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Contrarian Profits in the Futures Markets

by

Jang-Shee Lin

A dissertation submitted to the Graduate Faculty in Business in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

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Abstract

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Advisor: Dr. Avner Wolf

Many studies in the stock markets provide evidence of overreaction in term of Contrarian Profits. This study provides new evidence that there is overreaction in some futures markets and that there are some prevalent patterns in the contrarian profits.

It is shown that there are significant price reversals in opening prices in general, but generally not in the settlement prices. We find that over a whole-day trading period (Open-to-Open), most price reversals occur in the first half-day period (Open-to-Settlement). Trading beyond that, in the second half-day (Settlement-to-Open), generates insignificant or negative profits. This is evidence that overreaction in the opening prices is quickly corrected.

We find evidence that the degree of overreaction is related to the market setting. Days of large overreaction are associated with larger market movements, larger intraday volatility, and larger change in daily trading volume.

Substantial drop in trading volume is associated with larger overreaction. These are evidence that prices are less efficient when there is more information flow, higher volatility, and less trading activity.

We also found a weekday pattern. In many futures markets, the Friday contrarian profits tend to be higher than those of the other weekdays.

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Chapter 1. Introduction

Whether security prices efficiently reflect information has been one of the most extensively studied questions in Finance. A recent revival of this issue focused on the profitability of contrarian investment strategy. Beginning with the seminal study by De Bondt and Thaler (1985), many researchers have provided evidence for the overreaction hypothesis, which argues that investors in the stock market overreact to recent information. Stock prices have been found to move to a level beyond their fundamental values and exhibit systematic price reversals.

Such overreaction provides opportunities for investors to gain abnormal return by adopting a "Contrarian" strategy. If winners are over-priced and losers under-priced, then a portfolio of buying losers and shorting winners should provide returns higher than justified by the systematic risk of the portfolio. Such excess returns signify an irrationality of investors in their overreaction, and a violation of the weak form of market efficiency, since a simple trading strategy of using past stock prices could generate excess returns.

More recently, some researchers investigated more

closely the sources of such "Contrarian" profits. For example, Lo and Mackinlay (1990) provide evidence that a lead-lag relationship between large and small stocks accounts for a large part of the profit of one particular contrarian strategy. Thus, the extent to which overreaction generates excess return is smaller than previously thought.

However, most studies on overreaction are done on the stock markets. Few studies in this area have been done in the derivative markets. The futures and options markets are characterized by lower transaction costs, faster execution time, and higher leverage. It has often been suggested that information traders tend to use the futures or options market rather than the stock markets. New information tends to be reflected in the futures and options markets faster than in the stock markets.

A study of overreaction in the futures markets would provide independent evidence to the existing ones in the studies done on the stock market.

In this study, we use an extensive set of daily futures prices to test the overreaction hypothesis. We apply a contrarian trading strategy that exploits the price reversals among a group of related securities. Using daily settlement prices, we provide evidence that there are contrarian profits in some of the futures markets.

More importantly, by decomposing components of

contrarian profits over a whole-day (open-to-open) period into two consecutive half-day subperiods (open-to-settlement and settlement-to-open), we investigate how much the contrarian profits are generated in the subperiods. We provide two pieces of important evidence. First, we find that while daily settlement prices generate contrarian profits only in some futures markets, opening prices generate contrarian profits in all futures markets. The magnitude of contrarian profits are also larger for the opening prices. This corroborates with earlier findings that open-to-open returns tend to be more volatile than close-to-close returns. The more volatile opening prices are associated with larger overreaction.

Second, when the contrarian trading strategy is applied to a whole-day (open-to-open) trading period, most of the contrarian profits are generated in the first half-day (open-to-settlement) subperiod. Trading extended beyond that subperiod, or trading over the subsequent settlement-to-open subperiod, earns either statistically insignificant positive returns or small negative returns that are statistically significant. This is evidence that, while there may be some initial overreaction at the market opening, prices quickly revert back to an efficient level within a half-day time period, by the closing time.

Some recent studies find evidence that stock price autocorrelation and cross-correlation are related to

information flow and prior trading volume. We find evidence that higher contrarian profits are associated with days of high intraday volatility, large information flow, and large change in trading volume.

Finally, we also present evidence of weekday seasonal patterns in the contrarian profits, where for most futures the Friday contrarian profits tend to be higher than those on other weekdays.

This study is organized as follows: Chapter 2 reviews recent studies. Chapter 3 describes our data set, derives the empirical model, and presents empirical results on contrarian profits from daily settlement prices and from other daily holding periods. Chapter 4 presents effects of information flow, volatility, trading volume, and weekday seasonal patterns in contrarian profits. Chapter 5 presents the conclusions and the summary.

Chapter 2. Literature Review

2.1. Recent Developments in the Efficient Market Hypothesis

Although early studies on efficient market hypothesis typically concentrate on whether stock prices behave like a random walk, the perspective on the Efficient Market Hypothesis (EMH) has gone through some important changes in recent years. Early studies provide statistical evidence for, or against the random walk characteristic of stock returns. The general conclusions are that it is not possible to forecast stock returns.

Later emphasis shifts to a different angle. On the theoretical front, Leroy (1973) and Lucas (1978) present models where a random walk of asset return is neither a necessary nor a sufficient condition for an economic equilibrium.

In his second review paper on EMH, Fama (1991) points out that: (i) All tests of EMH are joint tests of both the EMH and the asset-pricing model; thus empirical results must be interpreted with caution. (ii) Consideration must be given to the effect of transaction costs and information on the process of price discovery. He proposes that the

current theme of EMH studies should be on how these studies improve on our ability to describe the time-series and cross-section behavior of securities returns.

EMH is now studied in a new perspective where information flow, institution setting, and transaction costs are incorporated into the analysis in explaining any anomalies detected statistically.

2.2 Overreaction in Security Markets

A study in experimental psychology by Kahneman and Tversky (1982) suggests that people tend to overreact to unexpected and dramatic events. Based on this behavioral observation, De Bondt and Thaler (1985) report empirical evidence on stock price overreaction. Using a half century of stock market data, they show that over 3 to 5-year holding periods, portfolio of prior losers tend to out-perform prior winners. Thirty-six months after portfolio formation, the portfolio of prior losers earns 25% more than the portfolio of prior winners, even though the latter is found to be significantly more risky. Thus, by using a "contrarian" investment strategy, it is possible to earn excess returns on the basis of past stock prices. This is evidence against the weak form of market efficiency, and evidence of the irrational overreaction of stock investors.

De Bondt and Thaler also report a strong January "price

correction" for the losers. Earlier studies on anomalies by Keim (1983) and Reinganum (1983) contain results that could potentially relate the overreaction results to seasonal and size related effects.

Chan (1988) presents evidence that risks of the winner and loser portfolios are not constant. This causes the measure of excess returns to be sensitive to how the risks are estimated. Fama and French (1988) present evidence that a mean-reverting factor risk premium might explain the negative serial correlation in stock prices. These studies either cast doubts on the original empirical results by De Bondt and Thaler or provide an alternative explanation of the empirical results to the overreaction hypothesis.

De Bondt and Thaler (1987) re-evaluate the overreaction hypothesis. They find that the winner-loser effect cannot be explained by changes in risk as measured by CAPM-betas. They provide evidence that their finding is not primarily a size effect. They demonstrate that the reversal patterns are consistent with overreaction.

A later study by Zarowin (1989b), however, shows that while losers do out-perform the winners, the poorest performers are also the smallest. When losers are matched with winners of the same size, there is little evidence of differential subsequent performance. Zarowin argues that

long-run price-reversal must be subsumed by the size and January phenomena. In a separate paper, Zarowin (1989a) examines short-run stock market overreaction, and found that losers significantly outperform winners regardless of which group is smaller. Furthermore, although there is a January effect in the short-run overreaction, there is still a significant abnormal performance for the losers outside of January. These provide evidence of a short-run overreaction.

In a study of the "smart money", De Bondt and Thaler (1990) show evidence that security analysts overreact in their forecasts of company earnings. The authors point to similar overreaction observed in economists' forecasts of changes in exchange rates and macroeconomic variables. They suggest that behavioral explanation of anomalous financial market outcomes should be reckoned with. A more recent study by Abarbanell and Bernard (1992), on the other hand, documents analysts' underreaction to earnings information.

Studying weekly returns of NYSE and ASE stocks, Lehmann (1990) finds evidence of sizeable return reversals, even after correction for bid/ask spreads and plausible transaction costs. Lehmann suggests that these apparent arbitrage profits reflect inefficiency in the market for short-term liquidity around large price changes.

Kaul and Nimalendran (1990) examine the NASDAQ stocks for short-run overreaction. With the advantage of having

the bid/ask prices together with the closing price, they are able to determine that, after extracting price measurement errors caused by the bid/ask spread, there is little evidence of overreaction. Using large one day price movement as their selection criterion, Atkins and Dyl (1990) find significant price reversals, in particular for initial price drops. They interpret this as evidence of overreaction. However, these price reversals are small relative to the bid/ask spreads of the stocks. They conclude that the market is efficient after accounting for transaction costs.

Pettengill and Jordan (1990) document a weekday pattern in winner-loser patterns, in addition to size and January related patterns in overreaction. Conrad, Hameed, and Nadin (1994) find a relationship between trading activities and contrarian profits. High transaction securities experience price reversals, while returns of low-transaction securities exhibit positive autocovariances.

Internationally, Alonso and Rubio (1990) find evidence of overreaction in the Spanish equity market, while Kryzanowski and Zhang (1992) find evidence against the overreaction hypothesis in the Canadian markets.

In the options market, Stein (1989) find evidence that long-maturity options tend to overreact to changes in

implied volatility of short-maturity options. A more recent study by Diz and Finucane (1993) identifies methodological problems in Stein's study, and finds no overreaction in the index options market.

In a recent study, Chopra, Lakonishok and Ritter (1992) find long term overreaction after adjusting for size and beta. Overreaction is also observed for short windows around quarterly earnings announcements. Conrad and Kaul (1993) examine possible problems associated with the upward bias in methodology used in earlier studies in overreaction. They find evidence that simple holding period returns to losers and winners have no relationship to overreaction.

2.3 Lead-lag Relationship and Contrarian Profits

Studies of overreaction almost uniformly use a contrarian trading strategy of buying winners and selling losers. A recent study by Lo and Mackinlay (1990) argues that contrarian profits might also arise out of a lead-lag relationship among securities. More specifically, they suggest that if large stocks lead in price movement while small ones lag in price movement, then a contrarian strategy would generate significant profits even if there is little overreaction.

Consider a case where one buys prior losers. These

losers might move up in the next trading session for two possible reasons: (i) previous overreaction (dropped too much), and (ii) moving up following the winners. In other words, losers might at the same times be the laggards.

Lo and Mackinlay derive an empirical model to decompose the contrarian profits into two components, one accounted for by overreaction and the other by lead-lag relationship. They provide evidence of positive cross-correlation among stocks. Large stocks are found to lead smaller stocks. This is consistent with earlier findings of positive autocorrelation of stock indexes, even though individual stocks tend to exhibit small negative autocorrelation. They also find that overreaction only accounts for less than 50% of the expected contrarian profits.

It is clear from the previous review of recent studies that the issue of overreaction and contrarian profits in the financial markets is not resolved. There is empirical evidence both for and against the hypothesis. There are many methodological debates. Last but not the least, evidence from derivative markets is scant.

As an important part of security markets, the derivative markets have gone through a period of tremendous growth in recent years. The growth in trading volume in various derivative markets has been substantially higher than that of the equity markets. Some derivative

securities, such as swaps, forward, and some option contracts, are traded over the counter. More standardized derivative securities are actively trading in several exchanges in the U.S. and all over the world.

Most of these exchange-traded derivative securities are characterized by low transaction costs, quick execution of orders, high leverage, and high liquidity. These characteristics make it possible for traders to react to new information more quickly and at a lower cost than in the equity or fixed income markets. It has often been suggested that derivative markets reflect information ahead of the equity or fixed income markets.

Given this quick reaction to new information flow, a detailed study on whether there is overreaction/contrarian profit in the derivative securities markets, the factors contributing to it, and any pattern in it, would provide valuable independent evidence to those found in the equity markets.

In the following chapter we present the contrarian trading strategy, our data set, and report daily contrarian profits in the futures markets.

Chapter 3. Contrarian Profits in the Futures Markets

In this chapter, we discuss the construction of the contrarian portfolio in futures markets. Lo and Mackinlay's model is used to decompose daily contrarian profits into two components: an overreaction component and a lead-lag component. Several contrarian portfolios are formed on related futures contracts. These futures should all react to the same information flow. The contrarian portfolio is designed to capture the differential (over) reaction to new information among the several futures contracts used in the portfolio. If some futures prices react to new information faster and to a greater degree than other futures prices, then the contrarian strategy would generate positive returns.

3.1 Construction of Contrarian Portfolio

3.1.1 Portfolio Construction

Following Lo and Mackinlay (1990), we construct a contrarian portfolio by using past performance of a futures contract. At time t, we buy the losers and sell the

winners, where the winners and losers are determined by the degree of price change k periods before. Using an equally weighted portfolio of all futures contracts (the equally weighted market portfolio) in the same portfolio as a bench mark, winners are the futures contracts with price change greater than that of the bench mark portfolio. Losers are the futures contracts with price change smaller than the bench mark portfolio. In other words, weights in period t depend on performance in period $t-k$.

Formally, let $W_{it}(k)$ be the weight of security i in period t. Then

$$W_{it}(k) = -(1/N)(R_{i,\,t-k} - R_{m,\,t-k}) \qquad i = 1, \ldots, N \qquad (1)$$

where

$$R_{m,\,t-k} = (1/N)\left[\sum_{i=1 \text{ to } N} R_{i,\,t-k}\right] \qquad (1a)$$

is the rate of price change of the equally weighted index portfolio for period $t-k$. For $k = 1$, current buy/sell decision is based on the performance of the futures contracts in the immediate prior period. The contrarian portfolio is constructed as an arbitrage portfolio, where the total of the long positions equals the total of the short positions. The sum of the long and the short positions is zero.

The total long (or short) position in period t can be computed by

$$\mathbf{TRADE}_t = 1/2 * \Sigma \mid \mathbf{W}_{i,t} \mid \qquad i = 1, \ldots, N$$

A futures contract gets a larger weight the further the prior period price change was different from that of the equally weighted portfolio. A futures contract with large positive prior price change will have a large negative weight, while a futures contract with a large prior price decline will have a large positive weight. This design will capture price reversal caused by earlier overreaction. The larger the initial overreaction is, the heavier the portfolio weight is.

If futures markets do overreact, and subsequently correct such overreaction, then our contrarian portfolio should provide positive returns. Also, on days when the differential price reactions among the futures contracts are larger, the total long (or short) position would also be larger.

3.1.2 Contrarian Profits and Its Components

We assume that for each time period t, the rate of price change $R_{i,t}$'s are jointly covariance-stationary. Let Γ_k be the auto-covariance matrix for lag k, k >= ϕ. For k > 1,

current portfolio weights would be determined by rates of price change more than one period ago. To capture short term price reversals on the daily scale, we set k to 1. The portfolio weight for a particular security is determined by its prior period rate of price change. If futures markets are not grossly inefficient, one would expect daily overreaction to be quickly corrected. Using k = 1 would capture price reversals when overreaction is corrected in the immediate following day. In our empirical tests, we vary the weight-setting period from using prior one-day rate of price change, prior two-day rate of price change, up to prior four-day rate of price change.

For each time period t, the profit of the contrarian portfolio can be computed by:

$$PROF_t = \Sigma\ W_{i,t} * R_{i,t} \qquad i = 1, \ldots, N$$

Following Lo and Mackinlay (1990), average profit over the test period can be calculated as:

$$E[\ PROF_t\ ] = \{(1/N^2) * (I'\ \Gamma_k\ I)\} - \{(1/N) * tr(\Gamma_k)\}$$
$$- \{(1/N) * [\Sigma\ (\mu_i - \mu_m)^2]\} \qquad i = 1, \ldots, N \qquad (2)$$

where I is the identity matrix and μ_m is the expectation of the equally weighted portfolio return.

We define L, the profitability index, and a constant $\sigma^2(\mu)$, where L is the sum of the first two components of equation (2), and $\sigma^2(\mu)$ is the third term in equation (2).

We have:

$$E[\ PROF_i\ ] = L - \sigma^2(\mu) \qquad (3)$$

Next define

$$CA_k = (1/N^2) * [(I'\ \Gamma_k\ I) - tr(\Gamma_k)] \qquad (4)$$

$$OA_k = -[(N-1)/N^2] * tr[\ \Gamma_k\ ] \qquad (5)$$

where CA_k depends only on the off-diagonal (cross autocovariance) terms of the autocovariance matrix Γ_k, and OA_k depends only on the diagonal (own autocovariance) terms.

We have:

$$E[\ PROF_i\ ] = CA_k + OA_k - \sigma^2(\mu) \qquad (6)$$

and $\sigma^2(\mu)$ is independent of the autocovariances.

By equation (6), we are able to measure the extent that contrarian profits are due to the cross-autocovariances CA_k, and the extent that it is due to own-autocovariances OA_k. The former arises out of the lead-lag relationship among securities, while the latter reflects price reversals.

If there is a positive cross-autocorrelation among securities, then contrarian profits would arise even without

price reversals. That is to say, in equation (6) $E[\ PROF_t\ ]$ could be positive even if $OA_k = \phi$, or there is no overreaction, as long as $L_k > \sigma^2(\mu)$.

We apply equations (4), (5), and (6) to estimate contrarian profit and its components.

3.2 Data

We use daily data for the following futures:

Market Segment	Futures Contract	Symbol	Exchange
Precious Metals	Silver	SV	Comex
	Gold	GC	Comex
	Palladium	PA	NYM
	Platinum	PL	NYM
Interest Rate	Eurodollar	ED	CME
	T Bond	US	CBT
	T Bill	TB	CME
	T Notes(5 year)	TY	CBT
	T Notes(10 year)	XB	MCE
	Muni Bond	MB	CBT
Stock Index	Major Market	BC	CME
	S&P 500	SP	CME
	NYSE Composite	YX	NYFE
	Value Line	KV	KC
	Mini Value Line	MV	KC
Foreign Currency	Canadian Dollar	CD	CME
	German Mark	DM	CME
	British Pound	BP	CME
	Japanese Yen	JY	CME
	Swiss Franc	SF	CME
	Euro-currency	EU	CME

We collect daily opening, settlement, high, low prices, and trading volume for the five-year period from January 1988 to December 1992. These data are obtained from Futures Industry Institute Data Center at Washington, D.C.

We note here that in the futures markets, the settlement price for a trading day is determined by a

committee with consideration given to prices generated in the short time period before the closing of the market. In some cases, the settlement price may not be the price for the last trade of the day. This procedure was implemented to prevent traders from manipulating the closing price of the day. In this study, often we refer to open-to-settlement (time period) or open-to-settlement futures price changes. This is a reference to the opening and closing time of the markets. However, the settlement prices are always used in measuring the contrarian profits.

For each commodity futures, we construct the nearby series, series ϕ, by using data for the most current contract month up to the last day of the month prior to the expiration month. We then switch to the next current contract month. On the switching day, the jump in futures price, e.g., the change in basis, is subtracted from all later data points. We have series ϕ for every futures used in the study.

For some futures with many months of active trading, we construct several time series using prices from deferred months. For example, Comex Silver futures (SV) and EuroDollar futures (ED) both have active daily trading 18 to 24 months before expiration. To construct series ϕ for SV, we collect daily data for January and February 1988 on the March 1988 contract. For series 1, we collect data for the same 2 months on the June contract. For series 3, on the

September contract, and so on.

The reason for constructing series from deferred month is to examine the possibility of lead-lag relationship and possibly different price reversal behaviors among these series. A priori, the current month contract should reflect information faster and more accurately than the deferred and later contract months. This would be a basis for differential overreaction and a possible lead-lag relationship among the several series.

3.3 Empirical Results on Settlement-to-Settlement Weights

Since most previous studies use closing prices for calculation of returns, in this section, we examine the results of the contrarian strategy as applied to the settlement-to-settlement trading period.

More specifically, we use the prior day settlement-to-settlement rates of price change to compute weights for each series in the portfolio. The portfolio is then held over the following daily settlement-to-settlement period to capture the contrarian profits. We use the model specified earlier in equations (4) and (5) to calculate the two components of the contrarian profits: CA and OA, i.e., the lead-lag component and the overreaction component. The contrarian strategy is applied separately to four sets of futures: Precious Metals Futures, Interest Rates Futures,

Index Futures, and Currency Futures. Four weight-setting periods are applied: rate of price change for prior 1-day period, rate of price change for prior 2-day period, rate of price change for prior 3-day period, and rate of price change for prior 4-day period.

3.3.1 Precious Metals

For the precious metal set, we have the following series:

Silver: SVϕ--SV6
Gold: GCϕ--GC6
Platinum: PLϕ--PL2
Palladium: PAϕ

Four sets of different portfolio weights (as calculated by equation (1)) are calculated by using rates of price change for prior 1-day period, prior 2-day period, prior 3-day period, and prior 4-day period.

We apply these weights to three portfolios:

portfolio 1: trading only the 7 series of SV,
portfolio 2: trading only the 7 series of GC,
portfolio 3: trading all the precious metal futures series (AMF).

Since there are only three active contract months for platinum and only one for palladium, we do not form separate portfolios for them.

Tables 3.1 through 3.3 report the dollar contrarian profit (PROF), the two components (CA and OA), and the dollar amount of trading (TRADE) required to generate these profits.

Table 3.1. Contrarian Profits and Components ($)
Portfolio 1: Silver Futures (SV)

Weighting Period		Mean	T
1-day:	CA	-3.517	-0.36
	OA	5.462	0.55
	PROF(SV)	1.940***	8.32
	TRADE(SV)	904.159	N/A
2-DAY:	CA	-14.950	-1.12
	OA	17.165	1.27
	PROF(SV)	2.209***	8.40
	TRADE(SV)	1076.700	N/A
3-DAY:	CA	-30.004*	-1.85
	OA	32.679**	1.99
	PROF(SV)	2.669***	8.75
	TRADE(SV)	1220.800	N/A
4-DAY:	CA	-35.107*	-1.91
	OA	37.675**	2.02
	PROF(SV)	2.563***	7.90
	TRADE(SV)	1314.000	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^6
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.2. Contrarian Profits and Components ($)
Portfolio 2: Gold Futures (GC)

Weighting Period		Mean	T
1-day:	CA	-19.562	-0.73
	OA	19.479	0.73
	PROF(GC)	-0.086**	-2.51
	TRADE(GC)	1122.180	N/A
2-DAY:	CA	-19.263	-1.08
	OA	19.166	1.23
	PROF(GC)	-0.097**	-1.96
	TRADE(GC)	1728.010	N/A
3-DAY:	CA	-21.720	-1.55
	OA	21.620	1.55
	PROF(GC)	-0.099	-1.63
	TRADE(GC)	2181.120	N/A
4-DAY:	CA	-26.390	-0.48
	OA	26.297	0.48
	PROF(GC)	-0.093	0.20
	TRADE(GC)	2572.830	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^7
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.3. Contrarian Profits and Components ($)
Portfolio 3: All Metal Futures (AMF)

Weighting Period		Mean	T
1-DAY:	CA	-2.357	-0.30
	OA	3.971	0.45
	PROF(AMF)	1.615	1.15
	TRADE(AMF)	2167.800	N/A
2-day:	CA	-11.888	-1.09
	OA	15.268	1.26
	PROF(AMF)	3.380*	1.75
	TRADE(AMF)	2997.900	N/A
3-DAY:	CA	-24.269*	-1.82
	OA	30.421**	2.06
	PROF(AMF)	6.152***	2.69
	TRADE(AMF)	3632.800	N/A
4-DAY:	CA	-28.730*	-1.91
	OA	34.404**	2.07
	PROF(AMF)	5.674**	2.16
	TRADE(AMF)	4104.100	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^6
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

From the tables above, we observe some general patterns. First, there are contrarian profits in the precious metals futures markets. The gold futures portfolio generates either small significant negative or insignificant profits. The silver futures portfolio, however, generates positive and significant profits. For the All Metal Futures (AMF) portfolios, all but the one-day results are positive and significant.

