Managing Stock Market Risk With Stock Index Futures

By Charles S. Morris

Stock market investments always have been risky because stock returns are volatile. Stock returns are volatile because investors continually assess the effects of economic events on firm values. Some events are specific to an individual firm and therefore affect only that firm's stock price. Other kinds of events affect virtually all firms, causing the value of the entire market to change. For example, when the stock market collapsed on October 19, 1987, the price of nearly every publicly traded stock fell.

Stock investors traditionally have managed the volatility of returns due to firm-specific events by diversifying their portfolios. But diversification cannot reduce the volatility of returns caused by marketwide events like the October 1987 collapse. To protect themselves from marketwide events, stock investors traditionally have had to sell some of their portfolio and to buy other, less risky securities or to buy stocks that are influenced less by marketwide events. Such methods, however, are often costly and inconsistent with desired investment strategies.

The development over the past decade of stock index futures has given investors in stocks a new and better way to manage stock market risk. This article explains how stock index futures allow investors to manage risk by hedging the exposure of stock portfolios to marketwide events. The first section of the article discusses how stock market risks have traditionally been managed. The second section describes stock index futures and discusses the growth of stock index futures trading. The third section shows how stock index futures are used to manage market risk and explains their advantages over traditional methods of managing market risk. The fourth section discusses some of the limitations of managing risk with stock index futures.

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Traditional forms of risk management

Investments in stocks are risky because their returns are uncertain. Stock returns are uncertain because stock prices and dividends vary over time. Volatility in prices and dividends comes from two sources. One source is economic events specific to individual firms. The second source is economic events that affect every firm in the economy. Investors have generally found it more difficult to manage the second type of stock market risk.

Events unique to a specific firm are the primary source of volatility in an individual firm's stock returns. Indeed, the volatility in returns caused by firm-specific events is called *firm-specific* risk. For example, if a pharmaceutical company discovers a new drug, its stock price may rise. This company's discovery, however, would not directly affect any other company's stock price. If the company does not get approval to market the drug from the Food and Drug Administration, only that company's stock price would fall.

The stock returns of individual firms are also affected by marketwide events that affect the stock returns of all firms in the economy. The volatility in returns caused by marketwide events is called *market risk.* For example, an increase in interest rates might lower the earnings outlook for virtually every firm in the economy, causing all stock prices to fall.

Investors manage risk by choosing the amount of risk they are willing to incur. Some investors are willing to bear relatively high levels of risk, while others are not. In general, investors will not choose to minimize risk because there are costs to reducing risk. Because the risk and the expected return of an investment are inversely related, the main cost of reducing risk is a lower expected return.

To successfully manage risk, investors must independently manage both firm-specific risk and market risk. Firm-specific risk is traditionally managed by holding a diversified portfolio of stocks. Diversification can reduce risk because events specific to an individual firm have no direct effect on other firms. For example, suppose an investor invests in the stocks of a pharmaceutical company and an oil company. If the oil company happens to discover a new oil field and the pharmaceutical company has a new drug petition denied, the increase in the oil company's stock price could offset some or all of the decrease in the pharmaceutical company's stock price. As a result, the volatility of a diversified portfolio's returns is likely to be lower than that of any of its component stocks.

Diversification across stocks, however, cannot reduce market risk. For example, if an increase in interest rates causes all stock prices to fall, the change in one firm's stock price could not offset the change in another firm's stock price. Even the value of a completely diversified portfolio that contains every traded stock—that is, the stock market as a whole—would fall. Thus, investors must use other methods to manage market risk.

Market risk can be managed in two ways using traditional risk management techniques. One way is to adjust the share of stocks in an investment portfolio.[1] For example, an investor can decrease a portfolio's exposure to market risk by decreasing the share of stocks in the portfolio and increasing the share of other assets, such as bonds. A second way to reduce market risk is to sell stocks that have a large amount of market risk and buy stocks with a small amount of market risk. For example, the value of an S&L is very sensitive to changes in interest

rates, while the value of a retail grocery store is not. Thus, an investor who has a portfolio that includes S&L stocks could reduce the portfolio's exposure to market risk by selling the S&L stocks and buying retail grocery stocks.

In contrast to diversification, these traditional methods for managing market risk are often costly and inconsistent with desired investment strategies. Adjusting portfolio shares is often inconsistent with a strategy of investing heavily in stocks. For example, the manager of a stock mutual fund must invest in stocks, but the manager cannot do so and simultaneously reduce market risk by selling stocks.

