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UNSYSTEMATIC FUTURES PROFITS WITH TECHNICAL TRADING RULES: A CASE FOR FLEXIBILITY

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Abstract

This paper studies the behavior of a fixed-parameter technical trading rule as applied to four commodity futures contracts. The evidence suggests that fixed-parameter rules are inflexible, leading to wide swings in performance both across commodities and time periods. Consequently, the paper recommends the use of flexible-parameter trading rules which adapt to changes in market conditions, instead of expecting the market to operate within the specifications of an unalterable set of rules.

INTRODUCTION

Considerable research has been conducted on the effectiveness of technical analysis and mechanical trading rules to ascertain the efficiency of the stock and commodity futures markets. Ever since the inception of the "random walk" model of stock and futures prices promoted by Samuelson (1965) and Fama (1970), the utility of technical trading systems has been largely discounted on a theoretical basis. Since the random walk model contends that price fluctuations occur randomly, technical systems which rely upon the existence of price trends cannot be profitable in the long run. However, a distinction is often made between price behavior in the stock market and the commodity futures markets. The random walk hypothesis has had more rigorous testing in stock markets than it has in the commodity futures markets.

In the futures markets, there is some evidence of systematic price changes. For example, Stevenson and Bear (1970) studied day-to-day changes of corn and soybeans futures prices over a seventeen year period and concluded that the use of mechanical rules to enter and exit a market could help a trader outperform the buy-and-hold strategy, given the existence of runs and serial price dependence. This conclusion was supported by Cargill and Rausser (1975), who rejected the random walk model as a realistic description of the futures markets.

More recently, Neftci and Policano (1984) examined the efficacy of two mechanical rules as applied to gold and Treasury bill futures, and found that such rules could be profitable over certain time periods. Tomek and Querin (1984) studied simulated data to show the existence of trends in a random series of numbers, implying that mechanical trading rules could perform a useful role. However, they found that these trends did not recur with measurable regularity.

It is the unsystematic nature of trends that could prove to be the undoing of fixed-parameter mechanical trading rules, since such rules are slow to respond to changes in market conditions. Without questioning the superiority of mechanical trading rules over the simple buy-and-hold strategy, this paper studies the consistency of such rules as applied to historical futures price data across different time periods and commodities. The remainder of this article is organized as follows: section I outlines the hypotheses to be tested; section II explains the research methodology and describes the data used for the study; section III discusses the empirical results of the analysis; section IV summarizes the conclusions.

HYPOTHESES

Given the inherent differences across commodities, it is likely that their price behavior could vary significantly at a given point in time. For example, there is no reason to assume that gold prices will move in step with soybean prices. As a

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result, there could be significant differences in the profits generated by a given mechanical rule at a point in time across commodities. Accordingly, it is hypothesized that a given trading rule might generate significantly different profits across commodities at a given point in time.

Secondly, it is hypothesized that profits derived from trading rules will vary significantly for a given commodity across time periods. This follows from the fact that market conditions for a given commodity are apt to change across time, and since these changes do not recur with measurable regularity, it is conceivable that a given mechanical rule might not perform consistently well across time periods. For example, in the case of gold, the late 1970's saw prices sky-rocket to as much as $850 an ounce. However, prices have been declining since 1981, and have vacillated between $300 and $400 an ounce between 1983 and 1987. It is hardly surprising, therefore, that the profits generated by a given rule for gold for the period 1979-1981 should substantially outweigh the profits generated by the same rule during 1983-1985 or 1985-1987.

Profit differences across time may also result from inherent differences among trading rules. For example, during periods of market consolidation, when prices are trading within a narrow range, a more sensitive rule may react to market fluctuations with greater precision, and hence greater profitability. However, when markets are trending in a particular direction, a highly sensitive trading rule might well misinterpret a minor correction to be a directional shift in the underlying trend, leading to premature entry into or exit out of a given trade.

RESEARCH METHODOLOGY AND DATA

Research Methodology

The dual moving average crossover rule, commonly used by technical traders, is employed to generate signals for entering into and exiting out of a trade. Moving averages of historic daily settlement prices are calculated. The lengths of the two moving averages are unequal, so as to allow for a crossover between the shorter and longer moving averages. The shorter the time period over which the moving average is calculated, the more responsive it is to price fluctuations. Therefore, when the shorter of the dual moving averages crosses *above* the longer moving average, this signifies an up-trend in prices, generating a buy signal at the crossover point. Similarly, when the shorter moving average crosses *below* the longer-term moving average, we have a downtrend in prices, and the crossover signals selling the commodity in question.

