8. Public Interest and Private Risk Management

Introduction

Other chapters of this report have shown how derivatives are used to manage risk and described the difficulties in measuring their effects on a company's financial position. The huge size of international derivative markets is evidence that private parties are better off when they use derivatives; but Enron's failure and the earlier financial crises discussed below raise the possibility that derivatives may shift private risk to society as a whole, leaving open the question of their overall economic impact. This chapter discusses four issues that are central to a balanced assessment of the role of derivatives in the economy:

- Would economically sensible investments be forgone in the absence of derivatives? Alternatively, do derivatives increase a firm's market value? If derivatives do increase worthwhile investment, then there is a clear public interest in their use.
- Do derivatives affect prices and volatility in the underlying commodity and security markets? If they tend to decrease volatility, then the functioning of markets would improve, and society would be better off.
- Can firms with market power use derivatives to manipulate underlying spot markets? If derivatives can be used to distort markets, then there might be a case for regulatory intervention.
- Does the widespread use of derivatives increase the likelihood of financial crisis? Is the public subsidizing private risk-taking through deposit insurance and liquidity backing from the Federal Reserve System? If derivatives do increase the likelihood of a "public bailout," how large are the likely costs?

Investment, Cost of Capital, and the Value of the Firm

This section discusses how the use of derivatives could affect the level and type of investment in energy-related businesses. As described below, hedging does have the potential to increase the value of the firm and the level of investment in it; however, the reasons are subtle.

A tenet of finance is that a firm will undertake an investment if the discounted present value of net revenues (revenues less operating costs) is greater than its capital costs.[112] Hedging can be a low-cost way of insuring against unexpectedly low prices or high costs. Because hedging reduces the variability of revenues and costs, it might seem that derivative use would "reduce risk" and increase investment. Similarly, because the value of a firm is the expected present value of the net revenues (discounted cash flows, revenue inflows less cash outflows) of a company's investment portfolio, hedging might seem to increase the value of the firm.

The general question of whether financial actions, including hedging, can affect the value of the firm (or the level of investment) was first analyzed within the context of debt versus equity financing by Modigliani and Miller (M&M) in 1958. In this context, because debt financing is less expensive than equity financing, one might think that the use of debt would increase the firm's value. M&M argued to the contrary, that in a perfect world with no taxes, no bankruptcy costs, etc., the financial decision as to how to fund a firm's investment (i.e., fund it using debt or equity financing) would not increase the value of the firm. That is, according to M&M, in a perfect world any financial activity would not affect the value of the firm or the level of investment.

M&M's arguments are complex and are only summarized here.[113] Suppose that the management of the firm attempted to increase the firm's value by using debt financing. M&M show that the firm's stockholders can borrow (lend) funds to buy (sell) the firm's stock, such that the overall value of the firm is unaffected by the use of debt financing.[114] In effect, they show that the owners of the firm would substitute their own debt for the firm's debt (using "homemade leverage"). Thus, "as long as investors can borrow and lend on their own account on the same terms as firms can, they can offset changes in corporate leverage with changes in personal leverage."[115] This would leave the value of the firm unaffected by the use of leverage.

[112] See Chapter 2 for more discussion.

[113] More detailed discussions about M&M arguments can be found in A.C. Shapiro, *Modern Corporate Finance* (New York, NY: Macmillan, 1990).

[114] The value of the firm is the sum of the market value of the firm's debt and equity. M&M show that the process of buying or selling stocks and bonds will produce changes in the market price of the debt and equity, such that the sum is unaffected by the use of debt.

[115] A.C. Shapiro, *Modern Corporate Finance* (New York, NY: Macmillan, 1990).

Stated somewhat differently, M&M's arguments are a straightforward application of the "law of the conservation of value," a law of finance which states that the value of the firm is basically the present value of the expected future stream of income from all its investments. In a perfect world, this value does not depend upon whether the assets are owned by the stockholders or by the holders of the firm's debt.

In the real world of taxes, capital rationing, transaction costs, imperfect information, and large bankruptcy costs, however, financing matters. In subsequent work, M&M showed that, in a more realistic world, the value of the firm could be increased by using debt. For example, the Internal Revenue Service allows firms to deduct interest (return to debt) as a cost for tax purposes, whereas dividends (the returns to equity) are taxed at the corporate level. Because of this differential treatment of taxes, the after-tax cost of capital would depend upon the use of debt. If a firm can reduce its tax liabilities by using debt financing, the use of debt will increase cash flows and increase investment.[116]

Baron (1976) used a "perfect world" argument similar to that of the original M&M model to conclude that any financing strategy, including the use of derivatives to hedge risk, will not affect the value of the firm and, therefore, will not affect the overall economics of the investment project.[117] In other words, given these assumptions, the investment and financing decisions are completely separable.