Substituting low market-risk stocks for high market-risk stocks also has several problems. First, very few stocks have a small amount of market risk because all firms are affected by marketwide events, such as changes in interest rates. Second, stocks that have a small amount of market risk might not fit into an investor's overall investment strategy. For example, an investor who has detailed knowledge about S&Ls but very little knowledge about retail grocery stores would not want to sell S&L stocks and buy retail grocery stocks. Finally, a stock with a small amount of market risk might have a large amount of firm-specific risk.

An introduction to stock index futures

The limitations of the traditional methods of managing market risk have led investors to search for new risk management techniques. Since they began trading in 1982, stock index futures have become an extremely popular tool for managing market risk. This section provides an overview of stock index futures, highlighting some of their similarities and differences with other types of financial futures.

What are stock index futures?

A financial futures contract is an agreement between two parties to buy or sell a financial asset, such as a Treasury bond or foreign currency, at a given time in the future for a predetermined price. Stock index futures are financial futures contracts in which the underlying asset is a group of stocks included in one of the major stock price indexes such as the Standard & Poor's 500 Composite Stock Price Index.

In a financial futures contract, nothing is exchanged when the contract is written because it is only an agreement to make an exchange at a future date. In a typical futures contract, the buyer of the contract agrees to take delivery of the underlying asset at the agreed price when the contract expires. The seller of the contract agrees to deliver the asset at the agreed price on the expiration date.

In most financial futures contracts, physical delivery of the asset rarely occurs. Indeed, in some futures contracts, delivery is not even permitted. In most financial futures contracts, a buyer or seller settles the contract by taking an offsetting position in the same futures contract before delivery. For example, a buyer of a March Treasury bond futures contract can offset the position by selling a March Treasury bond futures contract before the expiration date of the contract.

Stock index futures are one type of futures contract that requires traders to settle contracts by taking an offsetting position. The reason that delivery is not permitted in stock index futures is that it would be impractical for a person who, say, sells an S&P 500 index futures contract to deliver all 500 stocks in exactly the proportion in which they make up the index. Although delivery is not allowed, there is a "delivery"

or expiration date for stock index futures contracts. On this date, any unsettled contracts are settled by taking an offsetting position at the price of the underlying index.

Although delivery of the underlying stocks is not allowed in stock index futures contracts, thinking about the contract as if delivery were allowed may make the concept of a stock index future more intuitive. For example, if in March an investor were to buy a June S&P 500 index futures contract, the investor would simply be agreeing to buy in June the 500 stocks in the proportion in which they make up the index. Similarly, if an investor were to sell a June S&P 500 index futures, the investor would simply be agreeing to sell the stocks in June.

Profits and losses in stock index futures

As in other futures markets, traders in stock index futures will generally earn profits or suffer losses when they settle a contract. To make a profit, futures traders must sell futures for a higher price than they pay. Whether a stock index futures trader gains or loses, therefore, depends on two conditions: whether futures were initially bought or sold, and whether the price of the futures contract rises or falls between the time the initial contract is established and the time an offsetting position is taken.

A buyer of stock index futures makes a profit when the futures price rises and suffers a loss when the futures price falls. Suppose, for example, on March 10 an investor buys a June S&P 500 index futures contract for $300 per unit of the contract, and on April 20 settles the position by selling a June S&P 500 index futures contract for $305.[2] Under these circumstances, the investor would make a profit of $5 per unit because he offset his position by selling a futures contract for $5 more than he paid.[3] On the other hand, if the price falls to $297 on April 20, the investor would lose $3 per unit because he offset the position by selling a futures contract for $3 less than the original purchase price.

In contrast, a seller of stock index futures suffers a loss when the futures price rises and makes a profit when the futures price falls. Suppose on March 10 an investor sells a June S&P 500 index futures contract for $300 per unit of the contract, and on April 20 settles the position by buying a June S&P 500 index futures contract for $305. The investor would suffer a loss of $5 because he offset his position by buying a contract for $5 more than he initially received from selling the contract. On the other hand, if the price falls to $297 on April 20, the investor would make a profit of $3 because he offset his position by buying a contract for $3 less than he initially received from selling the contract.

Growth in stock index futures trading

Stock index futures are one of the more recent financial futures. Stock index futures are used primarily by institutional investors, such as stock mutual funds, pension funds, and life insurance companies. The first stock index futures contract began trading in February 1982, when the Kansas City Board of Trade introduced a contract based on the Value Line Index. This contract was soon followed by a futures contract based on the S&P 500 index, which began trading on the Chicago Mercantile Exchange in April 1982. A futures contract based on the New York Stock Exchange Composite Index began trading on the New York Futures Exchange in May 1982. Although other contracts have begun

CHART 1

Open interest in S&P 500 index futures

Note: Values are monthly averages of daily open interest in the nearest S&P 500 index futures contract with at least one month until expiration.

