Playing with fire: the risks and strategies of derivatives trading

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Abstract

For all derivatives trading, the trading strategies are the key to their successful use. This paper will focus its primary attention on the nature of these trades and how they can make or break a company, or an economy, in the two main methods of trading (options and forwards, with their specialized futures and swaps) and the main arenas for trade (OTC and exchanges). In the case of options, the profit-loss profile can be quite sanguine; for instance, downside risk on a long call is limited to the premium. Forwards are quite another story with their symmetrical profit-loss profile and high potential for both profit and loss. In this fairly unregulated branch of finance, the company's management cannot depend on a guiding hand from regulators but must count on three elements that determine success or failure: (1) risk management and planning for unpredictable market contingencies, (2) technical understanding, flexibility, and adroit trading, and (3) the valuation of derivatives and their underlying assets. Virtually all problems dealing with risk, such as exposures, competition, liquidity, exchange penalties and margins, profit-loss profiles, and available markets, require the risk management expertise. For skill number 2, the trades have very specific methods that, under carefully watched procedures, can succeed.[i] This article will analyze six specific trades as part of trading strategy and will use applicable profit-loss profiles and illustrations.

1. Introduction

Derivatives are both loved and reviled in the financial world, and for good reason. Employee stock options provide employees with ready access to a piece of the company's ownership with relative ease, while giving the opportunity to become wealthy if the company stock takes off. Microsoft is perhaps the best-known example of such wealthy employees who got in on the ground floor, were offered generous stock options as partial compensation, and reaped the benefits ten or twenty years later. On the negative side, derivative crises can wreak havoc on the financial system. Warren Buffet referred to derivatives as a "time bomb."[ii]The Great Recession of 2008 is probably the result, at least in part, of a derivative crisis over Credit Default Swaps (CDSs) used for their underlying collateralized debt obligations (CDOs, or mortgage-backed securities).[iii]

Derivatives comprise a huge sector of the American and worldwide financial systems, with their notional value estimated as greater than the worldwide GDP![iv] Why are so many bets placed on the underlying value of so many assets, such as stocks, bonds, commodities, and currency… and so many non-assets, such as interest rates and the stock index? One major reason for such wagers is the hedging function: use of derivatives to provide insurance against loss on an asset or important underlying factor (e.g., interest rates). The second reason is arbitrage: making money on slight market differences between two exchanges, or other subtle differences that garner income for a financial intermediary. The third reason is pure speculation. All three motives "make a market" for the derivative sector. Benefits are debatable, but based on size and influence, the derivative markets are unlikely to go away, and they have a big impact on investments in the capital markets.

The "cons" to derivative trading include the risk and the unforgiving losses that can seem to pile up so suddenly (although not necessarily without warning). The horror stories include the aforementioned CDOs, Barings Bank PLC in 1995, Long Term Capital Management in 1998, and Amaranth Advisors LLC in 2006. Their fame and fortune from derivative trading crashed in sudden and precipitate losses that rocked the financial world.

Another potential negative factor of derivative trading involves the use of leverage on underlying assets with high value compared to the derivative opening payment. Derivative traders can open very large positions on "margin" with an intermediary or an exchange, borrowing the money on contract by putting up margin that is only a fractional amount of the notional asset value.

Behind the mystery of derivatives we find a long history going back to ancient times, because derivatives are contracts on future prices and delivery dates (also called maturity or expiration dates) that were in some ways applicable in pre-Roman times just as much as they are today. How does a farmer insure himself against an adverse change in price on his corn or wheat or pork bellies? How does an oil company protect itself from adverse price change on future deliveries of thousands of barrels of oil? Hedging a commodity's future price and delivery (the equivalent of price insurance) was probably the first historical derivative contract.