Over the past 20 years there have been a series of studies examining how certain "market imperfections" affect the incentives to hedge, the value of the firm, and the level of investment. Most importantly, Froot et al. (1993) argued that hedging "helps ensure that a corporation has sufficient funds available to take advantage of investment opportunities."[118] Here the market imperfection is one that would cause external funding to be more costly than internal funding. Thus, without hedging, low cash flow forces a company either to bypass profitable investment opportunities because they could not be funded internally or to increase the cost of the investment because it must use more expensive external funds. The latter would decrease the overall economics of the project; however, hedging will reduce the probability of facing shortages in cash flows caused by decreases in output prices or increases in costs. Thus, hedging would decrease the probability that a firm would bypass economic investments.

Two studies published in the late 1980s argued that hedging reduces expected bankruptcy costs by reducing variability in cash flows. There are three types of bankruptcy costs. The first are the direct costs. In bankruptcy cases, lenders generally recover about 30 to 50 percent of the amount borrowed. When bankruptcy occurs the lawyers have first claim to the firm's assets.[119] After that, bondholders have first (senior) claims on the firm's assets. Whatever remains after their claims are satisfied is distributed to shareholders. The other costs include "the loss of tax shields and the losses of valuable growth options."[120]

There are also costs incurred when there is a real chance that a firm might go bankrupt. For example, a firm that could go bankrupt may lose customers to other firms. In the case of Enron, this in fact occurred. Additionally, as noted by Shapiro, when a firm faces financial duress, there are incentives to exit lines of business "under conditions when they would otherwise continue to operate," and/or to reduce the quality of goods and services.[121] Thus, by reducing the probability of default, hedging would reduce the expected costs associated with near, or actual, bankruptcy.

Bessembinder has made a somewhat similar argument. Analysts have noted that the issuance of senior claimants (debt) creates incentives to "underinvest." Because the benefits from increased investment are shared with senior claimants, equity holders bypass some economic projects. Bessembinder has shown that hedging, which again lowers the variability of a project's returns, reduces the incentive to underinvest because it "shifts individual future states from default to non default" and "this increases the number of future states in which equity holders are the residual claimants."[122] Thus,

[116] This argument should be familiar to those deciding whether to buy or rent a house. Clearly, everything else being equal, there is an incentive to a buy a house, because the interest on the mortgage is tax deductible.

[117] D.P. Baron, "Flexible Exchange Rates, Forward Markets, and the Level of Trade," *American Economic Review*, Vol. 66 (June 1976), pp. 1253-1266.

[118] D.G. Haushalter, "Financing Policy, Basis Risk, and Corporate Hedging: Evidence form Oil and Gas Producers," *Journal of Finance*, Vol. 55, No. 1 (February 2000), p. 110; and "Why Hedge? Some Evidence from Oil and Gas Producers," *Journal of Applied Corporate Finance*, Vol. 13, No. 4 (Winter 2001). See also K. Froot, D. Scharfsten, and J. Stein, "Risk management: Coordinating Corporate Investment and Financing Policies," *Journal of Finance*, Vol. 48 (1993), pp. 1629-1658.

[119] See J. Hull, *Options, Futures and Other Derivatives* (Upper Saddle River, NY: Prentice Hall, 1999), p. 628. Lawyers' fees can be substantial. According to the *Washington Post*, Enron's bankruptcy lawyers had billed more than $20 million through April 8, 2002, with no end in sight. A month earlier the bill was reported to be $8 million. *Washington Post* (April 8, 2002), p. E1.

[120] G.D. Haushalter, "Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers," *Journal of Finance*, Vol. 55, No. 1 (February 2000), p. 110.

[121] A.C. Shapiro, *Modern Corporate Finance* (New York, NY: Macmillan, 1990).

[122] H. Bessembinder, "Forward Contracts and Firm Value: Investment Incentive and Contracting Effects," *Journal of Financial and Quantitative Analysis*, Vol. 26, No. 6, p. 520.

hedging would effectively increase investment and the value of the firm.

There are also some incentives to hedge that are related to the progressive nature of the corporate tax structure. First, given the existence of progressive corporate tax rates, increases in the variability of the firm's income will increase the present value of its future tax liabilities, because the increased variability in income will increase the probability that the firm will fall into higher tax brackets. The same increase in variability will also increase the probability of losses and a corresponding reduction in tax liabilities, but there are no subsidies paid to companies by governments in that event. Thus, hedging, which reduces variability in income, will cause a reduction in expected taxes and thereby increase expected cash flows, after-tax profitability of investment, and the level of investment and value of the firm.