Source: Data Resources Inc.

trading since 1982, the S&P 500 index futures is the most popular stock index futures contract.[4]

Despite their relatively short history, stock index futures have gained widespread acceptance by stock market investors. One measure of activity in a stock index futures contract is open interest in the contract—the number of contracts not yet offset by opposite transactions. Chart 1 shows the open interest in the S&P 500 index futures contract from June 1982 to December 1988. Although open interest in S&P 500 index futures is fairly volatile, the trend is clearly upward. From June 1982 to December 1987, open interest rose at an average rate of 250 percent per year. While open interest has not grown much since the end of 1987, it has remained very high, suggesting that stock index futures remain popular among investors.[5]

Managing market risk with stock index futures

Stock index futures have been successful because they have opened up new dimensions for managing market risk through hedging. In contrast to traditional methods of managing

market risk, hedging with stock index futures is relatively inexpensive and is consistent with most investment strategies.

Why stock index futures can hedge market risk

Investors face market risk when marketwide events cause the value of their stock portfolios to change. The market risk of a portfolio is usually measured as the volatility of that part of the portfolio's returns that is correlated with the returns of the overall stock market.

To hedge market risk, an investor must be able to take a position in a hedging asset such that profits or losses on the hedging asset offset changes in the value of the stock portfolio when marketwide events occur. For example, when marketwide events cause the value of an investor's portfolio to fall, the investor needs to make a profit on the hedging asset. The risk reduction from hedging is not free, however. Because risk and expected return are inversely related, the primary cost is that the investor's expected return will also fall.

Stock index futures can hedge market risk effectively because changes in stock index futures prices will generally be highly correlated with changes in stock portfolio values caused by marketwide events.[6] That is, when marketwide events cause the value of the stock portfolio to change, these same events will cause stock index futures prices to change. As a result, the investor can use changes in the value of a stock index futures contract to offset—that is, to hedge—changes in the value of his portfolio caused by marketwide events.

The more diversified the portfolio, the greater the correlation between the value of the portfolio and the price of stock index futures. The reason is that the primary source of risk in a well-diversified portfolio is market risk. That is, diversification eliminates most of a portfolio's firm-specific risk. For example, Chart 2 shows the value of a well-diversified stock portfolio and the price of the S&P 500 index futures.[7] The portfolio is considered to be well diversified because market risk accounts for 99 percent of its total risk.[8] As expected, the futures price and portfolio value follow each other quite closely. Because of this close relationship, stock index futures should be very effective at hedging the risk of this portfolio.

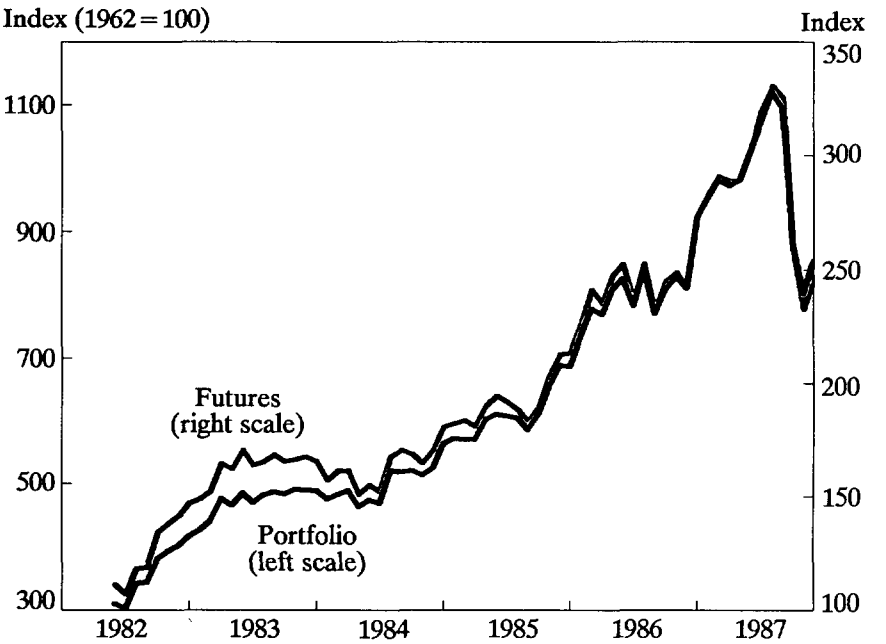
How stock index futures hedge market risk

