The Performance of Futures Funds: Implications for Futures Market Efficiency

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Paper presented,
American Agricultural Economics Association Meeting,
Cornell University
August 5-8, 1984

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I. Introduction

Futures funds have grown rapidly since their introduction in 1976. Nine such funds were active in January 1979 while sixty-four were in existence as of June 1983. Over the same period the dollar amount invested in these funds increased from 120 to 400 million dollars (Baratz).

Futures funds, which trade commodity futures contracts, operate similarly to the mutual funds that invest in securities. Typically, a futures fund is organized in the following fashion: a brokerage house, acting as general partner, sets up a limited partnership registered with the Securities and Exchange Commission, and issues a prospectus. It may call, for example, for a $5 million dollar fund, consisting of 5,000 units of $1,000 dollars each. A minimum purchase of five units is generally required. Public futures funds differ from private pools run by some brokers that are made up of 35 or fewer investors, each of whom invests more than most limited partners in public funds. Also, private pools are not required to be registered with the Securities and Exchange Commission.

The buying and selling of futures contracts for a futures fund is usually carried out by an independent, outside trading advisor in return for a fee and percentage of profits. A distinguishing characteristic of fund managers is their reliance on technical analysis to guide trading decisions. The two most frequently used types are charting and trend-following "systems". Exceptions are Harvest Futures I, Harvest Futures II, and Lake Forest Futures Fund whose trading advisors use a combination of technical and fundamental analysis (Crim; Baratz).

Futures funds provide investors with several advantages. First, they provide a diversified futures market portfolio. Second, funds offer a chance to participate in futures trading while limiting potential losses to the size of the initial investment. Third, they provide professional management whose trading decisions may well be "better" than the decisions of most of the investing public. Finally, funds offer advantages otherwise available only to large traders such as earning interest on margin deposits.

Despite the advantages, futures funds subject investors to considerable risk. For example, the front page of the prospectus for each fund reads: "The partnership will trade commodity futures contracts. Such business and these securities involve a high degree of risk. These securities are suitable for investment only by a person who can afford to lose his entire investment." (Heinold Securities, Inc.; Blyth Eastman Dillon & Co.). Precisely because of this riskiness investors need information concerning the ranking of commodity funds as an investment alternative. Other researchers interested in evaluating these funds as investments used inadequate techniques. More information can be gained by using Meyer's stochastic dominance procedure (Meyer, 1977a) to compare the performance of these funds to alternative investments.

In this paper the performance of futures funds is compared to returns from common stocks (as measured by Standard and Poor's Composite Index) and U.S. Treasury Bills. These results are used to draw implications concerning 1) the performance of futures funds relative to alternative investments and 2) the efficiency of futures markets.

The first section of the paper examines risk adjusted performance measures and market efficiency concepts. Subsequent sections present

the data and testing results. Finally, conclusions are drawn regarding the investment performance of futures funds and futures market efficiency.

II. Stochastic Dominance

The search for a risk adjusted measure of investment performance has been the focus of much research. Early efforts sought to produce a single measure that included risk (Sharpe; Treynor; Jensen). One of these, Sharpe's reward-to-variability criterion, was used by Powers to evaluate the futures funds. Unfortunately, this measure has been criticized because it is correlated with variability (Ang and Chua; Wilson and Jones).

Theoretical research on risk usually assumes investors attempt to maximize their expected utility. Empirical work has often only considered the mean and variance of probability distributions, placing unnecessary restrictions on the expected utility function. Rothschild and Stiglitz narrowed the gap between the theoretical and empirical work on risk by introducing a theoretically valid and empirically useful definition of increasing risk. This definition considers the entire probability distribution instead of just the first two moments.