For the purposes of this paper, the shorter-term moving average ranges from 3 to 15 days, in increments of 3 days. The longer-term moving average is based on historical data for the past 9 to 45 days, in increments of 6 days. Disregarding duplications and combinations of shorter- and longer-term moving averages which are exactly alike, we have a total of 31 daily moving average combinations in our study. The 31 rules are categorized into five groups according to the length of the shorter moving average parameter used: the three-, the six-, the nine-, the twelve-, and the fifteen-day moving average parameter groups.

The hypotheses will be tested using a two-way analysis of variance (ANOVA) technique. Checking for differences in profit for a given commodity across rules and different time periods, the ANOVA technique allows us to decompose total variance by (a) trading rules, (b) time periods. Similarly, the ANOVA model postulates that differences in performance for a given commodity across time could be a function of either (a) differences across trading rules, or (b) inherent differences in market conditions across time periods. Differences in performance not explained by either trading rule or time period are attributed to a random error term.

The analysis of variance will be carried out both in terms of absolute dollar profits as well as for the standardized "Z" scores of profits, where "Z" measures how many standard deviations the observed profit is above (or below) the mean profit for a given time period. The standardized profits are calculated to gain a clearer understanding of the relative performance of the 31 trading rules. Positive Z scores indicate higher than average profitability, whereas negative Z scores indicate lower than average profitability.

Data

Daily futures price data have been obtained from the Dunn and Hargitt futures data tape for the following four commodities: Comex gold, Treasury bonds, soybeans and Japanese yen. The commodities selected for the study include one metal, one grain, one currency, and one financial instrument, representing each of the major commodity groups traded on the futures exchanges. The period considered for the study ranges from November 1979 to November 1987. The data has been sub-divided into four equal sub-periods of two years each: 1979-1981, 1981-1983, 1983-1985, and 1985-1987. The data has been screened for obvious errors, such as missing values.

A continuous price series is constructed by concatenation of the nearest futures contract at any given time each commodity. A rollover to a new contract is effected about two weeks prior to the expiration of the current contract. Consequently, the price series considers the most actively traded period for each commodity. Moreover, concatenation enables us to work with a larger sample size, enhancing the power of our statistical tests.

RESULTS

Table 1 gives the average profit and standard deviation thereof for each of the four commodities and four sub-periods. It also presents the overall average profit and standard deviation across all four sub-periods. The Table also highlights the minimum and maximum profit earned for each of the commodities, and indicates the percentage of rules that resulted in a loss for a given commodity and time period.

Notice the wide swings in the performance of the moving average crossover rules as applied to gold and soybeans. Whereas 3% of the rules under review resulted in a loss for gold during 1979-1981, as many as 80% of the same rules were unprofitable during 1983-1985. In the case of soybeans, whereas 10% of the rules studied were unprofitable during 1979-1981, as many as 96% were unprofitable between 1985-1987! We observe a greater degree of consistency in the performance of the moving average rules in case of Treasury bonds and the Japanese yen. Whereas the maximum percentage of rules operating at a loss is 29% for Treasury bonds, it is only 16% for the yen, supporting the conclusion that there is a greater degree of consistency in the results achieved by the moving average crossover rules as applied to bonds and the yen.

Table 2 classifies the trading rules into parameter groups according to the length of the shorter moving average used in the dual moving average crossover rule. As a result, we have five groups: the three-day, the six-day, the nine-day, the twelve-day, and the fifteen-day. In the case of gold and soybeans, there is no measurable difference in the average Z scores across the five parameter groups studied. Reiterating the findings reported in Table 1, moving average crossover rules were simply not equipped to capture the price swings in these markets in a timely fashion. Consequently, altering the length of the shorter moving average did not have any marked impact on profitability.

In the case of Treasury bonds and the yen, where the moving average crossover rules performed with a greater degree of consistency, Table 2 suggests that the three- and six-day parameter groups performed better, on average, as compared to the twelve- and fifteen-day groups. The average Z scores for the three-day and six-day groups for Treasury bonds are 0.38 and 0.16 respectively, higher than the average Z scores of -0.18 and -0.38 for the twelve- and fifteen-day groups respectively. Similarly, in case of the yen, the average Z scores for the three- and six-day groups are 0.37 and 0.17, higher than the corresponding Z scores of -0.16 and -0.72 for the twelve- and fifteen-day groups. On balance, therefore, we find that shorter moving averages perform better than longer moving averages in the case of Treasury bonds and yen. Perhaps this is because the shorter the lag length of the moving average, the more responsive it is to changes in market conditions.