Second, the two components are uniformly opposite in sign, with the OA component always positive and the CA component always negative. While there are price reversals resulting from negative own autocorrelation (OA > ϕ). The cross autocorrelation among various series is negative (CA < ϕ). A clear lead-lag relationship found in the equity market does not exist in the precious metal futures. The negative CA components signal cross price reversals. The negative or insignificant profit on the gold futures portfolio is a result of the negative CA component being larger in size than the positive OA component.

Third, there is a tendency for contrarian profits to be larger and more significant as we go from using prior 1-day period to using prior 3-day and 4-day periods for portfolio weight determination. In the gold futures portfolio, we observe the tendency of less significant negative profit when we move to longer weight-setting periods. We also

observe that a longer weight-setting period leads to larger amount of trading (TRADE). The obvious reason is that longer weighting periods use longer holding periods and thus generate larger weights.

Fourth, some of the contrarian profits are economically significant. Consider the 1-day case of the silver portfolio. On a nominal trading amount of $904.159 on one side, the contrarian profit is about $1.94 per day. For a contract size of $25,000 (at current price of around $5 per troy ounce, 5,000 troy ounces per contract), this would amount to an average daily profit of about $53.64. Currently, with a discount futures broker, round-trip commission is lower than $20 per contract. The profit is larger than commission costs (round-trip commission of $40 for both the long and the short sides). For active traders such as floor traders, commission costs are substantially lower.

While this may be taken as evidence of short term price inefficiency, one must consider other factors that would lower the magnitude of profits in practice. Other transaction costs such as bid/ask spread must be allowed for. The ability to trade at the given prices could be severely limited for deferred contracts, where prices may be stale and liquidity is limited. The fact that all the contracts in a portfolio need to be executed at the same time would also limit the actual contrarian profits. It is

likely that only the most active traders would be able to earn these profits. One example would be the floor traders, who trade on small price inefficiency and in doing so provide liquidity to the markets.

For the gold futures portfolio, the significant negative profits in the 1-day and 2-day cases are clearly too small to be of any economic significance. The results for the All Metals Futures (AMF) portfolio are similar to those of the silver futures portfolio. The profits are smaller than those of the silver portfolio. In fact, as the gold futures portfolio does not generate positive profits, the results for the AMF portfolio probably reflect the profits earned by the silver futures used in the portfolio.

Next, we examine the contrarian profits from the interest rate futures set.

3.3.2 Interest Rate Futures

For interest rate futures, we construct the following series:

Eurodollar:	EDϕ--ED10
T-Bond :	USϕ--US4
T-Bill :	TBϕ--TB1
T-Note (5 year):	TYϕ--TY1
T-Note (10 year):	XBϕ--XB1
Muni Bond:	MBϕ--MB1.

We test the contrarian profits for the following portfolios:

Portfolio 4: EDϕ--ED10
Portfolio 5: USϕ--US4
Portfolio 6: all interest rate futures series (AIRF).

Since all but the Eurodollar and the T-Bond futures have only two active trading contract months, we do not form separate portfolios for them. Table 3.4 to 3.6 report the results.

Table 3.4. Contrarian Profits and Components ($)
Portfolio 4: Eurodollar Futures (ED)

Weighting Period		Mean	T
1-day:	CA	21.367*	1.85
	OA	-27.067**	-2.28
	PROF(ED)	-5.700***	-5.08
	TRADE(ED)	37047.000	N/A
2-DAY:	CA	10.929	1.10
	OA	-17.060	-0.26
	PROF(ED)	-6.132***	-3.00
	TRADE(ED)	60226.000	N/A
3-DAY:	CA	3.171	0.27
	OA	-10.360	-0.80
	PROF(ED)	-7.190***	-2.94
	TRADE(ED)	77661.000	N/A
4-DAY:	CA	4.994	0.36
	OA	-10.747	-0.71
	PROF(ED)	-5.753*	-1.90
	TRADE(ED)	92221.000	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^9
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.5. Contrarian Profits and Components ($)
Portfolio 5: T-Bond Futures (US)

Weighting Period		Mean	T
1-day:	CA	48.889	0.79
	OA	-47.791	-0.77
	PROF(US)	1.097	1.07
	TRADE(US)	8378.100	N/A
2-DAY:	CA	117.713	1.27
	OA	-116.272	-1.26
	PROF(US)	1.442	1.36
	TRADE(US)	11944.300	N/A
3-DAY:	CA	-102.548	-0.93
	OA	103.891	0.94
	PROF(US)	1.343	1.28
	TRADE(US)	14555.900	N/A
4-DAY:	CA	-121.019	-0.89
	OA	122.635	0.91
	PROF(US)	1.616	1.51
	TRADE(US)	16876.500	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^8
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.6. Contrarian Profits and Components ($)
Portfolio 6: All Interest Rate Futures (AIRF)

Weighting Period		Mean	T
1-DAY:	CA	2.439	1.56
	OA	-3.096	-1.08
	PROF(AIRF)	-0.656	-0.49
	TRADE(AIRF)	8630.550	N/A
2-day:	CA	3.478	1.50
	OA	-5.502	-1.28
	PROF(AIRF)	-2.024	-1.01
	TRADE(AIRF)	12633.000	N/A
3-DAY:	CA	-1.653	-0.59
	OA	4.117	0.80
	PROF(AIRF)	2.463	1.02
	TRADE(AIRF)	15660.000	N/A
4-DAY:	CA	-2.587	-0.75
	OA	5.920	0.94
	PROF(AIRF)	3.333	1.13
	TRADE(AIRF)	18028.000	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^7
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

The results for the interest rate futures are considerably different from those for the metal futures. In general, using settlement prices, contrarian strategy does not work in the interest rate futures. In the Eurodollar portfolio, all profits are significantly negative. The size of the negative profit is such (profits of $5.7 on notional trading amount of $37,047, or 0.015%) that it is of little economical significance. The reverse trading strategy would not have made economical profit. The profits are all insignificant in the other two portfolios. There is also no clear pattern in the two sub-components. This is indirect evidence that the daily settlement prices in the interest rate futures do not exhibit significant price reversals or lead-lag structures among the series.

We next report the results for index futures and currency futures.

3.3.3 Index Futures and Currency Futures

We construct the following series from index futures:

S&P 500:	SPϕ--SP2
NYSE Composite:	YXϕ--YX2
Value Line:	KVϕ--KV1
Mini Value Line:	MVϕ--MV1
Major Market:	BCϕ

For currency futures, we construct the following series:

Canadian Dollar:	CDϕ--CD3
German Mark:	DMϕ--DM2
Japanese Yen:	JYϕ--JY2
British Pound:	BPϕ--BP1
Swiss Franc:	SFϕ--SF1
Eurocurrency Unit:	EUϕ.

Since none of the individual futures have a large number of actively traded contract months, for each group, we only test the results for one portfolio using all the series in the group:

Portfolio 7: all index futures series (AIF).
Portfolio 8: all currency futures series (ACF).

Table 3.7 and 3.8 report the results.

Table 3.7. Contrarian Profits and Components ($)
Portfolio 7: All Index Futures (AIF)

Weighting Period		Mean	T
1-day:	CA	-1.128	-0.09
	OA	2.285	0.17
	PROF(AIF)	1.157	0.96
	TRADE(AIF)	805.652	N/A
2-DAY:	CA	-22.494	-0.86
	OA	24.419	0.91
	PROF(AIF)	1.925*	1.74
	TRADE(AIF)	1126.000	N/A
3-DAY:	CA	-27.609	-0.85
	OA	29.591	0.89
	PROF(AIF)	1.982	1.61
	TRADE(AIF)	1371.900	N/A
4-DAY:	CA	-34.915	-1.03
	OA	36.088	1.05
	PROF(AIF)	1.723	0.87
	TRADE(AIF)	1566.700	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^6
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.8. Contrarian Profits and Components ($)
Portfolio 8: All Currency Futures (ACF)

Weighting Period		Mean	T
1-DAY:	CA	6.421	0.77
	OA	-11.944	-1.09
	PROF(ACF)	-5.523	-1.55
	TRADE(ACF)	15776.000	N/A
2-day:	CA	-10.081	-0.87
	OA	10.420	0.68
	PROF(ACF)	0.034	0.07
	TRADE(ACF)	22924.000	N/A
3-DAY:	CA	-12.919	-0.86
	OA	11.132	0.57
	PROF(ACF)	-1.188	-0.29
	TRADE(ACF)	28033.000	N/A
4-DAY:	CA	-15.167	-0.88
	OA	14.446	0.65
	PROF(ACF)	-0.720	-0.13
	TRADE(ACF)	32730.000	N/A

NOTE: --All numbers obtained by multiplying the original numbers by 10^7
--***, **, and * denote significance levels at 1%, 5%, and 10% respectively

The results for the index and currency futures are similar to the ones for the interest rate futures: contrarian strategy does not work in the settlement prices in either the index futures or the currency futures. Except for the marginally significant case of the 2-day result for the index portfolio, all the other cases show insignificant profits. While all the OA components are positive, all but one of the CA components are negative, signaling possible presence of price reversal but no clear lead-lag relationship.

3.3.4 Conclusion

Our results in this section suggest that settlement prices in general do not generate significant contrarian profits. Of all the 8 portfolios tested, only the silver and the All Metal Futures portfolio result in significant positive profits. The latter probably only reflects the effect of the profits coming from the silver futures. All the other portfolios report insignificant profits, with the Eurodollar futures reporting significant negative but very small profits. The conclusion is that in general settlement prices do not generate contrarian profits. The results do not change when the weighting period is extended from prior one day period up to the prior 4-day period.

While the daily settlement prices appear to be in

general efficient with respect to a contrarian trading strategy, evidence that opening prices are more volatile than closing prices (French and Roll, 1986) would suggest that the same strategy as applied to opening prices may generate different results. Furthermore, if opening and closing prices exhibit different behaviors, then we might also expect different results when we decompose the daily holding period (open-to-open or settlement-to-settlement) into two sub-periods (open-to-settlement and settlement-to-open). In particular, if prices tend to revert back to an efficient level quickly, then one would expect all the contrarian profits to disappear quickly. Or, only trading in the first half-day subperiod immediately following the opening (closing) time would capture any contrarian profits. The following time period should not generate any significant positive contrarian profits. These issues are explored in the next section.

3.4 Contrarian Profits in Open Prices and Sub-periods

While settlement-to-settlement price changes do not generate contrarian profits, it is only one of several possible applications of the trading strategy on a daily basis. Evidence has been reported that open-to-open returns do not behave the same as settlement-to-settlement returns

(French and Roll, 1986). More specifically, open-to-open returns are more volatile. If volatility is a cause for overreaction, then one might expect opening prices to exhibit larger degree of price reversal.

Another equally important question is: how much time does it take for prices to revert back to an efficient level? While we cannot answer this question directly without intra-day prices, we could provide some partial answer by examining the contrarian profits earned over half-day sub-periods.

In this section, we report contrarian profits over four different weighting periods: Settlement-to-Settlement, Open-to-Open, Open-to-Settlement, and Settlement-to-Open. We also compute the contrarian profits from each of these weighting scheme as earned over the two following half-day sub-periods. If a market is highly efficient, one would expect contrarian profits to exist only for relatively short time period. By dividing an Open-to-Open (Settlement-to-Settlement) period into an Open-to-Settlement (Settlement-to-Open) and a subsequent Settlement-to-Open (Open-to-Settlement) period, we can examine if most contrarian profits are indeed earned only, or mostly, in the subperiod immediately following the weighting period. If this is so, then we have evidence of a relatively efficient market.

We calculate contrarian profits using the following four specifications:

	Weighting Period (Prior day)	Trading Period (Following day)
1.a	Settlement-to-Settlement	Settlement-to-Settlement
1.b	Settlement-to-Settlement	Settlement-to-Open
1.c	Settlement-to-Settlement	Open-to-Settlement
2.a	Open-to-Open	Open-to-Open
2.b	Open-to-Open	Open-to-Settlement
2.c	Open-to-Open	Settlement-to-Open
3.a	Open-to-Settlement	Settlement-to-Settlement
3.b	Open-to-Settlement	Settlement-to-Open
3.c	Open-to-Settlement	Open-to-Settlement
4.a	Settlement-to-Open	Open-to-Open
4.b	Settlement-to-Open	Open-to-Settlement
4.c	Settlement-to-Open	Settlement-to-Open

For each set of three related specifications, the same weighting period is applied. Results in Set 1 and Set 3 depend on whether settlement prices overreact and how much prices revert in the following periods. Results in Set 2 and Set 4 would capture price reversals and their patterns in the opening prices.

The difference between the 3 specifications within each set lies in the trading period. Specification **a** trades over the next whole day (open-to-open or settlement-to-settlement). Specifications **b** and **c** trade over the half-day sub-periods. By design, profits from **b** and **c** sum up to profits from **a**. If most contrarian profits are earned only in the first half-day sub-periods(i.e., the **b**'s), then this is evidence that prices correct quickly. On the other hand,

if the second sub-period (i.e., the **c's**) still earns significant profits, then prices do not correct quickly.

A priori, one would expect any contrarian profits to be earned quickly in sub-periods **b's**. On sub-periods **c's**, one would expect insignificant profits, or negative profits.

We construct another measure of contrarian profits by calculating the ratio of dollar contrarian profit to dollar nominal amount traded on one side: PROF/TRADE. This value is calculated to facilitate comparison among the 3 specifications within each set of results and results across sets. Since the trading strategy is applied to futures markets, there is no actual investment. The value PROF/TRADE is thus not a measure of return but a measure of the extent of price reversal over a given sub-period.

The analysis is applied to the same four sets of futures markets.

3.4.1 Precious Metal Futures

Table 3.9 to 3.11 report results in the precious metal group.

Table 3.9. Contrarian Profits in Sub-Periods
Gold Futures

Weight	Day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	-8.64E-09	0.000112	-0.0077%**	-2.51
ST/ST	ST/OP	9.38E-11	0.000112	0.0001%	0.01
ST/ST	OP/ST	-8.73E-09	0.000112	-0.0078%	-0.55
OP/OP	OP/OP	1.09E-05	0.001797	0.6051%***	17.10
OP/OP	OP/ST	8.52E-06	0.001797	0.4742%***	16.47
OP/OP	ST/OP	2.35E-06	0.001797	0.1308%***	6.23
OP/ST	ST/ST	4.81E-08	0.00096	0.0050%	0.53
OP/ST	ST/OP	-1.1E-07	0.00096	-0.0118%	-0.68
OP/ST	OP/ST	1.61E-07	0.00096	0.0168%	1.18
ST/OP	OP/OP	1.04E-05	0.001414	0.7357%***	17.41
ST/OP	OP/ST	8.35E-06	0.001414	0.5906%***	16.60
ST/OP	ST/OP	2.05E-06	0.001414	0.1447%***	6.15

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.10. Contrarian Profits in Sub-Periods
Silver Futures

Wight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	1.94E-06	0.000904	0.2146%***	8.32
ST/ST	ST/OP	2E-06	0.000904	0.2215%***	6.55
ST/ST	OP/ST	-6.3E-08	0.000904	-0.0070%	-0.38
OP/OP	OP/OP	3.04E-05	0.002827	1.0739%***	14.70
OP/OP	OP/ST	2.74E-05	0.002827	0.9697%***	15.16
OP/OP	ST/OP	2.95E-06	0.002827	0.1042%***	3.05
OP/ST	ST/ST	2.87E-08	0.001747	0.0016%	0.16
OP/ST	ST/OP	-1.6E-07	0.001747	-0.0090%	-0.25
OP/ST	OP/ST	1.86E-07	0.001747	0.0107%	0.30
ST/OP	OP/OP	2.93E-05	0.002057	1.4254%***	15.21
ST/OP	OP/ST	2.72E-05	0.002057	1.3238%***	15.05
ST/OP	ST/OP	2.09E-06	0.002056	0.1017%***	2.77

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.11. Contrarian Profits in Sub-Periods
All Metal Futures

Weight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	3.63E-07	0.002782	0.0131%	0.19
ST/ST	ST/OP	2.16E-06	0.002782	0.0776%	1.57
ST/ST	OP/ST	-1.8E-06	0.002782	-0.0646%**	-2.01
OP/OP	OP/OP	1.1E-05	0.003187	0.3451%***	6.79
OP/OP	OP/ST	7.31E-06	0.003188	0.2294%***	7.21
OP/OP	ST/OP	3.68E-06	0.003187	0.1156%***	2.80
OP/ST	ST/ST	-7.8E-07	0.002057	-0.0379%	-0.89
OP/ST	ST/OP	3.19E-07	0.002057	0.0155%	0.55
OP/ST	OP/ST	-1.1E-06	0.002057	-0.0534%*	-1.66
ST/OP	OP/OP	1.02E-05	0.002299	0.4451%***	7.81
ST/OP	OP/ST	8.41E-06	0.002299	0.3657%***	10.53
ST/OP	ST/OP	1.82E-06	0.002299	0.0793%*	1.66

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

From these tables, we find evidence that confirms our earlier suggestion that opening prices generate different patterns in contrarian profits from those of settlement prices. While the ST/ST vs. ST/ST results simply re-cap earlier results, the other items in the tables provide several interesting and important insights.

First, while there is some positive profits from silver

futures in settlement prices, there are larger and significant positive contrarian profits in the opening prices in all three portfolios. The same results can be observed in both the open-to-open weighting period and the settlement-to-open weighting period. This corroborates with evidence that opening prices are more volatile. The larger volatility induces larger overreaction among the several series and generates larger and more significant contrarian profits.

Second, in all cases of significant profits, most of the profits are earned in the half-day period immediately following the weighting period. In the opening price cases (sets 2 and 4), only a small fraction of contrarian profits are earned in the 2nd half-day (settlement-to-open) sub-period. In the ST/ST cases for silver futures--the only cases where settlement prices also generate positive contrarian profit--contrarian profits in the second half-day sub-period become insignificant. In general, we have evidence that prices tend to revert quickly such that most of the contrarian profits are earned in the first half-day period. It is interesting to note that for the opening price cases, most of the profits come in the following open-to-settlement period. These are the opening hours of a trading day. Apparently, a contrarian strategy would work best for a day-trader. There is only very small reward for carrying the position overnight.

Finally, the different weighting periods also generate different results. Comparing the results from using prior open-to-open period for weights to those using the prior settlement-to-open period for weights, we find the latter generates larger contrarian profits. If the settlement prices tend to be efficient, then overreaction occurs primarily on the opening price, upon arrival of new information in the beginning of the new trading day. The prior settlement-to-open price change would capture such overreaction. But if the last settlement price was efficient, then adding the weights from the last open-to-settlement price change would not capture additional overreaction.

Next, we report the results for the interest rate futures group.

3.4.2 Interest Rate Futures

We apply the same four sets of trading strategies to the three portfolios in the interest rate futures group: Eurodollar futures, T-Bond futures, and the portfolio of All Interest Rate Futures (AIRF). Tables 3.12 to 3.14 report the results.

Table 3.12. Contrarian Profits in Sub-Periods
Eurodollar Futures (ED)

Weight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	-5.7E-09	3.7E-05	-0.0154%***	-5.08
ST/ST	ST/OP	-2.2E-09	3.7E-05	-0.0060%***	-3.78
ST/ST	OP/ST	-3.5E-09	3.7E-05	-0.0093%***	-3.42
OP/OP	OP/OP	8.17E-09	5.43E-05	0.0151%***	3.25
OP/OP	OP/ST	7.83E-09	5.43E-05	0.0144%***	3.35
OP/OP	ST/OP	3.4E-10	5.43E-05	0.0006%	0.34
OP/ST	ST/ST	-5.7E-09	4.36E-05	-0.0132%**	-4.23
OP/ST	ST/OP	-1.8E-09	4.36E-05	-0.0041%**	-2.00
OP/ST	OP/ST	-4E-09	4.36E-05	-0.0091%***	-3.12
ST/OP	OP/OP	1.13E-08	2.48E-05	0.0457%***	6.12
ST/OP	OP/ST	1.18E-08	2.48E-05	0.0476%***	6.22
ST/OP	ST/OP	-4.6E-10	2.48E-05	-0.0018%	-0.70

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.13. Contrarian Profits in Sub-Periods
T-Bond Futures (US)

Weight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	1.1E-08	8.38E-05	0.0131%	1.07
ST/ST	ST/OP	3.41E-09	8.38E-05	0.0041%	0.25
ST/ST	OP/ST	7.56E-09	8.38E-05	0.0090%	0.90
OP/OP	OP/OP	3.01E-06	0.000907	0.3316%***	13.92
OP/OP	OP/ST	3.1E-06	0.000907	0.3420%***	15.50
OP/OP	ST/OP	-9.5E-08	0.000917	-0.0103%	-0.98
OP/ST	ST/ST	1.1E-08	0.000623	0.0018%	0.62
OP/ST	ST/OP	7.12E-08	0.000623	0.0114%	1.12
OP/ST	OP/ST	-6E-08	0.000623	-0.0097%	-0.97
ST/OP	OP/OP	3.1E-06	0.000609	0.5089%***	16.12
ST/OP	OP/ST	3.16E-06	0.000609	0.5196%***	16.50
ST/OP	ST/OP	-6.5E-08	0.000609	-0.0107%	-1.04

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.14. Contrarian Profits in Sub-Periods
All Interest Rate Futures (AIRF)

Weight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	-6.6E-08	0.000863	-0.0076%	-0.49
ST/ST	ST/OP	-8.2E-08	0.000864	-0.0095%	-1.53
ST/ST	OP/ST	1.58E-08	0.000827	0.0019%	0.14
OP/OP	OP/OP	1.05E-06	0.000971	0.1084%***	7.25
OP/OP	OP/ST	9.94E-07	0.000971	0.1024%***	7.40
OP/OP	ST/OP	5.85E-08	0.000971	0.0060%	1.12
OP/ST	ST/ST	-9.5E-09	0.000801	-0.0012%	-0.09
OP/ST	ST/OP	-1.2E-08	0.000801	-0.0015%	-0.27
OP/ST	OP/ST	2.31E-09	0.000801	0.0003%	0.02
ST/OP	OP/OP	9.26E-07	0.000444	0.2086%***	11.70
ST/OP	OP/ST	9.92E-07	0.000444	0.2233%***	13.61
ST/OP	ST/OP	-6.6E-08	0.000444	-0.0148%**	-1.98

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

The results in the interest rate futures not only confirm those found in the precious metal futures but are even stronger. In the T-Bond portfolio and the AIRF portfolio, only Set 2 and Set 4--those associated with opening prices--generate significant positive profits. The settlement price cases (sets 1 and 3) are all insignificant. In the Eurodollar futures portfolio, we observe significant positive but very small contrarian profits on the opening prices and significant negative profits in the settlement

price cases. This confirms our earlier evidence that the more volatile opening prices generate contrarian profits, while the contrarian strategy does not work in the settlement prices.