The ranking of distributions can be accomplished by stochastic dominance procedures (Hadar and Russell; Hanoch and Levy;). In theory, these stochastic dominance criteria are ideal methods for ranking distributions, but in practice they work poorly because of the large number of distributions that cannot be ranked. Furthermore, only first degree stochastic dominance allows for risk seeking behavior which we might expect for some investors in futures funds. These problems can be

negated by using a method introduced by Meyer (1977a) which utilizes the Arrow and Pratt measure of local risk aversion, $r(X) = -U''(X)/U'(X)$, where X is either income or wealth and $U'(X)$ and $U''(X)$ are the first and second derivatives of the utility function. Any utility function can be uniquely expressed in terms of $r(X)$ (Pratt). The sign of the second derivative of the utility function, $U''(X)$, indicates whether an investor is risk-averse [$U''(X) < 0$] or risk-seeking [$U''(X) > 0$].

Meyer considers a group of decision makers whose risk preferences fall in a certain interval. He defines $U(r_1(X), r_2(X))$ as the set of agents with preferences represented by $r(X)$ such that

$$r_1(X) \leq r(X) \leq r_2(X) \quad \forall X \tag{4}$$

where $r_1(X)$ and $r_2(X)$ are known functions. For first degree stochastic dominance $r_1(X) = -\infty$ and $r_2(X) = +\infty$ while for second degree stochastic dominance the range is $[0, +\infty]$.

Empirical applications of Meyer's procedure have assumed $r_1(X)$ and $r_2(X)$ to be constants, thus investigating stochastic dominance over intervals (Meyer, 1977b; Kramer and Pope; King and Robison, 1981a; King and Robison, 1981b; Martin and Petty). The difficulty in empirical application of Meyer's procedure is specifying $r_1(X)$ and $r_2(X)$. Meyer (1977b) selected several intervals from the range [0.5, 6] based on the certainty equivalence rule. The most comprehensive work to date on measuring individual's risk preferences is a review of studies in the agricultural economics literature by Young, et al. This study was used by Kramer and Pope to select $r_1(X)$ and $r_2(X)$ as a series of intervals from the range [-.04, .03]. King and Robison (1981b) suggest the range [-.001, .01] based on their estimates of individual's risk preferences.

These estimates were based on risk preferences of farmers not investors. We might expect more extreme risk-seeking behavior for futures fund investors and more extreme risk averse values for investors in treasury bills. Also r(X) is sensitive to the units of measurement. Kramer and Pope adjusted their data to a mean of 20. King and Robison suggested their range for annual net income. The data used in this study have a lower mean. Thus, we will consider a slightly wider range than the one considered by Kramer and Pope and King and Robison (1981b).

III. Market Efficiency

Fama defined an efficient market as one that fully reflects all available information and then used this definition to develop tests of efficiency. Danthine criticized Fama's zero autocorrelation in returns tests of market efficiency as simultaneously testing (1) market efficiency, (2) perfect competition, (3) risk neutrality, (4) constant returns to scale and (5) the impossibility of corner optima. Danthine and Panton have offered the alternative definition that an efficient market is one that does not yield a return above a return to risk. In other words, a trader can not earn an "above normal" return. Rausser and Carter have offered further criticism, "There is a growing awareness that much of the empirical work that has been conducted on futures market efficiency is without a sound foundation." This empirical work has concentrated on a search for a random walk or more general martingale model (e.g., Dale and Workman; Stevenson and Bear). Stein argued that efficient markets would not necessarily follow a martingale if there is feedback from the price, which equates the stock demand to the stock in

existence, to the rate of change in the stock. Grossman and Stiglitz argue that Fama's definition is invalid because information is costly and thus prices cannot perfectly reflect the information available.

A number of researchers have evaluated efficiency with tests of the forecasting ability of futures markets (e.g., Kofi; Rausser and Carter). Rausser and Carter (p. 471) argue "if a forecasting scheme can be discovered which generates probability distributions -- which in some sense stochastically dominate the futures prices probability distributions -- the necessary condition (relative accuracy) for inefficiency holds." However, Rausser and Carter base their evaluation on mean-squared error criteria. Trapp has criticized these statistical procedures because they do not necessarily select the model that would yield the highest profit. Furthermore, Rausser and Carter (p. 477) admit that in evaluating efficiency a relative cost/benefit analysis is most important. In order to accomplish this they suggest evaluating forecasts on the basis of achievable speculative profits adjusted for risk.