In view of the foregoing, a trader might be tempted to adopt a moving average crossover rule with a shorter lag length for trading Treasury bonds or the yen. In order to study the consistency of performance of a given trading rule over different time periods, the Pearson product-moment correlation coefficient was computed for the Z scores for each of the 31 rules across the four sample periods. The results are presented in Table 3. Table 3 clearly shows that in the case of Treasury bonds and the Japanese yen, there are no statistically significant correlations between the Z score for a given trading rule across time periods. Therefore, although shorter lag lengths perform better *on average* than longer lag lengths, an individual trading rule cannot be depended upon for consistent results.

Further support for this conclusion is found in Tables 4 and 5 which give rule-specific performance data in respect of Treasury bonds and the yen for each of the 31 rules over the four time periods. For example, in case of Treasury bonds, the 3- and 9-day rule has the highest Z score of 2.00 during 1979-1981. However, during 1981-1983, the 9-day has one of the lowest Z scores of -1.92! Similarly, in case of the yen, whereas the 6- and 9-day rule has the lowest Z score of -3.24 during 1979-1981, it is the best performer the following period, 1981-1983, with a Z score of 2.21! Whereas it turns in an above average performance during 1983-1985, it slumps once again in 1985-1987. Clearly, there is an inconsistency in the performance of individual trading rules which is camouflaged when the same rules are categorized into larger, homogeneous groups.

Part 1 of Table 6 gives the results of the ANOVA test of mean differences of profits across commodities and time periods. There is a statistically significant difference in profits across both commodities and time periods, confirming the first hypothesis. This suggests that a rule which works well for one commodity or during one time period need not necessarily work equally well during other time periods or for other commodities. For example, moving average rules did extremely well between 1979 and 1981 for gold, when gold prices sky-rocketed to $800 an ounce. However, in the absence of similar swings in the other commodities the moving average rules did not fare as well for the other commodities over the same period.

Part 2 of Table 6 tests for mean differences of profits for a given commodity across each of four time periods and each of the five categories of trading rules, referred to as “parameter group.” The analysis is carried out both in terms of absolute dollars and the standardized Z scores of profits. We observe from Table 6 that changes in market conditions across time period account for a significant proportion of the total profit variation. The variation due to time periods is statistically significant at the .01 level of significance for each of the four commodities studied, suggesting that a rule that works well for a given commodity in one time period need not work equally well for the same commodity across other time periods.

The variation due to parameter groups is significant at the .01 level in case of Treasury bonds, and at the .02 level in case of the Japanese yen. This significance is also observed when the profits are reported in terms of Z scores, albeit at the .05 level of significance in case of Treasury bonds. This confirms the finding that the shorter parameter length moving average crossover rules tended to outperform the longer lag length rules in case of bonds and the yen. However, there is no statistical significance observed across parameter groups in case of gold and soybeans, supporting the conclusion that none of the parameter groups studied were able to turn in a superior performance with any degree of consistency.

CONCLUSION

The conclusions arrived at in this paper support the findings of Stevenson and Bear (1970) to the extent that mechanical trading rules can be profitable at times. However, it would be naive to believe that a given rule will perform consistently well across different commodities and time periods. This is due to the fact that although price trends do exist, these trends do not recur with a regular periodicity. Therefore, the much-touted virtue of blind-faith allegiance to the dictates of a fixed-parameter mechanical system may not be so rewarding after all, given the serious inconsistencies in performance of such systems! The present study shows that strict adherence to a fixed-parameter system is potentially damaging to the technical trader.

These findings have powerful practical implications, in as much as they recommend that traders be wary about using fixed-parameter mechanical trading systems. Instead of expecting the market to adapt to a fixed, time-invariant set of rules, a mechanical system should be flexible in nature, adjusting its parameters dynamically in response to changes in market conditions as soon as they occur. Flexible systems are the key to success in any technical trading program in the futures market.

REFERENCES

[1] Cargill, T. and Rausser, G., “Temporal Price Behavior in Commodity Markets,” ***Journal of Finance***, Vol. 30, No. 4, September 1975.