The preceding discussion suggests that firm managers could use hedging to increase firm value and the level of investment. Managers may choose not to use derivatives or to use derivatives for speculation instead of hedging, depending in part on how they are compensated.[123] Whether the use of derivatives induced by actual incentives will increase the firm's value is unclear.

Stulz (1984) and Smith and Stulz (1985) have argued that the method of compensating managers can affect the incentive for them to hedge against variations in the firm's income. Managers' compensation often includes bonuses that are tied to accounting measures of earnings. If managers avoid risk, everything else being equal, they will prefer less variability in their income. One way of reducing this variability is to reduce the variability in the firm's earnings by hedging. If a risk-averse manager has a significant share of his personal wealth in company stock he will be inclined to hedge.[124]

Often managers do not hold a large proportion of their wealth in stock but are eligible for stock options. Options have become a popular way of tying a manager's income to the performance of the firm. If the strike price of the option is much higher than the current price of the stock, there is an incentive for the manager to take some risks by not hedging the firm's cash flows.[125] That is, management might be inclined to "roll the dice" in hope of huge gains from which they will profit, forgoing surer options with less upside potential. In fact, as discussed below, there is some empirical evidence for a negative correlation between hedging and the use of stock options in managers' compensation packages. That is, increases in the use of stock options in a manager's compensation package may lead to less hedging of the firm's income.

What the Data Show

Researchers are just beginning to test whether the arguments described above are consistent with real-world data. Empirical research has lagged because firms were not required to report their derivative positions until 1990. To date, the limited empirical evidence is consistent with the notion that factors such as taxes and distress costs influence firms' use of derivatives.

For example, a 1993 study by Nance, Smith, and Smithson found that firms which hedged faced more progressive tax structures and had higher expenditures on research and development.[126] Additionally, a 2000 study by Haushalter of hedging activity in the oil and gas industry found evidence that firms with higher amounts of financial leverage hedged more. This result is consistent with the notion that reducing distress costs is an incentive to hedge. He also found that companies with production facilities closer to Henry Hub hedged more than those located farther from Henry Hub, because they had less basis risk. Haushalter also found that large firms hedged more than smaller ones, perhaps reflecting the fact that larger firms are better able to specialize.[127]

As noted above, some of the reasons managers might hedge (or not) have more to do with their own compensation than with increasing stockholder wealth. Tufano (1996) found that as the number of stock options increases, the amount of hedging decreases, and as the value of the stock held by managers and directors increases, hedging increases.[128]

Most importantly, a 2001 study by Allayannis and Weston found that hedging activity increases the value

[123] This is an example of the so called "principal-agent" effect. In such cases, the agent behaves in a manner that will maximize his/her own income as opposed to the income of the principal. There is a long literature on this subject and how incentives should be structured so that the incomes of both the agent and the principal are maximized. See, for example, B. Holmstrom, "Moral Hazard and Observability," *Bell Journal of Economics*, Vol. 10, No.1 (Spring 1979), pp. 74-91.

[124] R. Stulz, "Optimal Hedging Policies," *Journal of Financial and Quantitative Analysis*, Vol. 19 (June 1984), pp. 127-140; and C. Smith and R. Stulz, "The Determinants of Firms' Hedging Policies," *Journal of Financial and Quantitative Analysis*, Vol. 20 (December 1985), pp. 391-405.

[125] The strike price must be sufficiently high so that the effects of risk aversion are offset.

[126] In this study, the researchers derived an effective tax rate schedule that included the ability to carry tax losses forward, investment tax credits, and effective taxes on nominal pre-tax earnings. See D. Nance, C. Smith, and C. Smithson, "On the Determinants of Corporate Hedging," *Journal of Finance*, Vol. 48 (1993), pp. 267-284.

[127] G.D. Haushalter, "Financing Policy, Basis Risk, and Corporate Hedging: Evidence from Oil and Gas Producers," *Journal of Finance*, Vol. 55, No. 1 (February 2000), p. 110.

[128] P. Tufano, "Who Manages Risk: An Empirical Analysis of Risk Management Practices in the Gold Mining Industry," *Journal of Finance*, Vol. 51 (1996), pp. 1097-1137.

of the firm. Specifically, they used a sample of firms that faced currency risk directly because of foreign sales or indirectly because of import competition. They found that firms with sales in foreign countries that hedged with currency derivatives had a 4.87-percent higher firm value (hedging premium) than similar firms that did not use derivatives.[129] Firms that did not have foreign sales but faced currency risk indirectly had a smaller, but statistically insignificant, hedging premium. The study also found evidence that after firms began hedging, their market value increased, and that after firms quit hedging, their value fell. Thus, there is evidence that hedging increases the value of the firm and, by implication, increases investment.