Second, in both the OP/OP and the ST/OP weighting cases, all the profits are earned in the open-to-settlement sub-period immediately following the weighting period. Trading over the next settlement-to-open sub-period are all insignificant except for the ST/OP weighting in the AIRF portfolio, where it turns significantly negative. Again, we have evidence that contrarian strategy work for day-trade, and that there is no reward at all for carrying the position overnight. Prices quickly revert back to an efficient level by the closing time.

We might also note that, while statistically significant, the magnitude of contrarian profits are small and unlikely to be economically significant.

Next, we examine the index futures and the currency futures groups.

3.4.3 Index Futures and Currency Futures

We apply the same four sets of specifications to the All Index Futures portfolio and the All Currency Futures portfolio. Tables 3.15 and 3.16 report the results.

Table 3.15. Contrarian Profits in Sub-Periods
All Index Futures (AIF)

Weight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	1.16E-06	0.000806	0.1436%	0.96
ST/ST	ST/OP	1.27E-06	0.000806	0.1571%	1.42
ST/ST	OP/ST	-1.1E-06	0.000806	-0.1346%	-0.13
OP/OP	OP/OP	1.37E-05	0.001653	0.8290%***	4.61
OP/OP	OP/ST	1.42E-05	0.001653	0.8597%***	5.02
OP/OP	ST/OP	-5.1E-07	0.001653	-0.0307%	-0.54
OP/ST	ST/ST	1.71E-06	0.001247	0.1373%*	1.90
OP/ST	ST/OP	1.88E-06	0.001247	0.1505%**	2.15
OP/ST	OP/ST	-1.6E-07	0.001247	-0.0132%	-0.18
ST/OP	OP/OP	1.38E-05	0.001049	1.3114%***	4.27
ST/OP	OP/ST	1.44E-05	0.001049	1.3699%***	4.94
ST/OP	ST/OP	-6.1E-07	0.001049	-0.0585%	-0.76

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 3.16. Contrarian Profits in Sub-Periods
All Currency Futures (ACF)

Weight	day-1	PROF	TRADE	PROF/TRADE	T
ST/ST	ST/ST	-5.5E-07	0.001578	-0.0350%	-1.55
ST/ST	ST/OP	-2E-07	0.001578	-0.0126%	-0.69
ST/ST	OP/ST	-3.5E-07	0.001578	-0.0224%*	-1.67
OP/OP	OP/OP	1.79E-06	0.001724	0.1036%***	4.57
OP/OP	OP/ST	1.29E-06	0.001724	0.0748%***	4.94
OP/OP	ST/OP	4.97E-07	0.001724	0.0288%*	1.86
OP/ST	ST/ST	-2.2E-07	0.001097	-0.0205%	-1.13
OP/ST	ST/OP	-1.2E-07	0.001097	-0.0111%	-0.81
OP/ST	OP/ST	-1E-07	0.001097	-0.0094%	-0.66
ST/OP	OP/OP	1.32E-06	0.001266	0.1045%***	4.52
ST/OP	OP/ST	1.39E-06	0.001266	0.1098%***	7.53
ST/OP	ST/OP	-6.7E-08	0.001266	-0.0053%	-0.30

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

The results from both the index futures portfolio and the currency futures portfolio again confirm the patterns found earlier. Trading on opening prices, those in Set 2 and Set 4, results in significant positive contrarian profits. Trading on settlement prices, those in Set 1 and Set 3, results in insignificant profits for all but the OP/ST weighting cases for index futures, where the profits, though significant, are much smaller relative to those of the opening price cases and less significant.

Second, similar to previous cases, practically all the profits are earned in the half-day sub-period immediately following the weighting period.

Relative to the profits found in other portfolios, the index futures portfolio generate larger profits. This may result from the substantial difference in trading activities among the several index futures. In particular, the Value Line index futures and the Mini Value Line index futures are substantially less active than the other index futures. This would result in substantial differential price (over) reaction to information flow. In practice, this would imply difficulty in actually capturing the calculated contrarian profits, since it might not be possible to trade the less liquid contracts at the opening price. The larger contrarian profits from the index futures portfolio thus do not automatically imply that the index futures markets are less efficient than the other futures markets.

3.4.4 Time of the Contrarian Profits

It is clear from our examination above that there is a common pattern across all the futures portfolios in the time pattern of contrarian profits: most profits occur in the open-to-settlement sub-period immediately following the open-to-open weighting period. Figures 1 to 4 graph the time pattern for the OP/OP weighting and the ST/OP weighting cases. The ST/ST weighting and OP/ST weighting cases are not graphed since almost all the results are insignificant. The 4 figures show a uniform pattern as discussed above.

Figure 1. Contrarian Profits in Sub-Periods
Portfolios: SV, GC, US, ED

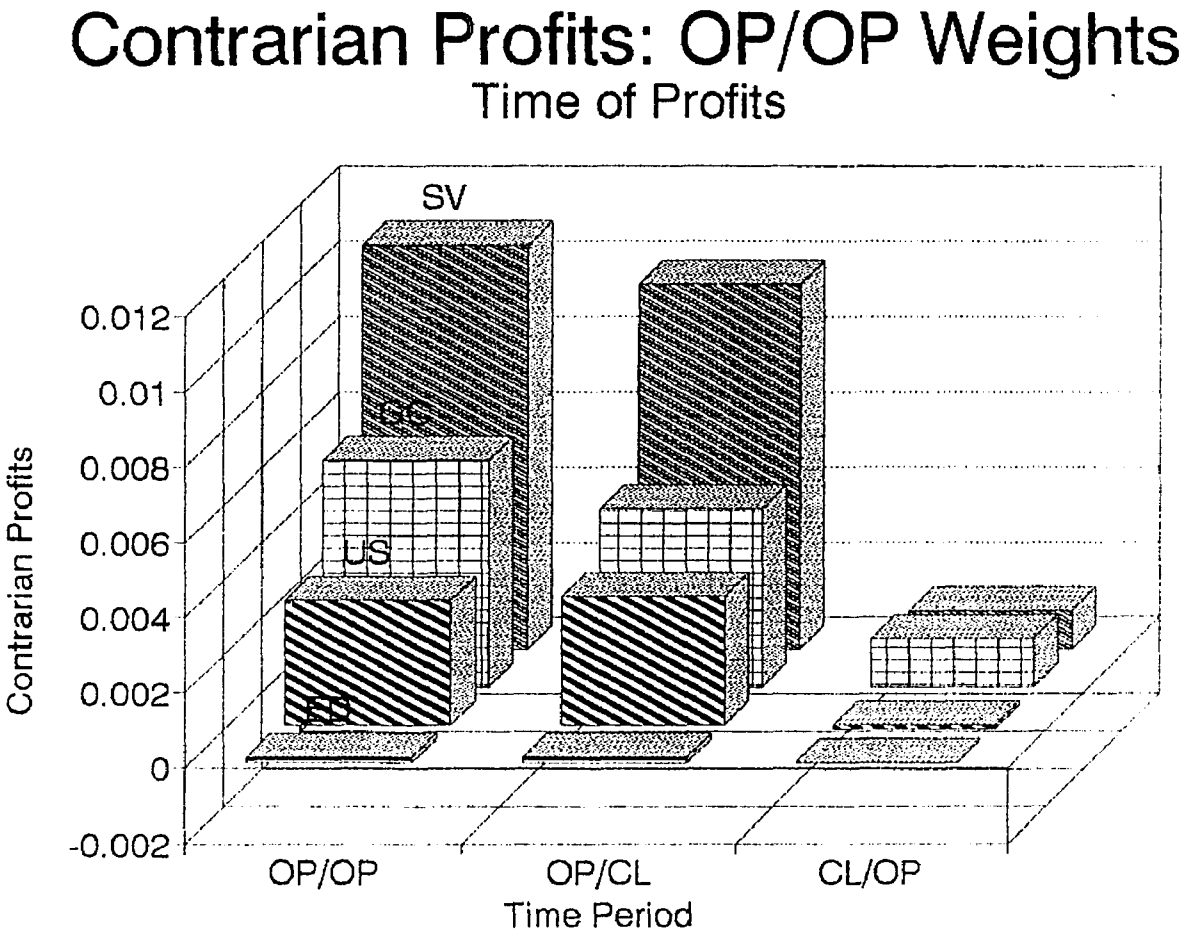


Figure 2. Contrarian Profits in Sub-Periods
Portfolios: SV, GC, US, ED

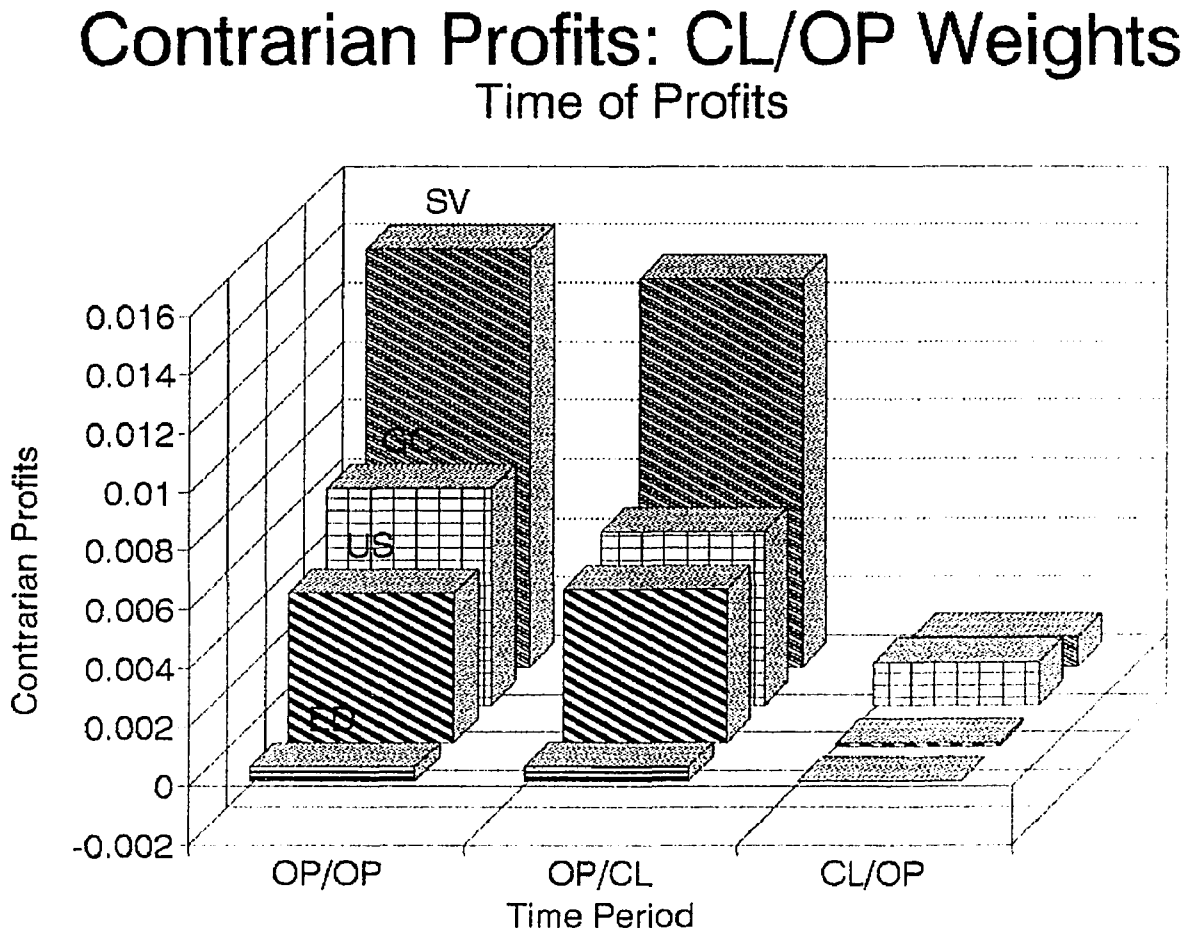


Figure 3. Contrarian Profits in Sub-Periods
Portfolios: Index, Metal, Rate, FX

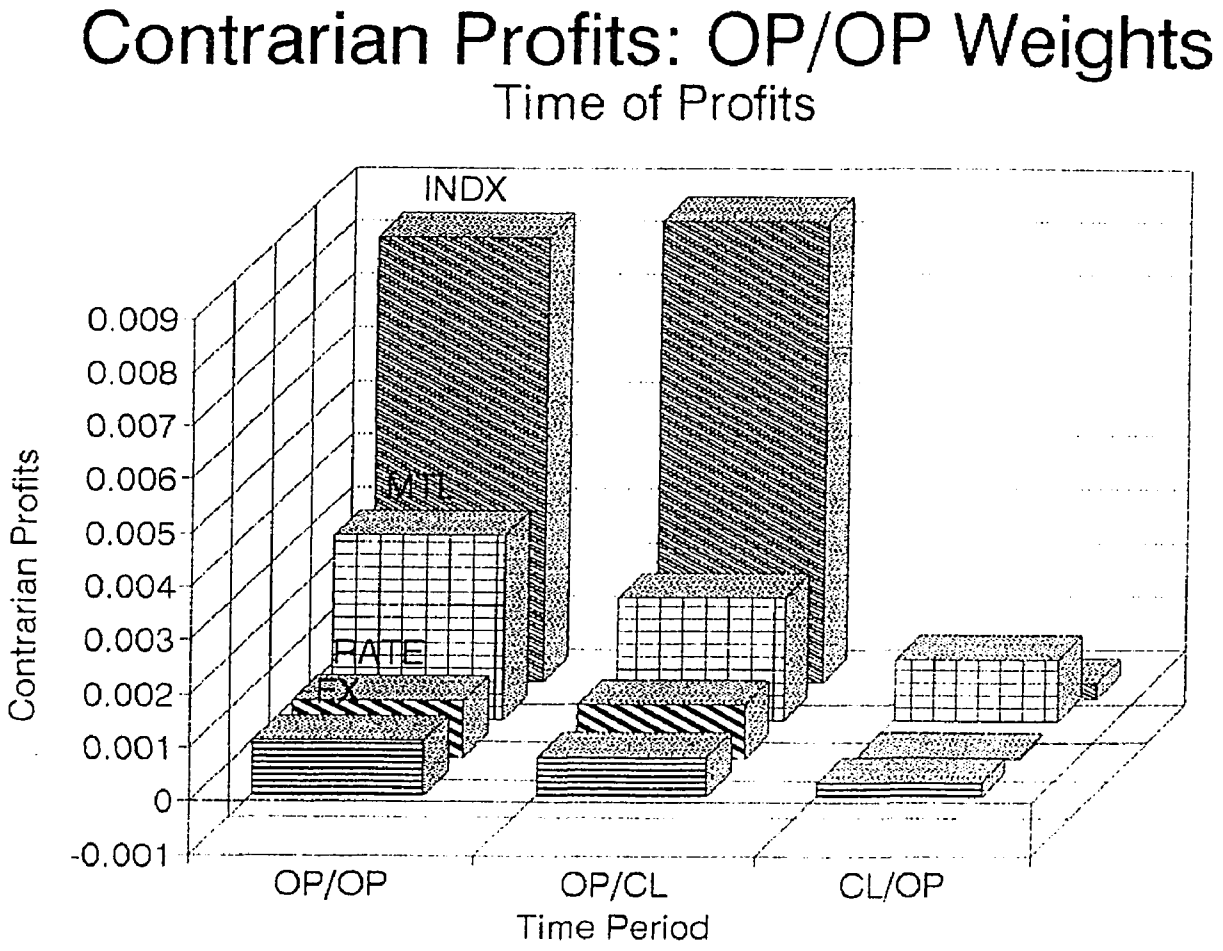
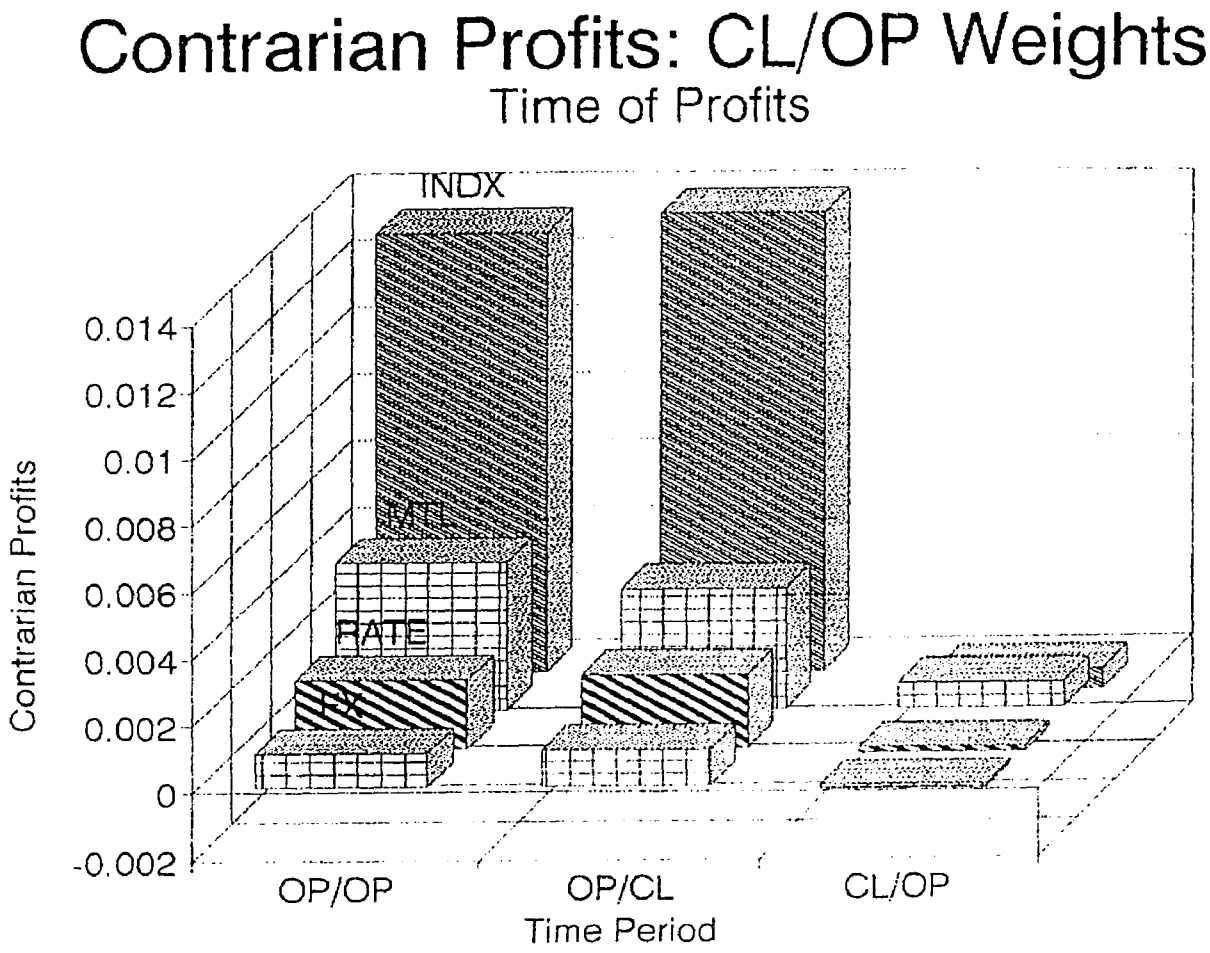


Figure 4. Contrarian Profits in Sub-Periods
Portfolios: Index, Metal, Rate, FX



3.4.5 Conclusions

Two important patterns are found in our examination of contrarian profits. First, settlement prices in general do not generate contrarian profits, except in a small number of cases. Opening prices, on the other hand, uniformly generate significant positive contrarian profits. The same results are observed whether one uses the prior open-to-open period or the prior settlement-to-open period for weight determination. This prevalent pattern corroborates with evidence from other studies that opening prices are more volatile than closing prices.

The second important pattern is observed in the general tendency for most of the contrarian profits to be earned in the first half-day sub-period immediately following the weighting period. For the open-to-open and settlement-to-open weighting cases, this means most contrarian profits are earned in the following open-to-settlement sub-period. Trading extended over the next settlement-to-open sub-period earns insignificant profit in most cases, and significant negative profits in some cases. This uniform pattern provides evidence that, to the degree that opening prices overreact somewhat, they revert back to an efficient level quickly, within the trading day. We can conclude that price inefficiency, in term of overreaction, does not carry beyond half-day sub-periods (open-to-settlement or settlement-to-

open).

While significant contrarian profits are theoretically available, and some, as discussed earlier, are economically significant, the profits are overall small. To the degree that the contrarian strategy depends crucially on execution on the opening prices (and in a few cases the settlement prices), only very active traders with settlement and quick access to the trading floor might be able to reap these profits. One might consider these profits the reward for floor traders in providing liquidity. To the degree that most of the profits do not extend overnight, and thus coming from day-trading, the floor traders, who are also mostly day-traders, earn the profits for bringing prices back to an efficient level within the trading day.

Chapter 4. Information Impact, Volatility, Volume Effects and Weekday Pattern in Contrarian Profits

The original study in contrarian profits by De Bondt and Thaler documents evidence of higher contrarian profits for winners and losers with larger initial price change. In addition, there is an asymmetry in that extreme losers tend to generate much larger price reversals (in gains) than winners (in losses). Other studies also provide evidence that both the magnitude and the sign of the initial information impact are significant factors in the magnitude of overreaction.

More recently, Kalok Chan (1993) provides evidence that auto-correlation and cross-correlation among large and small stocks are related to the magnitude of the market returns. A study by Conrad, Hadeem, and Niden (1994) provides evidence that short horizon contrarian profits are related to the trading volume of the stocks. Pettengill and Jordan (1990) provides evidence that there is a weekday seasonal pattern in stock market daily contrarian profits.

In this chapter, we examine the effects of market movement, intraday volatility, and change in trading volume on contrarian profits in the futures markets.

4.1 Effects of Information Impact, volatility, and Volume

A priori, we expect overreaction to be more severe when the initial information impact is large. We also expect overreaction to be larger when there is high volatility in the markets. In term of trading volume, Conrad, Hadeem, and Niden (1994) find that previousiy actively traded stocks tend to generate price reversals while stocks with a low trading volume tend to show price continuation.

With respect to daily volume, we would expect a significant change in trading volume to signal extreme reaction of traders to new information. In particular, a substantial decrease in trading volume could lead to less efficient price setting.

To measure the effect of these factors, we regress daily contrarian profits on variables that measure initial market movement, intraday volatility, and rate of change in daily trading volume. We concentrate on the ST/OP vs. OP/ST cases where the contrarian profits are largest and most significant. We estimate the following equation:

$$\mathbf{PROFX} = \alpha + \beta_1 * \mathbf{MKTMOVE} + \beta_2 * \mathbf{MKTSIGN} + \beta_3 * \mathbf{MKTMOVE*MKTSIGN} + \beta_4 * \mathbf{VOLTY} + \beta_5 * \mathbf{VLM} + \beta_6 * \mathbf{VLMSIGN} + \beta_7 * \mathbf{VLM*VLMSIGN} \quad (7)$$

where:

PROFX : measured by the $ contrarian profits as a percentage of $ trading amount, or, PROF/TRADE.

MKTMOVE : the absolute value of the previous settlement -to-open return of the equally weighted portfolio (as $R_{m,t}$ in equation 1a). This measures the information impact before or on the market opening.