[2] Fama, E.F., “Efficient Capital Markets: A Review of the Theory and Empirical Evidence,” ***Journal of Finance*** 25, May 1970.

[3] Neftci, S.N. and Policano, A.J., “Can Chartists Outperform The Market? Market Efficiency Tests for Technical Analysis,” ***Journal of Futures Markets***, Vol. 4, No. 4, 1984.

[4] Samuelson, P.A., “Proof that Properly Anticipated Prices Fluctuate Randomly,” ***Industrial Management Review***, Spring 1965.

[5] Stevenson, R. and Bear, R.,. “Commodity Prices: Trends or Random Walks,” ***Journal of Finance*** 25, March 1965.

[6] Tomek, W. and Querin, S., “Random Processes in Prices and Technical Analysis,” ***Journal of Futures Markets***, Vol. 4, No. 1, 1984.

TABLE 1
Summary Of Performance Of Trading Rules By Time Period & Commodity

Dual Moving Average Rules

	1979-1981	1981-1983	1983-1985	1985-1987	Average
Gold					
Average Profit	$58,283	-$2,798	-$7,421	-$1,207	$11,714
Standard Deviation	$19,595	$11,606	$6,557	$3,904	$29,576
Min Dollars	-$10,430	-$23,410	-$16,230	-$11,050	-$23,410
Max Dollars	$93,150	$28,070	$7,150	$7,550	$93,150
% Rules At Loss	3%	61%	80%	71%	54%
CV*	34%	NA	NA	NA	252%
Tbonds					
Average Profit	$9,897	$1,553	$7,949	$9,783	$7,295
Standard Deviation	$10,117	$6,930	$4,473	$8,769	$8,485
Min Dollars	-$12,912	-$18,694	-$4,125	-$5,775	-$18,694
Max Dollars	$30,087	$11,581	$15,875	$37,025	$37,025
% Rules At Loss	16%	29%	3%	13%	16%
CV*	102%	446%	56%	89%	116%
Yen					
Average Profit	$12,816	$10,044	$3,937	$15,961	$10,690
Standard Deviation	$5,509	$2,872	$3,905	$6,675	$6,614
Min Dollars	-$5,050	$2,800	-$4,650	$2,212	-$5,050
Max Dollars	$22,425	$16,400	$12,950	$28,787	$28,787
% Rules At Loss	3%	0%	16%	0%	6%
CV*	43%	28%	99%	42%	62%
Soybeans					
Average Profit	$9,800	$11,009	-$568	-$5,836	$3,601
Standard Deviation	$8,297	$9,029	$7,146	$2,513	$10,050
Min Dollars	-$4,662	-$7,475	-$9,750	-$9,762	-$9,762
Max Dollars	$28,512	$25,275	$14,250	$862	$28,512
% Rules At Loss	10%	20%	61%	96%	46%
CV*	85%	82%	NA	NA	279%

CV refers to the Coefficient of Variation, a statistical concept derived by dividing the standard deviation by the average return. Expressed as a percentage, CV reflects the degree of volatility, expressed as a percentage of the average value of a variable: the greater the percentage, the greater the volatility. If the average is a negative value, CV was not computed.

TABLE 2
Comparison Of Moving Average Rules
According To Length Of Shorter Average

