

The Economic Benefits and Risks Of Derivative Securities

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Derivative security markets have shown extraordinary growth over the past 10 years. But certain events have raised concern about the risks associated with derivatives trading. The stock market crash of October 1987 has, in part, been blamed on portfolio insurance strategies that used futures markets. Large losses associated with the use of derivatives by firms such as Procter & Gamble (\$137 million), Metallgesellschaft (\$1 billion), and Barings PLC (\$1.3 billion), and by Orange County, California (\$1.7 billion) have led to fear among some market participants that derivatives trading is

a very risky activity that could lead to a widespread disruption of the financial system.

What sometimes gets lost in the popular discussion about derivative-related losses are the benefits that derivative securities provide to firms, investors, and the economy as a whole. Derivative securities such as options, forwards and futures, and swaps can provide firms and investors with opportunities that might not otherwise be available. Derivatives aid in the allocation of risk across investors and firms, and they can lower the costs of diversifying portfolios. Derivative prices reveal information to investors that can make financial markets more stable.

But do derivative securities add significant risk to financial markets over and above the

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risks already present? The risks associated with derivatives are related to how these securities are used in a specific market setting and economic environment. Since derivatives are contracts, their use can entail legal risks. Derivatives may carry credit risks in that one party to the contract may default. Problems may also arise concerning the liquidity of derivative securities or the ease with which they can be traded. These same risks are, to one degree or another, associated with almost all financial assets.

THE DEVELOPMENT OF DERIVATIVES MARKETS

Derivatives markets are successful institutions because they make financial markets more efficient. This generally means that borrowing and lending can occur at lower cost than would otherwise be the case because derivatives reduce transaction costs. For example, more efficient mortgage markets mean that homeowners can borrow at lower cost. Similarly, firms can raise funds for investment at a lower cost when financial markets are efficient. This in turn can lead to faster economic growth.

The most common types of derivative securities are equity and interest rate options, currency derivatives, futures and forward contracts, and swaps.¹ In each case the derivative security is a contract between two parties. One party receives a claim on an underlying asset or on the cash value of the asset; the other party has an obligation to meet the corresponding liability (see *Derivatives Defined*).

Trading in derivative contracts has a long history. The first recorded accounts of derivative contracts can be traced back to the philosopher Thales of Miletus in ancient Greece, who, during winter, negotiated what were essentially call options on oil presses for the spring olive

harvest. De la Vega reported in 1688 that options and futures, or “time bargains” as they were then known, were trading on the Amsterdam Bourse soon after it was opened. Evidence also suggests that futures contracts for rice were traded in Japan in the 17th and 18th centuries.²

The first formalized futures exchange in the United States was the Chicago Board of Trade, which opened in 1848 with 82 members. In March 1851, the first futures contract was recorded. The contract called for the delivery of 3000 bushels of corn in June at a price of one cent per bushel below the March price. Listed stock options began trading in April 1973 on the Chicago Board Options Exchange (CBOE). Other exchanges began offering stock call options in 1975 and put options in 1977. Today, options on more than 1000 stocks trade on five U.S. exchanges.

In the United States, stock index futures began trading in 1982 and stock index options in 1983. By the end of 1993, stock index futures markets were established in 14 countries covering 95 percent of world equity market capitalization.³

No one knows how big the derivatives markets really are, in part because trading is global in scope and regulatory responsibility is fragmented. Data taken from a Congressional Research Service report on derivative financial markets show that the notional value of derivatives rose from about \$1.6 trillion in 1987 to about \$8 trillion in 1991 (Table). Notional value reflects the sum of the value of all the assets. However, notional value tends to overstate the size of the derivatives market, since it does not take into account offsetting transactions. If a bank undertakes a \$200 million swap of floating assets for fixed-rate ones, then later cancels

¹For a discussion of currency derivatives, see the article by Gregory Hopper.

²See page 3 in the book by Darrell Duffie.

³See the article by Joanne M. Hill.

Derivatives Defined

Forward Contract: A contract to buy or sell a specified amount of a designated commodity, currency, security, or financial instrument at a known date in the future and at a price set at the time the contract is made. Forward contracts are negotiated between the contracting parties and are not traded on organized exchanges.