In general, investors who hold stock portfolios hedge market risk by selling stock index futures.[9] An investor in a stock portfolio that contains market risk suffers a loss when the market falls because the value of his portfolio will also fall. But if the market falls, stock index futures prices will fall as well. When the market falls, therefore, an investor needs to make a profit from falling futures prices to offset the loss on his portfolio. Since sellers of futures make a profit when futures prices fall, the investor would hedge by selling futures. Similarly, when the market rises, the losses on the futures contract at least partly offset the profits on the original stock portfolio. Thus, by selling stock index futures, investors can reduce the price volatility of their portfolios caused by marketwide events.[10]

The reduction in price volatility that can be achieved by hedging is shown in Chart 3. This chart compares the values of the well-diversified portfolio and the same portfolio hedged by sales of S&P 500 index futures.[11] The value of the hedged portfolio is clearly less variable than the

CHART 2

Diversified portfolio value and futures price



Note: The futures price is the price of the nearest S&P 500 index futures contract with at least one month until expiration. The portfolio consists of stocks of the largest firms on the New York Stock Exchange (NYSE). These firms have a market capitalization (stock prices time shares outstanding) equal to 10 percent of the NYSE capitalization.

Sources: The futures prices are from Data Resources, Inc. The portfolio values are from the Center for Research in Securities Prices.

value of the unhedged portfolio. In fact, the volatility of returns on the hedged portfolio, measured by its variance, is 91 percent lower than the volatility of the returns on the unhedged portfolio. The effectiveness of the hedge in reducing market risk is easily seen in October 1987, the month of the stock market collapse. From the end of September 1987 to the end of October 1987, the value of the unhedged portfolio fell 19 percent, while the value of the hedged portfolio fell only 6 percent.

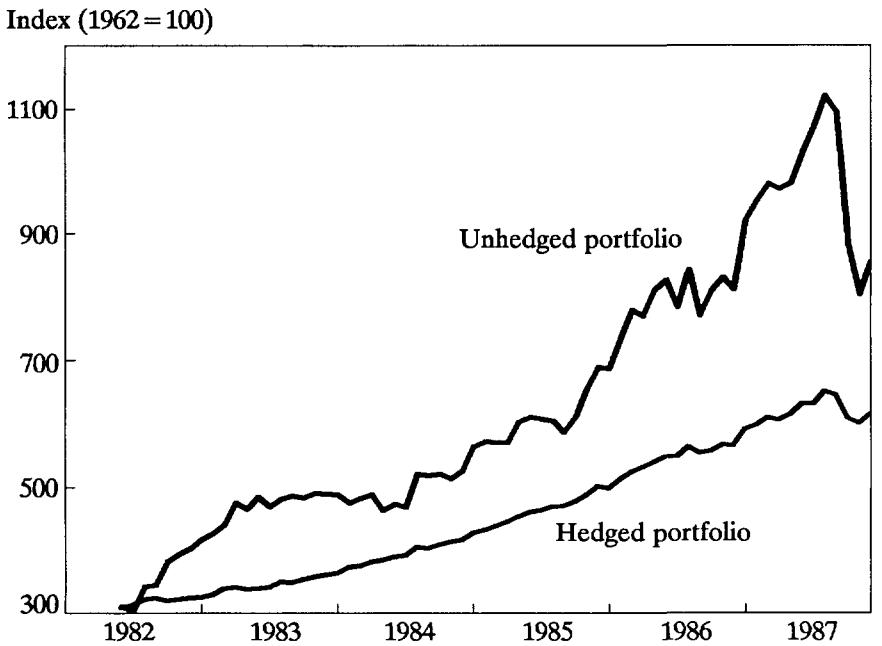
Advantages of stock index futures over traditional techniques

Managing market risk by hedging with stock index futures does not suffer from the same problems associated with traditional methods of managing market risk. Stock index futures are relatively inexpensive and are consistent with desired investment strategies.

Relative to traditional methods of managing market risk, stock index futures are inexpen-

CHART 3

Hedging market risk



Note: The portfolio consists of stocks of the largest firms on the New York Stock Exchange (NYSE). These firms have a market capitalization (stock prices times shares outstanding) equal to 10 percent of the NYSE capitalization. The hedged value is the value of the minimum-risk hedged portfolio of stocks using the nearest S&P 500 index futures contract with at least one month until expiration.