	1979-1981 Aver $	Aver Z	1981-1983 Aver $	Aver Z	1983-1985 Aver $	Aver Z	1985-1987 Aver $	Aver Z	Average Aver $	Aver Z
Gold										
Three Day	$47,388	-.56	$1,167	.34	-$8,201	-.12	-$2,351	-.29	$9,500	-.16
Six Day	$56,964	-.07	-$1,287	.13	-$4,834	.39	-$1,541	-.09	$12,325	.09
Nine Day	$59,145	.04	-$2,843	.00	-$5,873	.24	-$3,370	-.55	$11,764	-.07
Twelve Day	$64,636	.32	-$4,193	-.12	-$8,936	-.23	$386	.41	$12,973	.10
Fifteen Day	$66,726	.43	-$8,738	-.51	-$9,990	-.39	$1,542	.70	$12,385	.06
Tbonds										
Three Day	$16,101	.61	$3,459	.28	$8,571	.14	$14,260	.51	$10,598	.38
Six Day	$14,410	.45	-$240	-.26	$8,083	.03	$13,574	.43	$8,957	.16
Nine Day	$8,118	-.18	$2,714	.17	$6,191	-.39	$10,014	.03	$6,759	-.09
Twelve Day	$2,402	-.74	$3,104	.22	$8,974	.23	$6,010	-.43	$5,122	-.18
Fifteen Day	$6,019	-.38	-$1,858	-.49	$7,767	-.04	$2,457	-.84	$3,596	-.38
Yen										
Three Day	$11,421	-.25	$11,560	.53	$5,232	.33	$21,704	.86	$12,479	.37
Six Day	$10,571	-.41	$12,114	.72	$5,642	.44	$15,547	-.06	$10,969	.17
Nine Day	$15,075	.41	$9,883	-.06	$5,512	.40	$14,191	-.27	$11,165	.12
Twelve	$15,054	.41	$8,925	-.39	$2,508	-.37	$14,149	-.27	$10,159	-.16
Fifteen	$12,515	-.05	$6,560	-1.21	-$440	-1.12	$12,797	-.47	$7,858	-.72
Soybeans										
Three Day	$12,801	.36	$6,832	-.46	$325	.13	-$7,583	-.70	$3,095	-.17
Six Day	$8,219	-.19	$9,571	-.16	$2,446	.42	-$3,990	.73	$4,061	.20
Nine Day	$7,245	-.31	$13,775	.31	$1,925	.35	-$4,928	.36	$4,504	.18
Twelve Day	$11,191	.17	$11,621	.07	-$2,692	-.30	-$5,470	.15	$3,662	.02
Fifteen Day	$9,197	-.07	$14,820	.42	-$6,485	-.83	-$7,502	-.66	$2,507	-.29

TABLE 3
Correlations Of Z Scores
Moving Average Trading Rules

Gold	**1979-1981**	**1981-1983**	**1983-1985**
1979-1981	—		
1981-1983	-.43*	—	
1983-1985	-.49	.51*	—
1985-1987	.58	-.46*	-.49*
Tbonds	**1979-1981**	**1981-1983**	**1983-1985**
1979-1981	—	—	—
1981-1983	-.07	—	—
1983-1985	.07	.11	—
1985-1987	.02	-.05	.13
Yen	**1979-1981**	**1981-1983**	**1983-1985**
1979-1981	—	—	—
1981-1983	-.19	—	—
1983-1985	.07	.14	—
1985-1987	-.05	.21	.10
Soybeans	**1979-1981**	**1981-1983**	**1983-1985**
1979-1981	—	—	—
1981-1983	-.14	—	—
1983-1985	-.04	-.50	—
1985-1987	-.15	.10	.36