MKTSIGN : Sign of the opening market movement, +1 if day t's opening price is greater than day (t-1)'s settlement price, -1 if smaller. This differentiates positive information impact from negative information impact.

VOLTY : $VOLTY = (1 + R_{hi\text{-}lo}) / |(1 + R_{op\text{-}cl})|$ where $R_{hi\text{-}lo}$ is the percentage difference between the daily high price and the daily low price, and $R_{op\text{-}lo}$ is the open-to-settlement rate of price change. This variable measures intraday volatility. The larger the ratio, the larger is the intraday price range relative to the open-to-settlement price range.

VLM : Absolute value of the daily rate of change in volume.

$VLM = |(Volume_t - Volume_{t-1})/Volume_{t-1}|$.

VLMSIGN : Sign of daily rate of change in volume. +1 if day t's trading volume is larger than that of day (t-1), -1 if smaller.

Equation (7) measures the impact of initial market movement, intraday volatility, and change in trading volume on the magnitude of contrarian profits. If overreaction tend to be larger on days with larger information flow, then the variable **MKTMOVE** would have a positive coefficient. If there is a substantial asymmetry in overreaction between positive and negative information impact, then the variable **MKTSIGN** would be significant. If negative information tends to generate larger overreaction than comparable positive information then **MKTSIGN** would have a negative coefficient. The product term **MKTMOVE*MKTSIGN** measures the interaction between the magnitude and the sign of market movement.

The variable **VOLTY** measures the impact of intraday volatility on overreaction. It is reasonable to expect larger overreaction to be associated with days with larger intraday volatility. Trading activity reflects traders reaction to new information. A substantial change in trading volume would signal a change in the mood of the

markets in reaction to new information. Sudden change in trading activity can be expected to be associated with larger overreaction. The variable **VLMSIGN** measures whether increase in trading volume and decrease in trading volume have different impact on the degree of overreaction. One might expect a sudden drop in trading activity to be associated with less efficient price discovery. Finally, the product term **VLM*VLMSIGN** measures if there is any interaction between the magnitude and direction of change in trading volume.

In the calculation of the variables **VOLTY**, **VLM**, and **VLMSIGN**, we use the data of the current contract month series of futures prices and volume. Since this is the most active contract month, it is reasonable to expect this contract to react most quickly to current market conditions. For portfolios using more than 1 futures, i.e., the All Metal portfolio, the All Interest Rate portfolio, the All Index portfolio, and the All Currency portfolio, it is not possible to determine which one futures would best represent current market conditions. We omit the analysis for these portfolios.

The equation is estimated for the four portfolios and the results are reported in Tables 4.1 to 4.4.

Table 4.1. Contrarian Profits
Portfolio 1: Gold Futures

Variables	Coefficients	T
INTERCEPT	-0.2634820515***	-8.03
MKTMOVE	0.2696902863***	11.62
MKTSIGN	-2.52772E-05	-0.18
MKTMOVE*MKTSIGN	0.0207170809	0.93
VLM	0.0004498093**	1.99
VLMSIGN	-0.0008146486***	-5.31
VLM*VLMSIGN	-0.000268434	-1.19
VOLTY	0.2658569798***	8.14
F = 57.87*** R^2=0.2486		

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.2. Contrarian Profits
Portfolio 2: Silver Futures

Variables	Coefficients	T
INTERCEPT	-0.2756691163***	-7.39
MKTMOVE	0.3156278365***	12.84
MKTSIGN	-0.0002121845	-0.79
MKTMOVE*MKTSIGN	0.0205765987	0.87
VLM	0.0021133825***	3.42
VLMSIGN	-0.0005962893**	-2.02
VLM*VLMSIGN	-0.0021134799***	-3.42
VOLTY	0.2785089103***	7.53
F=49.5*** R^2=0.2252		

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.3. Contrarian Profits
Portfolio 3: Eurodollar Futures

Variables	Coefficients	T
INTERCEPT	-0.1430578166**	-2.49
MKTMOVE	0.2983273741***	3.93
MKTSIGN	-8.51697E-05***	-3.09
MKTMOVE*MKTSIGN	0.2644110074***	3.53
VLM	3.43179E-05*	1.7
VLMSIGN	-2.3815E-06	-0.1
VLM*VLMSIGN	-6.02212E-05***	-2.95
VOLTY	0.1431111487***	2.49
F=8.19*** R^2=0.042		

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.4. Contrarian Profits
Portfolio 4: T-Bond Futures

Variables	Coefficients	T
INTERCEPT	-0.1338955978***	-5.46
MKTMOVE	0.8068607723***	20.67
MKTSIGN	-0.0001818219**	-2.28
MKTMOVE*MKTSIGN	0.1546358627***	4.02
VLM	0.0001442361	1.04
VLMSIGN	-0.0001743206**	-2.07
VLM*VLMSIGN	-0.0006043693***	-4.35
VOLTY	0.1353035879***	5.54
F = 8.08*** R^2=0.3259		

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

From the four tables above, we observe some prevalent patterns in the regression results. The variable **MKTMOVE** is positive and highly significant for all four portfolios. This signals that larger initial information impact leads to larger overreaction, and consequently higher contrarian profits.

The variable **MKTSIGN** is negative for all four portfolios. It is significant for the Eurodollar and the T-Bond portfolios, but insignificant for the Gold and the Silver portfolios. Overall, contrarian profits on days with negative information are higher than days with positive information for the Eurodollar and T-Bond portfolios, confirming earlier evidence found by De Bondt and Thaler. The interaction term **MKTMOVE*MKTSIGN** is positive and significant for the T-bond and the Eurodollar portfolio, and positive but insignificant for the Gold and the Silver portfolio. On surface, this seems to indicate that large positive market movements are associated with larger overreaction, in contrast with the negative coefficients of **MKTSIGN**. However, while **MKTSIGN** differentiate days of positive market movement from days of negative market movement, it does not differentiate among different degree of positive and negative market movement. It is possible that, over different range, positive and negative market movements are associated with different degree of

overreaction. We investigate this possibility in a later section.

The **VLM** variable is positive and significant for all but the T-Bond portfolio, for which it is positive but insignificant. This is evidence that large overreaction tends to occur on days with large change in volume from the previous day. The larger the change, the larger the overreaction. More interestingly, the variable **VLMSIGN** is negative for all four portfolios, and significant for all but the Eurodollar portfolio. This signals that large overreaction tends to occur on days when the trading volume is significantly lower than that of the previous day. One likely reason for this result is that traders stay away from the market because of high volatility. It is quite reasonable to expect prices to be less efficient on days with thin trading. The interaction term **VLM*VLMSIGN** is negative for all four portfolios, and significant for all but the gold portfolio. This again is evidence that days with large negative change in trading volume tend to have larger contrarian profits.

The variable **VOLTY** is positive and highly significant for all 4 portfolios. Higher intraday volatility is associated with higher overreaction.

The general picture that emerges from above results is both interesting and plausible. One would expect days with

large information impact and higher volatility to exhibit larger overreaction. In term of volume, large changes in trading activity would correspond to days with a lot of information flow. A substantial drop in trading activity could be a sign that traders stay away from the market because of the uncertain information. A thin trading is associated with a larger overreaction.

4.2 Impact of Information Flow

To further examine the effect of information flow on the magnitude of overreaction, we measure the amount of contrarian profits for different magnitude of market movement in the opening prices.

Following the methodology in Chan (1993), we divide the prior market settlement-to-open rate of price change into five quintiles. Within each quintile, we further subdivide trading days into groups of positive and negative market movements. In total, we have ten groups of daily contrarian profits, differed by the magnitude and sign of the market settlement-to-open rate of price changes. We compute and compare the means of contrarian profits for the ten groups.

Table 4.5 reports the means for the ten groups of days and the difference in means between the negative and

positive days within each quintile of market movement.

Table 4.5. Contrarian Profits and Market Movements
Mean Contrarian Profits

Portfolio	Quintile	Sign +	Sign -	Difference
GC	0	0.37%	0.33%	0.04%
	1	0.42%	0.47%	-0.05%
	2	0.47%	0.47%	0.00%
	3	0.55%	0.52%	0.02%
	4	0.81%	0.77%	0.04%
SV	0	0.60%	0.60%	-0.01%
	1	0.67%	0.73%	-0.06%
	2	0.67%	0.70%	-0.04%
	3	0.92%	0.96%	-0.05%
	4	1.37%	1.29%	-0.08%
ED	0	0.01%	0.02%	-0.02%
	1	0.01%	0.02%	-0.00%
	2	0.01%	0.02%	-0.01%
	3	0.01%	0.03%	-0.02%
	4	0.05%	0.02%	0.03%
US	0	0.23%	0.21%	0.02%
	1	0.23%	0.22%	0.00%
	2	0.26%	0.29%	-0.04%
	3	0.32%	0.33%	-0.01%
	4	0.57%	0.49%	0.07%

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

All four portfolios exhibit increasing contrarian profits for larger market movements, confirming our earlier regression results. However, while we observe higher mean contrarian profits for negative market impacts in more cases, none of the differences is statistically significant. This confirms the earlier regression result for the gold and silver portfolios, where there is no asymmetric behavior between positive and negative market impact.

It is also interesting to note that for quintiles 4, days with largest market movement, contrarian profits are always higher for negative market movement. In contrast, the 4 lower quintiles for ED portfolio have larger contrarian profits for positive market movements. The same is observed in quintiles 2 and 3 for US portfolio, quintiles 1 and 2 for GC portfolio, and quintiles 1, 2, and 3 for SV portfolio. This confirms our earlier conjecture that over different range of market movement, the impact of positive and negative information may not be the same. This also explains why while **MKTSIGN** has negative coefficients, the interaction term **MKTMOVE*MKTSIGN** has positive coefficients.

We next compute the differences in means across the five quintiles, without differentiating between the signs of the market movements. Table 4.6 reports the results.

Table 4.6. Contrarian Profits and Market Movements
Difference in Mean Contrarian Profits

Quintiles Portfolio	GC	SV	ED	US
4 - 3	0.25%***	0.38%***	0.02%	0.02%
4 - 2	0.31%***	0.64%***	0.02%***	0.02%***
4 - 1	0.34%***	0.62%***	0.02%***	0.02%***
4 - 0	0.44%***	0.72%***	0.02%***	0.02%***
3 - 2	0.06%	0.26%***	0.00%	0.00%
3 - 1	0.09%	0.24%***	0.00%	0.00%
3 - 0	0.18%***	0.34%***	0.00%	0.00%
2 - 1	0.03%	-0.02%	0.00%	0.00%
2 - 0	0.12%***	0.08%	0.00%	0.00%
1 - 0	0.10%	0.10%	0.00%	-0.00%

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.6 presents clear evidence that larger market movement generates higher contrarian profits. For the Eurodollar portfolio and the T-Bond portfolio, only the largest quintile of days generate statistically significant higher contrarian profits. For the gold portfolio and the Silver portfolio, higher contrarian profits are observed even for the second and the third quintile. For the Gold portfolio and the Silver portfolio, the difference in mean contrarian profits also increases as the difference between quintile increases. Or, the mean difference between the largest and the smallest quintile is larger than the

difference in means between the largest and the second quintile, which again is larger than the difference in means between the largest and the third quintiles. This confirms our earlier regression result that larger market movement is associated with larger overreaction.

4.3 Effect of Intraday Volatility

To further examine the effect of intraday volatility on contrarian profits, we perform a similar analysis as in the last section. We rank trading days by intraday volatility, as measured by the variable **VOLTY**, into quintiles. We compute the means for the five quintiles and compare the difference in means. Table 4.7 reports the results.

Table 4.7. Contrarian Profits and Intraday Volatility Difference in Mean Contrarian Profits

Quintiles Portfolio	GC	SV	ED	US
4 - 3	0.23%***	0.19%***	0.00%	0.06%***
4 - 2	0.18%***	0.34%***	0.01%	0.04%
4 - 1	0.24%***	0.42%***	0.01%	0.07%***
4 - 0	0.27%***	0.45%***	0.01%	0.09%***
3 - 2	-0.04%	0.15%	0.00%	-0.02%
3 - 1	0.01%	0.24%***	0.00%	0.00%
3 - 0	0.04%	0.26%***	0.01%	0.03%
2 - 1	0.06%	0.09%	0.00%	0.03%
2 - 0	0.08%	0.11%	0.01%	0.05%
1 - 0	0.02%	0.02%	0.01%	0.02%

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

For all four portfolios, the highest quintile (days with largest 20% of intraday volatility) earns the highest contrarian profits. The differences are statistically significant. For the Silver portfolio, the third quintile also generates statistically higher contrarian profits.

All but the Eurodollar portfolio also exhibit clear tendency of larger difference for larger difference in intraday volatility.

4.4 Effect of Trading Volume

To further analyze the effect of trading volume, we rank daily rate of change in volume into five quintiles. We also differentiate between positive changes and negative changes. We compute the mean contrarian profits for the ten different groups and compare the differences in means.

Table 4.8 reports the mean contrarian profits for the five quintiles and compares the difference in means between positive and negative changes in daily volume.

Table 4.8. Contrarian Profits and Trading Volume
Mean Contrarian Profits and Differences

Portfolio	Quintiles	Sign +	Sign -	Differences
GC	0	0.42%	0.54%	-0.11%
	1	0.42%	0.56%	-0.14%
	2	0.42%	0.63%	-0.21%***
	3	0.37%	0.70%	-0.33%***
	4	0.39%	0.68%	-0.29%***
SV	0	0.94%	0.84%	0.10%
	1	0.68%	0.86%	-0.18%
	2	0.68%	0.92%	-0.24%
	3	0.52%	1.15%	-0.63%***
	4	0.63%	1.08%	-0.45%
ED	0	0.01%	0.02%	-0.01%
	1	0.01%	0.02%	-0.00%
	2	0.03%	0.02%	0.01%
	3	0.03%	0.02%	0.01%
	4	0.02%	0.05%	-0.03%*
US	0	0.29%	0.33%	-0.04%
	1	0.29%	0.37%	-0.08%
	2	0.27%	0.33%	-0.06%
	3	0.23%	0.37%	-0.14%
	4	0.23%	0.44%	-0.22%*

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.8 provides interesting results on the effect of trading volume in overreaction. In days of positive change in trading volume, it does not appear that large changes in trading volume are associated with high contrarian profits. In fact, all but the Eurodollar portfolios generate higher contrarian profits for the lower quintiles (quintiles 0, 1, 2) than for the higher quintiles (quintiles 4 and 5).

On the other hand, in days with negative changes in trading volume, higher quintiles generate higher contrarian profits. Looking at the difference in mean, higher quintiles experience statistically significant differences, with the negative changes in trading volume generating larger contrarian profits than positive changes in trading volume.

It appears that larger overreaction occurs in days when trading volume is significantly lower than that of the previous trading day. One possible reason is that traders stay away from the market because of high volatility. Thus, the reduced trading activity causes price to be less efficient.

Since the effects are different across positive and negative changes in volume, we do not compute the mean differences for the quintiles combining the positive and negative changes.

Based on the previous three sections, we conclude that a larger overreaction tends to occur in days with more information, high intraday volatility, and significantly lower trading activity. This not only confirms our earlier results from the regression, but also provides a clearer depiction of the various effects.

4.5 Weekday Pattern in Contrarian Profits

In this section we examine the weekday seasonal pattern in daily contrarian profits. Pettengill and Jordan (1990) provide the only investigation of the calendar seasonal patterns in contrarian profits. However, their weekday patterns may be questionable due to a methodological problem. They use three-year formation period in selecting winners and losers. They then estimate the next three-year return as the contrarian return. Daily returns for the second three-year period are used to test for weekday patterns.

While the procedure is similar to other studies of long term overreaction, daily returns generated from a long-term contrarian portfolio cannot properly measure the day to day price reversals due to short term overreaction. Our contrarian trading strategy uses daily price changes both for contrarian portfolio formation and contrarian profit estimation. This provides us with a more accurate measure for investigating the weekday patterns in contrarian profits.

Since contrarian profits are predominantly generated out of trading on the opening prices, we only report weekday patterns in contrarian profits as earned on open-to-open weighting and settlement-to-open weighting cases. We

examine the weekday pattern in contrarian profits in the same four sets of futures contracts.

4.5.1 Precious Metals Futures

In this section, we examine the contrarian profits earned over different weekdays in the precious metal group. We again consider the same three portfolios in the precious metal group: silver futures portfolio, gold futures portfolio, and the portfolio of all the metal futures.

Tables 4.9 to 4.11 report the results. Figures 5 to 10 graph the results.

Table 4.9. Weekday Pattern in Contrarian Profits
Portfolio 1: Silver Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	2.49E-05	0.002868	0.8692%***	6.07
		2	2.38E-05	0.002609	0.9112%***	6.03
		3	3.44E-05	0.002711	1.2703%***	7.05
		4	3.43E-05	0.002931	1.1689%***	6.05
		5	3.49E-05	0.003034	1.1495%***	8.29
OP/OP	OP/ST	1	2.4E-05	0.002868	0.8384%***	6.25
		2	2.34E-05	0.002609	0.8963%***	7.05
		3	2.75E-05	0.002711	1.0131%***	6.44
		4	3.12E-05	0.002931	1.0635%***	6.08
		5	3.14E-05	0.003034	1.0349%***	9.50
OP/OP	ST/OP	1	8.84E-07	0.002868	0.0308%	0.46
		2	3.88E-07	0.002609	0.0149%	0.16
		3	6.97E-06	0.002711	0.2572%***	3.58
		4	3.09E-06	0.002931	0.1054%	1.38
		5	3.48E-06	0.003034	0.1145%	1.62
ST/OP	OP/OP	1	2.39E-05	0.001955	1.2214%***	5.76
		2	2.48E-05	0.001991	1.2467%***	7.73
		3	3.23E-05	0.002017	1.5997%***	6.92
		4	3.34E-05	0.002120	1.5734%***	6.60
		5	3.27E-05	0.002216	1.4737%***	7.67
ST/OP	OP/ST	1	2.34E-05	0.001955	1.1969%***	5.30
		2	2.38E-05	0.001991	1.1977%***	8.40
		3	2.86E-05	0.002011	1.4221%***	6.60
		4	3.03E-05	0.002120	1.4276%***	6.20
		5	3.04E-05	0.002216	1.3707%***	9.30
ST/OP	ST/OP	1	4.8E-07	0.001955	0.0246%	0.37
		2	9.75E-07	0.001991	0.0490%	0.52
		3	3.67E-06	0.002011	0.1826%**	2.54
		4	3.09E-06	0.002120	0.1458%*	1.73
		5	2.28E-06	0.002216	0.1030%	1.15

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.10. Weekday Patterns in Contrarian Profits
Portfolio 2: Gold Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	1.03E-05	0.001935	0.5314%***	7.28
		2	8.39E-06	0.001691	0.4961%***	7.47
		3	1.04E-05	0.001694	0.6142%***	8.70
		4	1.14E-05	0.001804	0.6331%***	7.55
		5	1.42E-05	0.001865	0.7590%***	7.81
OP/OP	OP/ST	1	8.61E-06	0.001935	0.4450%***	6.31
		2	6.51E-06	0.001691	0.3852%***	7.80
		3	7.95E-06	0.00169	0.4694%***	8.00
		4	8.45E-06	0.001804	0.4682%***	8.00
		5	1.13E-05	0.001865	0.6072%***	7.75
OP/OP	ST/OP	1	1.67E-06	0.001935	0.0864%**	2.01
		2	1.88E-06	0.001691	0.1109%**	2.46
		3	2.45E-06	0.001694	0.1448%***	3.36
		4	2.97E-06	0.001804	0.1649%***	3.17
		5	2.83E-06	0.001865	0.1518%***	2.98
ST/OP	OP/OP	1	9.26E-06	0.001447	0.6398%***	7.62
		2	8.63E-06	0.001359	0.6351%***	7.52
		3	9.87E-06	0.001313	0.7518%***	9.10
		4	1.11E-05	0.001458	0.7616%***	7.52
		5	1.34E-05	0.001503	0.8938%***	7.85
ST/OP	OP/ST	1	7.99E-06	0.001447	0.5523%***	6.49
		2	6.93E-06	0.001359	0.5097%***	7.71
		3	7.76E-06	0.001313	0.5913%***	8.07
		4	8.38E-06	0.001458	0.5747%***	7.87
		5	1.10E-05	0.001503	0.7290%***	7.63
ST/OP	ST/OP	1	1.27E-06	0.001447	0.0875%*	7.89
		2	1.70E-06	0.001359	0.1253%***	2.34
		3	2.11E-06	0.001313	0.1605%***	3.25
		4	2.73E-06	0.001458	0.1870%***	3.14
		5	2.48E-06	0.001503	0.1648%***	3.13

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.11. Weekday Patterns in Contrarian Profits
Portfolio 3: All Metal Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	1.11E-05	0.003236	0.3416%***	3.59
		2	7.77E-06	0.003095	0.2511%***	2.94
		3	1.09E-05	0.002956	0.3703%***	3.45
		4	9.55E-06	0.003318	0.2879%**	2.25
		5	1.61E-05	0.003344	0.4817%***	3.38
OP/OP	OP/ST	1	8.99E-06	0.003236	0.2779%***	3.80
		2	6.11E-06	0.003095	0.1974%***	3.60
		3	4.79E-06	0.002956	0.1622%***	2.60
		4	5.13E-06	0.003318	0.1547%*	1.83
		5	1.19E-05	0.003344	0.3557%***	4.78
OP/OP	ST/OP	1	2.06E-06	0.003236	0.0636%	0.95
		2	1.66E-06	0.003095	0.0538%	0.76
		3	6.15E-06	0.002956	0.2080%***	2.00
		4	4.42E-06	0.003318	0.1331%	1.50
		5	4.21E-06	0.003344	0.1259%	1.02
ST/OP	OP/OP	1	8.96E-06	0.002274	0.3939%***	3.65
		2	7.5E-06	0.002285	0.3284%***	3.10
		3	1.12E-05	0.002124	0.5282%***	3.90
		4	9.92E-06	0.002452	0.4047%***	2.95
		5	1.39E-05	0.002372	0.5856%***	3.99
ST/OP	OP/ST	1	8.48E-06	0.002274	0.3730%***	4.17
		2	7.06E-06	0.002285	0.3089%***	5.37
		3	8.12E-06	0.002124	0.3823%***	5.47
		4	6.32E-06	0.002452	0.2577%***	2.80
		5	1.24E-05	0.002372	0.5223%***	7.50
ST/OP	ST/OP	1	4.76E-07	0.002274	0.0209%	0.26
		2	4.48E-07	0.002285	0.0196%	0.22
		3	3.10E-06	0.002124	1.1159%	1.11
		4	3.60E-06	0.002452	0.1470%	1.40
		5	1.50E-06	0.002372	0.0634%	0.52

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Figure 5. Weekday Pattern in Contrarian Profits