Sources: The futures prices are from Data Resources, Inc. The portfolio values are from the Center for Research in Securities Prices.

sive because the transaction costs of establishing a futures position are low. When a position is established, the only outlays are broker fees and an initial margin deposit with the broker.[12] The fees paid to brokers and traders are quite small. For example, the cost of establishing and settling a position in an S&P 500 index futures contract is only $25.[13] Because a single S&P 500 index futures contract is worth 500 times the futures price, the total value of a contract that costs, say, $300 would be $150,000, and the $25 fee would be less than .02 of a percent of the underlying value of the contract. The initial margin is also relatively small—the margin on an S&P 500 index futures contract used for hedging purposes is $4,000. The cost of meeting the initial margin requirement is very small because investors generally can earn interest on the initial margin by using U.S. government securities to meet the margin requirement.[14]

Hedging market risk with stock index futures is also consistent with most investment strat-

egies. In contrast to traditional methods of managing market risk, an investor who hedges market risk with stock index futures does not have to alter the composition of his portfolio. For example, stock fund managers do not have to sell part of their portfolios to reduce market risk. Nor would an investor in S&L stocks have to sell his stocks and buy low market-risk stocks with which he might not be familiar. To manage market risk by hedging with stock index futures, the investor simply has to sell the correct amount of stock index futures contracts.

Limitations of stock index futures

Despite the advantages of hedging market risk with stock index futures, there are some limitations. One important limitation is that stock index futures provide no protection against firm-specific events. In addition, the investor can be exposed to other forms of risk.[15]

Basis risk

Hedging with futures allows investors to reduce, but generally not to completely eliminate, risk. Basis risk is the risk that remains after a portfolio has been hedged. Because stock index futures only hedge market risk, firm-specific risk is the primary source of basis risk in a portfolio hedged with stock index futures.[16]

The basis risk of a hedged stock portfolio will be high when the portfolio contains a large proportion of firm-specific risk. That is, stock index futures will not be very effective in reducing the overall risk of a relatively undiversified portfolio. The reason is that firm-specific events generally have no impact on the value of the market and therefore will not affect futures prices. Because fluctuations in portfolio values due to firm-specific events are not related to futures prices, stock index futures will not provide a good hedge for these changes in portfolio values.[17]

The significance of basis risk is shown in Charts 4 and 5. Chart 4 compares the value of a relatively undiversified stock portfolio and the price of the S&P 500 index futures contract. In contrast to the well-diversified portfolio (Chart 2) in which firm-specific risk accounted for just 1 percent of total risk, firm-specific risk accounts for 34 percent of the total risk of the portfolio in Chart 4.[18] The futures price and portfolio value are related, but not nearly as closely as are the futures price and well-diversified portfolio value.

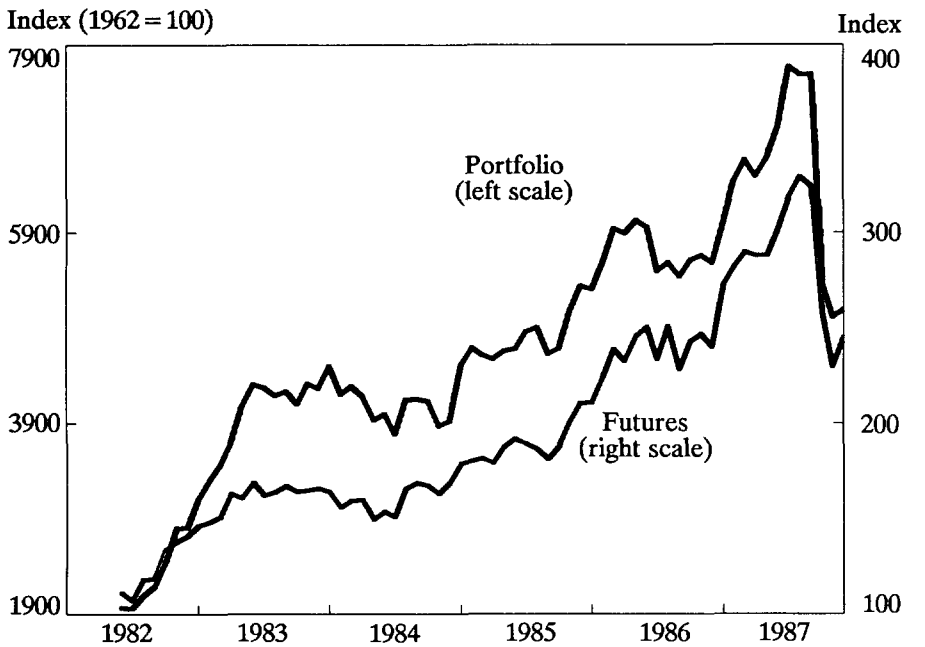
Because the value of the relatively undiversified portfolio and the futures price are not closely related, stock index futures should be less effective at hedging the total risk of this portfolio. Chart 5 compares the values of the unhedged portfolio and the same portfolio hedged by sales of S&P 500 index futures.[19] The variance of returns on the hedged portfolio is just 27 percent lower than that of the unhedged portfolio. The relative ineffectiveness of the hedge is easily seen in October 1987. From the end of September 1987 to the end of October 1987, the value of the hedged portfolio fell 24 percent, only slightly less than the 29 percent decline in the value of the unhedged portfolio.