Effects of Derivatives on the Volatility of Market Prices

The theoretical work described above assumes that the use of derivatives will not affect the overall volatility of the market. If this assertion is not correct, hedging could reduce social welfare even if it increased firm value. The general issue of the effects of speculation goes as far back as Adam Smith in 1776 and John Stuart Mill in 1871.[130] Both argued that speculators profit by buying when prices are low and selling when they are high. Successful speculation would be expected, therefore, to lower price volatility. Milton Friedman made similar arguments for almost 60 years, beginning in the 1940s.[131]

Kaldor (1939) argued that sophisticated speculators would exacerbate price changes by selling to less informed agents at prices above the competitive price. In a more formal model, Baumol (1957) argued that speculators amplified price changes by buying after prices have increased, causing additional price increases.[132]

Because derivatives are highly leveraged investments, they enhance both the incentive and means for speculation. Thus, if speculation is destabilizing, the introduction of derivatives will increase volatility. Additionally, derivatives can increase the speed at which new information about the fundamentals of a product is reflected in prices. Thus, in markets with derivatives, prices should respond more quickly to new information, which would increase volatility in the commodity market. In this case, however, the greater volatility would be associated with more accurate prices and improved allocation of resources.[133]

Academic researchers have intensively studied the actual relationship between derivatives and market volatility. A recent literature review included more than 150 published studies in this area.[134] The results of studies dealing with commodities are shown in Table 16. (Because the focus of this report is on energy, the volatility studies dealing with financial assets are not discussed here.)

Almost all the studies found that the use of derivatives either reduced or had no effect on market volatility. Two of the studies examined the relationship between the use of derivatives and crude oil prices. It appears that there have been no studies of the effect of derivatives on the volatility of electricity and natural gas markets.

Two basic methodologies were used in the research summarized in Table 16. One method compared the

Table 16. Results of Various Studies on the Effects of Derivatives on Commodity Prices

Author	Commodity	Effect on Volatility
Emergy (1896)	Cotton, wheat	Lower, lower
Hooker (1901)	Wheat	Lower
Working (1960)	Onions	Lower
Gray (1963)	Onions	Lower
Powers (1970)	Pork bellies, cattle	Lower
Tomek (1971)	Wheat	Lower
Johnson (1973)	Onions	No effect
Taylor and Leuthold (1974)	Cattle	Lower
Brorsen, Oellermann, and Farris (1989)	Cattle	Higher
Weaver and Banerjee (1990)	Cattle	No effect
Antoniou and Foster (1992)	Crude oil	No effect
Netz (1995)	Wheat	Lower
Kocagil (1997)	Four metals	No effect
Fleming and Osydiek (1999)	Brent crude oil	Higher

Source: Energy Information Administration.

[129] About 36 percent of the firms in this sample that had foreign sales did not hedge. Note that this study did not address the issue of why they failed to hedge if doing so would increase firm value. See G. Allayannis and J. Weston, "The Use of Foreign Currency Derivatives and Firm Market Value," *Review of Financial Studies*, Vol. 14 (2001), pp. 243-276.

[130] Adam Smith, *The Wealth of Nations* (1776); and John Stuart Mill, *Principles of Political Economy*, 7th edition (1871).

[131] M. Friedman, "The Case for Flexible Exchange Rates," in *Essays in Positive Economics* (Chicago, IL: Chicago Press, 1953).

[132] See W. J. Baumol, "Speculation, Profitability, and Stability," *Review of Economics and Statistics*, Vol. 39 (1957), pp. 263-271. Additionally, Milton Friedman noted that this type of speculation would result in losses if the good was then sold at the higher price. The exact opposite would be true when prices are falling. See C. Kindleberger, *Manias, Panics, and Crashes*, 4th edition (New York, NY: John Wiley & Sons), p. 24, 1989.

[133] See, for example, A. Antoniou and A. Foster, "The Effects of Futures Trading on Spot Price Volatility: Evidence for Brent Crude Oil using Garch," *Journal of Business Finance and Accounting*, Vol. 19 (June 1992), pp. 473-484.

[134] S. Mayhew, "The Impact of Derivatives on Cash Markets: What Have We Learned?" Working paper, Department of Banking and Finance, Terry College of Business, University of Georgia (Athens, GA, February 2000).

volatility of the underlying cash market before and after derivative trading began. This approach is useful in isolating the short-term effects, but the comparisons do not isolate other factors that may have caused the observed changes. The other method correlated increases (decreases) in the level of derivative trading with volatility.

