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## AN EXAMINATION OF FUTURES CONTRACT INVESTMENT POTENTIAL

T. Randall Fortenbery*
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Robert J. Hauser

Faculty Working Paper No. 135 November 1988



DEPARTMENT OF ECONOMICS AND BUSINESS
NORTH CAROLINA STATE UNIVERSITY
RALEIGH, NORTH CAROLINA

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*The authors are Assistant Professor, Department of Economics and Business at North Carolina State University and Associate Professor, Department of Agricultural Economics at the University of Illinois, respectively.

Measuring risk premiums in futures markets has been the focus of a considerable body of futures market literature. Keynes defined risk premiums to be the reward gained by a futures speculator who offsets a hedger's market position. Within this context, risk premiums have usually been measured as the expected monetary return to a speculator associated with holding a futures position.[1] However, risk premiums represent only a portion of potential benefits to be derived from futures market speculation, and thus may not fully express speculative rewards.

In addition to risk premiums, a speculator may be able to acquire risk management benefits through a reduction in overall portfolio risk. This risk management benefit may be available to a speculator who can identify futures contracts and futures trading strategies with returns that are inversely correlated with other investments held in the portfolio. This is an important point. Previous research efforts have not attempted to explicitly measure this component of futures market investment potential, but several researchers, including Dusak, and Lee and Leuthold have hypothesized that such a benefit may exist based on their findings of inverse correlations between futures returns and stock returns. Thus, measuring the investment potential of futures contracts involves quantifying this risk management benefit as well as the risk premium. The purpose of this paper is to develop and apply a methodology capable of quantifying both futures market risk premiums, as historically defined, and risk management benefits. The resulting measure is for a general

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[1]It should be noted that risk premiums are generally defined as the speculative return associated with normal backwardation, or the downward bias of futures prices relative to spot prices. There may be speculators capable of generating positive returns to futures trading because of some specialized trading skill in addition to normal backwardation, and thus risk premiums may not be the only explanation for positive futures trading returns when they are found to exist.

class of speculators who possess no specialized trading skills, but who have acquired a representative portfolio attainable in the market.

The idea of measuring futures market risk premiums in a portfolio context was first introduced by Dusak in the 1970s. Her work was followed by Bodie and Rosansky; Lee and Leuthold; Carter, Rausser, and Schmitz; Marcus; and Baxter, Conine, and Tamarkin. The focus of these studies was to identify a proxy for the perfectly diversified market portfolio, and then measure risk premiums relative to the market portfolio. Thus, risk premiums were assumed to be a market phenomenon and not unique to an individual investor's portfolio. The results of previous analyses regarding the existence of risk premiums are mixed. However, these studies have been similar in terms of underlying assumptions. The first of these assumptions is that there is a group of hedgers and a group of speculators in the market that are distinct and separate, and that they and their market activity can be identified as two separate groups. Second, if there is a risk premium available to futures speculators, the risk premium is global and as such should be measured relative to the return of the perfectly diversified market portfolio. The implication of a global market risk premium is that any futures speculator can receive at least the futures market risk premium as a reward for market activities, and that the premium would have the same expected value for all speculators. The third basic assumption does not apply to some of the more recent research but is still quite common. This assumption is that if a risk premium is found for a sample of commodities, it is indicative of a general market phenomenon; i.e., risk premiums can then be assumed to exist across all commodities and across time.

Consistent with previous studies, futures market risk premiums are defined here as a positive change in expected portfolio return resulting from the addition of a futures contract to a portfolio. An extension to this premium reward is also considered. If the addition of a futures contract to a portfolio results in a reduction in portfolio risk but no increase in portfolio return, then it is concluded that a risk management benefit exists but no risk premium. It should be noted, however, that the distinction between risk premiums and risk management benefits is somewhat nebulous. Both risk premiums and risk management benefits provide trading rewards to an investor, and over some range of expected utility, an investor may be indifferent between a risk premium and a risk management benefit. Regardless of semantics, the focus of this analysis is on measuring the investment potential of futures contracts in terms of both risk premiums and risk management benefits.