Futures Contract: A contract to buy or sell a specified amount of a designated commodity, currency, security, or financial instrument at a known date in the future and at a price set at the time the contract is made. Futures contracts are traded on organized exchanges and are thus standardized. These contracts are marked to market daily, with profits and losses settled in cash at the end of the trading day.

Option Contract: A contract that gives its owner the right, but not the obligation, to buy or sell a specified asset at a stipulated price, called the strike price. Contracts that give owners the right to buy are referred to as call options and contracts that give the owner the right to sell are called put options. Options include both standardized products that trade on organized exchanges and customized contracts between private parties.

Swap Contract: A private contract between two parties to exchange cash flows in the future according to some prearranged formula. The most common type of swap is the “plain vanilla” interest rate swap, in which the first party agrees to pay the second party cash flows equal to interest at a predetermined *fixed* rate on a notional principal. The second party agrees to pay the first party cash flows equal to interest at a *floating* rate on the same notional principal. Both payment streams are denominated in the same currency. Another common type of swap is the currency swap. This contract calls for the counterparties to exchange specific amounts of two different currencies at the outset, which are repaid over time according to a prearranged formula that reflects amortization and interest payments.

out its position by entering a \$200 million contract of fixed-rate for floating-rate debt with the same counterparty, notional value is recorded at \$400 million, despite the fact that the two transactions offset each other.

Growth in the use of derivative contracts has proceeded at a rapid pace since 1991. The Bank for International Settlements (BIS) conducted a survey of foreign exchange and derivative market participants worldwide. The survey found a notional value of \$47 trillion for over-the-counter (OTC) derivative contracts outstanding at the end of March 1995.⁴ Of that total \$17.7 trillion represented foreign exchange derivatives and \$28.8 trillion represented interest rate

derivatives. The survey also calculated a notional value for exchange-traded derivative contracts of \$8.2 trillion.⁵ Daily average turnover in OTC derivative contracts was found to be \$880 billion and that of exchange-traded contracts was \$570 billion.

The size of the markets suggests that users of these contracts derive significant benefits from including derivatives in their investment

⁴OTC derivatives are contracts not traded on organized exchanges but rather negotiated privately between parties.

⁵The figures from the BIS are not directly comparable to those in the table because the surveys differ.

strategies. At the same time, the size of the derivatives market has led to fears that a disruption could have a wide-ranging impact on financial markets in general. We will focus first on some of the economic benefits of derivatives: they reallocate risk among financial market participants, help to make financial markets more complete, and provide valuable information to investors about economic fundamentals. Then we will discuss risks associated with the use of derivatives.

SOME ECONOMIC BENEFITS OF DERIVATIVE SECURITIES

At first glance, the economic benefits of derivatives might not be apparent, since derivatives are zero-sum monetary games: the amount paid by one side of the contract is the amount received by the other side.⁶ When the contract expires or is exercised, the gains and losses completely offset each other. But even though derivatives represent zero-sum monetary games, they need not represent zero-sum economic games.

Individuals and firms that use derivative instruments can do so to hedge, to speculate, or

⁶We are ignoring transaction costs for now.

TABLE

Markets for Selected Derivative Instruments, Notional Principal Values at Year End

in Billions of U.S. Dollar Equivalent

	1987	1989	1991
Exchange-Traded Instruments ^a	725	1762	3518
Interest Rate Futures	488	1201	2159
Interest Rate Options ^b	122	387	1072
Currency Futures	14	16	18
Currency Options ^b	60	50	59
Stock Index Futures	18	42	77
Stock Index Options ^b	23	66	132
Over-the-Counter Instruments ^c	867	2402	4449
Interest Rate Swaps ^d	683	1503	3065
Currency and Cross-Currency ^{d,e}	184	449	807
Interest Rate Swaps			
Other Instruments ^{d,f}	---	450	577
TOTALS	1592	4164	7967

^aExcludes options on individual shares and derivatives involving commodity contracts.

^bCalls plus puts.

^cExcludes data on forward rate agreements, OTC currency options, forward foreign exchange positions, equity swaps and warrants on equity. Data collected by International Swap Dealers Association (ISDA).

^dContracts between ISDA members reported only once.

^eAdjusted for reporting of both currencies.