*one-tail significance $p < .01$
**two-tail significance $p < .001$

TABLE 4
Summary Of Moving Average Trading Rules
T-Bonds

Moving Average	1979-1981		1981-1983		1983-1985		1985-1987		Average	
Parameters	Aver $	ZScore	Aver $	ZScore	Aver $	ZScore	Aver $	ZScore	Aver $	ZScore
3 & 9 days	$30,087	2.00	($11,731)	-1.92	$5,700	-.50	$15,662	.67	$9,930	.06
3 & 15 days	$625	-.92	$8,456	1.00	$11,300	.75	$37,025	3.11	$14,352	.98
3 & 21 days	$2,237	-.76	$6,631	.73	$1,837	-1.37	$22,812	1.49	$8,379	.02
3 & 27 days	$9,525	-.04	$4,681	.45	$9,125	.26	$13,800	.45	$9,283	.28
3 & 33 days	$25,387	1.53	$9,244	1.11	$10,475	.56	$5,750	-.46	$12,714	.69
3 & 39 days	$19,250	.92	$3,056	.22	$10,425	.55	$5,287	-.51	$9,505	.30
3 & 45 days	$25,600	1.55	$3,881	.34	$11,137	.71	($512)	-1.17	$10,027	.36
6 & 9 days	$27,912	1.78	($16,369)	-2.59	$3,012	-1.10	$13,187	.39	$6,936	-.38
6 & 15 days	$14,075	.41	$619	-.13	($4,125)	-2.70	$7,275	-.29	$4,461	-.68
6 & 21 days	$1,937	-.79	$7,456	.85	$5,362	-.58	$5,412	-.50	$5,042	-.25
6 & 27 days	$10,137	.02	($1,019)	-.37	$10,200	.50	$19,762	1.14	$9,770	.32
6 & 33 days	$11,975	.21	$4,319	.40	$15,875	1.77	$20,387	1.21	$13,139	.90
6 & 39 days	$16,200	.62	$169	-.20	$13,350	1.21	$24,375	1.66	$13,524	.82
6 & 45 days	$18,637	.86	$3,144	.23	$12,912	1.11	$4,625	-.59	$9,830	.40
9 & 15 days	($1,400)	-1.12	$5,894	.63	$2,975	-1.11	$8,075	-.19	$3,886	-.45
9 & 21 days	$10,275	.04	$7,481	.86	$1,462	-1.45	$8,737	-.12	$6,989	-.17
9 & 27 days	$11,337	.14	($2,506)	-.59	$7,587	-.08	$11,300	.17	$6,930	-.09
9 & 33 days	$10,662	.08	$6,669	.74	$3,412	-1.01	$10,962	.13	$7,926	-.02
9 & 39 days	$9,825	-.01	($2,707)	-.61	$15,137	1.61	$12,537	.31	$8,698	.32
9 & 45 days	$8,012	-.19	$1,456	-.19	$6,575	-.31	$8,475	-.15	$6,130	-.16
12 & 15 days	($500)	-1.03	$11,581	1.45	$8,175	.05	($5,775)	-1.77	$3,370	-.33
12 & 21 days	($2,275)	-1.20	$3,594	.29	$5,662	-.51	$9,412	-.04	$4,098	-.37
12 & 27 days	($12,912)	-2.25	($3,444)	-.72	$14,500	1.46	$5,987	-.43	$1,033	-.49
12 & 33 days	$11,912	.20	$5,331	.55	$7,137	-.18	$11,150	.16	$8,883	.18
12 & 39 days	$8,262	-.16	($169)	-.25	$10,362	.54	$15,250	.62	$8,426	.19
12 & 45 days	$9,925	.00	$1,731	.03	$8,012	.01	$37	-1.11	$4,926	-.27
15 & 21 days	($11,087)	-2.07	($18,694)	-2.92	$3,350	-1.03	$3,575	-.71	($5,714)	-1.68
15 & 27 days	$6,050	-.38	($4,256)	-.84	$8,437	.11	$5,612	-.48	$3,961	-.40
15 & 33 days	$16,012	.60	$3,894	.34	$10,537	.58	$5,312	-.51	$8,939	.25
15 & 39 days	$11,637	.17	$6,581	.73	$8,112	.04	($937)	-1.22	$6,348	-.07
15 & 45 days	$7,487	-.24	$3,181	.23	$8,400	.10	($1,275)	-1.26	$4,448	-.29

