Price Effects of Addition or Deletion from the Standard & Poor's 500 Index

Evidence of Increasing Market Efficiency

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I. Introduction

The S&P 500 consists of 500 stocks chosen for market size, liquidity, and industry group representation. It is both one of the most widely used benchmarks of US equity performance, and also widely tracked by investors who wish to remain diversified. Prior to 1989, if a component of the index needed to be replaced for any reason S&P would announce and implement the change after trading had closed on a single day. In October 1989 S&P changed this policy to allow approximately one week of trading between the announcement date and the change date. This new knowledge of high demand for the added stock on a certain day gives us a chance to test the efficient market theory. This article examines price and volume history for firms added to or deleted from the S&P 500 from January 1990 through December 2000.

Perhaps the most significant contribution of this study is the evidence of an increase in market efficiency over time. We have found that as our proxy for investor interest has increased significantly over time, the trading profit available to investors has fallen. We believe that this is the first study that has shown such a relationship, although future work should concentrate on evaluating the actual relationship between possible abnormal returns, investor interest in this trade, and indexing based on the S&P 500.

For additions we found a positive average abnormal return of 4.34% from the close on the announcement day to the close of trading the next day. We found an additional 5.45% increase from the close of trading on the day after announcement to the closing price on the day of addition. Using a previously studied trading strategy (Lynch and Mendenhall 1997 and Beneish and Whaley 1996) of selling short (buying) $1 of the index and going long (short) $1 of the stock for additions (deletions) this 5.45% increase could have been turned into trading profits which significantly outweighed any trading costs. After the addition of the stock to the index, we found that price release over the seven-day release period determined by Lynch and Mendenhall (1997) results in a total 3.12% increase from the open after announcement through the price release. Although this is similar to the amount found by other researchers, we were not able to verify the 3.12% as significant.

We found similar results for those stocks that were deleted from the index, but with returns, as would be expected, in the opposite direction. Overnight returns from the announcement day close to the next morning's open (3.26%) were only about half of the 6.51% decrease from the initial day close-close change. From the open after announcement, we found a 10.15% decrease which could have been captured by traders using our strategy of shorting on the open and covering at the close. Interestingly, for deletions we also find that there is almost no price release, and find a significant permanent price decrease of 10.13% which may be related to lower overall demand for the removed stock.

The semi-strong form of the efficient market hypothesis states that the all publicly available information is reflected in securities prices. Under this theory, the market's historical knowledge of high abnormal returns for index additions and deletions would drive a security's price up to its expected addition-day value on the day after announcement. Although most index funds do not buy until the addition day, rational investors would not sell for less than the expected addition-day price. The fact that there is the 5.45% increase from the end of the day after announcement to the close is a violation of this hypothesis. However, we do find that over time this effect has decreased, indicating that the market is becoming more efficient.

The existence of a price reversal in the days following the addition also points to a violation of the efficient market. High volumes on the day of addition point to heavy index trading as funds like the Vanguard 500 add the stock to their portfolio. This makes sense because many index fund managers' incentives are based on minimizing tracking error. If fund managers added a stock before the official addition to take advantage of historical price increases they would not be rewarded, and face significant penalties if the stock were to decline from their purchase and the closing price on the addition day. We can see in Figure 5 that over time the volume of trading on the close day has risen at a faster pace than days between announcement and close (a slope of 0.0017 on the AD vs. 0.0001 for the days between AD+1 and CD), indicating a continued preference for addition-day purchases on the part of large fund managers.

Instead of attempting to determine the release date, we used seven days for additions and five days for deletions. These time period were determined by Lynch and Mendenhall (1997) in their study of the same price effects. We confirmed these price release figures, except that for deletions the price release in the early days following the close are followed by renewed selling and price decline through the end of our sample at CD+10.

Although the continued evidence of significant abnormal trading returns available to investors indicates an inefficient market, we see evidence of the slow erosion of those profits. First, the prevalence of indexing has taken off over our time period. One proxy that we look at (IFM) is the fraction of the net asset value (NAV) of the S&P 500 companies that is owned by the Vanguard 500 index fund. This fraction increased over 10 times from January 1990 to December 1998, and the Vanguard 500 fund owned nearly 1% of the NAV of S&P 500 companies by 2001. We also found a proxy (CD-MAV) for indexing in the abnormal volume of trading on the addition day (CD) as a fraction of the stock's historical trading volumes. This rise in indexing would be expected to increase the demand for shares on the addition day, and thereby the profits available to those who bought on the open after announcement (AD+1) and sold at the close on CD (this return will be referred to as OC-MAR going forward). Admittedly, there are problems with both of these as proxies for indexing, including discrepancies between Vanguard's growth and the amount of money actually indexed, and the dispersal of block trading over the period before and after CD. We also found them to be positively, if not significantly, correlated (Figure 7).