Another method employed by researchers to investigate efficiency is to simulate returns from a technical trading strategy (e.g., Peterson and Leuthold; Taylor). These studies suffer from two deficiencies: 1) they have not accounted for risk and 2) they represent simulated rather than actual returns. Simulated returns ignore the action of scalpers and possible lags in getting an order filled. Importantly, the futures fund returns analyzed in this paper represent actual returns and thus do not suffer from the previous criticisms.

The discussion in this section points out the growing concensus that an efficient market is, as Danthine suggested, one in which a trader can not earn profits above the "normal" returns level available

in other economic sectors. In this paper "normal" returns are represented by returns from the two most common investments, common stocks (the S&P 500) and interest bearing deposits (U.S. Treasury Bills). Meyer's stochastic dominance procedure is an ideal tool for comparing commodity fund returns to common stock and treasury bill returns. If the futures funds are preferred to the other "normal" investments (over a range of risk preferences expected to include most investors), then futures funds yield "above normal" returns which are characteristic of inefficient futures markets.

IV. Data

The data consist of monthly total percentage returns from common stocks, U.S. treasury bills, and the futures funds. The base for the common stock returns is Standard & Poor's (S&P) Composite Index. This index is a market value weighted index, which means the weight of each stock in the index is proportional to its price times the number of shares outstanding. The S&P Composite Index includes 500 of the largest stocks in terms of value of outstanding shares.

Ibbotson and Sinquefield's method of calculating monthly common stock returns is used. Their results are published annually, and updates through May 1983 were obtained. In their method the monthly returns are calculated as

$$R_{m,t} = [(P_{m,t} + D_{m,t})/P_{m,t-1}] - 1 \qquad (1)$$

where $R_{m,t}$ is the common stock total return during month t; $P_{m,t}$ is the value of the S&P Composite Index at the end of month t; and $D_{m,t}$ is the estimated dividends received during month t. The series runs from December 1978 to May 1983.

The source for monthly U.S. Treasury bill returns was the same as for common stocks (Ibbotson and Sinquefield). To reflect achievable returns, rather than yields, the returns measure the gain for a one-month holding period of a one-bill portfolio.

U.S. Treasury bill monthly returns are designated as

$$R_{f,t} = [P_{f,t}/P_{f,t-1}] - 1 \qquad (2)$$

where $R_{f,t}$ is the U.S. Treasury bill total return during month t; and $P_{f,t}$ is end of calendar month t discount bill prices. Prices used are the average of bid and ask. The series runs from December 1978 to May 1983.

Monthly futures fund returns were obtained from Klopfenstein previous to April 1982. Thereafter, returns were taken from the monthly "Funds Review" published in Commodities. The total monthly return for futures fund i during month t, $R^i_{c,t}$ is calculated as

$$R^i_{c,t} = [(NAV^i_{c,t} + D^i_{c,t})/NAV^i_{c,t-1}] - 1 \qquad (3)$$

where $NAV^i_{c,t}$ is the net asset value per unit of futures fund i at the end of month t: and $D^i_{c,t}$ is the cash distribution received during month t.

Two sample periods were considered. The first sample, December 1978 to May 1983, contains six funds. Nine funds were in existence at the beginning of this sample period. However, one ceased trading due to the death of the trading advisor and two others were dissolved after losing over 50 percent of their capital. The bankrupt funds are not included because they have no continuous series of monthly returns and rational investors would prefer other investment alternatives to the bankrupt funds. The second sample, January 1981 - May 1983, includes

the six funds from the first sample plus fourteen funds which started trading later than December 1979.

The mean and standard deviation of monthly returns for the funds, common stocks, and treasury bills are presented in Table 1. Three funds had a mean return greater than both common stocks and treasury bills over the 1978-1983 period. The remaining funds had positive means which were greater than the mean return to treasury bills. All six funds had standard deviations higher than that of either common stocks or treasury bills. When the shorter 1981-1983 period is considered, nine of the twenty funds examined had mean monthly returns greater than common stocks. Also, six funds had mean returns which were negative. Similar to the longer period, no fund had a standard deviation over 1981-1983 which was lower than common stocks or treasury bills.