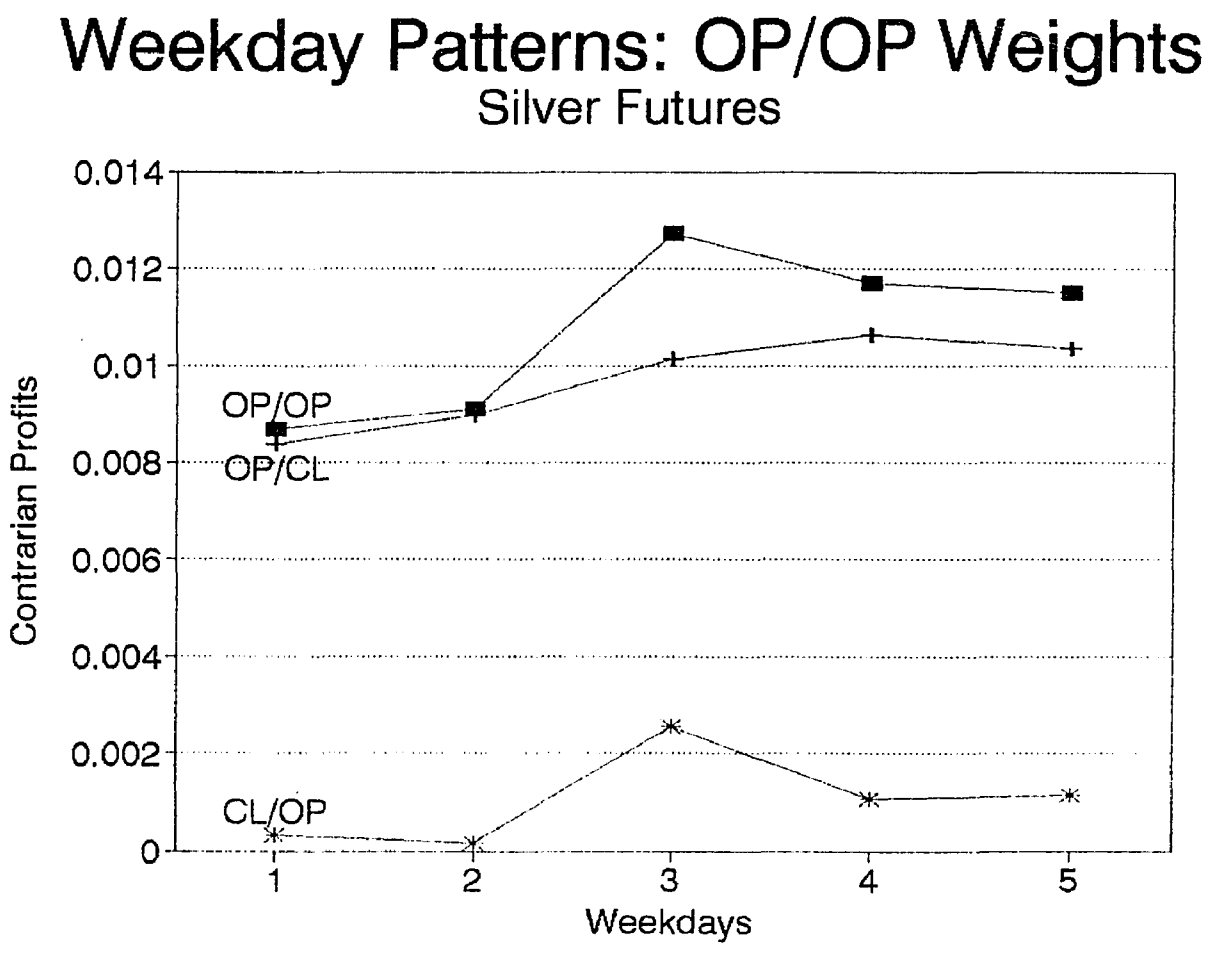


Figure 6. Weekday Pattern in Contrarian Profits

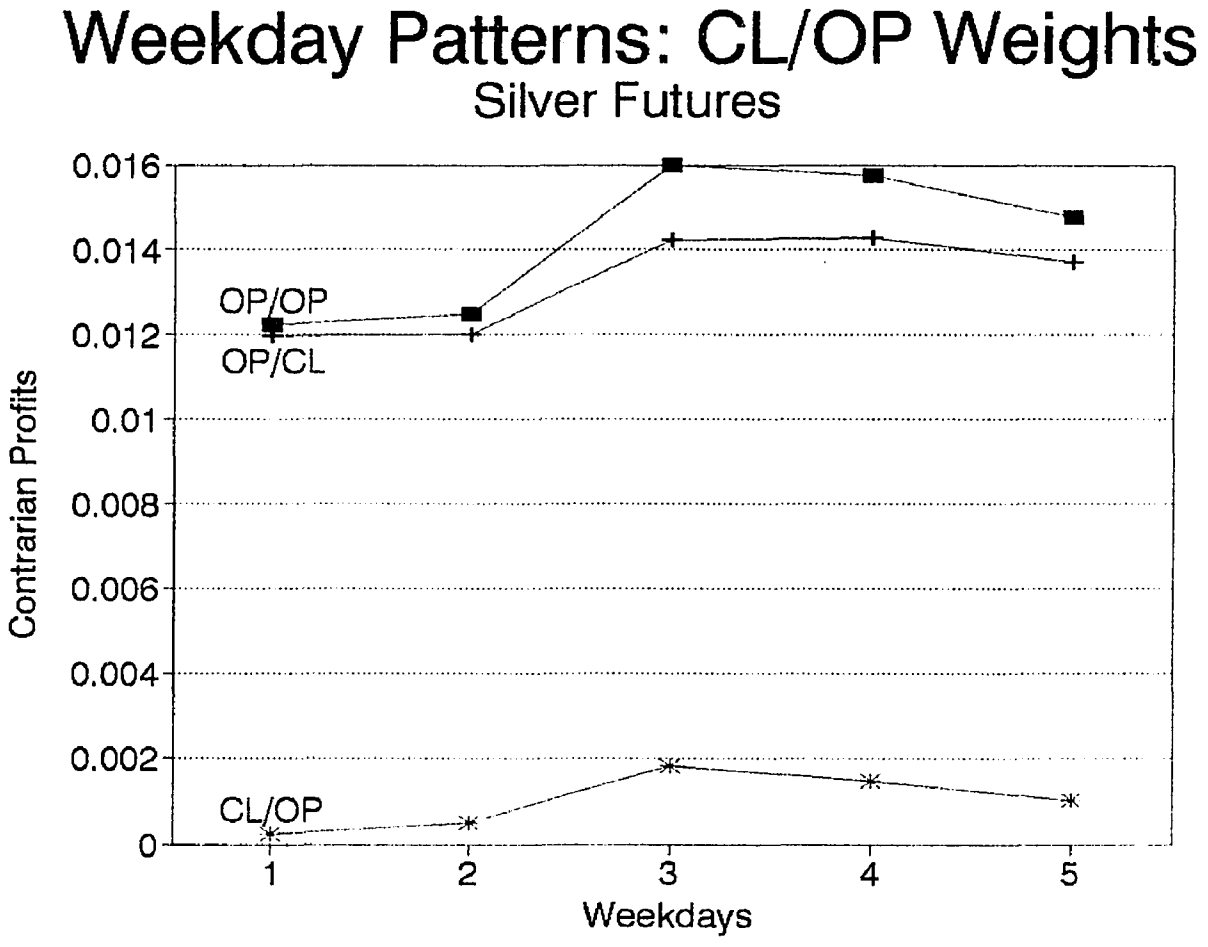


Figure 7. Weekday Pattern in Contrarian Profits

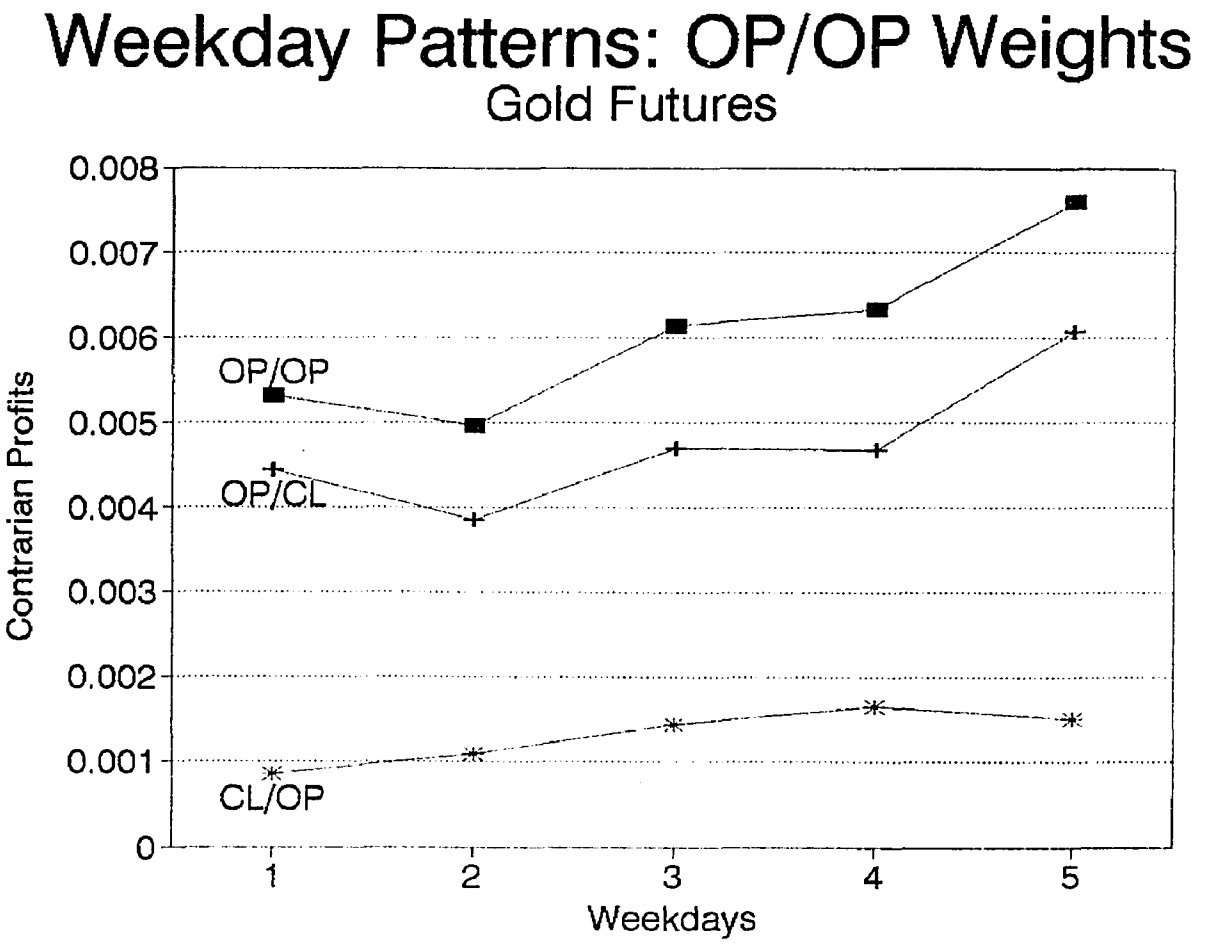


Figure 8. Weekday Pattern in Contrarian Profits

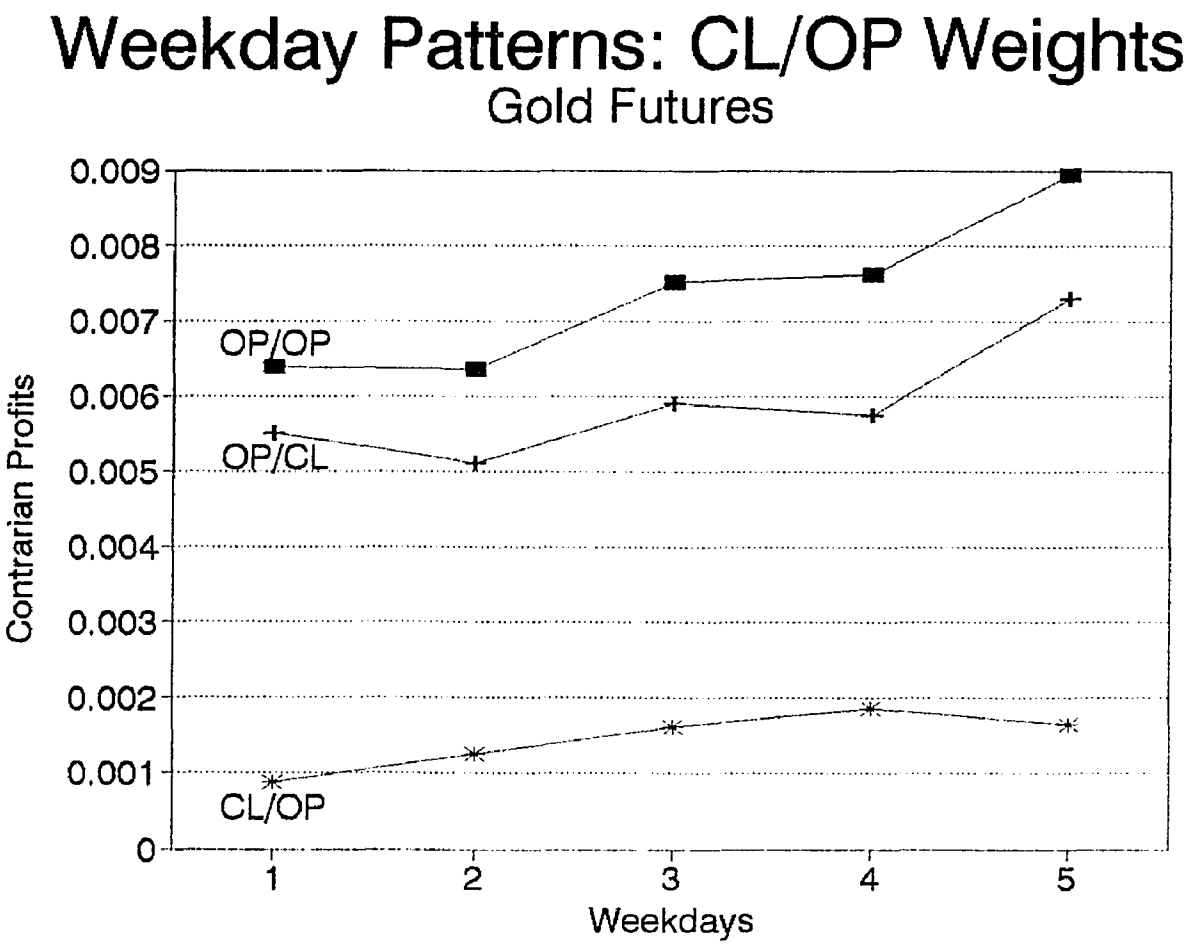


Figure 9. Weekday Pattern in Contrarian Profits

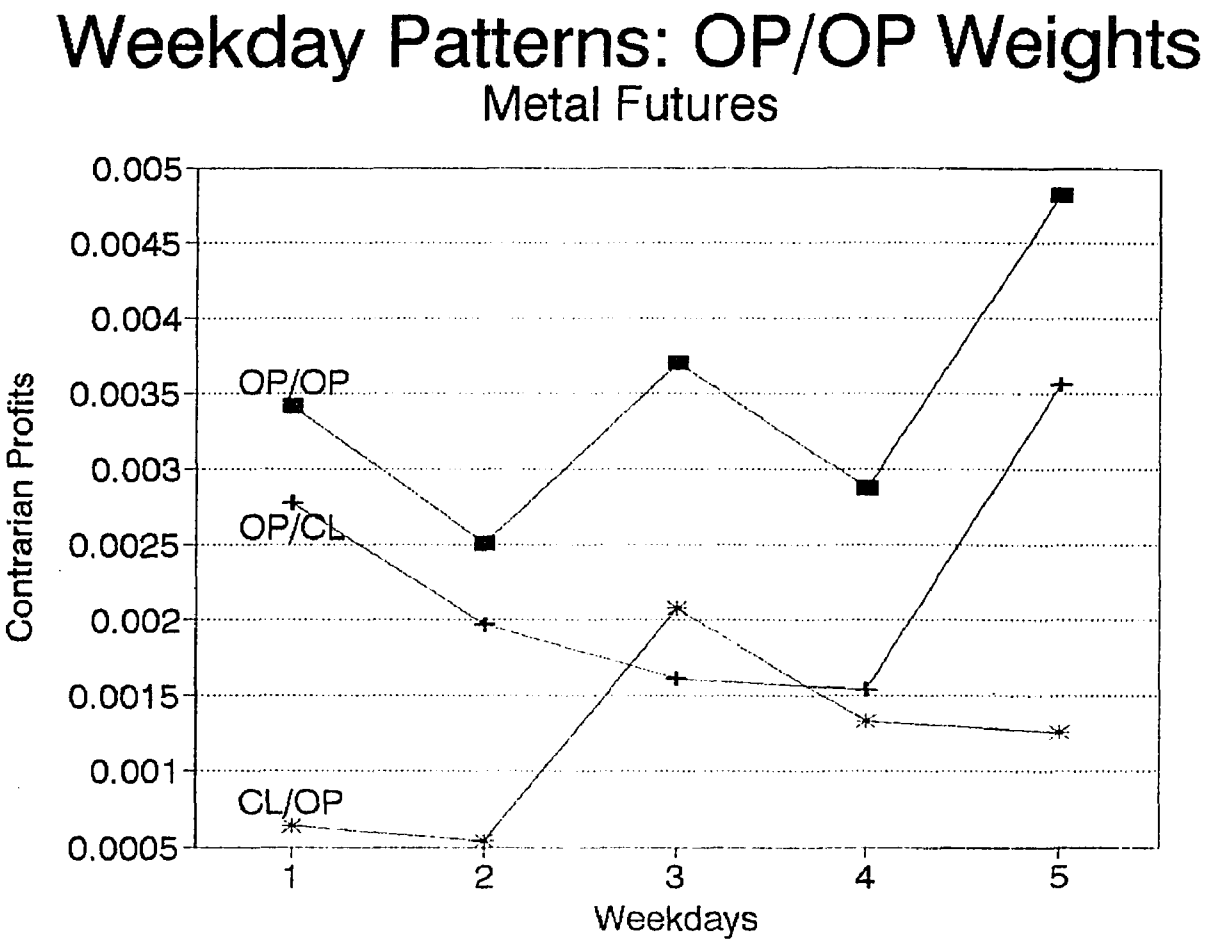
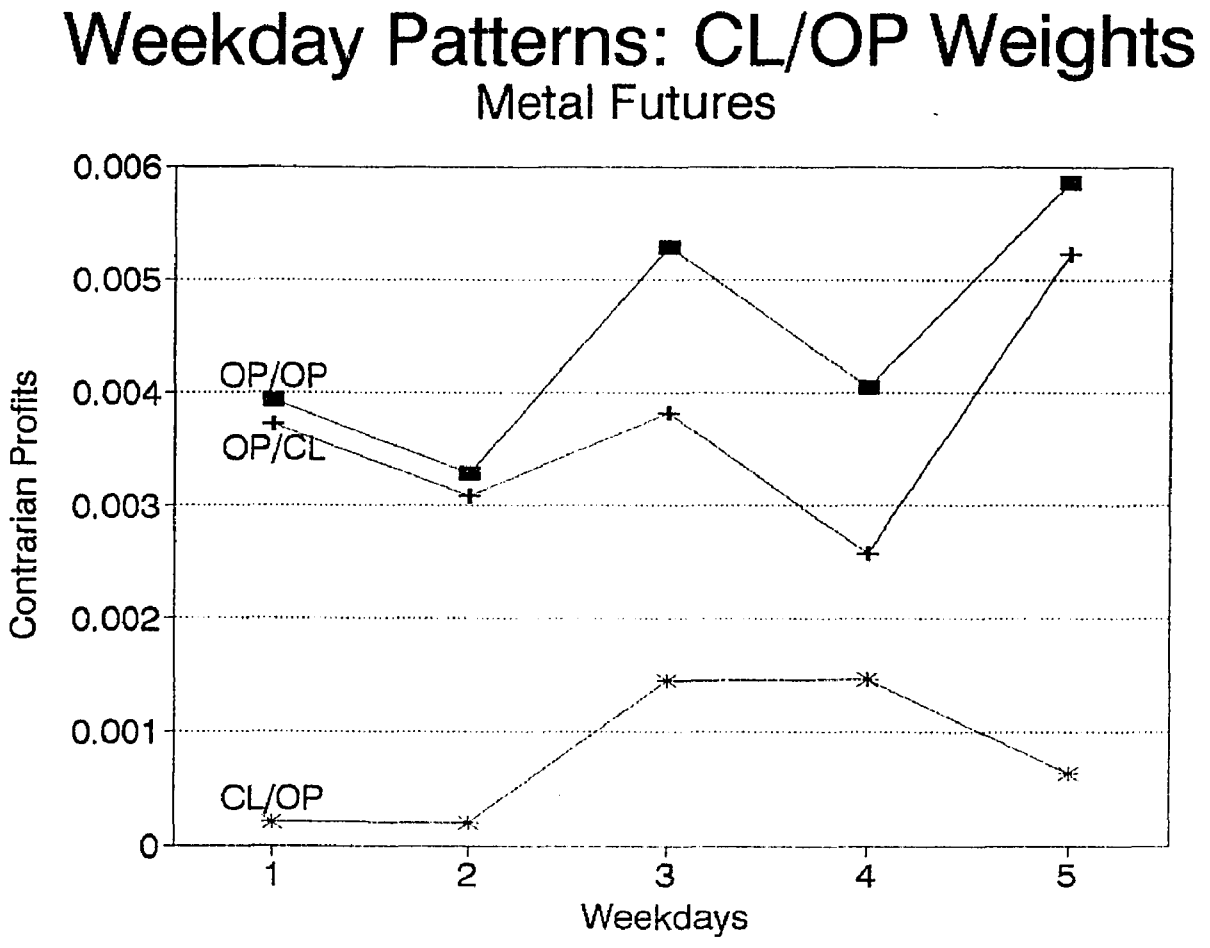


Figure 10. Weekday Pattern in Contrarian Profits



From the tables and graphs above, we can observe some general patterns. First, the tendency for most contrarian profits to occur in the first half-day (open-to-settlement) sub-period exists for all weekdays. Only in the gold futures portfolio there is a small portion of significant profits over the next settlement-to-open sub-period. For the silver futures and the All Metal Futures portfolio, profits from the next settlement-to-open sub-periods are almost all insignificant. This pattern is clearly observed in Figures 5 to 10, where the OP/ST line lies close to the OP/OP line and far above the ST/OP line.

We also observe that there is a tendency for the Monday and Tuesday profits to be lower than that of the later three weekdays. For the silver futures portfolio, Wednesday profit is the highest. For the other two portfolios, Friday profits are the highest.

4.5.2 Interest Rate Futures

For interest rate futures, we construct the same three portfolios: Eurodollar futures portfolio, T-Bond futures portfolio, and the All Interest Rate Futures portfolio. Tables 4.12 to 4.14 and figures 11 to 16 report the results.