2. Six Basic Derivative Trades

We shall consider six basic derivative trades by studying their risk/loss profiles. These trades are regarded as directional, because they are shown on the upcoming profit-loss profiles to have a clear commitment with no offsetting hedge. (At least, the profit-loss profiles do not show an offset.) Hedge trades try to offset the price change in a commodity or asset of some type. Therefore, with hedging, these derivative trades have a risk-reducing counterpart.[v] This is not the case with a directional derivative trade, such as a naked call option. (By naked we mean there is no offsetting, risk-neutralizing asset or derivative contract.) Speculators in a directional trade bet that the price of the underlying asset or index, for example, will go up in the case of a purchased derivative on opening, called "long."They bet that the value of the underlying asset will go down in the case of a derivative that is sold on opening, or "short."

The buyer of the long forward contract intends to hold the contract up to maturity, or until such time before or at maturity when the price exceeds an agreed-upon strike price. Any amount above the strike price can close the contract at a profit when the buyer sells. The contract is derived from the value of the underlying asset—in this case, the price of oil per barrel.

The profit-loss profile, Figure 1 and Table 1, is high risk and theoretically unlimited in potential gains as price per barrel continues to climb. The downward loss stops when dollars per barrel reach zero. Breakeven in this case occurs at strike price of $35/bbl, ignoring transaction cost. (Note: A shift in breakeven point, as well as transaction or other relevant costs, could reposition the profit-loss line, but not its 45-degree angle.) Forward contracts are traded over-the-counter (OTC) using an intermediary such as an investment bank or bank subsidiary engaged in trading. The market is made by offering the contract to counterparties, or the intermediary may offer to serve as counterparty. As losses become apparent over the life of the open contract, the intermediary may issue margin calls—basically, a percentage of the notional value of the underlying asset intended to make sure that both parties will fulfill the contract requirements. The party with the losing position on an open contract (not yet reaching maturity) must pay the margin requirement or potentially forfeit the contract. Margins can become increasingly punitive if losses mount on open contracts. In some large derivative crises, the margins have had a big effect on the losing party's liquidity. Bankruptcies have occurred, in dire cases, from the double combination of losses and margins, as well as interest on debt in the case of leveraged derivatives.

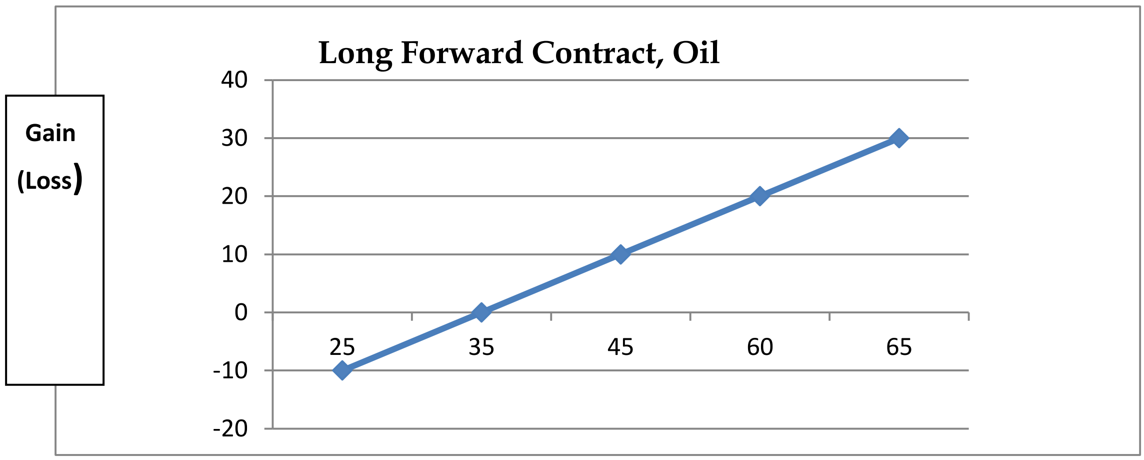

Figure 1: Long Forward Contract

Long forward Table of Profit a ... y:

Spot Price of Oil at Maturity

Spot Price at Matur	n (Loss)
$25	($10)
$35	$0
$45	$10
$55	$20
$65	$30

Table 1: Long Forward Contract

Now consider the short forward contract on oil price per barrel, Figure 2, which also has a symmetrical profit-loss profile. The seller, or writer, of a short forward contract opens the contract by selling what he does not own, borrowing the funds "on margin" from the intermediary, and paying the funds back by buying the commodity at maturity. Therefore, the seller must exercise the contract at maturity. The contract may or may not require delivery of the underlying asset. This is an over-the-counter trade.