The previous information illustrates the need to analyze futures fund returns in a framework which incorporates risk. Many funds had higher mean returns than either common stocks or treasury bills, but this must be weighed against the substantially higher risk associated with the funds.

V. Results

The range of risk preferences used to compare the monthly returns of futures funds, common stocks and treasury bills was [-0.1, 0.1]. This range is expected to include the majority of investors. For the period 1978-1983, all six funds are preferred to treasury bills for all risk seeking investors (Table 2). None of the funds are dominated by treasury bills for risk neutral preferences. Treasury bills only become attractive as the level of risk aversion is increased. One fund is

Table 1. Mean and Standard Deviation of Monthly Futures Fund Returns.[a]

Fund or Security	Dec.1978-May 1983		Jan. 1981-May 1983	
	Mean	Standard Deviation	Mean	Standard Deviation
U.S. Treasury Bills	0.90	0.22	0.94	0.25
S & P 500	1.54	4.48	1.16	4.54
Harvest Futures Fund I	2.73	16.39	0.63	14.05
Illinois Commodity Fund	2.10	8.79	1.63	9.22
The Resource Fund	3.08	6.17	2.30	5.93
Thomson McKinnon Futures Fund	1.41	6.72	0.97	7.18
Recovery Fund I	1.26	11.15	-1.67	9.36
Recovery Fund II	1.06	11.69	-2.47	9.27
Aires Commodity Fund	--	--	1.83	8.88
Boston Futures Fund I	--	--	-0.79	12.53
Boston Futures Fund II	--	--	-1.06	12.79
Chancellor Futures	--	--	0.55	9.19
Commodity Trend Timing	--	--	1.19	6.86
Commodity Venture	--	--	2.33	5.48
Gallileo Futures Fund	--	--	0.27	8.15
Harvest Futures Fund II	--	--	1.35	14.43
Horizon Futures Fund	--	--	1.68	7.05
Hutton Commodity Partners	--	--	0.66	5.93
E.F. Hutton Commodity Ltd. Partnership II	--	--	3.37	16.88
Lake Forest Futures	--	--	-1.46	7.05
Peavey Fund I	--	--	-0.90	12.78
The Futures Fund	--	--	2.30	6.65

[a] Mean and standard deviation expressed as percent per month.

Table 2. Comparison of Futures Funds with Stocks and Treasury Bills, December 1978 - May 1983.[a]

		Treasury Bills			S & P 500		
$r_1(X)$	$r_2(X)$	Funds > Bills	Indifferent	Bills > Funds	Funds > S & P	Indifferent	S & P > Funds
-.10	-.02	6	0	0	6	0	0
-.02	-.005	6	0	0	3	3	0
-.005	.005	5	1	0	3	0	3
.005	.02	3	2	1	2	1	3
.02	.04	1	2	3	1	1	4
.04	.10	1	0	5	1	0	5

[a] Negative values of r(X) represent risk seeking preferences while positive values represent risk aversion. Risk neutrality is represented by the range [-.005, 005].

preferred to treasury bills over the full range of risk preferences considered.

The comparison with stock returns for the 1978-1983 period again shows all funds are preferred by highly risk seeking investors (Table 2). The S & P 500 is preferred to half of the funds by risk neutral investors. As with treasury bills, the S & P 500 becomes more attractive as the level of risk aversion increases and one fund is preferred to the stocks over the full range of risk preferences considered. Only this one fund can be said to exhibit "above normal" returns.

Over the period 1981-1983, fund performance is less attractive. A majority of the funds are preferred to both alternatives only for highly risk seeking preferences (Table 3). Risk neutral investors slightly favor treasury bills over the funds during this period.[2] One fund dominates treasury bills over the full range of risk preferences considered and two funds dominate the S & P 500.

The ranking of futures funds, common stocks, and treasury bills for each period depends heavily on risk preferences (Table 4). For example, E.F. Hutton's Commodity Ltd. Partnership II fund is ranked first over 1981-1983 in the highly risk seeking and risk neutral categories, but drops to fourteenth in the highly risk averse category. Similar to the earlier comparisons, the rankings of both common stocks and treasury bills rise appreciably as the level of risk aversion increases.