## Methodology

Since it is not assumed that the futures market investment potential is homogeneous across investors, no attempt is made here to measure the futures market investment potential relative to the market portfolio. However, an individual investor's portfolio investment set must be identified. The investor is defined as one who views his initial investment set to consist solely of stocks traded on the New York Stock Exchange. This investment set is then augmented by futures contracts, and the investment potential of futures contracts measured.

The futures market investment potential is measured through E-V analysis. The general approach is somewhat similar to that of Howard and D'Antonio, except that the focus is on speculators rather than hedgers, and the precise value of the futures contract to the investor is measured differently.[2]

To measure the investment potential of futures contracts, efficient E-V frontiers are estimated for portfolios with and without futures contracts as an investment option. If an investment potential exists, then the frontier that includes the futures contracts will lie up and to the left of the frontier that excludes futures, as illustrated in Figure 1. The frontier points used are those representing the optimal risky portfolio on each E-V frontier. Following Elton and Gruber, this optimal risky portfolio is found at the tangency between the E-V frontier and the capital market line. These are points A1 and B1 in Figure 1. Given the above definition, the risk premium to the futures contract in Figure 1 is the difference between expected portfolio return at points B1 and A1. In this illustration there is a positive risk premium associated with the futures contract. There is also a risk management benefit. It is measured by the difference in the variance between points A1 and B1. Note that if the optimal risky portfolio associated with frontier B lies inside the quadrant defined by the dashed lines, both a risk premium and a risk management benefit are available. If the optimal portfolio for frontier B is to the right of the vertical dashed line and above the horizontal dashed line, then there is a risk premium but no risk management benefit. If the optimal risky portfolio on frontier B lies below the horizontal dashed line, no risk premium exists, but there is still a risk management benefit. This is the potential investment area not considered in previous risk premium studies. Note that without

[2]Howard and D'Antonio measured the hedging value of the Standard and Poor's 500 Futures Index for a stock investor. Their methodology was also based on E-V analysis. They concluded that there is no hedging potential to the stock futures index.

information on a specific investor's utility function, we do not know if the investor's preferred portfolio (which may include the risk-free asset) lies inside or outside the dashed quadrant along ray $R_F B1$. Thus, analyses that ignore the investment area below the horizontal dashed line do not fully consider the investment potential of futures contracts. As a result, failure to identify a futures market risk premium does not imply a lack of investment potential in futures markets. To conclude no investment potential exists, one must also show that there is no risk management benefit to be derived from trading futures contracts.

## Empirical Model

The first step in analyzing futures market investment potential is to construct a portfolio frontier for an investment set consisting solely of stocks. This is done using quadratic programming (QP). The specific QP formulation is as follows:

$$(1) \qquad \text{MINIMIZE } V(Z) = \sum_{i=1}^{n} \sum_{j=1}^{n} q_i \sigma_{ij} q_j$$

subject to:

$$\sum_{i=1}^{n} q_i U_i \geq M$$

$$\sum_{i=1}^{n} q_i = 1$$

$$q_i \geq 0 \text{ for } i = 1,2,\ldots,n$$

where $q_i$ is the proportion of each risky investment i in the portfolio; $\sigma_{ij}$ is the variance-covariance matrix of expected rates of return; $U_i$ is the expected rate of return for investment i; and M is the minimum acceptable rate of portfolio return. This model is solved iteratively with parametric variations in M.

Since it is impractical to consider the entire universe of stocks in solving the QP model, proxies representing industry groups of stocks are used. The proxies used are the four individual indices of the Standard and Poor's 500 Stock Index. There are four individual indices representing utilities, industrials, financials, and transportation stocks.[3]

Using data from July 1976 to December 1985, monthly returns to stock portfolios are computed as the percentage change in average monthly index values plus the average monthly rate of dividend returns to each index. An E-V frontier is then estimated using the four stock indices as the investment set. The resulting capital market line is defined by the highest linear function between the risk-free rate of return on the vertical axis and a tangency on the E-V frontier. The tangency point between the capital market line and the E-V frontier represents the optimal risky portfolio.