Losses on the underlying asset can plunge indefinitely, as long as the spot price keeps rising. So losses are theoretically unlimited. Gains can occur until the price plummets to zero. The profit-loss profile in this illustration assumes breakeven at $60/bbl. The breakeven is determined by the writer (seller) of the short forward contract. For example, the writer would hope, in this case, to profit from declining prices. As a hedge, the short forward may be written by the oil supplier as he makes a commitment to sell oil at or above $60, but is afraid that the price will decline by the required delivery date. It should be noted that a hedge, such as the short forward, does not have to be perfectly correlated, and it can even be made on a percentage of the total commitment to deliver the commodity at an agreed price. (The physical delivery contract for the oil and the hedging derivative can be unrelated and separate contracts.) The writer of a short forward contract must close the contract no later than maturity date.

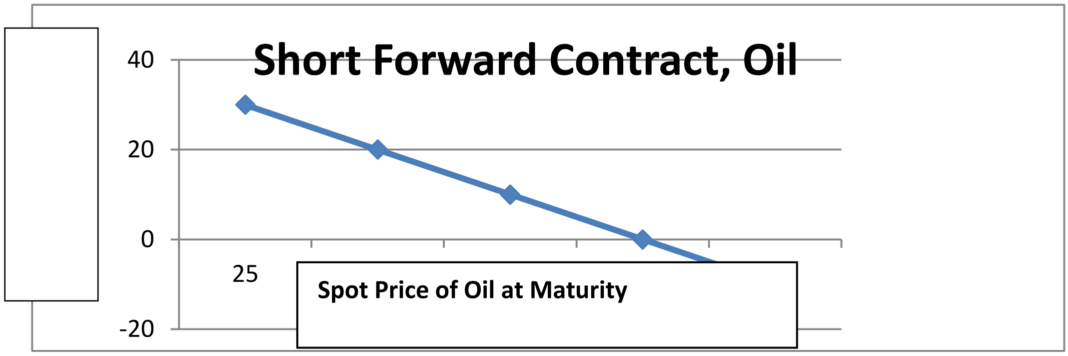

Figure 2: Short Forward Contract

Consider the long call option on the price of oil per barrel, Figure 3, which has an asymmetrical profit-loss profile. The long call option gives the buyer the right, but not the obligation, to sell the option by the maturity date. The sale of the option is called exercising the option. If the option buyer is able to sell at a price above the strike price, the option closes in-the-money, and he makes a profit or gain. Otherwise, he loses the premium. If out-of-the-money, the option buyer may choose to let the option expire. Since options are traded on an exchange, such as NYMEX, ICE, or CBOT[vi], most options are traded and closed without the actual delivery of the underlying assets. These are cash closings.

This means that the gain is made with rising price, while losses are limited to the premium. The strike price in this case is $60/bbl and is based on the buyer's expectation of rising prices. In this example, an out-of-the-money call option would cost the buyer only the premium of 5% of strike price, or $3, at maturity. There may also be a small interest charge included in the total cost to the buyer (not shown).

The short call option's profit-loss profile, shown in Figure 4, is also asymmetrical, but the opposite of the long call. The writer or seller of the short call option opens the contract by selling what he does not own, borrowing the funds "on margin" from the exchange, and paying the funds back by buying the commodity at maturity. Therefore, the seller must exercise the contract at maturity. Since this is an exchange-traded derivative, the contract usually does not require delivery of the underlying asset.

In the illustration above, the seller of the short call option has written the strike price at $60/bbl. Any spot price at or below $60 at maturity will be either at-the-money or in-the-money, so the seller would pocket the premium paid by the buyer (in this case, 5% or $3). Any price above $60 would begin incurring losses to the seller, and greater than breakeven, the seller suffers net loss. Notice that between $60 and $63 the seller would keep part of the premium, since breakeven occurs at $63. The seller must exercise the option at maturity by buying the oil at the maturity market price, while having previously "sold" the oil at the strike price. Losses on 1 million barrels could be substantial at a maturity price higher than the strike price.

