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Trading a Portfolio of Commodity Futures Using a 10-Day Channel Strategy

by

Emmett Elam
and
Dan Vaught*

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*Emmett Elam is Assistant Professor, Department of Agricultural Economics and Rural Sociology, University of Arkansas, Fayetteville, Arkansas 72701 and Daniel Vaught is a Graduate Research Assistant, Department of Agricultural Economics, University of Illinois, Urbana, Illinois 61801.

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Abstract

A 10-day channel strategy was used in simulated trading of a portfolio of cattle, soybean, silver and sugar futures from 1969-83. The return on the portfolio was significantly above the expected return for a portfolio with comparable risk. This is support for the hypothesis that trends exist in futures prices.

Trading a Portfolio of Commodity Futures
Using a 10-Day Channel Strategy

A formal theory of pricing efficiency in speculative markets was developed by Samuelson and Mandelbrot. The theory says that the day-to-day movement in stock, bond and futures prices should be random. If price movements are random, technical analysis which is based on trading trends in prices, cannot be used to achieve above normal returns after adjustments are made for risk.

The debate over whether price changes are random has a long history, even predating the development of the theory of efficient pricing. The first published study was by Bachelier who in 1900 concluded that price changes should be random. Statistical investigations in the 1950's and early 1960's showed that speculative prices were approximately random, and any divergences from randomness were fairly minor. More recently, Kamara surveyed the literature and found little compelling evidence to reject the random walk hypothesis.

Despite the empirical findings that do not reject the Samuelson-Mandelbrot hypothesis, some researchers believe it is very unlikely that truly efficient pricing can exist. According to Beja and Goldman, prices are often in disequilibrium because of changes in fundamental factors, and adjustment to new equilibrium prices does not occur immediately. During the time the adjustment is taking place, prices can move in trends. This is consistent with Goldenberg's conclusion that prices are best approximated by a non-Markovian diffusion process which can have exponentially correlated price changes.

Recent studies confirm that correlation in price changes may indeed exist. For example, Neftci and Policano concluded that moving averages could be used to predict movement in gold and T-Bill futures prices. Helms, Kaen and Rosenman found "persistent dependence" in daily and intraday soybean, soybean meal and oil prices. Bird rejected the random walk hypothesis for the coffee, cocoa and sugar markets traded in London and found that price dependencies could be exploited using a filter trading strategy. Studies by De Bondt and Thaler and by Howe showed that extreme movements in stock prices due to unexpected news events led to reactions in prices in the opposite direction. The reactions tended to occur over time and consequently should be exploitable by trend following strategies.

The results in this paper provide additional evidence that speculative prices move in trends. This conclusion is based on the trading results for a portfolio of cattle, soybean, silver and sugar futures. The four commodities were traded over a 15 year period using a technical trading strategy called a channel (discussed below). Based on a statistical test, the return on the four commodity portfolio (FCP) was significantly greater than the return for a portfolio with comparable risk.

An outline of the paper is as follows. The data and simulated trading procedure are discussed in the second section. Statistical measures of the performance of the FCP are presented in the third section. The returns for the FCP are compared to the returns for futures funds in the fourth section. The conclusions are provided in the last section.

Trading Simulation

A portfolio of cattle, soybean, silver and sugar futures was traded from 1969-83 using a technical trading strategy called a channel. A price channel is formed by the highest and lowest closing prices over the last n days, weeks, etc. When the latest close moves out of the channel, the trader goes long (short) if the breakout is on the upper (lower) side of the channel. Once a long (short) position has been taken, it is only reversed (the strategy is always in the market) when the price goes through the bottom (top) of the channel. A channel trading strategy is profitable if movements in price are followed by further moves in the same direction.

The channel length was set at 10 days. This length was not based on an optimization strategy designed to pick the most profitable length channel, but rather was arbitrarily chosen. Incidentally, it happens to be the same length channel recommended for trading copper futures by Donchian, who first proposed the channel strategy.