New risks

One new type of risk involved in futures trading is marking-to-market risk. This is the risk that arises because futures traders have to cover their futures losses at the end of each day. All futures exchanges require every unsettled futures position to be marked to market every

CHART 4

Undiversified portfolio value and futures price



Note: The futures price is the price of the nearest S&P 500 index futures contract with at least one month until expiration. The portfolio consists of stocks of the smallest firms on the New York Stock Exchange (NYSE). These firms have a market capitalization (stock prices times shares outstanding) equal to 10 percent of the NYSE capitalization.

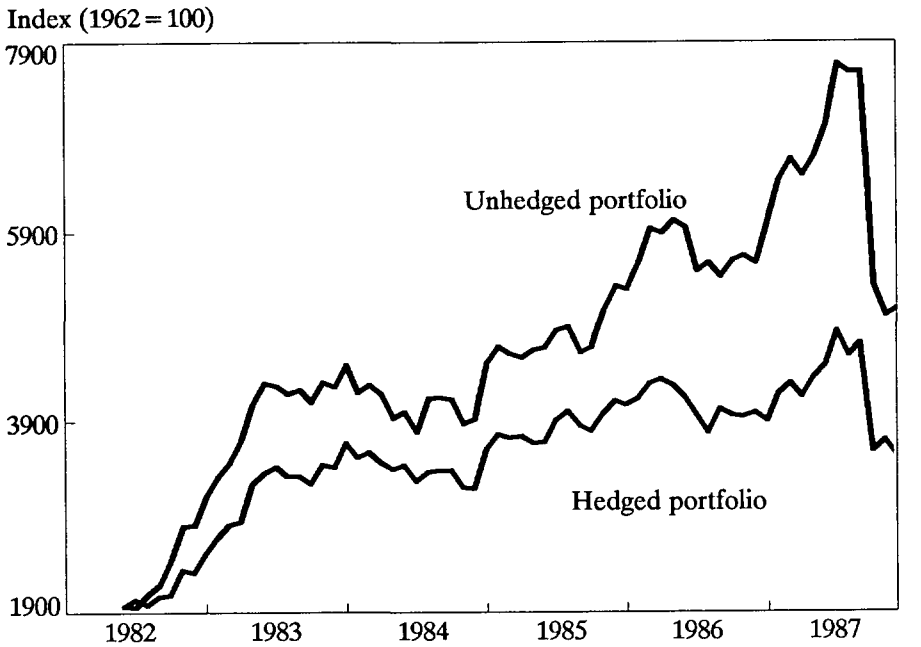
Sources: The futures prices are from Data Resources, Inc. The portfolio values are from the Center for Research in Securities Prices.

night and settled daily. That is, at the end of each day, funds are transferred from individuals who lose on their contracts to individuals who gain on their contracts so that buyers and sellers actually realize the gains and losses from daily price changes as they occur. A problem could occur for those who suffer losses on their futures position, though, because they must make immediate cash outlays. Although losses on stock index futures contracts are generally offset by gains on the stock portfolio being hedged, investors usually do not receive those gains as they occur. Therefore, investors would either have to liquidate some of their investments and lose the associated income flows or pay interest on borrowed funds to cover their futures losses as they occur.

A second type of risk involved in futures trading is managerial risk. Managerial risk, broadly defined, is the risk stock index futures will be used inappropriately and result in greater, rather than less, risk. This is really a "catch all" category that accounts for anything else that can go wrong with a hedging program.

CHART 5

Hedging an undiversified portfolio



Note: The portfolio consists of stocks of the smallest firms on the New York Stock Exchange (NYSE). These firms have a market capitalization (stock prices times shares outstanding) equal to 10 percent of the NYSE capitalization. The hedged value is the value of the minimum-risk hedged portfolio of stocks using the nearest S&P 500 index futures contract with at least one month until expiration.

Sources: The futures prices are from Data Resources, Inc. The portfolio values are from the Center for Research in Securities Prices.

One major reason that managerial risk arises is that stock index futures can be used for speculative purposes. In addition to being good assets for hedging market risk, stock index futures are also good assets for speculating on stock market movements for two reasons. First, it costs very little to establish a futures position, and second, stock index futures are just as risky as the market. An institution that wants to hedge with futures must have internal controls to make sure those responsible for hedging are not speculating.