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[2] For the period 1978-1983 treasury bills were preferred to stocks for r(X) greater than .07. However, for 1981-83 treasury bills were preferred for r(X) greater than .05. This information is useful in determining the relevant range of risk aversion parameters to use in further research of this type. Since a large number of investors prefer treasury bills, some investors must be more risk averse than these levels.

Table 3. Comparison of Futures Funds with Stocks and Treasury Bills, January 1981 - May 1983.[a]

		Treasury Bills			S & P 500		
$r_1(X)$	$r_2(X)$	Funds > Bills	Indifferent	Bills > Funds	Funds > S & P	Indifferent	S & P > Funds
-.10	-.02	13	6	1	11	7	2
-.02	-.005	11	2	7	9	2	9
-.005	.005	8	3	9	7	2	11
.005	.02	6	2	12	6	1	13
.02	.04	3	3	14	3	3	14
.04	.10	1	2	17	2	1	17

[a] Negative values of r(X) represent risk seeking preferences while positive values represent risk aversion. Risk neutrality is represented by the range [-.005, 005].

Table 4. Ranking of Futures Funds, Common Stocks, and U.S. Treasury Bills.[a]

Fund or Security	Rank		
	Highly Risk Seeking	Risk Neutral	Highly Risk Averse
	December 1978 - May 1983		
The Resource Fund	5	1	1
Harvest Futures Fund I	1	1	8
Illinois Commodity Fund	4	3	5
S & P 500	7	4	3
Thomson McKinnon Futures Fund	6	5	4
Recovery Fund I	3	6	6
Recovery Fund II	2	7	7
U.S. Treasury Bills	8	8	2
	January 1981 - May 1983		
E.F. Hutton Commodity Ltd. Partnership II	1	1	14
Commodity Venture	12	2	1
The Futures Fund	9	3	4
The Resource Fund	11	3	3
Aires Commodity Fund	4	5	9
Horizon Futures Fund	12	6	6
Harvest Futures Fund II	2	6	21
Illinois Commodity Fund	7	6	11
S & P 500	19	9	4
Commodity Trend Timing	15	9	8
U.S. Treasury Bills	20	11	2
Thomson McKinnon Futures Fund	16	11	10
Chancellor Futures	9	13	13
Hutton Commodity Partners	17	13	6
Harvest Futures Fund I	3	13	22
Gallileo Futures Fund	14	16	12
Boston Futures Fund I	6	17	18
Peavey Fund I	4	18	19
Boston Futures Fund II	7	19	20
Lake Forest Futures	22	20	14
Recovery Fund I	18	21	16
Recovery Fund II	20	22	17

[a] The range of risk aversion parameters for the highly risk seeking, risk neutral, and highly risk averse categories are [-.1, -.08], [-.005, .005], and [.08, .1], respectively.

However, in both periods at least one fund ranked higher than either common stocks or treasury bills for each risk category.

VI. Conclusions

The results of this study indicate that one futures fund yielded "above normal" returns. However, a majority of the futures funds are preferred to both of the other investments only by risk seeking investors, probably a relatively small group. Since only a small number of investors would prefer the futures funds, the hypothesis that futures markets are efficient cannot be rejected. However, the results indicate futures markets may have been inefficient for a relatively brief period during 1980.[3] This period was characterized by structural change in financial and currency futures markets and a major manipulation in the silver futures market. Such occurrences may have favored technical trading schemes, which guide the trading decisions of nearly all fund managers. An alternative hypothesis is that potential for large profits existed at the time of the introduction of these funds, but as more users of computer based trading schemes entered the market, the potential for profit disappeared. More research is needed into the causes of profits to the technical trading strategies upon which the majority of these funds base their trading.

The conclusions of this study must be viewed in light of several criticisms. First, the relatively short time span of the sample period may not be adequate. Second, no portfolio or liquidity effects were

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[3] If only 1980 is considered all but one of the six funds dominates the other investments over the range $[-\infty, .08]$.

considered. Third, the exclusion of the returns from bankrupt funds means the risk of investing in futures funds is substantially underestimated. However, this only strengthens the conclusion that futures funds as a group have not exhibited "above normal" returns.

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