The channel strategy was traded using two futures contracts for each commodity--

Cattle (40,000 pounds)	April and October
Soybeans (5,000 bushels)	May and November
Silver (5000 ounces)	March and September
Sugar (112,000 pounds)	March and September

Positions were closed in maturing contracts and moved into later ones on the last trading day of the month immediately prior to the month of maturity of a futures contract. On days when the commodity market was limit up or down, the channel strategy was not allowed to initiate a trade

or reverse a position. Instead, the limit price was included in recalculating the channel and the price for the following day was compared to the high and low prices for the previous 10 days to determine if a position should be initiated or reversed.

A margin of 50 percent of the value of a contract was required. For example, the margin for a 5000 bushel soybean contract with a price of $5 per bushel was $12,500. This is a much higher margin than the 5-10 percent required by a commodity broker, but only slightly higher than the 35-40 percent margins used by professional futures fund managers.[1]

Trading was started in January 1969 with initial capital of $200,000. The trading capital was allocated equally among the four commodities. If the value of any position changed 25 percent or more during the simulation, the portfolio was realigned to an equal weighting. The 25 percent rule reduced commission costs (which were $30 per round-turn trade) compared to adjusting the portfolio on a daily basis.

All capital in the trading account was assumed to earn interest at the 90-day T-Bill rate. Interest can be earned on margin capital because T-Bills can be deposited as margin on futures positions. This is acceptable since the purpose of margin is to guarantee that losses are paid, and any collateral that has value (e.g., T-Bills, money market funds, bonds, and stocks) can provide this function.

Performance of the Four Commodity Portfolio (FCP)

The annual returns for the FCP are shown in Table 1. Over the 15 year period, the portfolio increased in value over $3 million. The increase was not consistent, however. For 1969-70, the portfolio lost

Table 1. End-of-the-Year Value of the Four Commodity Portfolio, 1969-83.

Year	End-of-the-Year Value in Dollars
1969	169,029
1970	179,601
1971	202,594
1972	245,033
1973	363,177
1974	723,966
1975	723,874
1976	724,076
1977	784,069
1978	772,941
1979	1,478,036
1980	898,719
1981	1,354,355
1982	2,239,642
1983	3,321,136

Note--The value of the portfolio was $200,000 at the beginning of 1969.

value. It increased thereafter until the speculative bubble in the silver market in 1980. The large loss in 1980 occurred because the channel strategy was long during March when the silver futures market was limit down for 13 consecutive days. During 1981-83, the portfolio increased in value over three and a half times.

The average annual return on the FCP is 26.4 percent compared to 8.8 percent for stocks; whereas the standard deviation for the FCP is 39.4 compared to 17.5 for stocks. The average annual return on the FCP is 3 times the return on stocks but the standard deviation is only 2.3 times the standard deviation of stocks. The ratio of the return divided by the standard deviation is 0.67 for the FCP compared to 0.50 for stocks. This says that the return per unit of risk borne is higher for the FCP than for stocks.

A statistical procedure developed by Jensen was used to determine whether above normal returns are generated by the channel strategy. The concept of a normal return is based on capital asset pricing theory which takes into consideration the riskiness of the trading strategy and assumes that pricing is efficient (Sharpe (1964)). The Jensen procedure involves regressing the returns for the strategy (R_p) minus the riskless rate (R_f, proxied by the return on 90-day T-Bills) on the return for the portfolio of all assets (R_m) minus the riskless rate--

$$R_p - R_f = a + b(R_m - R_f) + e$$

where a and b are fixed parameters and e is a random error term. If the intercept in the regression is significantly greater than zero, the returns on the trading strategy are above normal for the given riskiness of the trading strategy.