Other studies have used different measures of volatility. The earlier studies simply looked at high-low ranges or used simple standard deviations before and after derivatives were introduced into a given market. The later studies introduced methodological refinements, the most important of which were adjusting for seasonal factors and allowing for the fact that volatility might not be constant in the pre- and post-event samples. Given the different approaches, the consistency of the results is remarkable.

Two studies examining the effects of derivative trading on the crude oil market produced some slightly different results. The more recent of the two, by Fleming and Ostdiek, found some evidence that volatility increased in the 3-week period after the introduction of NYMEX crude oil futures, but the introduction of crude oil options and derivatives for other energy commodities had no effect on crude oil price volatility.[135] The earlier of the two studies, by Antoniou and Foster, did not find any evidence that the introduction of futures contracts on Brent crude oil in 1988 increased the volatility of Brent crude oil prices.[136]

There are a number of differences in the two studies that might explain why they obtained different results. First, Brent crude oil futures studied by Antoniou and Foster are traded on the International Petroleum Exchange in the United Kingdom, whereas the crude oil futures studied by Fleming and Ostdiek are traded on the NYMEX in the United States. There are differences in the structure of the two markets that perhaps could explain the differences in the results of the two studies. Second, removing the seasonal and other factors from the measure of volatility is difficult, and differences in the methods of computing volatility in the two studies might also explain the differences in the results.

Lastly, as can be seen from Table 16, the bulk of the studies dealt with agricultural commodities, and only two of them focused on one energy commodity—crude oil. Oil and natural gas have some important similarities: both can be stored, and both are traded in large liquid spot markets. Thus, it is plausible that future studies will also find that derivatives have not affected the volatility of natural gas prices. For the reasons discussed in Chapter 4, however, it would be premature to extrapolate these results to electricity markets.

Market Power

The analysis so far suggests that there are benefits from using derivatives. There are also costs. Issues dealing with the risks from the use of derivatives and possible third-party failures are discussed in the next section. The question discussed here is whether a firm with market power in the cash market can use derivatives to distort commodity prices. For example, there is evidence of market power in the deregulated electricity markets,[137] suggesting that such a firm's use of derivatives could increase market volatility.

Economic theory suggests that a firm with market power can influence price by altering supply.[138] The analytical question is whether the existence of derivative markets gives the firm another way to manipulate supply. There have been a number of theoretical papers in this area. Unfortunately, there is but one empirical paper, which deals with the electricity market in New Zealand.

One way of manipulating the spot (cash) market is by "cornering and squeezing" it. Under this strategy, a firm will buy large amounts of future contracts and then demand delivery of the good as the contracts become due. By "cornering" the futures market, the firm has artificially increased demand for the good. At the same time, the firm, which has market power in the cash market, would restrict supply to "squeeze" the market. The combination of the two can cause substantial increases in price. In other words, the dominant firm can amplify the price effects of withholding supply by becoming a large trader and simultaneously increasing demand.

The best real-world example of such a strategy is the infamous manipulation of the silver market by the Hunt family (and others) who at one time held about $14 billion worth of silver. In January 1979, before the market manipulation, silver was selling for about $6 an ounce.

[135] J. Fleming and B. Ostdiek, "The Impact of Energy Derivatives on the Crude Oil Market," *Energy Economics*, Vol. 21 (1999), pp. 135-167.

[136] A. Antoniou and A. Foster, "The Effects of Futures Trading on Spot Price Volatility: Evidence for Brent Crude Oil using Garch," *Journal of Business Finance and Accounting*, Vol. 19 (June 1992), pp. 473-484.

[137] Note that there is also the question of whether a firm with no market power in the cash market can manipulate the derivatives market. This question is addressed in S. Mayhew, "The Impact of Derivatives on Cash Markets: What Have We Learned?" Working paper, Department of Banking and Finance, Terry College of Business, University of Georgia (Athens, GA, February 2000).

[138] Typically, such a firm could increase price by reducing supply. In electricity markets, under certain circumstances, the same outcome can be achieved by increasing supply. See J.B. Cardell, C. Cullen-Hitt, and W.W. Hogan, "Market Power and Strategic Interaction in Electricity Networks," *Resource and Energy Economics* (January 1997).

Then in 1979, the Hunts began to buy silver futures and demand delivery (i.e., they cornered the market). At the same time, they bought large quantities of silver and held the physical silver off the market (i.e., the market was squeezed). As a result, in January 1980 silver prices reached about $48 an ounce. Then, the regulators and the exchanges instituted "liquidation-only trading." That is, traders were only allowed to close existing contracts; they could not establish any new positions. This forced traders (the Hunts and others) to exit the market as existing contracts became due, so that the manipulators could not continue to accrue large numbers of contracts and were gradually forced to withdraw from the market. The day after the rule was passed, silver prices fell by $12 per ounce, and by March 27, 1980, they fell to about $10 per ounce.