^fCaps, collars, floors, and swaptions

Source: As reported by the Bank for International Settlements: Futures Industry Association; ISDA; and various futures and options exchanges worldwide.

to engage in arbitrage. When individuals or firms hedge risks with derivatives, they are attempting to use these contracts as a kind of insurance against a bad future outcome.

Hedging. An example of using derivative instruments to hedge is provided by an adver-

tisement by the Student Loan Marketing Association (Sallie Mae) in the *Wall Street Journal* for December 31, 1991. Sallie Mae is a publicly held company that provides private capital funding for guaranteed student loans. The ad showed how Sallie Mae used combinations of swap arrangements to hedge the risks of borrowing money overseas.

Suppose Sallie Mae sells bonds with fixed interest rates and denominated in pounds sterling in the U.K. financial market. Sallie Mae, which is a U.S.-based organization, would like to avoid exchange rate risk between the U.S. dollar and the pound sterling and so enters into a currency swap arrangement. Sallie Mae swaps the principal amount of the bond in pounds sterling for U.S. dollars at the current exchange rate. When Sallie Mae has to pay interest to its U.K. bondholders, the parties swap payments again, with Sallie Mae receiving pounds sterling to meet interest payments in exchange for U.S. dollars at the rate fixed in the swap contract. Finally, when the bonds come due, the counterparties swap the principal payment. The swap arrangement allows Sallie Mae to insure itself against exchange rate fluctuations, since the total cost of interest and principal is fixed in U.S. dollar terms.

Derivative contracts are widely used to hedge a variety of risks. In 1993, the Group of Thirty published *Derivatives: Practices and Principles*, which reported on the use of OTC derivatives by various categories of users. Of the private-sector nonfinancial corporations responding to the survey, 87 percent used interest rate swaps, 64 percent used currency swaps, 78 percent used forward foreign exchange contracts, 40 percent used interest rate options, and 31 percent used currency options.

How do firms use derivative contracts to hedge the risks they face? Of the respondents, 82 percent indicated they used OTC derivatives to hedge risks arising from new financing, 33 percent to hedge exposure from foreign currency translation, 69 percent to hedge foreign

exchange transaction exposures, and 78 percent to manage or modify the characteristics of their existing assets and liabilities.

Financial institutions are major players in the derivatives markets as well. According to the Group of Thirty report, 92 percent of financial institution respondents used interest rate swaps, 69 percent used forward foreign exchange contracts, 69 percent used interest rate options, 46 percent used currency swaps, and 23 percent used currency options. This group of respondents uses derivatives to hedge risk arising from new financing (84 percent), foreign currency translation exposures (46 percent), and transaction exposures (39 percent), and to offset option positions embedded in the institutions' assets and liabilities (39 percent).⁷

When used to hedge risks, derivative instruments transfer the risks from the hedgers, who are unwilling to bear the risks, to parties better able or more willing to bear them. In this regard, derivatives help allocate risks efficiently between different individuals and groups in the economy.

Speculating. Investors can also use derivatives to speculate and to engage in arbitrage activity. Speculators are traders who want to take a position in the market; they are betting that the price of the underlying asset or commodity will move in a particular direction over the life of the contract. For example, an investor who believes that the French franc will rise in value relative to the U.S. dollar can speculate by taking a long position in a forward contract on the franc. If the value of the franc on the expiration date is above the delivery rate set when the forward contract was written, the speculator earns a profit on the contract.

The use of a forward contract for speculation has an advantage over actually buying

⁷The option positions embedded in institutional assets and liabilities include such things as call or prepayment features in loans and bonds.

francs and holding them because neither party puts any money up-front when entering into the forward contract.⁸ Thus, the forward contract gives the investor much more leverage than buying the underlying asset in the cash market.

While speculation may seem to be no more than gambling on future price movements, speculators play an important role in financial markets because they provide liquidity. This liquidity enables other investors, who may be using derivatives to hedge risks, to more easily buy and sell derivative contracts.