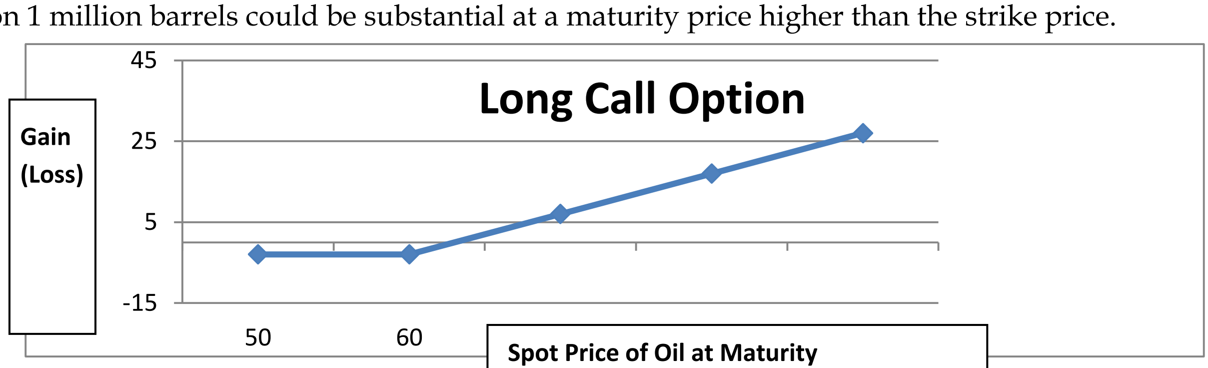

Figure 3: Long Call Option

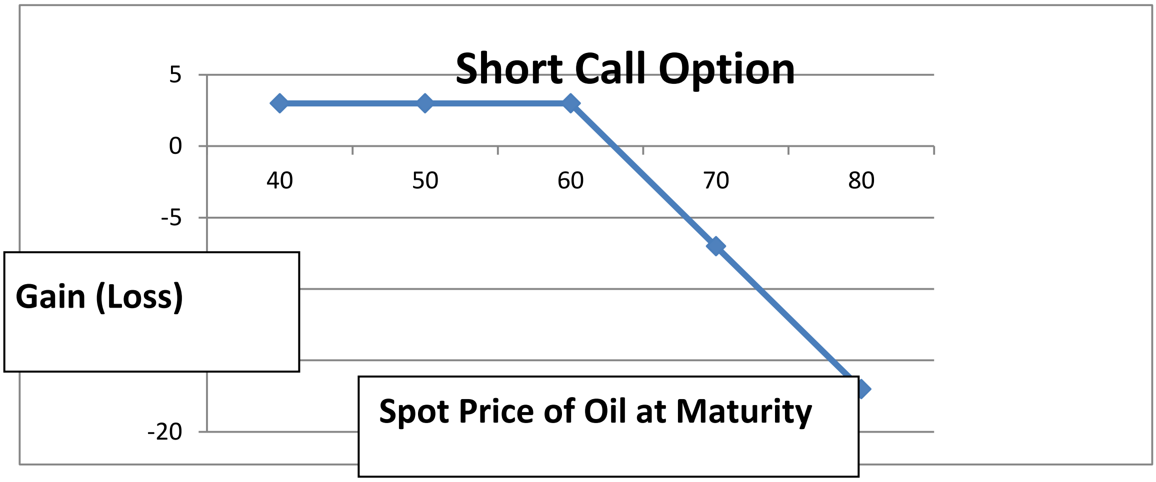

Figure 4: Short Call Option

The long put option, Figure 5, has an asymmetrical profit-loss profile with gains occurring to the buyer when maturity market price is below the breakeven price. At prices above strike price of $60, the buyer must pay full premium at a loss. The buyer of a long put option expects price to fall, and therefore plans to exercise the option (sell the commodity) at the strike price, taking a profit. Suppose the spot price of oil at maturity were $50. The long put buyer would sell the commodity at the higher strike price and pocket the difference. If the spot price at maturity were above strike price, the long put buyer would not exercise the option and forfeit the premium.