Market corners and squeezes are illegal, but hard to prove. In fact, the Hunts, their co-conspirators, and their brokers were sued, and a $200 million judgement was awarded. The brokers and Lamar Hunt paid about $34 million and $17 million, respectively. The remaining amounts were never collected, because the other parties declared bankruptcy.

There are two other ways in which a dominant firm can use futures to increase prices. First, the key factor in the corner and squeeze strategy is the supply response of the dominant producer. Consider a world where there is one dominant firm that can set the market price and a number of smaller firms that simply react to the price. A number of theoretical studies have argued that under certain circumstances it would be rational for the dominant firm to lower futures prices, because the smaller firms' response to the lower prices would be to reduce output.[139] As a result of this strategy, the market share of the dominant firm would increase. In traditional market power analysis, there is a pricing strategy called "predatory pricing," where the dominant firm lower prices below marginal costs to force smaller firms out of the market. Again, it can be shown that under certain circumstances a dominant firm can achieve a similar outcome by using derivatives.

The dominant firm could also attempt to introduce some instability into the futures markets, thereby increasing risk and thus costs for the other firms, which would reduce their output and benefit the dominant firm. It should be noted that most analysts view this type of manipulation as more theoretical than practical, because in most cases the costs of introducing instability would exceed the benefits.[140]

It must be stressed that all of these strategies to use derivative markets to increase market power in the cash market are rational only under special circumstances. The research suggests that there is no general case to be made against futures trading when there is imperfect competition in the product market.

In a recent analysis, Wolak examined how one type of derivative (a contract for differences, also called a swap) could affect the spot price of electricity. A contract for differences could have the effect of fixing the price of electricity at a given level, creating an incentive to bid very low prices to ensure that the power is dispatched. When everyone does this, prices will fall. In the early days of the restructured electricity market in New Zealand, prices were indeed very low. Wolak noted that the government required generators to enter into a large number of futures contracts when the New Zealand market was restructured. He had some evidence that the low prices were partly the result of those contracts. He concluded that if one is concerned about market power, "then effective price regulation can be imposed by forcing a large enough quantity of hedge contracts on newly privatized generators."[141]

Derivatives and Financial Failure

Derivative contracts generally require little money "up front" but can impose huge cash obligations on their writers and buyers. The trouble begins when unforeseen market changes require one party to the contract to post large amounts of cash quickly to cover collateral obligations. This section discusses some infamous cases in which the use of derivatives has been involved with large-scale financial failures. Enron's collapse is not examined; analysis of its collapse will occupy scholars for decades.

Apart from the human tragedies, private failures are of public interest because they could lead to the failure of other firms to the point of a "public bailout." Such a bailout could have important public policy implications. First, as was the case with the Savings and Loan debacle in the late 1980s, a bailout could have major budgetary implications. Second, if decisionmakers perceive that there is a real possibility of a bailout, there may be an incentive to undertake investments that are too risky. (In economics, this problem is called "moral hazard.") At least according to some, one example of this would be deposit insurance that induced the owners of some savings and loan institutions to make very risky real estate

[139] See D.M.G. Newbery, "The Manipulation of Futures Markets by a Dominant Producer," in R.W. Anderson, ed., *The Industrial Organization of Futures Markets* (Lexington, MA: Lexington Books, 1984), p. 44.

[140] *Ibid.*, pp. 55.

[141] F. Wolak, "An Empirical Analysis of the Impact of Hedge Contracts on Bidding Bejavior in a Competitive Electricity Market." Unpublished manuscript, Department of Economics, Stanford University (Palo Alto, CA, January 2000), p. 45.

loans. After outlining the reasons for four of the largest derivatives-related failures, this section briefly discusses the protections in place to limit public liability for private failures.

An example of a failure resulting from the use of derivatives to speculate is the bankruptcy of Orange County, California. In the early 1990s, the manager of the Orange County Investment Pool successfully invested the funds in long term bonds. When interest rates fell, bond prices increased, and as a result the fund's yield was greater than the market rate of return. Then, in 1993, believing that interest rates would continue to fall, the manager undertook a more aggressive investment strategy, buying "inverse floaters" whose returns were inversely related to the London Interbank Offer Rate (LIBOR). He also made extensive use of "reverse repos"—an investment strategy that amounts to buying Treasury bonds on margin. In both cases, profits were potentially very large if interest rates continued to fall. Unfortunately, just the opposite happened. In February 1994, the Federal Reserve Board started to increase interest rates, and by late 1994 they had been increased six times. In addition, the LIBOR rate rose from 3.6 percent to 6.8 percent. As a result, the fund lost about $1.7 billion, leading to the County's bankruptcy.

