energy business is small relative to the credit risk positions from the derivative contract business, little reduction in credit risk would be attained.

An alternative version of this proposal would be to encourage the major financial institutions to again become the major players in OTC energy transactions. This certainly was the case early in the development of the market, to the extent that the major investment banks became known as the "Wall Street Refiners". The real issue in both variants of this policy direction is degree of capitalization of the counterparty and the reduction of counterparty risk. Market participation and the structure of participating firms ultimately responds to profit incentives. Requirements that altered the least cost, profit maximizing choices of firms would make the OTC contract less desirable, but perhaps safer.

Another reform proposal is to establish a clearing house along the lines of the NYMEX and other derivative markets. In fact, the NYMEX is actively competing to take over the role of clearinghouse for OTC derivative transactions.[13] Some of the potential benefits of establishing a clearing house are important. Counterparty credit and performance risk would be substantially reduced. This is would be significant because the aversion to credit and performance risk is currently a major factor in reducing activity on OTC transactions. Participant operating capital needed to secure positions might be reduced as the diversification and netting of the clearing house might require lower aggregate capital due to risk spreading. Confidence in OTC transactions has been very low since the collapse of Enron. It is conceivable that the use of a clearing house could restore a part of the faith that has been lost. Whether liquidity would be increased as the result of a clearing house is an open question.

[13] See "NYMEX OTC Clearing", presented at the North American Energy Standards Board Annual Meeting, September 25, 200, Hunt Valley, MD.

Although a centralized location would enhance knowledge concerning buying and selling opportunities, the custom nature and specific risk profiles of the contracts would remain. It is likely that the use of a clearing house would provide a higher degree of price transparency which might contribute to enhanced liquidity.

Given the fragile nature of confidence in OTC contracts and the current concern with credit and performance risk, some have suggested that the answer might lie in structured derivative product companies.[14] These companies are generally subsidiaries of major financial corporations which are specially structured to act as derivative intermediaries while maintaining triple-A credit ratings. These companies accomplish this by the way they manage both market and credit risk. Market risk, in the case of energy derivatives, generally price risk, is cancelled through a set of mirror transactions, collateralized hedges, with the derivative product companies' parent or affiliated company. Credit risk is minimized to a level consistent with a triple-A rating by earmarking capital. This typically results in derivative product companies having higher capital costs than other derivative trading companies even though capital costs are explicitly minimized. Finally, these companies usually have a well defined, transparent workout structure in place for situations in which other preventative measures to protect against risk fail and contracts associated with the derivative product company must be liquidated. Derivative product companies worked well in interest rate and currency derivative markets in the 1990s, but never really dominated the market. The higher costs of these firms negate a good part of the rationale for engaging in OTC transactions. The root problem for derivative product companies has always been that market participants have not been willing to pay for the specific benefits they provide. If market participants value the reduced default and credit risk derivative product companies offer at least as highly as the extra cost they impose, then the approach might be workable. Given the heightened concern with credit worthiness in OTC energy transactions the conditions and timing might be better than in the past.

Although the proposals discussed above all touch on the issue of price transparency it is worth mention in the context of documenting and reporting transactions and derivative holdings. Companies have used derivatives to carry out illegal and deceptive financial strategies. Even though the root problem was the desire to engage in illegal or deceptive activities, it is still true that derivative contracts were the vehicle by which these activities were carried out. Most observers agree that anti-fraud and anti-manipulation safeguards would be more effective if pricing and documentation of transactions were more transparent. Also, the complex, largely unobservable, web of transactions created through derivative trading can be opaque to regulators as well as investors and might contribute to unrecognized systemic risk. Some organized form of reporting OTC contracts has been suggested as a way to address this issue. The trade-off here is that one of the goals of OTC derivative trading is just this opaqueness. In a market with relatively few large firms, revealing what one believes to be the direction of the market or one's own strategy

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[14] An extensive analysis of structured derivative product companies can be found in, Eli M. Remolona, William Bassett, and In Sun Geoum, *Risk Management by Structured Derivative Product Companies,* Federal Reserve Bank of NY Economic Policy Review, April, 1996.

to competitors might have significant costs. Additionally, if one's strategy is explicitly reacted to by competitors, actual events in the market might be affected.

In summary, the OTC energy derivative market is a young market that is still in the process of finding its appropriate place in the larger energy markets. That it serves a need in the energy industry is not in doubt, its growth and dollar value attest to that. It is also clear that it has been misused for illegal and deceptive purposes. Finding the balance between safe-guarding participants' interests without unduly damaging the business purposes the market was designed to meet, is the challenge facing reform proposals.