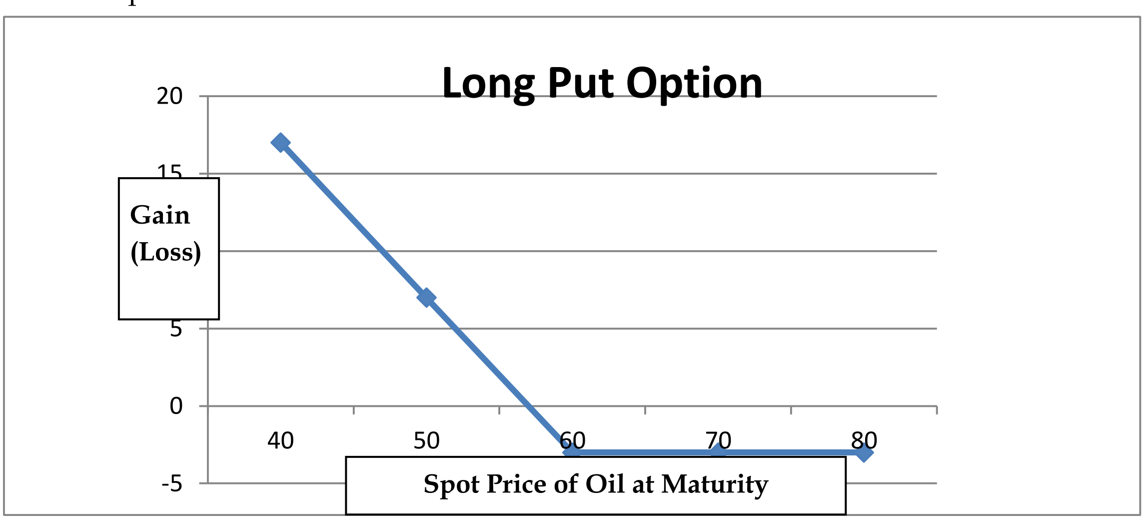

Figure 5: Long Put Option

The short put option, Figure 6, has an asymmetrical profit-loss profile that is the opposite of the long put option. The seller of the short put option has written the strike price at $60/bbl. Any spot price at or above $60 at maturity will be either at-the-money or in-the-money, so the seller would pocket the premium paid by the buyer (in this case, 5% or $3). Any price below $60 would begin incurring losses to the seller, and below breakeven, the seller suffers net loss. Notice that between $60 and $57 the seller would keep part of the premium, since breakeven occurs at $57. Below breakeven, the buyer would exercise the option at maturity, requiring the seller to buy the oil at the strike price when market price is lower, losing the seller the difference.

The seller's losses on 1 million barrels could be substantial at a maturity price lower than breakeven.