Table 4.12. Weekday Pattern in Contrarian Profits
Portfolio 4: Eurodollar Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	-2.20E-09	6.71E-05	-0.0033%	-0.42
		2	8.07E-09	4.97E-05	0.0162%**	2.06
		3	7.86E-09	4.74E-05	0.0166%*	1.66
		4	2.68E-09	4.89E-05	0.0055%	0.89
		5	2.55E-08	5.85E-05	0.0436%***	2.71
OP/OP	OP/ST	1	-3.1E-09	6.71E-05	-0.0047%	-0.68
		2	7.7E-09	4.97E-05	0.0155%	1.57
		3	4.51E-09	4.74E-05	0.0095%	1.33
		4	2.56E-09	4.89E-05	0.0052%	1.11
		5	2.87E-08	5.85E-05	0.0491%***	3.26
OP/OP	ST/OP	1	8.87E-10	6.71E-05	0.0013%	0.43
		2	3.78E-10	4.97E-05	0.0008%	0.14
		3	3.35E-09	4.74E-05	0.0071%	1.65
		4	1.22E-10	4.89E-05	0.0002%	0.08
		5	-3.2E-09	5.85E-05	-0.0055%	-1.29
ST/OP	OP/OP	1	8.57E-09	2.35E-05	0.0365%**	2.18
		2	7.38E-09	2.40E-05	0.0307%***	2.86
		3	7.1E-09	2.18E-05	0.0325%***	3.39
		4	5.03E-09	2.34E-05	0.0215%**	2.33
		5	2.96E-08	3.14E-05	0.0943%***	3.90
ST/OP	OP/ST	1	8.9E-09	2.35E-05	0.0379%**	2.23
		2	8.62E-09	2.40E-05	0.0359%**	2.19
		3	6.52E-09	2.18E-05	0.0298%***	4.67
		4	4.27E-09	2.34E-05	0.0182%***	2.69
		5	3.17E-08	3.14E-05	0.1011%***	4.23
ST/OP	ST/OP	1	-3.4E-10	2.35E-05	0.0014%	-0.54
		2	-1.2E-09	2.40E-05	-0.0052%	-0.54
		3	5.8E-10	2.18E-05	0.0027%	0.64
		4	7.66E-10	2.34E-05	0.0033%	0.71
		5	-2.1E-09	3.14E-05	-0.0067%	-1.25

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.13. Weekday Pattern in Contrarian Profits
Portfolio 5: T-Bond Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	2.39E-06	0.000960	0.2490%***	6.72
		2	2.30E-06	0.000845	0.2721%***	7.02
		3	2.34E-06	0.000807	0.2894%***	5.61
		4	3.46E-06	0.000871	0.3976%***	6.13
		5	4.66E-06	0.001061	0.4394%***	6.88
OP/OP	OP/ST	1	2.24E-06	0.000960	0.2336%***	7.90
		2	2.32E-06	0.000845	0.2749%***	9.27
		3	2.52E-06	0.000807	0.3121%***	7.52
		4	3.58E-06	0.000871	0.4111%***	6.26
		5	4.97E-06	0.001061	0.4687%***	7.54
OP/OP	ST/OP	1	1.48E-07	0.000960	0.0154%	1.02
		2	-2.40E-08	0.000845	-0.0028%	-0.13
		3	-1.80E-07	0.000807	-0.0227%	-0.70
		4	-1.20E-07	0.000871	-0.0135%	-0.49
		5	-3.10E-07	0.001061	-0.0293%	-1.35
ST/OP	OP/OP	1	2.71E-06	0.000569	0.4761%***	8.70
		2	2.33E-06	0.000538	0.4327%***	7.93
		3	2.52E-06	0.000540	0.4671%***	7.02
		4	3.31E-06	0.000625	0.5292%***	7.03
		5	4.73E-06	0.000784	0.6040%***	7.42
ST/OP	OP/ST	1	2.63E-06	0.000569	0.4625%***	9.75
		2	2.22E-06	0.000538	0.4130%***	9.11
		3	2.45E-06	0.000540	0.4546%***	7.43
		4	3.50E-06	0.000625	0.5604%***	6.59
		5	5.14E-06	0.000784	0.6557%***	8.04
ST/OP	ST/OP	1	7.74E-08	0.000569	0.0136%	0.77
		2	1.06E-07	0.000538	0.0198%	1.11
		3	6.72E-08	0.000540	0.0124%	0.52
		4	-2.00E-07	0.000625	-0.0312%	-1.19
		5	-4.00E-07	0.000784	-0.0517%**	-2.17

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.14. Weekday Pattern in Contrarian Profits
Portfolio 6: All Interest Rate Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	1.23E-06	0.001158	0.1061%***	2.88
		2	8.51E-07	0.000869	0.0979%***	3.25
		3	1.24E-06	0.000885	0.1396%***	4.35
		4	8.83E-07	0.000948	0.0932%***	2.99
		5	1.07E-06	0.000998	0.1070%***	3.22
OP/OP	OP/ST	1	1.04E-06	0.001158	0.0901%**	2.50
		2	7.95E-07	0.000869	0.0915%***	3.50
		3	1.12E-06	0.000885	0.1268%***	4.24
		4	9.40E-07	0.000948	0.0992%***	3.80
		5	1.08E-06	0.000998	0.1081%***	3.46
OP/OP	ST/OP	1	1.86E-07	0.001158	0.0161%*	1.90
		2	5.60E-08	0.000869	0.0064%	0.58
		3	1.13E-07	0.000885	0.0128%	1.10
		4	-5.70E-08	0.000948	-0.0060%	-0.36
		5	-1.10E-08	0.000998	-0.0011%	-0.10
ST/OP	OP/OP	1	1.09E-06	0.000454	0.2394%***	4.38
		2	7.21E-07	0.000395	0.1826%***	6.75
		3	7.48E-07	0.000395	0.1896%***	5.06
		4	9.25E-07	0.000445	0.2078%***	5.22
		5	1.16E-06	0.000537	0.2167%***	6.72
ST/OP	OP/ST	1	1.11E-06	0.000454	0.2434%***	4.55
		2	7.04E-07	0.000395	0.1784%***	8.07
		3	8.40E-07	0.000395	0.2127%***	6.17
		4	1.01E-06	0.000445	0.2262%***	6.50
		5	1.32E-06	0.000537	0.2466%***	8.83
ST/OP	ST/OP	1	-1.80E-08	0.000454	-0.0039%	-0.35
		2	1.65E-08	0.000395	0.0042%	0.30
		3	-9.10E-08	0.000395	-0.0231%	-1.10
		4	-8.20E-08	0.000445	-0.0184%	-0.91
		5	-1.60E-07	0.000537	-0.0299%*	-1.89

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Figure 11. Weekday Pattern in Contrarian Profits