Arbitrage. Arbitrageurs represent another important group of derivatives users. Arbitrageurs look for opportunities to earn riskless profits by simultaneously taking positions in two or more markets. Arbitrage opportunities can occur when prices in financial markets get out of sync. When this happens, arbitrageurs step in and, by doing so, help to get market prices back into alignment. This activity helps to keep prices consistent across markets. Arbitrage trades can be quite complex, but we will give a simple example to show how such trades can work.⁹

Suppose that the interest rate on 13-week Treasury bills is 10 percent and the rate on 26-week Treasury bills is 10.5 percent. The rates on the two Treasury bills imply that the 13-week Treasury bill rate in three months will be about 11 percent.¹⁰ Also, suppose that a T-bill futures

⁸Recall that a forward contract is an agreement between two parties to buy or sell an asset at a specific time in the future. The price at which the asset is to be delivered on that future date is called the delivery price. The delivery price is set in such a way that the price of the forward contract at the time it is made is zero to both parties.

⁹For more detail on arbitrage and derivatives, see the book by John C. Hull.

¹⁰This follows from the fact that the return on the 26-week T-bill can be expressed as a geometric average of the returns on two successive 13-week T-bills:
 $(1.105)^2 = \sqrt{(1.10)(1.11)}$.

contract allows one to buy or sell a 13-week T-bill for delivery in three months at a rate of 10.75 percent. Since these two future interest rates differ, there is an opportunity to earn a risk-free profit. Arbitrageurs can exploit this mispricing if, in three months, they can borrow money at 10.75 percent and invest it at 11 percent. They do so by trading the futures contract and Treasury bills.¹¹

Arbitrage activity also helps to keep asset markets liquid and thus reduces transaction costs. Arbitrageurs are taking positions in derivative instruments and in the assets that underlie them. Therefore, arbitrage helps to reduce liquidity premiums, or the difference between the purchase price and the sale price of the underlying assets.

Leverage. Derivative contracts also aid in risk allocation because of the cheap leverage opportunities they provide to the investor. We've already hinted at the leverage obtained by using forward contracts. In that case, leverage comes about because no cash has to be put up at the time the parties enter into the contract.

Options are also leveraged investments. Take the case of a call option on a stock like AT&T. On March 28, 1996, a July call option on 100 shares of AT&T stock with a strike price of \$60 sold for \$400. AT&T shares in March were selling for a little less than \$62. To purchase 100 shares of AT&T would have cost an investor close to \$6200. If, in July, AT&T shares sell for \$65 per share, the holder of the option will exercise it and reap a profit of approximately

¹¹This requires three steps. First, sell the futures contract short, which means that the arbitrageur will be committed to delivering T-bills with an implied rate of 10.75 percent in 90 days. Second, borrow money at the 10 percent rate for 13-week T-bills. Third, invest the borrowed money in 26-week T-bills at 10.5 percent. Steps two and three guarantee that a rate of 11 percent is earned on T-bills after 90 days, while step one guarantees that a T-bill yielding 10.75 percent can be sold after 13 weeks.

\$100 on his \$400 investment in the call option.¹² If the shares had been bought outright, the investor would have gained \$300 on a \$6200 investment.¹³ Of course, if AT&T shares sell for \$62 in July, the investor loses the \$400 investment in the call option. But if he owned the shares outright, his dollar loss would be negligible.

Is leverage a good thing for financial markets? Generally yes, because leveraged positions give investors access to risk-return tradeoffs they otherwise would not have. Broadening the menu of available choices helps individuals tailor risk to their own investment, hedging, or arbitraging situation. Derivative contracts allow investors to leverage relatively small amounts of funds over a wide class of assets and thus diversify their portfolios.

However, leverage can work to an investor's disadvantage as well. In the Orange County, California, bankruptcy episode, the investment fund took a highly leveraged bet that interest rates would not rise. When rates did rise, the fund lost value to a much greater extent than it would have, had it not been leveraged (see *Orange County and Derivative Securities*).

Complete Markets and Derivative Instruments. In addition to efficient allocation of risk, derivatives offer another important benefit: they can provide investors with opportunities that would otherwise be unavailable to them at any price. That is, derivatives can provide payoffs that simply cannot be obtained with other, existing assets.

¹²If the call is exercised, the profit on the transaction can be expressed as the difference between the underlying asset price and the option strike price, less the cost of purchasing the call.

¹³Leverage can be gained in stock market transactions by purchasing stocks on margin. Current regulations allow up to 50 percent of a long position in a stock to be borrowed. However, the leverage obtained by using derivatives on stocks is substantially higher than the leverage obtained by purchasing stock on margin.