The regression results for the above equation are shown in Table 2. Two regressions were run--(1) with R_m proxied by the S&P 500 index plus dividends and (2) with R_m proxied by a 0.90 weighting of the S&P 500 index plus dividends and 0.10 weighting of the Dow Jones index of futures prices (Marcus; and Baxter, Conine and Tamarkin). First note that the intercepts in both of the regression are significantly different from zero at the 0.05 level. This says that the returns on the FCP are above normal for the riskiness of the trading strategy. The fact that an above normal return is achieved is evidence that trends exist in cattle, soybean, silver and sugar futures prices. The magnitude of the intercepts indicates that the above normal return is approximately 0.20 percent per annum. Also, note that the estimated slope parameters are negative, which is consistent with the findings of Bodie that commodity futures prices are negatively correlated with financial asset prices. The negative slopes suggest that including futures along with stocks in a portfolio will increase the portfolio's return for a given risk.[2]

Comparison of FCP and Futures Fund Returns

It is interesting to compare the trading returns for the FCP with the returns for futures funds which for the most part use technical trading strategies. Three studies have been published on futures funds. The geometric average (or continuously compounded) annual fund returns from the three studies and the study periods are: -3.6 percent, Elton, Gruber and Rentzler (1979-85); 7.7 percent, Murphy (1980-85); and 15.2 percent, Irwin and Brorsen (1975-83). The geometric average annual return on the

Table 2. Jensen Regressions for the Four Commodity Portfolio

Market Portfolio	Intercept	Slope	R^2	DW[a]
Stocks[b]	0.198 (0.093)[c]	-0.952 (0.543)	0.19	1.89
Stocks and Commodities[d]	0.200 (0.097)	-0.900 (0.621)	0.14	1.97

a. Neither of the Durbin-Watson statistics are significant at the 0.05 level.

b. S&P 500 index plus dividends.

c. Estimated standard errors of the parameters are shown in parentheses. Based on a one-tailed t-test, both intercepts are significantly different from zero at the 0.05 level.

d. A 0.90 weighting for the S&P 500 index plus dividends and a 0.10 weighting for the Dow Jones Index of commodity futures prices.

FCP is 18.7 percent. The return for the FCP is 3.5 to 22.3 percentage points above the average returns for futures funds.

A management fee was not subtracted in deriving the FCP return, however. The return on the FCP, reduced by an average futures fund management fee of 8.5 percent (Irwin and Brorsen), is 10.2 percent.[3] This is 5 percentage points below the return from the Irwin and Brorsen study, and 2.5 and 13.8 percentage points above the respective returns reported in the EGR and Murphy studies. The average fund return from all three studies is 6.4 percent, which is 3.8 percentage points less than the FCP return minus the management fee.

A person who is interested in investing in a futures fund might instead consider using the channel strategy. One advantage is that the return on the FCP (18.7 percent) is higher than the return for the average futures funds (6.4 percent). To a large extent, the difference in the returns is accounted for by the 8.5 percent futures fund management fee. There is still a 3.8 percentage point difference, which is presumably due to the superior trading advice provided by the channel strategy compared to that of the average futures fund manager.

Another reason to use the channel strategy is because of the statistical evidence (from the Jensen tests in Table 2) which shows that the channel strategy can achieve above normal returns. As French and Henderson note, it is very difficult to find even professional investment advice (e.g., a mutual or futures fund) that has achieved significant above normal returns--

> Given the level of noise in security--and even diversified portfolio--returns, detecting statistically significant performance

> is difficult. With current techniques [for measuring performance], a manager would have to be a wizard to consistently produce statistically significant superior performance.

According to the above definition and based on the Jensen tests for the FCP, anyone who uses the 10-day channel strategy for trading a portfolio of cattle, soybean, silver and sugar futures is classified as a "wizard."

Conclusions

A technical trading strategy called a channel was used to trade the FCP over a 15 year period. The return on the FCP was significantly above the expected return for a portfolio with comparable risk. This is support for the hypothesis that trends exist in futures prices as implied by the disequilibrium theory of Beja and Goldman. The return from trading these trends was higher than the average return for futures funds.

If trends exist in futures prices, this implies that selective hedging strategies based on technical analysis should improve the returns from a farming operation. It appears that more consideration should be given to technical strategies in marketing programs.

Footnotes

1. The margin figures for futures funds were derived from reported margin to capital ratios assuming that the typical margin for a futures contract was 7.5 percent.

2. The same conclusion was reached by Irwin and Brorsen and by Herbst and McCormack.

3. Futures fund management fees are high compared to the estimated 1 percent management fee for mutual funds (Sharpe (1981)).

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