Individual futures contracts are then added to the investment set and the E-V frontier is reestimated. The optimal portfolio for the new E-V frontier is identified, and the risk premiums and risk management benefits are measured. Following Bodie and Rosansky, the return to the futures positions are calculated as the monthly percentage changes in the futures prices plus the risk-free rate of return. The average ninety-day Treasury Bill (T-bill) rate

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[3]It is assumed that the portfolios identified using the indices are close proxies for portfolios which are actually attainable. However, this is not a critical assumption since the primary emphasis of this analysis is to identify a methodology which can be applied to any unique investment set, and not the results derived from the specific investment set considered here.

is used to represent the risk-free rate of return because it is possible to post T-bills for futures margin requirements.

The portfolio E-V frontiers are not intended to represent the most efficient investment sets possible. There are several investment alternatives these portfolios do not consider such as real estate, bonds, and, initially, individual futures contracts. The purpose of these initial frontiers is to provide a point from which the potential effects of futures contracts on the returns to relatively well diversified investors are investigated. There are two reasons why no attempt is made to consider perfectly diversified investors; i.e., investors who hold the "market" portfolio. First, it is probably impossible to identify the market portfolio. This is evident from earlier studies. Past researchers have chosen a proxy for the market portfolio (Dusak) and then been criticized for a poor choice (Carter, Rausser and Schmitz), and so on. These debates have made it clear that there are no universally acceptable market proxies. The second and more important reason is that it is unlikely that an investor could or would hold the market portfolio. If, in general, investors held perfectly diversified portfolios, there would be no reason to consider the investment potential of futures contracts, or any other security, since they could have no positive impact on investors' holdings. Also, if an investor is interested in holding the market portfolio then, by definition, it would be simpler to hold a single risk-free instrument.

By restricting the investors' set of investment alternatives to the four stock indices (utilities, industrials, financials, and transportation), the E-V frontier in Figure 2 is estimated. This frontier represents all the efficient risky portfolios attainable by an investor who views his investment alternatives to consist solely of stocks. By assuming a risk-free rate of return equal to the ninety-day T-bill rate, an optimal risky portfolio for the investor is identified that yields an expected monthly rate of return of 1.29 percent and a risk level of 6.11 percent per month.[4]

Four agricultural futures contracts are examined for investment potential. These are the live cattle, the live hog, the corn, and the soybean contracts. In addition to examining the four contracts individually in a portfolio context, the investor is assumed to take positions in more than one contract, and long and short positions in the Commodity Research Board's Commodity Futures Index (CFI). This is done to consider the implication of more diversified futures positions.

Several trading scenarios are considered for each contract. The first is a routine buying strategy where the investor trades long in the nearby contract. Since futures contracts do not expire every month, positions are opened and closed only in those months preceding contract expiration. As a result, to estimate monthly observations it is necessary to divide the gross return of a futures trading strategy by the number of months a position is held. For live cattle, for instance, this requires dividing each gross return by two. This is because live cattle contracts expire every other month, thus a position is opened and closed every two months.

The second trading scenario considered is the same as the first, except that the investor takes a short position in the nearby contract. The third and fourth strategies are the same as the first and second, respectively except that more distant maturing contracts are traded. For these strategies, a

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[4]This study uses the variance of expected returns as a proxy for risk. Saying that the risk level for a specific portfolio is 6% a month is identical to saying that the variance of expected monthly returns is 6%. As a result, the terms risk and variance are used interchangeably.

position is taken in a contract that is approximately six months from maturity. This position is offset and a position taken in the next distant contract when that contract is six months from maturity. These last two strategies are employed to evaluate potential differences in the risk or return characteristics that may be caused by contracts of varying maturities. One reason only routine trading strategies are considered is that they provide a good illustration of how to use the methodology. The second reason is that as the trading strategy becomes more sophisticated, the identification of routine or general risk premiums (or risk management benefits) becomes less clear, since some trading rewards may be the result of special trading information or skill.

The specific months in which futures positions are opened and closed for each contract and trading strategy are given in Table 1. Note that the trading months vary depending on the contract being traded.

## Results

A graphical interpretation of adding long nearby live cattle contracts to the stock investment set is given in Figure 3. The addition of the cattle contract causes the E-V frontier to move out to the left, indicating that trading benefits are available for the nearby live cattle contract traded long. These benefits as well as those for other contracts are quantified in Table 2.