In theory, derivative contracts can be written to provide any conceivable pattern of payoffs that depend on future conditions. Or, in economists' language, derivatives can make markets complete. Why are complete markets desirable? Because they provide maximum flexibility for investors, since any possible pattern of returns can be achieved using a portfolio of existing securities.¹⁴ In addition, economic theory tells us that a complete market is economically efficient, which means that resources cannot be reallocated in such a way as to make everyone better off.

In reality, there are obstacles to achieving complete financial markets. For example, writing and enforcing contracts that cover certain contingencies present difficulties; costs make some transactions infeasible; and government regulations may interfere with the market's ability to provide some payouts. Given these obstacles, we want to create securities that will help us get closer to complete markets. This is where derivative instruments come in: derivatives can help move financial markets toward completeness.¹⁵

Furthermore, it may be much less costly to complete markets by using derivative securities than by creating new basic securities. Thus, derivative securities can lower transaction costs for investors.

TRANSACTION COSTS AND INFORMATION

The standard method for calculating the prices of options and other derivative securities assumes that securities markets are effec-

¹⁴For a detailed discussion of options and complete markets, see the articles by Stephen Ross and Nils Hakansson.

¹⁵It need not be the case that partially completing an incomplete market is always best. For example, the article by Franklin Allen and Douglas Gale shows that, under certain conditions in an incomplete market, financial innovation may not be efficient.

Orange County and Derivative Securities

Orange County, California, declared bankruptcy in December 1994 after an investment fund run by the county treasurer reported losses that eventually amounted to \$1.7 billion. News reports of the incident highlighted the fact that the Orange County Investment Pool (OCIP) held derivative securities and often gave the impression that derivatives were to blame for the county's losses. The OCIP did hold derivative securities, which amounted to about 40 percent of invested funds. But OCIP lost about 20 percent of its investors' funds because of a risky bet on the direction of interest rates that turned out to be terribly wrong.

The county's investment strategy was essentially to borrow short and lend long. Usually, long-term interest rates are higher than short-term interest rates because the short-term return to holding long-term bonds is risky. A higher interest rate on long-term bonds helps compensate investors for bearing this risk. When short-term interest rates are lower than long-term rates, it can be profitable to borrow at the short-term rate and lend the borrowed money at the long-term rate. So funds from the OCIP were invested in long-term bonds. The OCIP got more bang for its buck by leveraging up its investment: the pool posted the long-term bonds as collateral and borrowed against them at the short-term interest rate. It then took the borrowed money and purchased more long-term bonds.

The strategy was profitable as long as interest rates stayed the same or declined. But in February 1994 interest rates began rising. When interest rates rise, the price of bonds falls. As a result, the long-term bonds in the OCIP declined in value at the same time that the cost of short-term borrowing was rising.

The OCIP also invested in interest rate derivative securities called inverse floaters. These derivatives gain value when interest rates fall and lose value when they rise. When interest rates rose in 1994, these securities took a big hit.

The losses in the OCIP can be approximately broken down as follows.* The initial value of the OCIP portfolio was \$7.6 billion. Through leverage, however, the total value of invested funds was on the order of \$20 billion. The OCIP had a \$12 billion investment in fixed-rate bonds that had an average maturity of four years. When interest rates rose in 1994 these bonds lost about \$360 million. About \$8 billion of OCIP funds were invested in inverse floaters, which lost about \$620 million. Short-term borrowing of about \$12.4 billion led to additional losses, through the payment of interest, on the order of \$620 million.

*These figures are taken from the book by Philippe Jorion.

tively complete. Nils Hakansson has pointed out that this is something of a paradox. If markets are complete, options are redundant assets. So why do they exist?

Transaction Costs. Robert Merton has developed one solution to this paradox. Individual investors may face high transaction costs for certain types of financial trades, but large firms will have lower transaction costs in securities markets because of the large volume of trades they undertake. For these large firms, markets will be effectively complete, since they can create different securities by engaging in carefully constructed trading over time (called dynamic trading) at low cost. The firms can

then sell claims on these dynamic trades as derivative securities to individuals, passing on the lower transaction costs. The assumption of market completeness, and thus standard option-pricing theory, would be approximately correct because of the presence of these large firms with their low transaction costs.