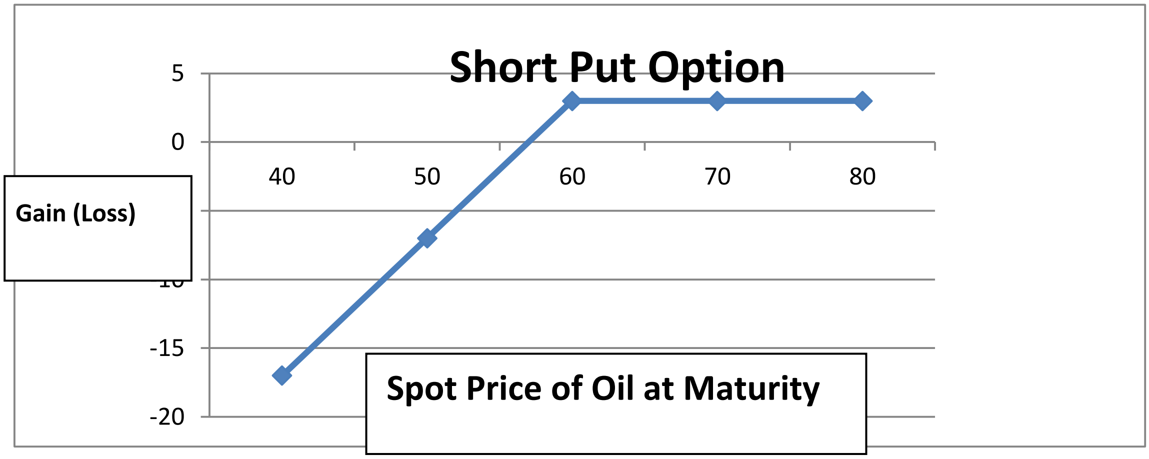

Figure 6: Short Put Option

3. A New Paradigm for Risk Assessment

It is clear from the above examples that losses on some derivative positions can potentially be huge. At first glance it would appear that the majority of high-volume players in the derivative markets, including banks, hedge funds, energy and commodity companies of various kinds, and multinational corporations, have shown the proper risk management and restraint to avoid derivative disasters—most of the time. However, statistical studies indicate that the frequency of derivative crises over the past two decades is far out of line with the normal distribution curve, and in fact, the frequency of disastrous events from traditionally used analysis would categorize such events as astronomically improbable—yet the events have occurred. A 20-year list of statistically improbable events affecting the economy includes the Asian Tiger crisis, the Long Term Capital Management (hedge fund) meltdown of 1998, the dot-com bubble of 2000, the 9/11 terrorist attack, the fall of Barings Bank PLC, Enron, Lehman Brothers, and Bear Stearns, the 2006 failure of Amaranth Advisors (largest hedge fund failure in history), and the Great Recession of 2008.

Therefore, use of the normal distribution with trading tools such as Value at Risk may be lacking this consideration of the extreme event. In recent years, statistical experts have proposed a new paradigm to more accurately assess the risk of disaster.[vii]Analysts are becoming aware that outliers on the distribution curve—once thought to be very improbable—might be better included in "fat tails" of an updated distribution using "extreme value theory."

Risk management in derivatives trading involves a number of precautions that have been ignored at the peril of companies such as LTCM, Bear Stearns, and Lehman Brothers. The first rule is to avoid excessive unhedged trading (directional trading). There are exceptions when hedging can actually add to problems (e.g, Metallgesellschaft AG in 1998), but it is usually less risky to hedge one's trading in derivatives.[viii]The second rule is to avoid excessive leverage. The derivative trading of hedge funds has been highly leveraged, which increases default risk and liquidity risk. The third rule is to seek liquid markets and avoid high-volume positions in illiquid markets.

Over-the-counter (OTC) trading is not as regulated as exchange trading, and may involve more customized contract preparation. At times such contracts are called structured contracts. The advantage clearly comes from the company or the intermediary's ability to customize the conditions for the trade. The disadvantage may be the lack of liquidity.

Even with exchange-traded funds, excessive volume of trades by one party can limit the number of willing counterparties for trades that are deemed too risky. This is known as an illiquid market. If the trader cannot find willing counterparties after a position is taken, he cannot unwind (hedge) the position and may suffer losses. Such great losses occurred with Barings Bank in 1995, with Long Term Capital Management in 1998, and with Amaranth Advisors in 2006.

Let's examine Amaranth's dilemma in 2006.[ix]The company experienced the largest hedge fund loss in history. Amaranth operated as a hedge fund that took on increasingly large futures positions in natural gas, trading on NYMEX and ICE at such volume that the market for natural gas futures became illiquid. (Futures are similar to forwards, but are traded on an exchange.) In 1995, the company fared extremely well due to Hurricanes Katrina and Rita, which devastated the Gulf Coast and stunted natural gas supply. So natural gas prices spiked, reaping big profits on Amaranth's long positions. Unfortunately, the company bet long again in the spring of 2006, but this time with disastrous results. In essence, Amaranth's trading volume was so large that the company dominated the volume on NYMEX and ICE (over 50% of open contracts for each trading position on the exchanges). Amaranth essentially bet on the colder winter weather for year-end 2006, expecting an eventual rise in natural gas prices, as demand was supposed to outstrip supply. The company was in trouble with its huge long positions well before winter arrived, because prices fell steeply during the spring and summer. Unable to unwind (hedge) long positions in the summer, Amaranth saw its margins mount excessively. To avoid bankruptcy, at the end of 2006, the company's energy portfolio was purchased by JP Morgan Chase and Citadel, after Amaranth paid them a cash concession of more than $2.5 billion. Ironically, JP Morgan Chase was Amaranth's clearing agent during the bulk of the company's trades.