When measured at the optimal risky portfolio points, the live cattle futures contract does not provide risk premiums for any of the trading strategies. However, risk management benefits are indicated. The greatest risk management benefit is derived from trading the live cattle contract long.

Trading the nearby contract long reduces risk by 1.5 percent per month with no change in the expected rate of return, while trading the distant contract long results in a risk reduction of about 2.3 percent per month, but also a reduction in the expected rate of return of about 0.12 percent per month. Without information on a specific investor's utility function, we cannot determine which live cattle contract traded long is most beneficial to a given investor because the one with the lowest risk also has the lowest rate of return. When applying this methodology to a specific investor, however, a preference can be determined based on the individual's utility mapping.

The results associated with the four trading strategies for hog futures are very similar to those for live cattle. As shown in Table 2, there is no evidence of risk premiums when hog contracts are included in the investment set. Again, however, some risk management benefits exist. As in the case of cattle, the largest risk management benefit is derived from trading the hog contract long. This benefit, however, is not as large as the risk management benefit available from trading live cattle long. Thus, while the hog contracts behave much like the live cattle contracts, their effects on the portfolio's risk and return characteristics are not as large as those for live cattle.

For the nearby live cattle traded long, the futures contract represents 26.19 percent of the portfolio, and in the case of nearby hogs traded long, 17.92 percent. Bodie and Rosansky argue that futures should comprise 30 percent of the optimal market portfolio, whereas Marcus contends that 10 percent is more appropriate. For this investor the optimal percentage of individual livestock futures in the portfolio falls between these two estimates.

risk management benefit is derived from trading corn short rather than long. When corn is traded short on the nearby contract, frontiers similar to those for nearby live cattle traded long are generated. As can be seen from Table 2, trading the nearby corn contract short yields no risk premium, but as in the case of the live cattle contract traded long, there exists a measurable risk management benefit. This same result is generated when the distant corn contract is traded short. When the nearby corn contract is traded long, there is no risk premium and little risk management benefit. Trading the distant corn contract long has the same impact as the nearby corn contract traded long. Neither a risk premium nor a substantial risk management benefit is identified in the distant corn contract traded long.

For soybean futures, long positions in either the nearby or distant contracts do not cause an increase in risk premium. For the nearby contract traded long, there is also no risk management benefit available to the investor (Table 2), although there is some risk management benefit if the distant contract is traded long.

When soybeans are traded short, the shift in the initial E-V frontier appears more dramatic than for any other contract. Figure 4 shows the frontier derived by including the nearby soybean futures contract traded short in the investment set compared to the original all-stock frontier. Note that at the maximum rate of return, 1.36 percent per month, the frontier that includes soybeans as an investment choice lies to the left of the all stock frontier. This is unique because in all other cases this rate of return was a point at which the frontiers including and excluding futures contracts converged (illustrated by the case of nearby live cattle futures traded long in Figure 2). Also note from Table 2 that trading the nearby soybean futures contract short is the only instance in which the expected rate of return to the optimal portfolio increases when an individual futures contract is included in the investment set. By definition this implies a risk premium to the stock investor from trading the soybean futures contract short. However, the risk premium is only 0.04 percent per month. It is likely that this represents an insignificant increase in the investor's expected rate of portfolio return, since it results in an annual increase in the expected rate of portfolio return of only 0.48 percent. Note further that trading the soybean futures contract short provides less risk management benefit than any other trading strategy for an individual contract in which a risk management benefit is identified. Thus, while the nearby soybean contract traded short appears to provide the most dramatic shift in the investor's E-V frontier, it does not appear to provide as great a trading benefit as some other individual contracts and trading strategies.

If the investor includes both livestock futures in his investment set, the risk management benefit is even greater than for either individual futures. If he simultaneously includes nearby live cattle and nearby hogs in the investment set, the expected rate of return associated with the optimal portfolio falls from 1.29 to 1.27 percent per month, and portfolio variance declines by 2.03 percent per month. This variance level is about five tenths of a percent below the best portfolio performance of an individual nearby livestock futures contract. The total futures position of the portfolio is a little over 30 percent. This is evident in Table 3. Note that for all other trading scenarios considered here, holding both livestock futures simultaneously is more beneficial than trading an individual livestock future using the same strategy. The implication is that there is some benefit to this investor from diversifying in livestock futures markets.