In reality, derivative securities provide investors with low-cost ways to diversify portfolios. For example, stock index options allow their users to trade an entire portfolio of stocks as a single financial product. It is much more difficult, and expensive, for individual investors to trade a basket of stocks representing, say, the S&P500 on the stock exchange, than it is to trade

an S&P500 stock index futures contract. In addition, it is almost always the case that an option on a portfolio is less expensive than a portfolio of options on the underlying stocks.¹⁶ Stock index options and futures allow investors to trade at a fraction of the cost of trading the underlying basket of stocks on the cash market or buying portfolios of options.¹⁷

Derivatives also provide beneficial opportunities for diversification because they offer easy and cheap access to classes of assets, such as commodities, that would otherwise be very expensive. For example, investors can buy futures contracts on oil, corn, gold, and a host of other commodities to help diversify their portfolios. In addition, investors can buy futures on commodity indexes. To purchase these underlying commodities in the cash market would require a large investment. By purchasing futures, investors can benefit from favorable price movements in these classes of assets in a relatively inexpensive way. Of course, investors would also risk large losses from adverse price movements.¹⁸

Derivatives and Market Information. We saw that, in complete markets, derivatives provide no new investment opportunities beyond what is available from existing assets. Indeed, modern finance methods compute the price of an option by finding a dynamic trading strategy using the underlying asset and T-bills that

replicates the payout of the option. A dynamic trading strategy means that the amount of money invested in the asset and in T-bills is adjusted over time to ensure that the portfolio payout is the same as the option payout.

But even if these option-pricing models are accurate, options are not necessarily redundant assets. Sanford Grossman contends that the prices of traded options convey information about the underlying stock that may serve to lower its volatility. Grossman argues that many large investors using dynamic trading strategies instead of traded options to achieve desired returns can cause an increase in the volatility of the underlying stock.

Consider the case of portfolio insurance. Portfolio insurance refers to the desire of portfolio managers to eliminate the risk that their portfolios' value will fall below a certain level. One method of implementing portfolio insurance is by using put options. If an investor buys a put option on a stock, the risk that the value of the portfolio composed of the put and the stock will fall below the strike price of the put is eliminated.¹⁹ However, when investors' portfolios contain many stocks, it may not be possible to buy puts on all of them. In this case, the portfolio manager can implement portfolio insurance by using a dynamic trading strategy that replicates the payout of a put option on the portfolio.

Portfolio managers who use dynamic trading strategies are counting on their ability to sell shares of the stocks in the portfolio before the market price of the shares falls below their

¹⁶An option on a portfolio will be cheaper than the portfolio of options provided the underlying assets are not perfectly correlated. When assets are not perfectly correlated, diversification has benefits, since it lowers the volatility of the portfolio. Option prices fall as volatility falls.

¹⁷In some cases the investor may be able to purchase shares in a mutual fund that closely approximate his desired portfolio. This would also be a low-cost way to diversify, but it does not give the leverage opportunities that come with using derivatives.

¹⁸See the article by Anatoli Kuprianov for case studies of the Metallgesellschaft and Barings derivatives losses.

¹⁹On exercise, the payoff function for a put option can be expressed as the difference between the strike price and the underlying stock price. If we denote the strike price by K and the stock price by S , in the event that S is less than K at exercise, the put option payoff is $K - S$. If we hold both the stock and a put on the stock, when the stock price falls below K and the option is exercised, the total value of the portfolio is $S + (K - S) = K$. K represents a floor below which the value of the portfolio will not fall.

floor. But if many portfolio managers are using dynamic trading to implement portfolio insurance, many traders are attempting to sell shares once the market begins falling. But as everyone tries to sell, the market is forced lower and lower, and thus the dynamic trading strategy may not work since traders find they are unable to sell stock at a price above the targeted floor: prices may fall too far, too fast.

Suppose, though, that put options were available to those portfolio managers who wanted insurance. If everyone were trying to buy puts to implement insurance, the price of puts would go up. In essence, insurance would become more expensive. As insurance becomes more expensive, there will be less demand for it, and so, fewer portfolio managers would use insurance. Since the demand for insurance is a driving factor in the determination of stock volatility, the higher price of the puts is telling market participants that stock market volatility is expected to be higher in the future and that the net demand for insurance is high.²⁰ The price of the put options serves to coordinate the strategies of the users of portfolio insurance by revealing expectations about stock price volatility.