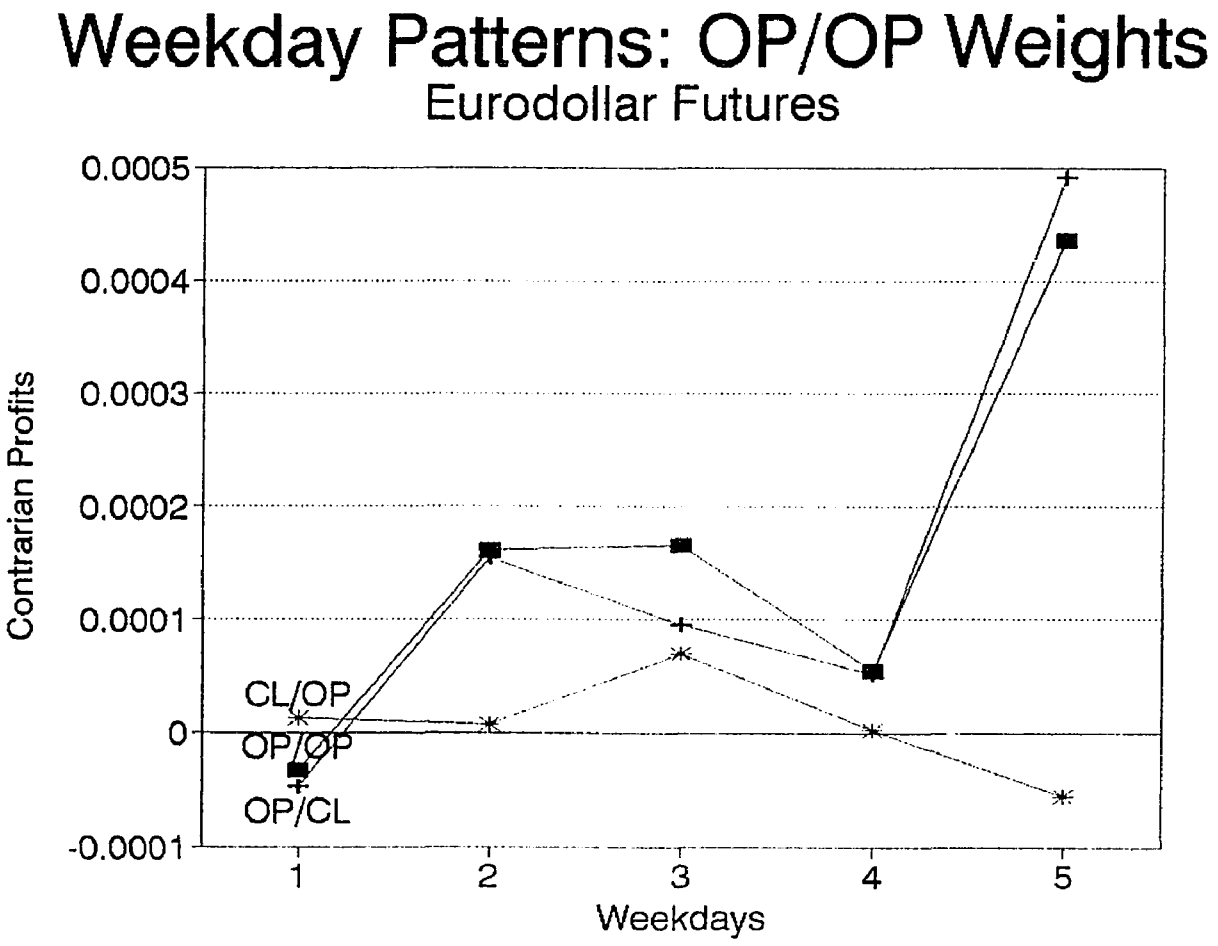


Figure 12. Weekday Pattern in Contrarian Profits

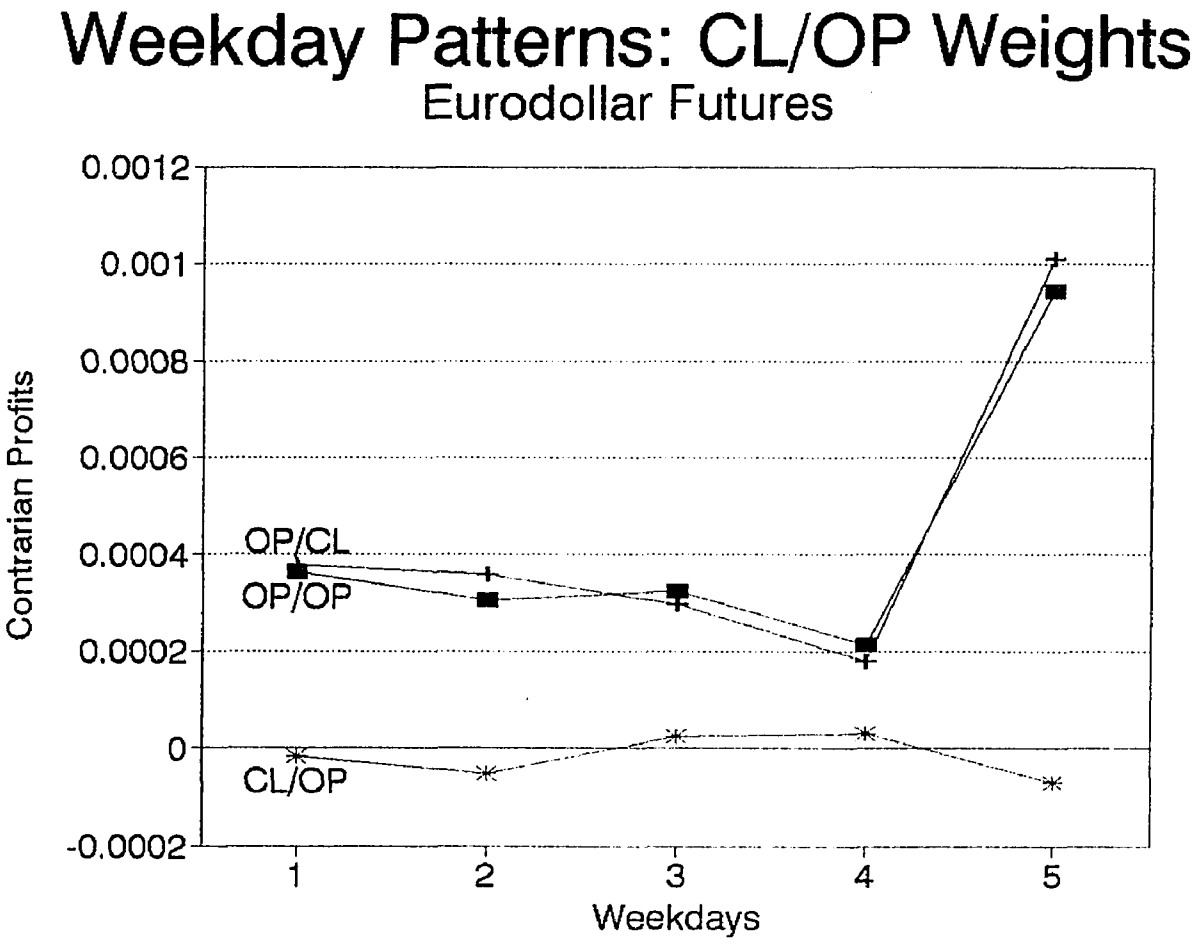


Figure 13. Weekday Pattern in Contrarian Profits

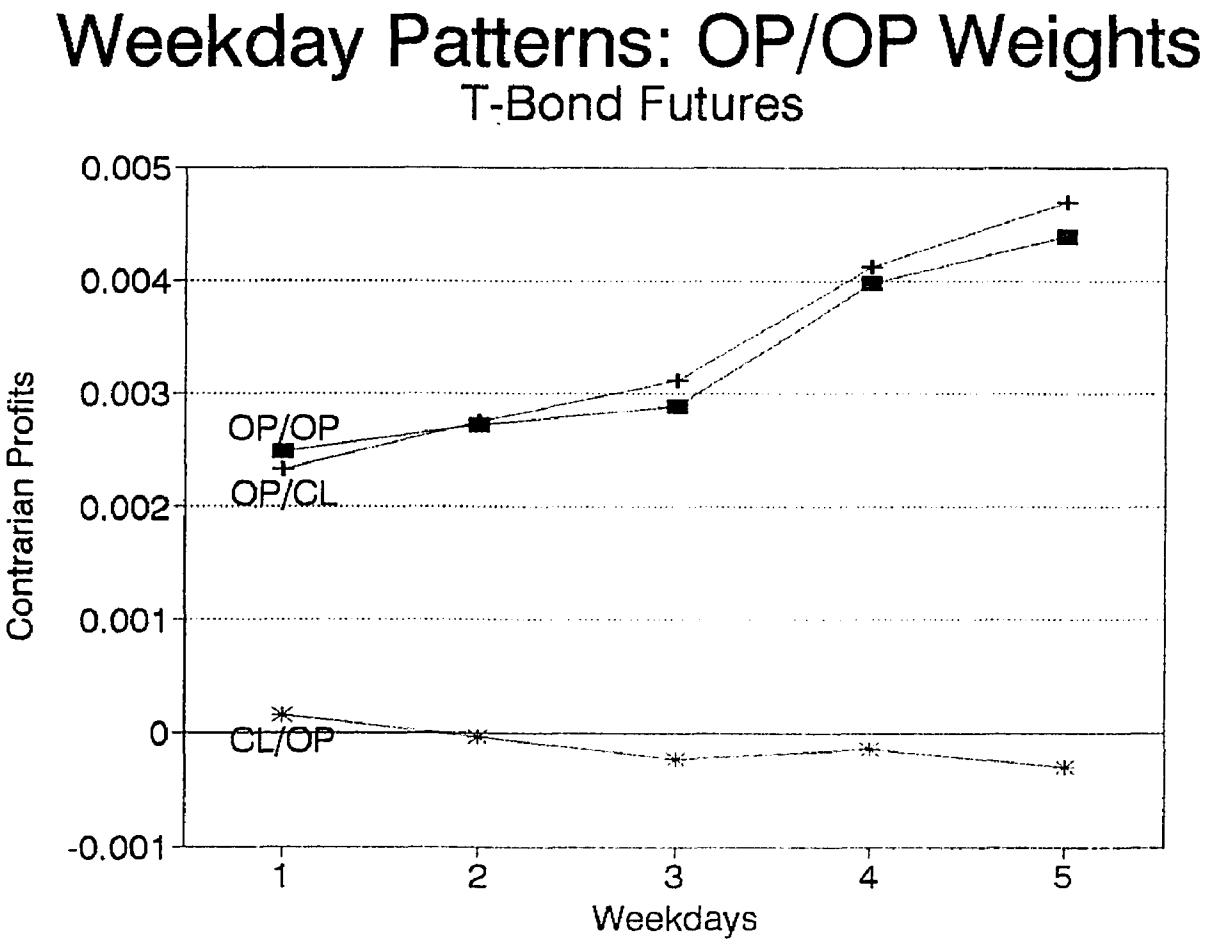


Figure 14. Weekday Pattern in Contrarian Profits

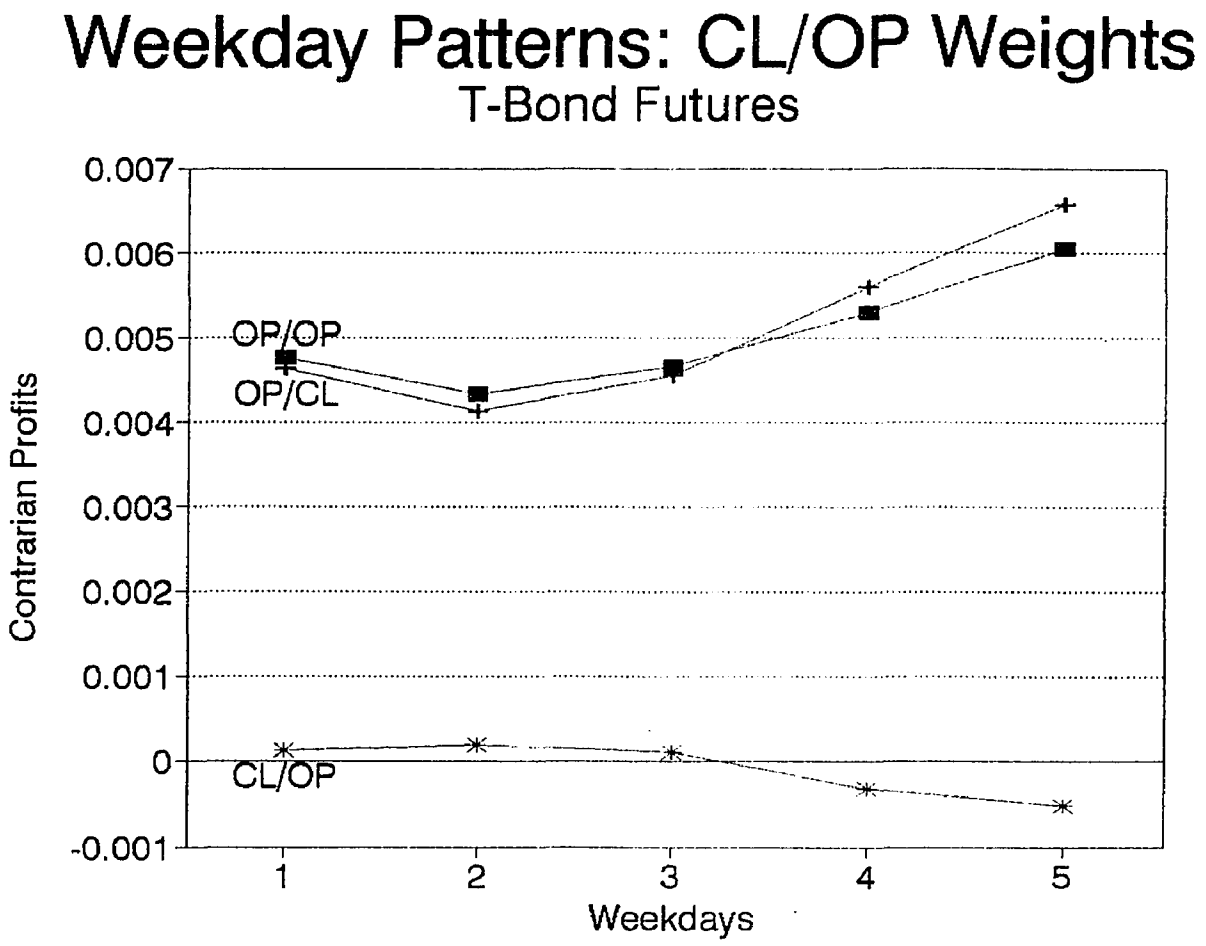


Figure 15. Weekday Pattern in Contrarian Profits

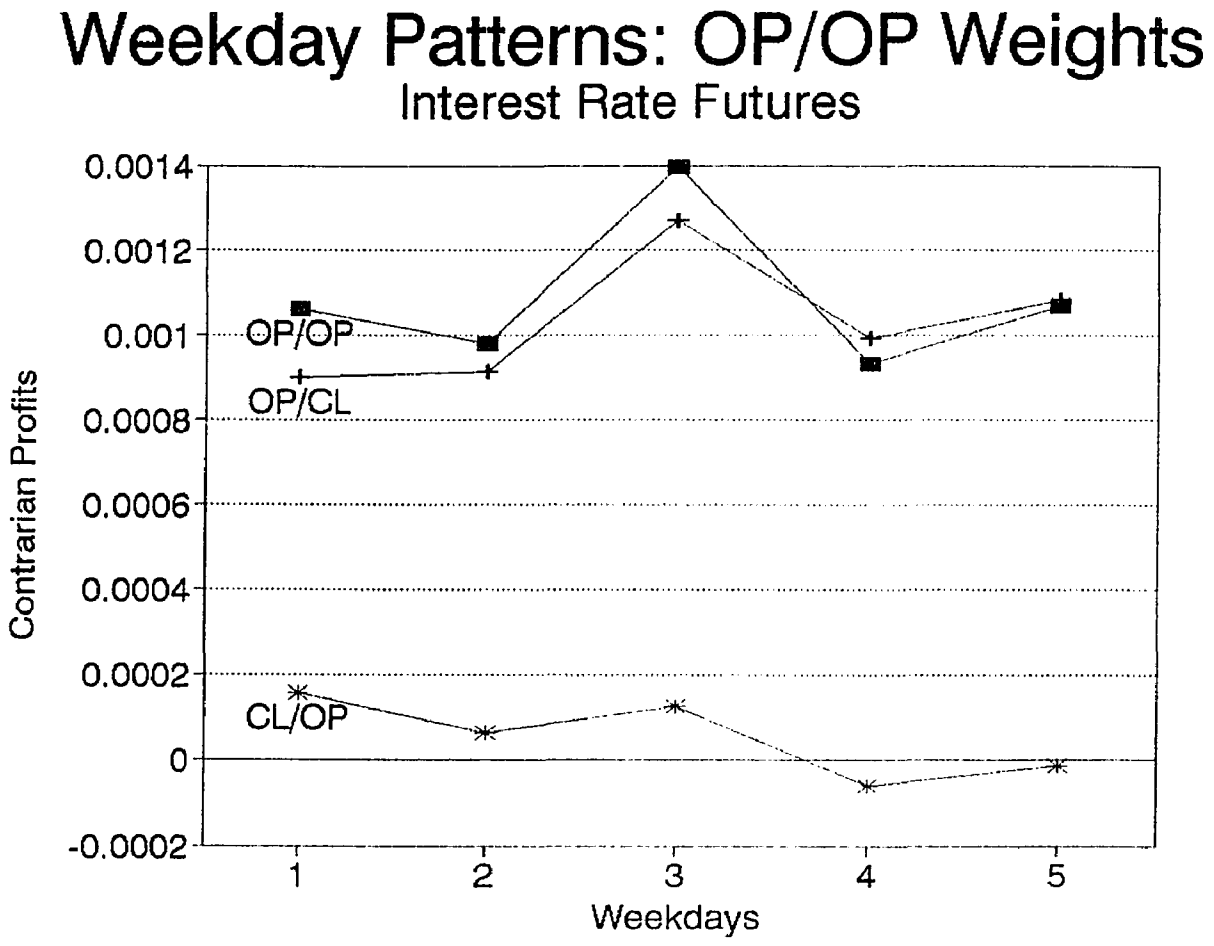
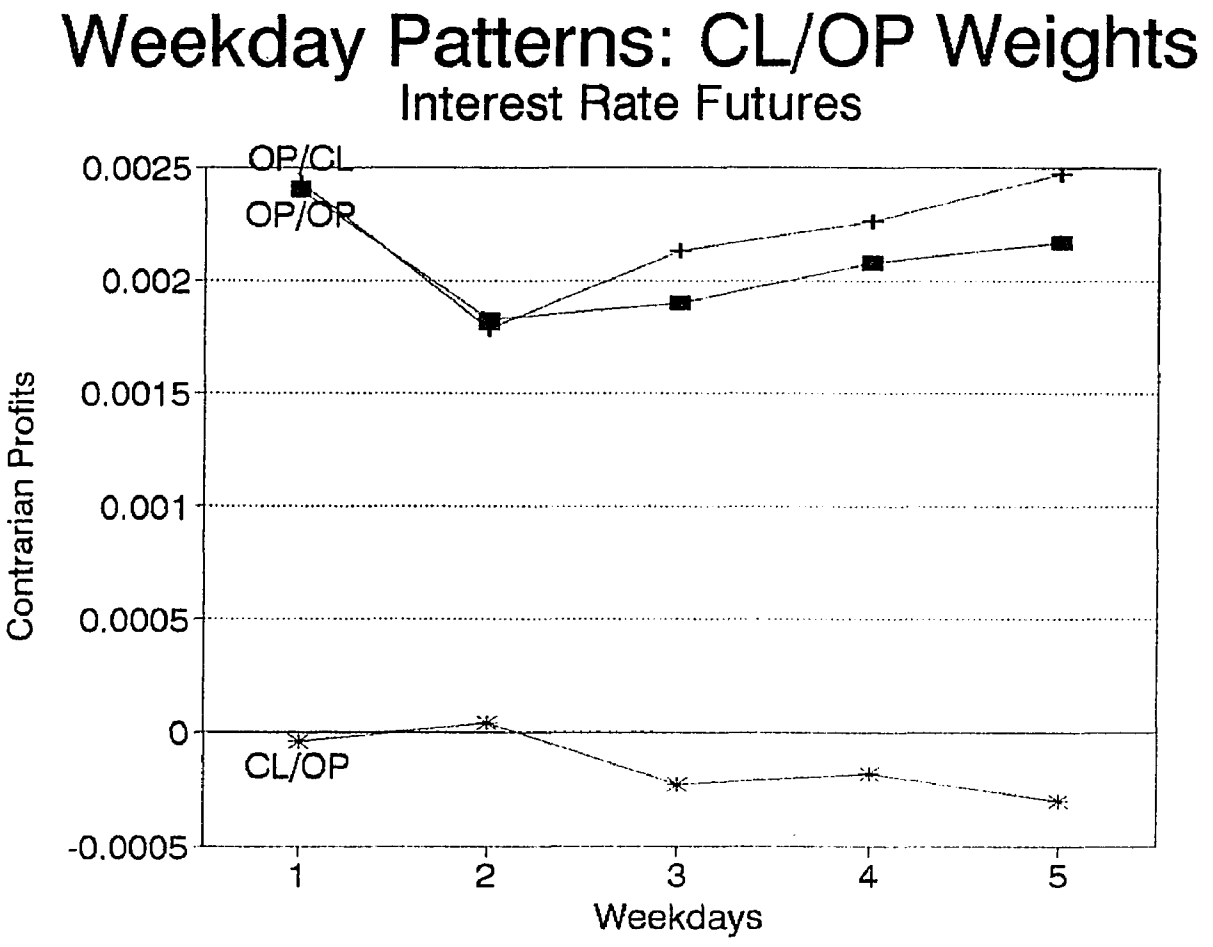


Figure 16. Weekday Pattern in Contrarian Profits



The results on the interest rate futures confirm the two patterns that we observe earlier in the metals futures. All contrarian profits occur over the open-to-settlement half-day sub-period immediately following the weighting period. The profits in the next settlement-to-open sub-period are all insignificant, except for two marginally significant instances.

Second, in both the Eurodollar futures portfolio and the T-Bond portfolio, Friday profits are substantially larger than those of the other weekdays, both in the OP/OP weighting and the OP/ST weighting cases. In the Eurodollar futures portfolio, Friday profits are three times as large as those of the next highest weekday. In the T-bond futures portfolio the difference is about two times. In the All Interest Rate Futures portfolio, although not always the highest, Friday profits also tend to be large. Figures 11 to 16 illustrate the two patterns quite clearly.

4.5.3 Index Futures and Currency Futures

Since there is not a large number of series for any of the individual futures, for each group, we only test the results for one portfolio using all the series in the group. Table 4.15 and 4.16 report the results. Figures 17 to 20 graph the results.

Table 4.15. Weekday Patterns in Contrarian Profits
Portfolio 7: All Index Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	9.62E-06	0.001689	0.5695%***	3.06
		2	1.57E-05	0.001683	0.9343%***	3.85
		3	1.02E-05	0.001708	0.5982%***	4.33
		4	8.80E-06	0.001603	0.5487%***	5.50
		5	2.40E-05	0.001581	1.5173%**	1.77
OP/OP	OP/ST	1	1.37E-05	0.001689	0.8090%**	2.48
		2	1.70E-05	0.001683	1.0124%***	3.38
		3	1.30E-05	0.001708	0.7583%***	3.34
		4	5.75E-06	0.001603	0.3588%***	4.76
		5	2.16E-05	0.001581	1.3666%*	1.91
OP/OP	ST/OP	1	-4.00E-06	0.001689	-0.2395%	-1.62
		2	-1.30E-06	0.001683	-0.0781%	-0.87
		3	-2.70E-06	0.001708	-0.1601%	-1.59
		4	3.04E-06	0.001603	0.1899%	1.34
		5	2.38E-06	0.001581	0.1507%	1.03
ST/OP	OP/OP	1	1.05E-05	0.000997	1.0545%***	3.95
		2	1.39E-05	0.001156	1.2061%***	4.90
		3	9.28E-06	0.001037	0.8952%***	4.24
		4	9.02E-06	0.000973	0.9270%***	5.36
		5	2.59E-05	0.001081	2.4001%*	1.70
ST/OP	OP/ST	1	1.07E-05	0.000997	1.0690%***	4.21
		2	1.64E-05	0.001156	1.4219%***	3.42
		3	1.23E-05	0.001037	1.1832%***	3.98
		4	8.64E-06	0.000973	0.8875%***	6.91
		5	2.37E-05	0.001081	2.1930%*	1.82
ST/OP	ST/OP	1	-1.40E-07	0.000997	-0.0145%	-0.37
		2	-2.50E-06	0.001156	-0.2158%	-1.00
		3	-3.00E-06	0.001037	-0.2880%	-1.60
		4	3.84E-07	0.000973	0.0395%	0.59
		5	2.24E-06	0.001081	0.2071%	0.95

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Table 4.16. Weekday Pattern in Contrarian Profits
Portfolio 8: All Currency Futures

Weight	day-1	WKDAY	PROF	TRADE	PROF/TRADE	T
OP/OP	OP/OP	1	3.99E-06	0.002002	0.1994%***	3.84
		2	1.34E-06	0.001651	0.0812%	1.60
		3	2.28E-06	0.001683	0.1357%***	2.95
		4	1.08E-06	0.001578	0.0685%	1.28
		5	1.47E-07	0.001702	0.0087%	0.18
OP/OP	OP/ST	1	1.58E-06	0.002002	0.0788%**	2.16
		2	9.85E-07	0.001651	0.0597%*	1.75
		3	1.78E-06	0.001683	0.1056%***	3.39
		4	1.10E-06	0.001578	0.0695%**	2.31
		5	1.00E-06	0.001702	0.0587%*	1.67
OP/OP	ST/OP	1	2.41E-06	0.002002	0.1206%***	3.69
		2	3.55E-07	0.001651	0.0215%	0.73
		3	5.06E-07	0.001683	0.0301%	1.06
		4	-1.60E-08	0.001578	-0.0010%	-0.02
		5	-8.50E-07	0.001702	-0.0501%	-1.41
ST/OP	OP/OP	1	2.07E-06	0.001439	0.1437%***	2.84
		2	1.25E-06	0.001255	0.0992%*	1.94
		3	7.85E-07	0.001172	0.0670%	1.59
		4	1.31E-06	0.001174	0.1117%*	1.68
		5	1.19E-06	0.001289	0.0924%**	2.03
ST/OP	OP/ST	1	1.27E-06	0.001439	0.0882%***	2.73
		2	1.25E-06	0.001255	0.0995%***	2.87
		3	1.21E-06	0.001172	0.1036%***	3.83
		4	1.13E-06	0.001174	0.0965%***	3.11
		5	2.11E-06	0.001289	0.1640%***	4.59
ST/OP	ST/OP	1	7.99E-07	0.001439	0.0555%	1.60
		2	-3.90E-09	0.001255	-0.0003%	-0.01
		3	-4.30E-07	0.001172	-0.0367%	-1.22
		4	1.79E-07	0.001174	0.0152%	0.25
		5	-9.20E-07	0.001289	-0.0716%**	-2.15

NOTE: ***, **, and * denote significance levels at 1%, 5%, and 10% respectively

Figure 17. Weekday Pattern in Contrarian Profits

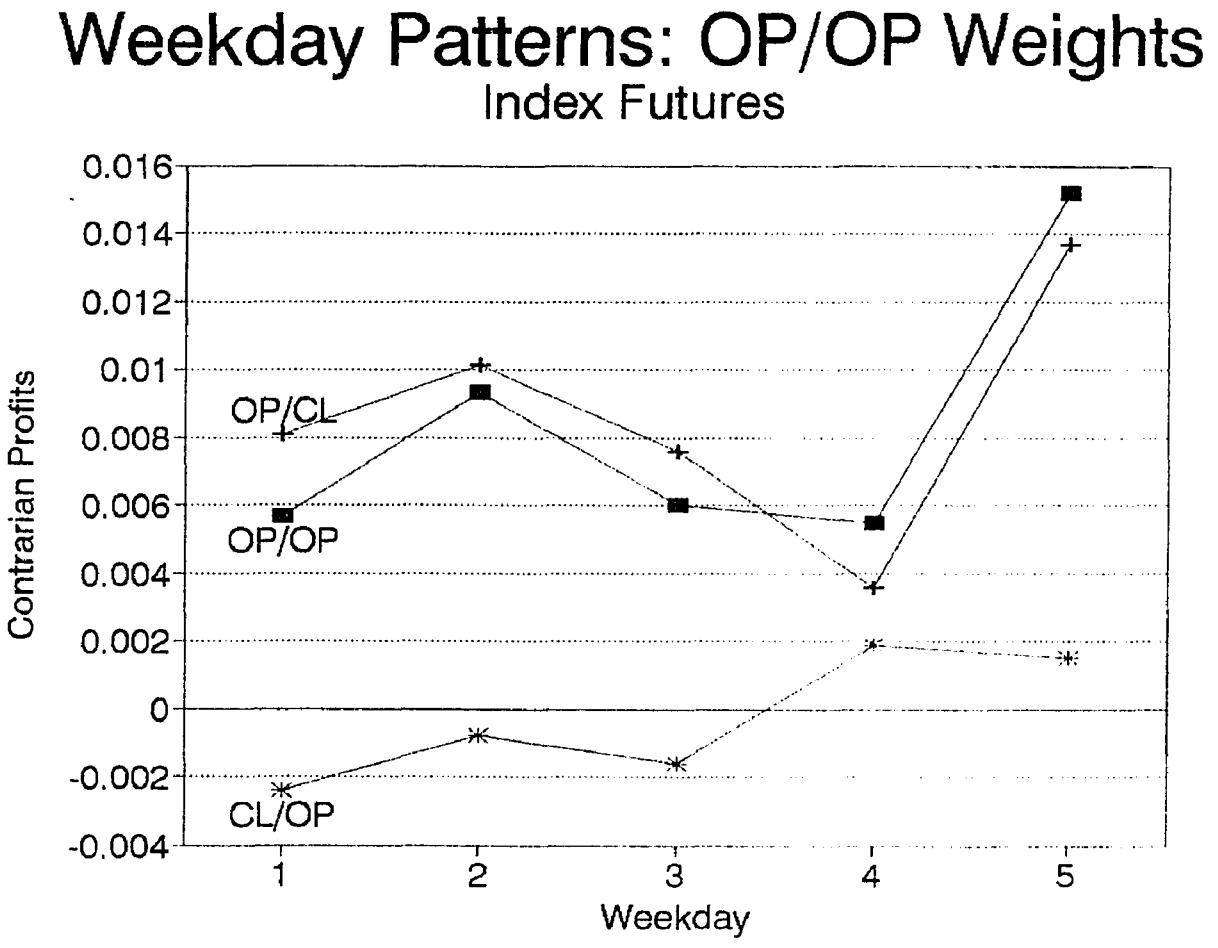


Figure 18. Weekday Pattern in Contrarian Profits

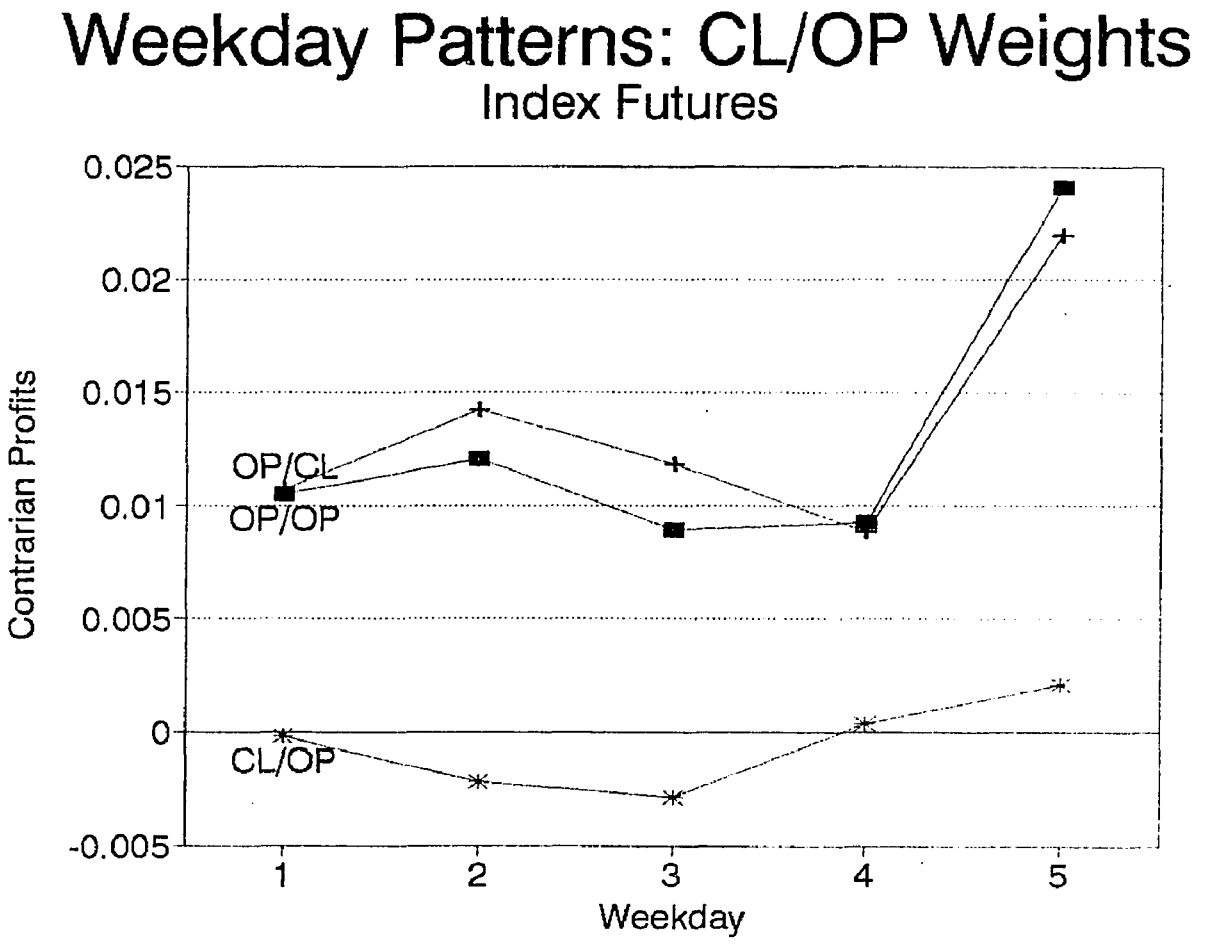


Figure 19. Weekday Pattern in Contrarian Profits

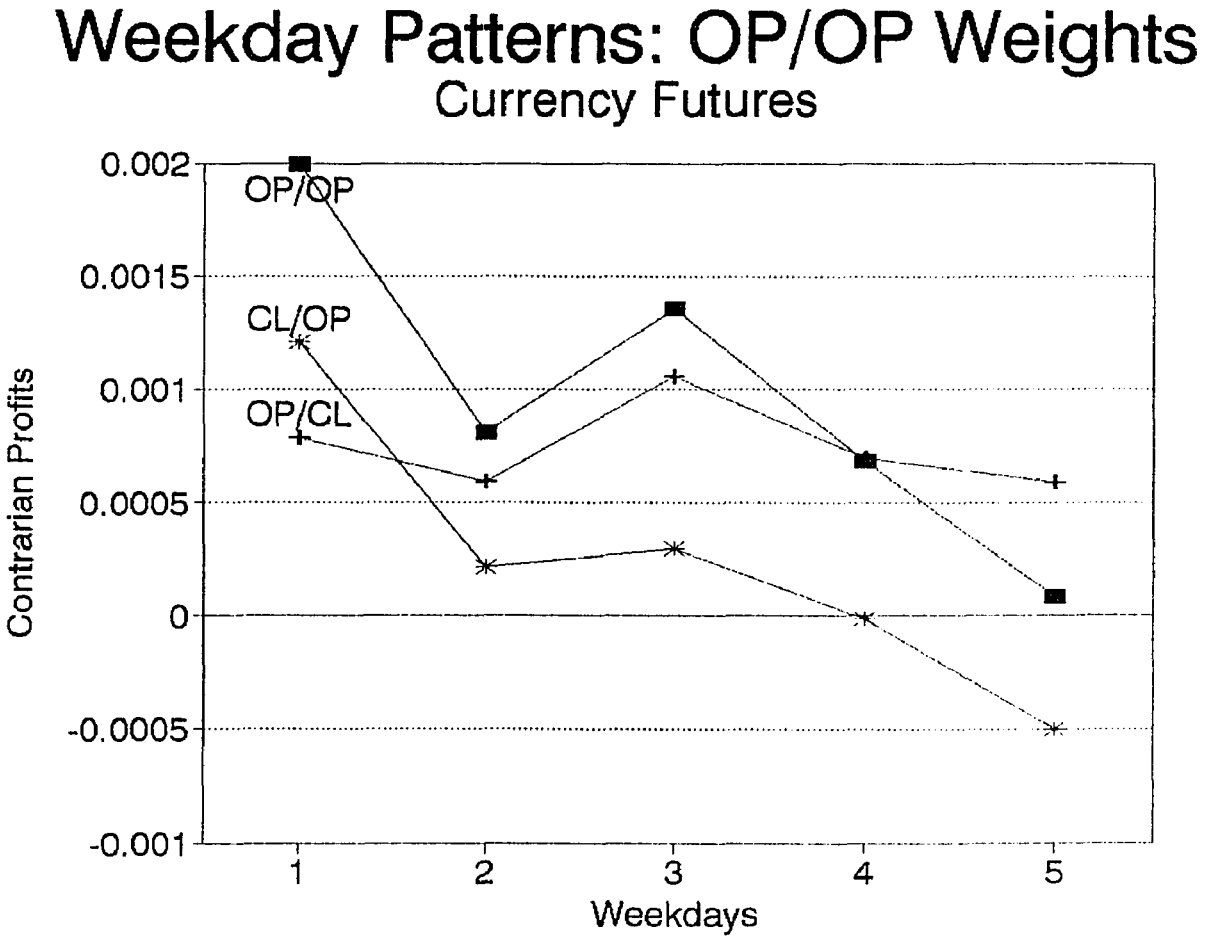
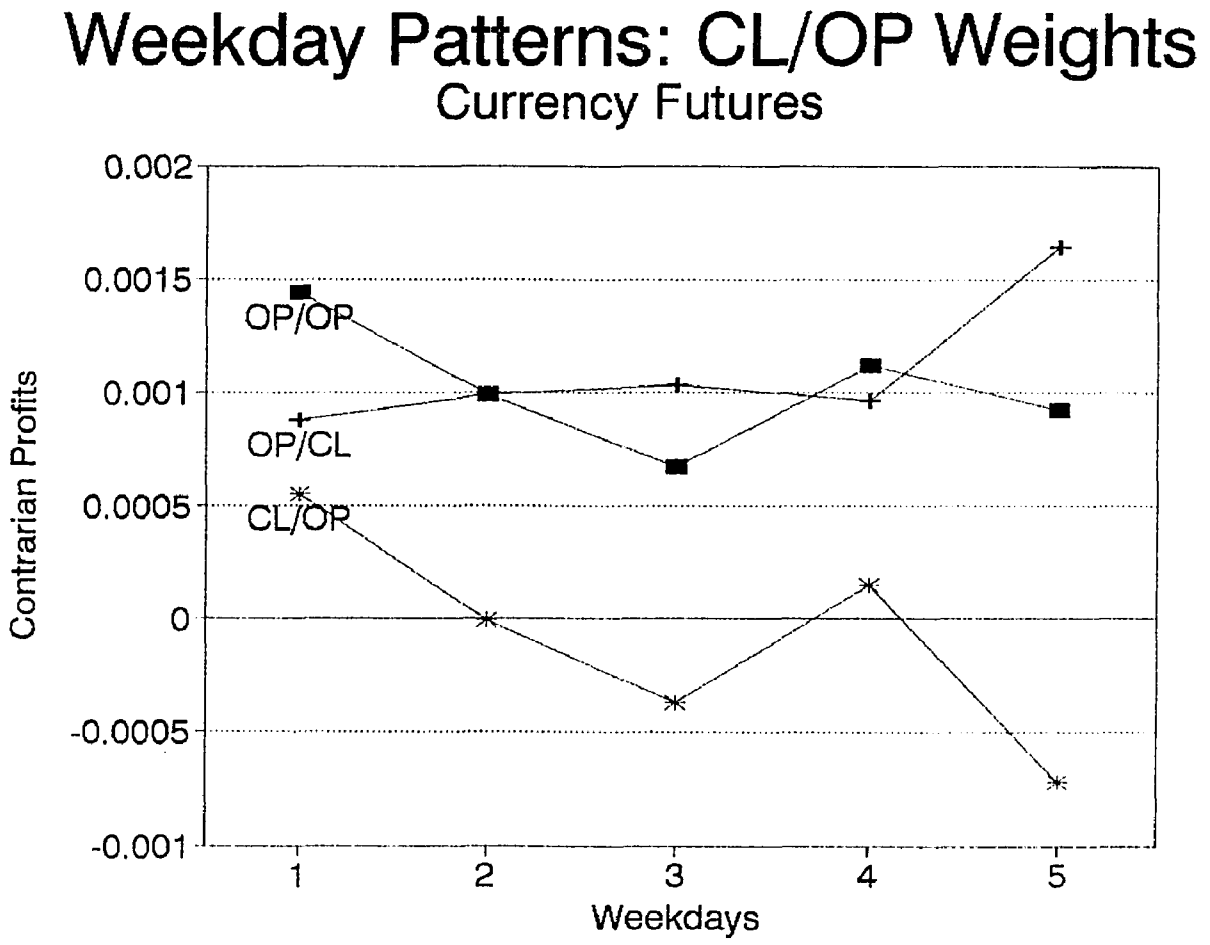


Figure 20. Weekday Pattern in Contrarian Profits



The results on the index futures portfolio are similar to the ones from the interest rate futures: contrarian profits occur entirely over the open-to-settlement half-day sub-period following the weighting period and that Friday profits are higher than those of the other weekdays.