When the investor is allowed to trade both grains short simultaneously, the same type of shift in the E-V frontiers associated with trading nearby soybeans short is realized, but the benefits to the traders are larger. The monthly expected rate of return when both nearby grains are traded short is 1.35 percent per month, with a monthly risk level of 3.38 percent. This is the only other trading strategy in which expected portfolio return increases as a result of futures contracts. Again, however, it is a very small increase in expected return. More interesting than the rather small risk premium is the reduction in optimal portfolio risk, and the percentage of the optimal portfolio held in futures. Portfolio risk is reduced from 6.11 percent per month to 3.38 percent per month, or by a yearly rate of over 32 percent. In addition, soybeans and corn combined comprise almost half the optimal portfolio. This is the most dramatic effect found on the investor's portfolio, and one that is quite substantial. The implication is that, as is the case with livestock, there are benefits to diversifying in the grains markets.

Results are generated allowing the investor to hold either a long or short position in the CFI to proxy the effects of being totally diversified in the futures market. Since the largest impacts in the previous sections were generated in the nearby contracts, a nearby strategy is considered here. Note from Table 3 that there is very little difference between trading the CFI index short or long. There is some portfolio risk reduction available from either strategy but at a substantial reduction in expected portfolio return. Thus, there are several strategies for both individual and combined contracts discussed above that represent superior investments to the CFI index.

there are several strategies for both individual and combined contracts discussed above that represent superior investments to the CFI index.

It is likely that both the short and long position in the CFI generate such similar results because they are both heavily dominated in terms of their return characteristics by the ninety-day T-bill rate. The expected rates of return to the CFI for both the long and short positions without the ninety-day T-bill rate included are very nearly zero, and when these two strategies are included in the investment set without including the T-bill rate in their returns, neither is held as a part of the optimal portfolio, and thus neither benefits the market position of the investor. One reason might be that the individual contracts that should be held long and those that should be held short cancel out each other when they are forced to be held the same way.

Thus, while livestock and grains results suggest some benefit to the investor from diversifying in the futures market, total diversification in futures contracts (as represented by the CFI) does not appear to be worthwhile.

## Summary and Conclusions

The E-V model used in this research is found to be useful in identifying the investment potential of futures contracts. It differs from previous futures market research in two ways. First, it allows measurement of both the risk premium and risk management benefit of futures market investments. Previous analyses dealing with the rewards to futures market speculation focused primarily on identifying risk premiums. It is argued here that the absence of futures market risk premiums does not imply an absence of speculative rewards. To conclude that no speculative rewards exist for a given addition of a futures position. The E-V model specified here can measure both risk premiums and risk management benefits.

The second difference between the E-V model specified here and other models used to measure risk premiums is that the E-V model allows risk premiums and risk management benefits to vary across investors and across commodities. Rewards to futures speculation may be a unique function of a specific portfolio's risk and return characteristics. Previous research assumed that risk premiums were a market phenomenon, in terms of both their existence and magnitude. Thus, all speculators were expected to receive identical rewards from similar futures market positions.

For the investor and futures contracts considered here, there are no substantial futures market risk premiums. There are, however, trading benefits associated with including some futures contracts in the investment set. These benefits are realized as reductions in the level of portfolio risk, and are referred to here as risk management benefits to futures contracts. The finding of no risk premium is consistent with the results of Dusak, Lee and Leuthold, and others. In addition, the finding of a risk management benefit supports the hypothesis introduced by Dusak, and Lee and Leuthold, as well as that by Bodie and Rosansky. They all argue that futures contracts can diversify the non-systematic risk components of stock portfolios.

One surprising result is that the largest reduction in portfolio risk from trading livestock contracts is realized from long positions, whereas the greatest benefits from trading the grains comes from short positions. This is surprising because it suggests that the livestock and grain markets are inversely correlated, which seems counterintuitive. Given that corn is a major input in livestock feeding, we would expect the prices for livestock and corn to move in similar directions, indicating that they should have similar effects on the risk and return characteristics of stock portfolios when they are traded the same way. This result may be due to the data period considered in the study. The first part of the data period is marked by grain prices falling from the historical highs, while livestock prices experienced steady increases. Thus, the inverse relationship between the grain and livestock futures contracts may be a function of these general trends, and not of general market relationships.