The bankruptcy of Barings, PLC, in early 1995 also illustrates the problems that can occur when derivatives are used for speculation and when the trading activity is not properly controlled. In early 1995, a trader working for Barings Future Singapore (BFS) wrote both put and call options on Japan's Nikkei 225 stock index with the same strike price. This strategy, called a "straddle," was not authorized. A straddle will be profitable if the price of the underlying asset (in this case the Nikkei 225) remains close to the option strike price. If, however, prices either increase or decrease relative to the option strike price, very large losses will result. Unfortunately for Barings, the Nikkei 225 did fall substantially. As a result, Barings lost about $1.5 billion and was placed in "administration" by the High Court in the United Kingdom. Indeed, this failure shows what can happen when appropriate risk control systems are not in place.

Hedging can require substantial amounts of ready cash (liquidity). In practice hedging will only reduce (but will not eliminate) risk. For example, MG Corporation (MGRM), the U.S. oil trading arm of Metallgesellschaft (MG), sold forward supply contracts that committed it to supply about 160 million gallons of motor gasoline and heating oil over a 10-year period at a fixed price. This obviously exposed MGRM to substantial losses if spot prices were greater than the agreed-upon fixed selling price, and MGRM decided to hedge the risk with oil futures (and swaps).

The problem was that the futures contracts were very short term (a few months) in nature, while the supply contracts were longer term. Thus, every few months MGRM had to replace the futures contracts, and this presented some problems. First, MGRM had to do a lot of trading and was therefore dependent upon the liquidity of the NYMEX market. Additionally, the oil products it was contracted to deliver were in different locations from the products traded on the futures exchanges, exposing the company to some basis risk. Lastly and most importantly, the rollover strategy is not without costs unless the price of oil for immediate delivery ("nearby oil") is equal to the price of futures contracts ("deferred month oil").

Based on historical price patterns, on average, nearby prices were greater than deferred month prices, and thus MGRM could expect its rollover strategy to generate some profits. However, because oil prices fell in the first year, the nearby prices were less than the deferred prices, and the rollovers of the futures contracts generated substantial cash losses, causing some funding problems. As a result, in late 1993 the company closed out all the positions and took a loss of about $1.3 billion. (That decision turned out to be an unfortunate one. Over the next year futures prices returned to their historical patterns, and the rollover strategy could have produced some gains.)

Even after the decision was made to terminate MGRM's hedging program, experts disagreed about the appropriateness of that decision.[142] Nevertheless, one lesson here is that hedging strategies can be complex and are not without costs and risks. Indeed, management should anticipate risks and liquidity requirements before entering into such strategies. Additionally, when spot market oil prices fell in 1993, the value of MGRM's forward contracts increased. Under German accounting rules at the time, MG was not permitted to include the unrealized gains in its forward contacts as income, but it was required to deduct the unrealized losses on its futures contracts. As a result, its losses were overstated. At least according to Steinherr, this could have affected the MG board's decision.[143] Additionally, one study argued that the increase in the value of the forward contracts was less than 50 percent of the losses from rolling the futures contracts over. Thus, the hedge was far from perfect. There was no agreement among the experts about whether there was any better hedging strategy.[144]

[142] See, for example, A. Steinherr, *Derivatives: The Wild Beast of Finance* (New York, NY: John Wiley & Sons, 1998); and M. Miller, *Merton Miller on Derivatives* (New York, NY: John Wiley & Sons, 1997).

[143] A. Steinherr, *Derivatives: The Wild Beast of Finance* (New York, NY: John Wiley & Sons, 1998), p. 95.

[144] *Ibid.*, p. 95.

The failures just discussed were largely the result of "managerial" factors. The collapse of Long Term Capital Management (LTCM) was due to the fact that "history did not repeat itself." LTCM was a very risky hedge fund that invested heavily in derivatives. (A hedge fund is a limited partnership, managing the investment of wealthy people. Minimum investments are over $300,000, and each partnership has fewer than 99 investors.) The hedging strategies used in this fund were based on a very detailed mathematical model, and many of the relationships were based largely on historical experience.