4. Derivatives during the credit crisis of 2008

The credit crisis of 2008 and the Great Recession was probably caused in large part by credit default swaps (CDSs), which were derivatives on mortgages that were bundled together as CDOs, or "collateralized debt obligations."[x] When the underlying mortgages could not be paid, the foreclosures began to erode the value of the collateral, and hence the derivatives. Banks and intermediaries were left holding derivative positions and unable to unwind those, while unable to sell the homes that had been foreclosed and repossessed. After a very long history of continuously rising home values, very few anticipated the possibility that the homes could actually decline in value, thus undermining the value of both collateral and their derivatives. This happened because far too many home buyers had been issued credit without the capacity to make the mortgage payments (sub-prime mortgages), and through a snowballing effect, the mounting foreclosures brought down values in entire neighborhoods across the nation. When value becomes tenuous, the investment pool and its derivatives are decimated.

5. Lessons Learned

Without doubt, derivatives serve the function of price insurance or interest-rate insurance against adverse circumstances. They also provide liquidity through speculation and arbitrage, and although speculation may be denigrated, parties willing to assume risk add to market flexibility. Derivative trading strategy can be as complicated and high-risk as imagination may allow in this relatively unregulated sector of finance. For the good of companies engaging in hedge funding, arbitrage, investing, and simple hedging, the avoidance of high-risk trading involves controls on leverage, unhedged positions, excessive volume, and speculation. Risk management now has a new set of tools available, adding extreme value theory as an alternative to Value at Risk (use of the normal distribution curve). The aforementioned rules of risk management in derivative trading should be applied with care. For the specific trading methods cited herein, each method has a use based on the directional expectation of the investor, but a certain amount of hedging (offsetting position) is recommended to avoid the potential for catastrophic loss.

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ENDNOTES

[i] An excellent review of both exemplary and non-exemplary derivative trading strategies is found in John Marthinsen, *Risk Takers: Uses and Abuses of Financial Derivatives*, second edition.

[ii] Warren Buffet projected a strong negative opinion of derivatives. One illustration said that derivative contracts could wager on anything, even the number of twins born in Nebraska in a given year. Refer to Warren Buffet, “Chairman’s Letter.”

[iii] Christopher Brown and Cheng Hao. “Treating Uncertainty as Risk: The Credit Default Swap and the Paradox of Derivatives.” *Journal of Economic Issues*, XLVI No. 2, June 2012, pp. 303-311.

[iv] Alan White. “Is the Derivatives Business Too Big?” *Journal of Derivatives*, Vol. 20 Issue 1, pp. 11-13.

[v] It should be noted here that hedge funds engage in trades that may not be hedging, but instead, directional trades; so “hedge fund” could be considered a misnomer for this type of investing company.

[vi] NYMEX, or New York Mercantile Exchange; ICE, or Intercontinental Exchange (based in Atlanta); CBOT, or Chicago Board of Trade.

[vii] For example, according to Jackwerth and Rubenstein, the traditional probability of the stock market crash of 1997 was supposed to be so unlikely that it should not have happened “in the lifetime of the universe.” Markose and Alentorn have cited academics who have proposed “extreme value theory” and “fat tails” for risk assessment rather than the normal distribution. Refer to Markose, S., and A. Alentorn (2011), andJackwerth and Rubenstein (1996).

[viii] The Metallgesellschaft AG story is related by John Marthinsen in *Risk Takers: Uses and Abuses of Financial Derivatives*, second edition.

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[x] Refer to Christopher Brown and Cheng Hao in “Treating Uncertainty as Risk: The Credit Default Swap and the Paradox of Derivatives.”