An interesting result is that risk premiums are not found for the futures contracts and speculator considered here. However, every contract considered provides opportunities to reduce the risk level of an all-stock portfolio, and thus we conclude that there is some futures market investment potential available to the speculator identified in this study. This is an important result because it empirically verifies the argument that futures contracts can provide a positive trading benefit to speculators even in the absence of positive risk premiums. It should be noted that the E-V results do not account for transactions costs associated with acquiring and maintaining either stocks or futures positions, and that the investment benefits are measured relative to optimal risky portfolios. An actual investor's optimal portfolio may include a risk-free asset, and thus lie somewhere else along the capital market line.

In light of the discussion above, implications for further research include breaking the investor's choice set down into several individual stocks and futures contracts. If this is done, then the E-V model could be solved relative to levels of investor return rather than rates of return. The objective of the E-V model would then be to minimize portfolio risk subject to minimum acceptable levels of income, rather than minimum acceptable rates of return. The primary advantage of disaggregating the investment set would be empirical results more applicable to individual investors. The disadvantage would be a model with a significant increase in the number of parameters, and thus higher computational costs associated with its solution. The degree to which investment alternatives should be disaggregated depends on how investor specific one wishes the empirical results to be, and what resource constraints are faced in solving the models.

In addition to disaggregating the investment set, further research could be conducted considering different futures contracts and different futures trading rules. Work could also be conducted for different time periods and for investment sets that contain assets other than stocks and futures contracts. All such efforts could contribute to our understanding of the investment potential of futures contracts.

Table 1. Trading months for various futures contracts.

| Contract | Maturing Month | Nearby Roundturn Open | Nearby Roundturn Close | Distant Roundturn Open | Distant Roundturn Close |
|---|---|---|---|---|---|
| Live Cattle | February | November | January | August | October |
| | April | January | March | October | December |
| | June | March | May | December | February |
| | August | May | July | February | April |
| | October | July | September | April | June |
| | December | September | November | June | August |
| Hogs | February | November | January | August | October |
| | April | January | March | October | December |
| | June | March | May | December | January |
| | July | May | June | January | February |
| | August | June | July | February | April |
| | October | July | September | April | June |
| | December | September | November | June | August |
| Corn | March | November | February | September | November |
| | May | February | April | November | January |
| | July | April | June | January | March |
| | September | June | August | March | June |
| | December | August | November | June | September |
| Soybeans | January | October | December | July | September |
| | March | December | February | September | November |
| | May | February | April | November | January |
| | July | April | June | January | February |
| | August | June | July | August | May |
| | November | July | October | May | July |

Table 2. Optimal portfolio characteristics when individual futures contracts are included in the investment set.

| Investment | Return[a] | Risk[b] | Percentage of Optimal Portfolio |
|---|---|---|---|
| All Stocks | 1.29 | 6.1142 | 100 |
| Cattle Contracts | | | |
| Nearby Long | 1.29 | 4.7931 | 26.190 |
| Nearby Short | 1.23 | 4.7931 | 7.446 |
| Distant Long | 1.17 | 3.8300 | 26.677 |
| Distant Short | 1.15 | 3.8122 | 26.111 |
| Hog Contracts | | | |
| Near Long | 1.29 | 5.0076 | 17.923 |
| Near Short | 1.29 | 6.1091 | 0.5316 |
| Distant Long | 1.27 | 4.7712 | 19.092 |
| Distant Short | 1.25 | 5.5708 | 5.5026 |
| Corn Contracts | | | |
| Near Long | 1.29 | 6.0911 | 1.4404 |
| Near Short | 1.26 | 4.6979 | 22.694 |
| Distant Long | 1.28 | 6.0040 | 1.4384 |
| Distant Short | 1.28 | 4.3377 | 30.758 |
| Soybean Contracts | | | |
| Near Long | 1.29 | 6.1142 | 0.0000 |
| Near Short | 1.33 | 5.4547 | 16.735 |
| Distant Long | 1.27 | 4.9335 | 3.4799 |
| Distant Short | 1.27 | 4.9335 | 3.4799 |

[a]Measured as percent per month.
[b]Measured as percent per month.