Managerial risk also arises because hedging strategies involving stock index futures can become complicated. Because they can be complicated, it is possible for managers to make incorrect decisions that significantly lower a portfolio's value. For example, suppose a manager wants to minimize the market risk of a stock portfolio, but he overhedges by selling too many futures contracts. If the market were to rise, the losses on the futures position could be much

greater than the gains on the portfolio. Thus, when overhedged, the riskiness of a portfolio is greater than the minimum level of risk and the expected return is less than that associated with the minimum level of risk. In fact, the riskiness of an overhedged portfolio can even be greater than the riskiness of the unhedged portfolio. To control this risk, it is important that managers understand the complexities of hedging with stock index futures, the capabilities and limitations of a hedging program, and the need to continually monitor hedging programs.

Conclusion

Stocks have always been relatively risky investments. While investors in stocks have always been able to manage the firm-specific risk component of total risk through diversification, managing the market risk component has traditionally been costly and inconsistent with desired investment strategies. The development of stock index futures, however, has provided investors in stocks with a new, low-cost tool for managing market risk. As a result, stock index futures are one of the most successful financial innovations of recent years. They have become an essential part of virtually every stock portfolio manager's tool kit for managing market risk.

This article showed how stock index futures can be used successfully to manage market risk. It must be remembered, though, that hedging with stock index futures can be complex, and investors must thoroughly examine all aspects of stock index futures and hedging techniques before implementing a hedging strategy.

Endnotes

[1] In a sense, adjusting the share of stocks in an investment portfolio is diversification, but it is diversification across different types of assets as opposed to diversification across different stocks. Throughout this article, diversification means diversification across different stocks.

[2] Actually, the quoted price of a futures contract itself is an index. The value of an S&P 500 index futures contract is $500 times the level of the index. The value of one unit of the contract, therefore, is 1/500 of the total value of the contract, or $1 times the level of the index. The total value of one contract at $300 per unit is $150,000 (500 units times $300 per unit).

[3] Because the contract is for 500 units, the actual profit is $2,500 (500 units times $5 per unit).

[4] The Value Line Index, Standard and Poor's 500 Composite Stock Price Index, and New York Stock Exchange Composite Index contracts are each worth $500 times the index level. A contract equal to $250 times the Major Market Index is traded on the Chicago Board of Trade exchange, and a contract equal to $100 times the Value Line Index (Mini Value Line) is traded on the Kansas City Board of Trade exchange.

[5] One reason open interest has leveled off is that many traders have shied away from trading stock index futures since the stock market collapsed in October 1987.

[6] These changes are highly correlated because both are highly correlated with changes in the value of the overall market. As discussed in the text, market risk is measured by the correlation between portfolio returns and market returns. Stock index futures prices are highly correlated with the value of the market because (1) broad stock indexes, such as the S&P 500 index, are used to measure the value of the market, and (2) stock index futures prices are highly correlated with the underlying index.

The price of any futures contract is always highly correlated with the price of the underlying asset. The theoretical relationship between the price of a futures contract and the

price of its underlying asset is known as the cost-of-carry theory of futures prices. Prices do deviate slightly from cost of carry, though, because of transaction costs and capital market imperfections. For a detailed discussion of the relationship between stock index futures prices and stock prices, see Bradford Cornell and Kenneth R. French, "The Pricing of Stock Index Futures," *The Journal of Futures Markets* (Spring 1983), pp. 1-14.

7 The best stock index futures contract for hedging a particular stock portfolio is the futures contract whose price is most correlated with the value of the portfolio. Stock prices move together, though, so most of the stock indexes—and therefore most of the stock index futures prices—move together. Thus, for the purposes of these examples, it makes little difference which futures contract is used. The S&P 500 index futures contract is used in all examples because it is by far the most popular of the stock index futures contracts.

8 Total risk is measured by the variance of the portfolio's total monthly returns over the period from July 1982 to December 1987. Market risk is measured by the variance of the predicted returns from a regression of the portfolio's monthly returns on market returns over the same period. For a discussion of how market risk is measured, see Thomas E. Copeland and J. Fred Weston, *Financial Theory and Corporate Policy*, 2d ed., (Reading, Mass: Addison-Wesley Publishing Co., 1983).

The S&P 500 index is used to measure market returns. Theoretically, the market portfolio contains every asset in the economy. Since it is not possible to observe the true market returns, however, an imperfect measure must be used. While there are many broad stock indexes that can be used to measure market returns, the various indexes generally move together. As a result, the qualitative conclusions reached in the text remain the same as long as one of the broad indexes is used to measure market returns.