For the currency futures portfolio, contrarian profits still occur mostly in the open-to-settlement half-day period following the weighting period. The weekday pattern in the contrarian profits for currency futures appears to be different from the other portfolios. The Monday profits seem to be the highest. The Friday profits tend to be the lowest.

4.5.4 General Weekday Patterns

In this section we present graphs of the weekday patterns from the same weighting scheme for several portfolios. This provides a better view of the common patterns across portfolios.

Figures 21 and 22 present the open-to-open weighting cases for the following portfolios: Silver, Gold, Metals, T-bond, Interest Rate futures, and Eurodollar portfolio. Figures 23 and 24 are the results for the same portfolios using the settlement-to-open weighting. Only the profits for trading over the OP/OP and OP/ST periods are graphed,

since almost all the ST/OP results are insignificant. It is clear from these graphs that there is a tendency for the Friday profits to be the highest.

Figure 21. Weekday Pattern across Portfolios
Portfolios: SV, GC, US, ED, RATE, MTL

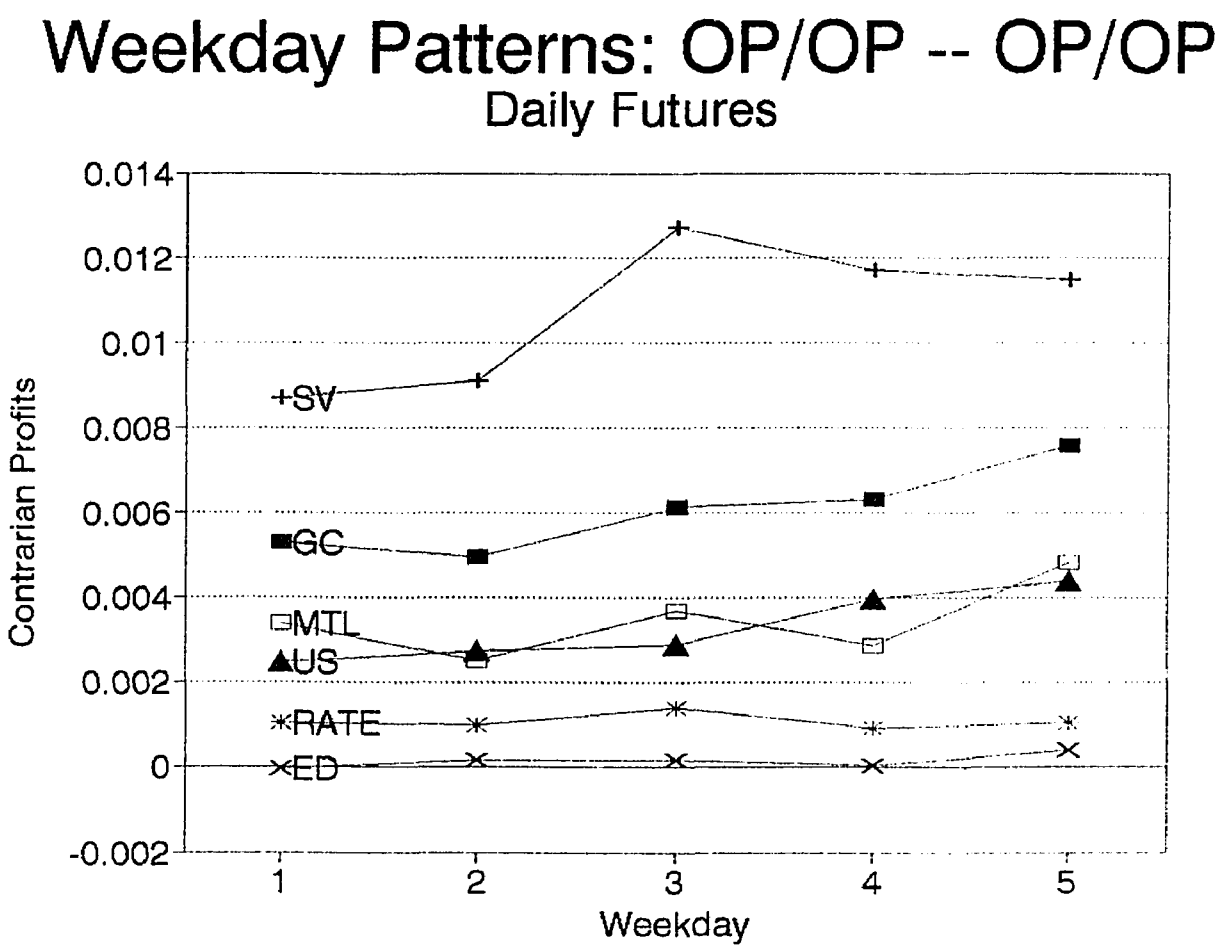


Figure 22. Weekday Pattern across Portfolios
Portfolios: SV, GC, US, ED, RATE, MTL

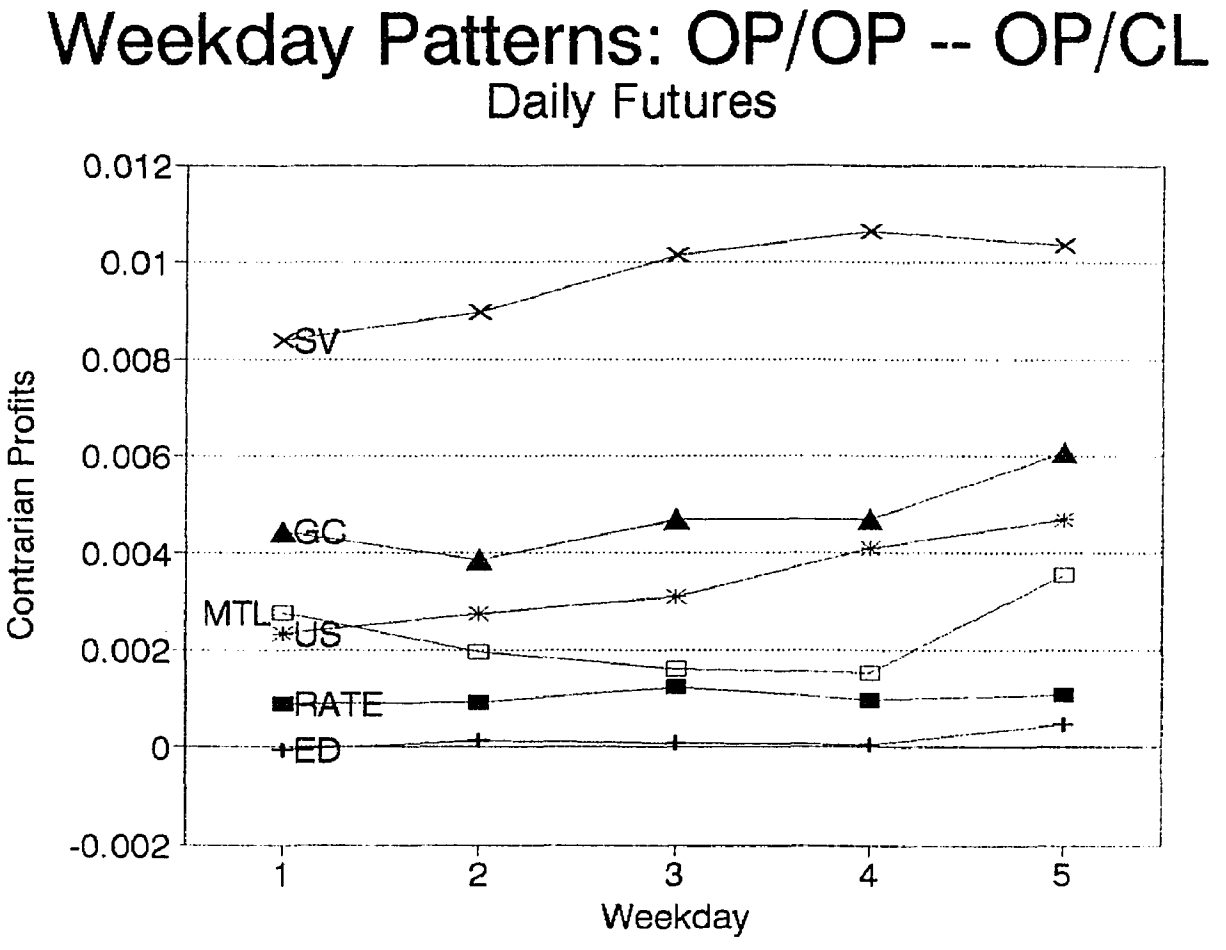


Figure 23. Weekday Pattern across Portfolio
Portfolios: SV, GC, US, ED, RATE, MTL

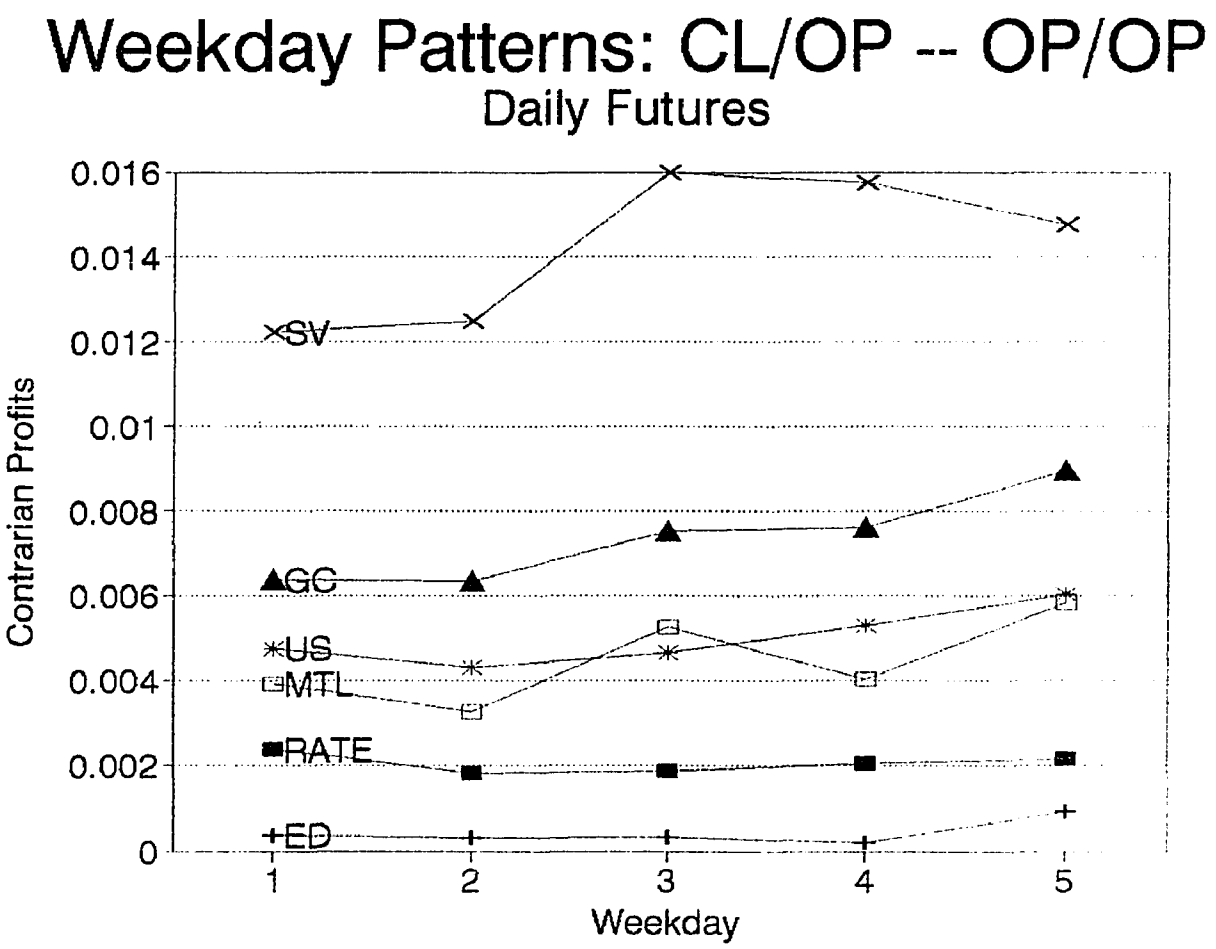
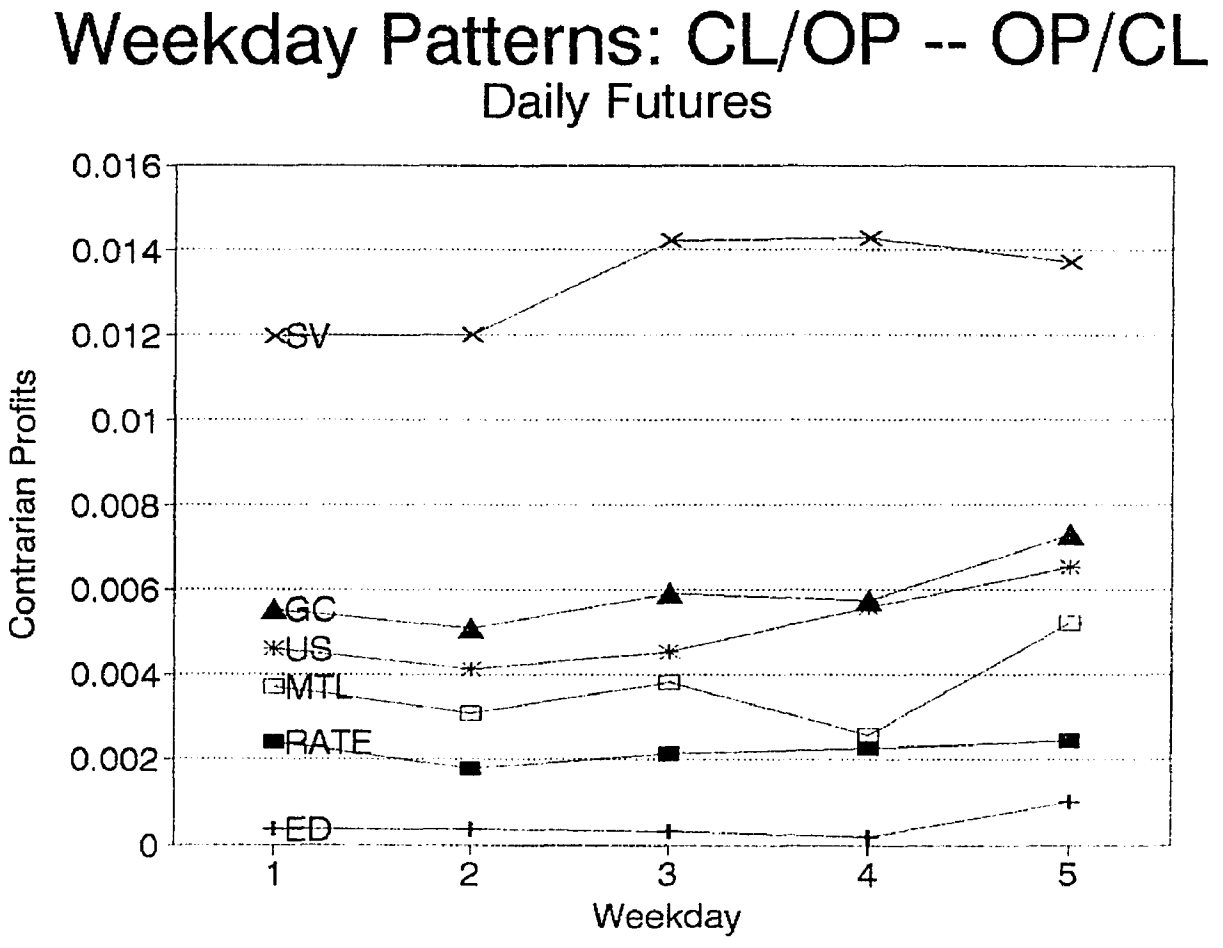


Figure 24. Weekday Pattern across Portfolios
Portfolios: SV, GC, US, ED, RATE, MTL



4.5.5 Conclusions

Our results in this section provide two pieces of insights. We observe across weekdays a consistent pattern of quick price reversals. Contrarian profits occur almost entirely in the open-to-settlement half-day sub-period following the weighting period, while the next settlement-to-open half-day sub-period earns either insignificant or small significant negative profits. There is also a tendency for the Friday contrarian profits to be the highest among those of the weekdays. Wednesday contrarian profits also tend to be high. Only the currency futures portfolio does not exhibit this pattern. A possible reason is that currency futures prices react to international information as well as trading activity in other markets. This in turn may cause the opening and settlement prices to behave different from other futures prices that are not affected by international considerations. Earlier studies in the weekday seasonal patterns in stock returns document Friday returns as higher than the other weekdays. Our finding is that the degree of overreaction tend to be larger on Fridays.

Chapter 5. Summary and Conclusions

In this study, we present the first extensive investigation in short-term contrarian profits in the futures markets. By using an extensive set of daily futures prices, we are able to provide additional evidence of the existence of overreaction in the actively traded futures markets. These evidence corroborate with similar earlier studies that are almost exclusively done on the stock markets. In addition, we also document some important patterns in the behavior of contrarian profits over sub-periods and weekdays.

Our first set of findings are that when trading on the settlement prices, only a small number of futures exhibit significant contrarian profits, while most futures exhibit insignificant or small significant negative profits. This is evidence that daily settlement prices are in general efficiently set, with respect to a contrarian trading strategy.

When we expand our examination to using other daily periods for application of the contrarian strategy, we find a different picture. We compare results from using settlement-to-settlement, open-to-open, settlement-to-open, and open-to-settlement periods for weight determination. Applying the same contrarian strategy, we find that while

the settlement-to-settlement and open-to-settlement cases generate insignificant profits, the open-to-open and settlement-to-open cases generate positive significant contrarian profits. In other words, while in settlement prices we find no contrarian profits, in opening prices we do. This corroborate with evidences from other studies that open-to-open returns tend to be more volatile than settlement-to-settlement returns. To the degree that opening prices involve more volatility, one would expect more tendency for overreaction, resulting in higher contrarian profits.

In term of the magnitude of the profits, the evidence is that, while there is contrarian profits in the daily level, they are small economically. More importantly, the profits depend critically on execution on the opening prices for a number of futures contract all at the same time. Such difficulty in simultaneous execution would make it highly unlikely that all but the most active traders would be able to earn the profits. Consequently, these profits are most likely only available to active (floor) traders who offer liquidity for small price movements, or for informed traders who earn the profits by trading against the overreaction and thus correct the overreaction. The contrarian profits documented here can be considered one possible type of reward for the floor traders.

The most important new finding in this paper is the occurring time of the contrarian profits, in term of sub-periods. We show clear evidence that, almost uniformly in all futures portfolios, practically all the contrarian profits available over a whole-day period (open-to-open or settlement-to-settlement) occur in the first half-day sub-period (open-to-settlement or settlement-to-open). Trading extended to the next half-day sub-period (settlement-to-open or open-to-settlement) carries mostly insignificant profits, and in a few cases small significant negative profits.

This is strong evidence that prices revert quickly back to an efficient level within the trading day. Contrarian trading over the overnight period show uniformly insignificant or significant but negative profits. It appears that contrarian profits only exist for day-trading, a pattern making such profits a likely reward for the floor traders who do not carry overnight positions.

The theory of Efficient Market argues that security prices reflect new information quickly and correctly. Most event studies in capital market transactions report evidence that in general prices do move to efficient level over reasonably short time frame. Our results are consistent with these findings.

With daily prices, we are only able to examine contrarian profits down to the half-day sub-periods. In an active market, one would expect price inefficiency to last

over an even smaller time period. One possible extension of the current study is to use intra-day prices and apply the same contrarian trading strategy. In light of the evidence that, over the open-to-settlement trading day, there tend to be two active trading periods, namely the early hour and the last hour, one might expect the intra-day pattern to be a complex one.

In term of the contrarian profits from the opening prices, when we compare the results in using the prior open-to-open period for weight determination to those in using the prior settlement-to-open period for weight determination, we find that the latter account for almost all of the former. In other words, adding the prior trading hours into weight determination does not add materially to the contrarian profits. In fact, in several cases, the most profitable trading strategy is to use the prior settlement-to-open period for weight determination and trade over the following open-to-settlement period (ST/OP vs. OP/ST).

This seems to indicate that, while opening prices overreact, by the closing time, prices tend to have reverted back to an efficient level. The next opening prices may overreact again. The overreaction occurring in the opening prices is best captured in only the overnight settlement-to-open rate of price change, which is an overreacted price change. The open-to-settlement period, on the other hand,

incorporates both the correct movement for the day and the correction. As such, it does not add to the degree of overreaction that the contrarian strategy is designed to capture.

We also provide strong evidence that overreaction is related to information impact, intraday volatility, and change in trading volume. More specifically, larger information impact tend to generate larger contrarian profits. The degree of overreaction increases when traders are faced with larger information flow. This has been documented in several studies in the stock markets. Our evidence is new in that it is observed in the futures markets and it is on a daily scale.

We find that days with higher intraday volatility and large negative change in trading volume generate higher contrarian profits. It is reasonable to expect larger overreaction when market price is more volatile. It is also reasonable to expect traders to stay away from the market when volatility is high. Less active trading in turn is associated with larger overreaction. Our evidence from these market factors provides a plausible market behavioral explanation for different magnitude in overreaction from different market settings.

When we examine the patterns of contrarian profits

across weekdays, we find two patterns. First, all the patterns found earlier is found uniformly across weekdays. We find that for all weekdays it is the opening prices that generate contrarian profits. The pattern that the first half-day sub-period accounts for most of the contrarian profits is found for all weekdays.

Second, there is some weekday seasonal pattern in that Friday profits tend to be higher than those of the other weekdays. This corroborate with prior finding in the stock return seasonality that Friday returns tend to be the highest among the weekdays. The same behavioral cause might have led to a tendency to have larger overreaction in Friday as versus the other weekdays.

In conclusion, this study provides the first extensive study in daily contrarian profits in the futures markets. We document several pieces of new and important evidence in the behavior of contrarian profits. It is significant that these patterns are found across a large number of futures markets.

In the sense suggested by Fama, our findings provide a confirmation of efficiency rather than inefficiency in the futures markets. Our evidence points to a picture of very short-term profits for only the most active traders, where the profits only exist for a relative short time period. In this picture, although there is some degree of overreaction

in the opening prices, as new information starts to be digested and incorporated into prices, by the closing time prices have reverted back to an efficient level, when all information has been correctly digested, and no more contrarian profit is available. The floor traders earn such profits for providing liquidity, while informed traders earn such profits for correcting the overreaction.

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