If everyone is using a dynamic trading strategy and cannot observe a price for insurance, there is no way to easily tell how large the net demand for portfolio insurance is. Stock market volatility could then be higher when dynamic trading strategies are used to implement insurance compared to the case where put options are used. According to the Brady Commission report, portfolio insurance and index arbitrage accounted for about 20 percent of to-

²⁰An investor using an insurance strategy will sell equity after a fall in price and purchase equity after a rise in price. A net demand for portfolio insurance manifests itself in an increase in equity price volatility regardless of whether the insurance is implemented by the use of put options or by dynamic trading strategies. See the articles by Sanford Grossman for details.

tal sales on the New York Stock Exchange on October 19, 1987, the day the stock market crashed.

When financial markets are complete and there are no frictions like transaction costs and imperfect information, derivative instruments are redundant assets. In such a setting, the presence or absence of derivatives has no implications for the riskiness of financial markets or the volatility of underlying assets. In reality, financial markets are not complete and there are frictions, so the presence or absence of derivatives matters for the economy.

The theoretical and empirical evidence on how the introduction of derivatives affects the economy is limited. However, the existing evidence suggests that derivatives do not appear to add to financial market risk as a whole.²¹ However, they do involve some risks to individuals and firms.²²

RISKS ASSOCIATED WITH THE USE OF DERIVATIVE INSTRUMENTS

Many firms and individuals use derivative instruments as part of an overall strategy to manage the various risks they face. Sophisticated risk-management techniques evaluate the overall riskiness of investment portfolios that include options and other derivatives. However, assessing the risks of these portfolios generally requires practitioners to use models of option pricing that are only approximations. Sometimes these models do not perform as well as practitioners would like, and, after the fact,

²¹Jerome Detemple and Philippe Jorion review some of the theoretical and empirical work on the effects of option introduction on the stock market. The empirical work in the article suggests that after the introduction of an option, the price of the underlying stock rises and the volatility of the underlying stock falls.

²²The paper by Rajna Gibson and Heinz Zimmermann has a more detailed discussion of the risks associated with the use of derivatives.

the firm can find itself exposed to more or less risk than it desired. In addition, financial innovation has led to new and more exotic securities that are increasingly difficult to price. Thus, the *inaccuracies in various pricing models* may lead investors and traders astray.

Another risk is that one party may default on the contract, which is called *credit risk*. Credit risk is not much of a problem for derivatives traded on organized exchanges, since these exchanges are designed in such a way that their contracts are almost always honored.²³ Credit risk is much more of a problem in the OTC market, where two parties negotiate a derivative contract specific to their needs. For example, a bank may enter into offsetting swap arrangements with two firms. If neither firm defaults, the bank is fully hedged. But if one firm defaults, the bank will still have to honor its arrangement with the other firm, and so it faces a credit risk. Banks can try to mitigate some of this risk by requiring collateral from the firms participating in the swap arrangement or by obtaining third-party guarantees.

Another risk in the use of derivative instruments is *liquidity risk*, which refers to the ease with which the contract can be traded. Liquidity risk is not specific to derivative contracts; it can play a significant role in any financial market during periods of high volatility or signifi-

cant changes in economic fundamentals. However, even during the market crash of October 1987, both standardized and OTC derivative markets remained viable, and no market collapse or major liquidity crisis occurred. The structure of the standardized and OTC markets appears to have been adequate to manage liquidity risk in the past. Further, there is little evidence that liquidity risk has increased with the size of derivatives markets.

When securities become illiquid, however, it is more difficult to determine their market value. As a consequence, when firms try to sell illiquid securities they may find that the market value of their portfolios and securities differs substantially from the values that are “on the books.” The models that firms use to manage their risks and make financial decisions may then give incorrect answers because incorrect values for the securities were used in the analysis.

CONCLUSION

Derivatives markets have shown tremendous growth over the last 10 years. While much has been made of recent derivatives-related losses, the economic benefits provided by derivative securities are more important. Derivatives help the economy achieve an efficient allocation of risk. They assist in completing markets, thereby providing firms and individuals with new investment opportunities. Derivatives provide information to financial market participants and may help reduce overall market volatility.

²³Organized exchanges use arrangements such as daily marking to market and clearinghouses to guarantee performance of the contract.

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