Table 3. Optimal portfolio characteristics when trading more than one futures contract.

| Investment | Return[a] | Return[b] | Percentage of Optimal Portfolio |
|---|---|---|---|
| All Stocks | 1.29 | 6.1142 | 100 |
| Livestock Contracts | | | |
| Nearby Long | 1.27 | 4.0840 | |
| Cattle | | | 21.736 |
| Hogs | | | 9.7252 |
| Nearby Short | 1.23 | 5.3449 | |
| Cattle | | | 7.4362 |
| Hogs | | | 0.0900 |
| Distant Long | 1.18 | 3.5741 | |
| Cattle | | | 19.593 |
| Hogs | | | 12.248 |
| Distant Short | 1.15 | 3.8125 | |
| Cattle | | | 26.107 |
| Hogs | | | 0.0000 |
| Grain Contracts | | | |
| Nearby Long | 1.29 | 6.0911 | |
| Corn | | | 1.4404 |
| Soybeans | | | 0.0000 |
| Nearby Short | 1.35 | 3.3766 | |
| Corn | | | 9.1230 |
| Soybeans | | | 39.075 |
| Distant Long | 1.27 | 4.9335 | |
| Corn | | | 0.0000 |
| Soybeans | | | 3.4799 |
| Distant Short | 1.23 | 4.0979 | |
| Corn | | | 28.947 |
| Soybeans | | | 4.2255 |
| Futures Index | | | |
| Long | 1.19 | 4.1730 | 25.6666 |
| Short | 1.18 | 4.4907 | 19.2660 |

[a]Measured as percent per month.
[b]Measured as percent per month.

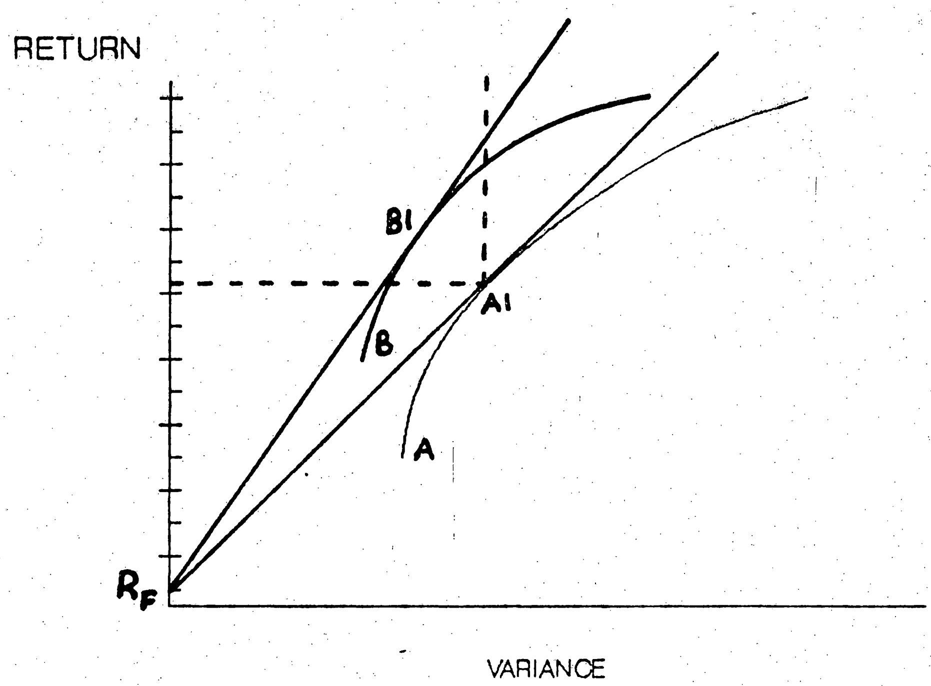


Table 1. Risk premiums and risk management benefits defined.