One key for LTCM was the spread between developed and developing countries' government bond prices. In particular, their investment strategy was based on a historical relationship which suggested that if this spread became unusually wide it would subsequently narrow to normal levels. However, in mid-1998, after the Russian government devalued the rubble and declared a moratorium on future debt repayments, the spread increased rather than narrowed. As a result, the fund's capital fell from $4.8 billion to about $600 million. The Federal Reserve Bank of New York organized a consortium of banks and investment houses to rescue the fund. LTCM survived but had to turn over 90 percent of the fund's equity to its rescuers.

As this history demonstrates, derivative use is not without costs, which in some cases can be ruinous. In principle, a major failure could start a series of failures of otherwise solvent firms and disrupt other financial and physical markets. Indeed, fear of contagion was the rationale for the Fed's intervention in the rescue of LTCM. It must be noted, however, that for a number of reasons large failures are in fact uncommon.

Bad experience has given managers ample reason to understand the risks associated with their hedging operations and to discipline traders. Even so, a well-conceived, well-executed hedging strategy has a small chance of material losses. The small risk of failure is inherent and cannot be eliminated. Recognizing this, rating companies and trade organizations have taken steps to identify firms subject to losses they cannot withstand and to contain the inevitable failures.

Moody's Investors Services, for example, is currently reexamining the creditworthiness of all energy trading firms.[145] Moody's is essentially assessing the ability of firms to raise enough cash to cover claims quickly in the event that unlikely but plausible market conditions move against them. Their focus is on ". . . sustainable cash flow generation, debt levels, and the quality and diversity of assets . . ." and on ". . . disclosure in financial reporting . . . ."[146,147] The Edison Electric Institute has initiated a master netting agreement for use by companies trading electricity-related derivatives and is heading the industry's effort to adopt credit standards and to guarantee performance. This effort is in the spirit of Moody's suggestion that energy trading would benefit from ". . . a clearing system that would provide liquidity, transparency and a more efficient transfer of credit risk . . . ."[148]

In addition, the banking authorities—the U.S. Federal Reserve Board, the Comptroller of the Currency, and the Federal Deposit Insurance Corporation—have imposed financial safeguards on the few investment banks that remain active in energy trading. The banking system also provides investment banks with subsidies in the form of liquidity (access to the Fed's discount window) in the event of crisis and with deposit insurance. Recent research indicates that these subsidies are small and probably are offset by regulatory costs, and that they are, in any case, effective in preventing liquidity crises.[149]

Over-the-counter energy traders, such as Mirant, Duke Capital, Williams, and Reliant, face far less government oversight than do investment bankers conducting similar business, and the private initiatives mentioned above may prove ineffective. On the other hand, Enron's case showed that the collapse of the largest U.S. energy trader was not enough to threaten domestic financial markets.

Conclusions

This chapter has examined four issues related to the societal benefits and costs that result from using derivatives. Existing theoretical and empirical work suggests that the use of derivatives does in fact increase the level of investment and increase a firm's market value. The bulk of the empirical studies find that the use of derivatives has either reduced or had no effect on the volatility of commodity prices; however, one of the two

[145] Moody's Investors Services, *Moody's View on Energy Merchants: Long on Debt-Short on Cash Flow Restructuring Expected* (May 2002).

[146] *Ibid.*, p. 3.

[147] Moody's has identified several red flags that they are using in this difficult assessment: high leverage and meager cash flow; loan agreements with extensive use of credit triggers calling for more collateral in the event of a ratings downgrade or adverse market movements; lack of financial reporting transparency, especially by business segment; large proportions of income from long-lived contracts that are marked to model; synthetic leases; hybrid securities; and project finance devices that may add obligations to the company.

[148] *Ibid.*, p. 1.

[149] See, for example, G. Whalen, *The Competitive Implications of Safety Net-Related Subsidies*, Office of the Comptroller of the Currency, Economics Working Paper 97-9 (May 1997); and A. Lehnert and W. Passmore, *The Banking Industry and the Safety Net Subsidy*, Staff Working Paper, Federal Reserve System Board of Governors (1999).

studies examining the effects of futures trading on crude oil markets found that in the short term the introduction of futures increased the volatility of crude oil prices. As just noted, this result is the "exception rather than the rule." There have been no published academic studies examining whether derivative use increases the volatility of natural gas or electricity prices. Additionally, theoretical analyses on whether firms with market power can use derivatives to manipulate spots markets are inclusive.

The use of derivatives can be very risky, and there have been some cases in which their misuse has proved to be ruinous; however, the public as a whole was not affected by those failures. Moreover, the Federal Reserve, by its implicit commitment to provide liquidity and avert financial crisis, is providing a small subsidy to those banks that use derivatives, because banks are heavily involved with derivative use. The subsidy probably is overwhelmed by the costs of bank regulation and is in any case unavoidable and appears to be worth the cost.