TABLE 5
Summary Of Moving Average Trading Rules
Japanese Yen

Moving Average Parameters	1979-1981 Aver $	1979-1981 ZScore	1981-1983 Aver $	1981-1983 ZScore	1983-1985 Aver $	1983-1985 ZScore	1985-1987 Aver $	1985-1987 ZScore	Average Aver $	Average ZScore
3 & 9 days	$12,950	.02	$10,050	0.00	$9,225	1.35	$18,187	.33	$12,603	.43
3 & 15 days	$13,950	.21	$13,950	1.36	$1,525	-.62	$27,337	1.70	$14,191	.66
3 & 21 days	$9,025	-.69	$12,775	.95	$3,225	-.18	$27,337	1.70	$13,091	.45
3 & 27 days	$12,750	-.01	$10,500	.16	$5,275	.34	$28,787	1.92	$14,328	.60
3 & 33 days	$11,700	-.20	$13,550	1.22	$6,125	.56	$21,937	.90	$13,328	.62
3 & 39 days	$9,025	-.69	$10,625	.20	$4,125	.05	$12,837	-.47	$9,153	-.23
3 & 45 days	$10,550	-.41	$9,475	-.20	$7,125	.82	$15,512	-.07	$10,666	.03
6 & 9 days	($5,050)	-3.24	$16,400	2.21	$8,375	1.14	$9,962	-.90	$7,422	-.20
6 & 15 days	$4,925	-1.43	$13,275	1.12	$1,200	-.70	$19,362	.51	$9,691	-.12
6 & 21 days	$13,075	.05	$12,775	.95	$4,400	.12	$21,387	.81	$12,909	.48
6 & 27 days	$15,575	.50	$11,125	.38	$8,950	1.28	$18,962	.45	$13,653	.65
6 & 33 days	$16,925	.75	$12,875	.99	$6,875	.75	$19,512	.53	$14,047	.75
6 & 39 days	$18,400	1.01	$11,000	.33	$4,875	.24	$9,312	-1.00	$10,897	.15
6 & 45 days	$10,150	-.48	$7,350	-.94	$4,825	.23	$10,337	-.84	$8,166	-.51
9 & 15 days	$5,325	-1.36	$5,050	-1.74	$9,075	1.32	$16,762	.12	$9,053	-.42
9 & 21 days	$14,525	.31	$9,000	-.36	$5,900	.50	$21,637	.85	$12,766	.32
9 & 27 days	$22,425	1.74	$10,975	.32	$12,950	2.31	$12,562	-.51	$14,728	.97
9 & 33 days	$21,725	1.62	$11,625	.55	$2,575	-.35	$ 7,912	-1.21	$10,959	.15
9 & 39 days	$15,525	.49	$13,175	1.09	$300	-.93	$ 9,962	-.90	$9,741	-.06
9 & 45 days	$10,925	-.34	$9,475	-.20	$2,275	-.43	$16,312	.05	$9,747	-.23
12 & 15 days	$12,100	-.13	$9,550	-.17	$4,475	.14	$14,787	-.18	$10,228	-.09
12 & 21 days	$14,875	.37	$9,500	-.19	$3,150	-.20	$24,862	1.33	$13,097	.33
12 & 27 days	$21,325	1.54	$8,200	-.64	$5,625	.43	$9,037	-1.04	$11,047	.07
12 & 33 days	$17,175	.79	$8,400	-.57	$4,000	.02	$12,237	-.56	$10,453	-.08
12 & 39 days	$14,225	.26	$9,000	-.36	$225	-.95	$ 4,312	-1.75	$ 6,941	-.70
12 & 45 days	$10,625	-.40	$8,900	-.40	($2,425)	-1.63	$19,662	.55	$9,191	-.47
15 & 21 days	$16,400	.65	$9,050	-.35	($4,650)	-2.20	$19,737	.57	$10,134	-.33
15 & 27 days	$17,425	.84	$2,800	-2.52	$5,950	.52	$18,087	.32	$11,066	-.21
15 & 33 days	$12,975	.03	$5,325	-1.64	($1,125)	-1.30	$9,562	-.96	$6,684	-.97
15 & 39 days	$9,050	-.68	$8,725	-.46	($675)	-1.18	$2,212	-2.06	$4,828	-1.10
15 & 45 days	$6,725	-1.11	$6,900	-1.09	($1,700)	-1.44	$14,387	-.24	$6,578	-.97

TABLE 6
Summary Of Analyses Of Variance & Comparisons Of Group Means

Analysis	Mean Square	df	F**	Sig
Moving Average Profits				
Commodity	1671973111	3	23.70	<.01
Time Period	11794469223	3	166.90	<.01
Commodity x Period	7217852052	9	102.70	<.01
Error	70650973	480		
Moving Average Parameter Groups				
Gold-Profits				
Parameter Group	48688818	4	.33	<.86
Time Period	30095450655	3	203.90	<.01
Group x Period	147398345	12	.99	<.45
Error	147540050	104		
Gold-Z Scores				
Parameter Group	.332	4	.32	<.86
Group x Period	1.110	12	1.09	<.37
Error	1.013	104		
Tbonds-Profits				
Parameter Group	194152533	4	3.47	<.01
Time Period	479009763	3	8.55	<.01
Group x Period	68185225	12	1.21	<.28
Error	56003827	104		
Tbonds-Z Scores				
Parameter Group	2.42	4	2.52	<.04
Group x Period	.86	12	.86	<.55
Error	.961	104		
Yen-Profits				
Parameter Group	66116388	4	3.05	<.02
Time Period	809352808	3	37.47	<.01
Group x Period	36310472	12	1.67	<.08
Error	21658361	104		
Yen-Z Scores				
Parameter Group	3.94	4	4.82	<.01
Group x Time Period	1.59	12	1.94	<.04
Error	.819	104		
Soybeans-Profits				
Parameter Group	14168856	4	.26	<.90
Time Period	2064212154	3	39.26	<.01
Group x Time Period	58962142	12	1.12	<.35
Error	52583209	104		
Soybeans-Z Scores				
Parameter Group	1.08	4	1.14	<.34
Group x Time Period	1.42	12	1.50	<.13
Error	.948	104		

*In analyses of Z scores, the results for factor of Time Period are not reported, since the Z score transformation made all time the averages of all time periods equal. "Sig" refers to probability of result by chance.