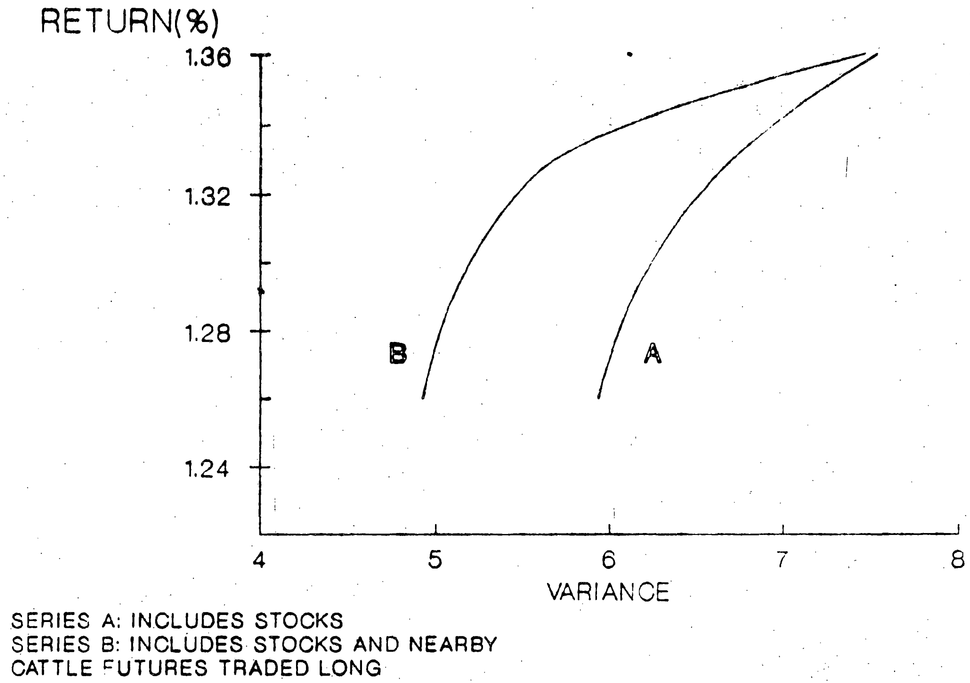


Figure 2. Results trading nearby live cattle futures long.

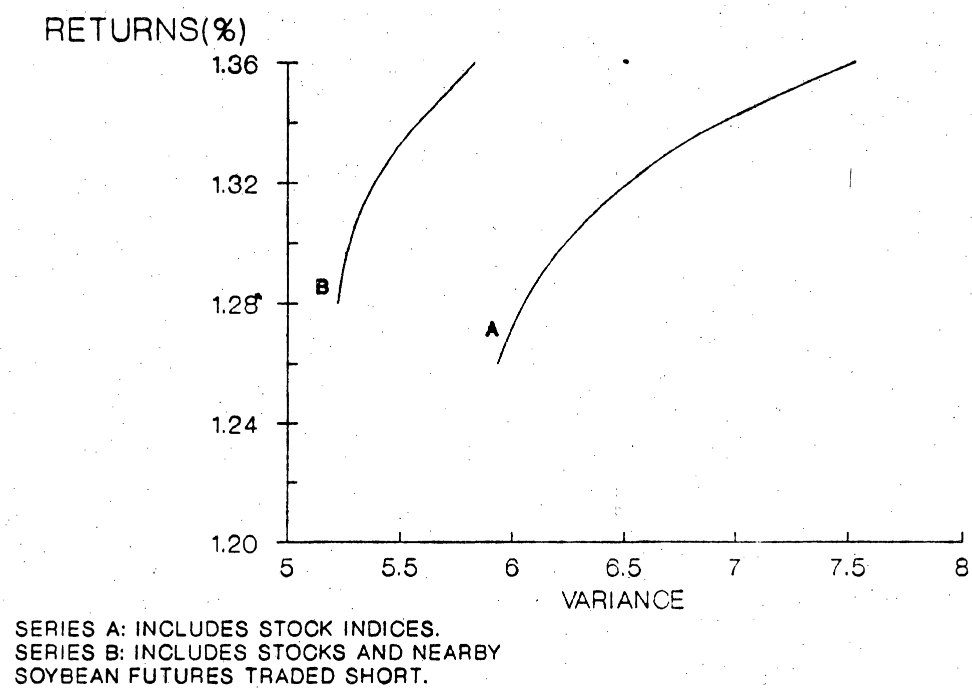


Table 3. Results trading nearby soybean futures short.

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