9 Although this section describes how stock index futures hedge market risk, stock index futures are also often used for reasons other than purely hedging market risk. Some strategies, such as stock selection and market timing, are used in an attempt to outperform the market. Portfolio managers also use stock index futures to give them more flexibility in liquidating a portfolio. For more information on these strategies, see Stephen Figlewski, *Hedging with Financial Futures for Institutional Investors: From Theory to Practice* (Cambridge, Mass.: Ballinger Publishing Co., 1986) pp. 115-54. Stock index futures are also used in portfolio insurance strategies. For a discussion of portfolio insurance, see Peter A. Abken, "An Introduction to Portfolio Insurance," *Economic Review*, Federal Reserve Bank of Atlanta (November/December 1987), pp. 2-25. Finally, stock index futures are used by arbitragers who try to make a profit from discrepancies between actual stock index futures prices and the prices that would be predicted from the cost-of-carry theory of futures prices. For a discussion of index arbitrage, see John J. Merrick, Jr., "Fact and Fantasy About Stock Index Futures Program Trading," *Business Review*, Federal Reserve Bank of Philadelphia (September/October 1987), pp. 13-23.

10 Although investors in stock portfolios generally sell stock index futures to hedge their portfolios, there are times when they buy stock index futures. For example, a portfolio manager who wants to purchase some stocks but does not expect to have the necessary funds for several days faces the risk that the market will rise in the interim. The manager could hedge the risk that arises from changes in the market by buying futures. If the market rises, the loss from having to pay a higher price for the stocks will at least be partly offset by the profit on the futures. On the other hand, if the market falls, the profit from buying the stocks at a lower price will at least be partly offset by the loss on the futures.

11 For simplicity, this example assumes that the investor wants to minimize risk. In general, investors would not *minimize* the risk of a stock portfolio with stock index futures. The reason is that the expected return on such a portfolio is the risk-free rate, which the investor could get at a much lower cost by simply investing in Treasury bills. The example also ignores the effects of margin requirements, transaction costs, taxation, accounting practices, and regulatory requirements on the value of the hedged portfolio, all of which could affect the value of the hedge and the hedging strategy. The prices are end-of-month data, and the futures price is on the nearest contract with at least one month until expiration.

The example does not account for the possibility that risk could be reduced further by (1) using futures with contract months that are further out, or (2) estimating the number of contracts to sell over shorter time periods and then adjusting the number of contracts to account for the changes. On the other hand, the example could be overstating the degree of risk reduction because the number of contracts sold is estimated from actual price data over the hedging period, whereas investors must estimate the number of contracts using data from periods prior to the hedging period.

12 The margin on a futures contract is "good faith" money deposited with a broker to assure him that losses can be covered in the event of adverse price movements.

13 See Arnold Kling, "Futures Markets and Transaction

Costs," in Myron L. Kwast, ed., *Financial Futures and Options in the U.S. Economy: A Study by the Staff of the Federal Reserve System* (Washington, D.C.: Board of Governors of the Federal Reserve System, 1986), pp. 41-54.

14 The minimum initial margin and the minimum level that must be maintained are set by the exchanges and are changed from time to time. The margin level depends on factors such as the volatility of the price of the underlying instrument. Margins also may depend on whether a person is just buying or selling futures alone or is buying or selling futures to establish a hedge. The margin on an outright purchase or sale of an S&P 500 index futures for speculative purposes is $6,500. Although investors can earn interest on the initial margin by depositing U.S. government securities, they can not earn interest on additions to the margin account because additions must be made with cash. Cash is required because additions are for losses on a contract that are transferred to the accounts of parties that have gained from price movements.

15 One risk that individuals do not have to be concerned about is the risk of the opposite party defaulting on a futures contract. The reason is that every futures exchange has a clearing organization that is a party to every futures contract in order to guarantee the integrity of the contract. In effect, then, the clearing house is the seller in every contract bought and the buyer in every contract sold.

16 Hedging a stock portfolio with stock index futures will completely eliminate risk only if the values of the portfolio and the futures are perfectly correlated. In general, the correlation is not perfect for two reasons. The primary reason is that most portfolios contain firm-specific risk. In addition, though, stock index futures do not even provide full protection from marketwide events because the value of the market is not perfectly correlated with the value of the futures contract. In other words, even if an investor were to diversify away all firm-specific risk and hold the market portfolio, the hedged portfolio would still contain some residual, or basis, risk.

17 Although stock index futures are less effective at hedging the total risk of a portfolio with a relatively large share of firm-specific risk, they are equally effective at hedging the market risk of portfolios with large or small shares of firm-specific risk.

18 Firm-specific risk is measured by the variance of the residual returns from a regression of the monthly portfolio returns on the S&P 500 index returns over the period from July 1982 to December 1987.

19 The qualifications and assumptions that applied to the hedge of the well-diversified portfolio in Chart 3 also apply to this example (see note 11).