Mitigating this indexing effect, however, is the increase in investors' awareness of our trading strategy. Although it would be very difficult to determine the number of investors or the amount of money following this risk arbitrage strategy, we developed two proxies for the increase. First, we look at the abnormal volume on the day after announcement (AD+1 MAV) under the assumption that enterprising traders would be buying at the open to capture as much profit as possible. Second we look at the actual returns earned by a trader who followed this strategy, under the assumption that the more arbitrageurs following the strategy, the higher the opening price would be. With a limited amount of demand from index funds on the close day and therefore a limited CD closing price, the higher the AD+1 open price the lower OC-MAR would be.

Although interesting, these proxies did not completely explain the relationship between indexing and abnormal returns, and we find that in most samples as IFM and CD-MAV increase the returns available to traders actually *decrease* (Figures 9-20). We expect that this is a result of the investor interest proxies over powering the increase in indexing. When we attempt to regress OC-MAR using both variables, the correlation between the two and high variance in the data make it difficult to separate out the relationships.

There are also implications in this paper for the existence of a downward-sloping demand curve for securities (Harris and Gurel 1986, Shleifer 1986). As index fund managers buy up securities around the change period, the supply of stock available for trading in the non-indexed marketplace is reduced, theoretically causing the market-clearing price to increase. The reverse should be true for deletions, where an increase in supply from index fund selling would decrease the market-clearing price. If the demand curve for securities were horizontal, any increase or decrease in demand would not affect the permanent price of the stock. We find that there is still a positive but not significant price increase for additions, and a significantly negative permanent price decrease for deletions from the announcement through the end of the price release period determined by Lynch and Mendenhall. Although inconclusive, this may indicate a downward sloping demand curve for securities.

This is not the only explanation for the increase (decrease) that we see when a stock is added (deleted) to the S&P 500. Other explanations include temporary price pressure resulting from heavy index fund buying and selling (the temporary price pressure hypothesis), a liquidity change resulting from inclusion in a widely followed index (the liquidity hypothesis Amihud and Mendelson 1986, 1993), or any non-public information that is implied in S&P's announcement of the change (the information hypothesis Jain 1987). If inclusion in the index were to affect the stock's liquidity, then the stock price should rise by the amount of any resulting decrease in trading costs. The information hypothesis is based on the possibility that S&P uses significant non-public information in the decision about which stock to add to the index. By adding a stock to it's index S&P is giving implicit approval and in some cases legitimacy to a stock or industry. Finally, the price pressure hypothesis argues that the buying by index funds drives up the price only temporarily, and that after index funds are done buying their initial allotment this pressure would fade and prices return to their equilibrium level.

The results that we present here are able to partly clarify this mass of alternatives. The significant announcement day change is consistent with all four hypotheses (temporary price pressure, downward sloping demand, liquidity, and additional information). We would assume that in an efficient market any additional information or change in liquidity would be priced into the overnight change after the announcement, and we do in fact see a significant abnormal return over that time. Increased demand from traders resulting in temporary price pressure can explain the abnormal returns available to traders between the open on the day after the announcement and the close for deletions. However, only the downward-sloping demand curve hypothesis can explain a permanent price increase or decrease from the open after announcement (when information and liquidity has been priced) and the end of the release period (when all temporary price pressure has been relieved). Once the stock has been added and most of the index selling is complete (as measured by the ending of the Lynch and Mendenhall five day release period for deletions) there still remains a statistically significant price decrease for our deletion sample from the open after announcement to the end of the release period. This decrease can only be explained by a downward sloping demand curve for securities.

Although we will not spend a lot of time on theory in this paper, we will go more into the empirical evidence to support various hypotheses in section III, along with the presentation of our results. Readers wanting a further discussion of these hypotheses should see Lynch and Mendenhall (1997). The next section will detail the sample of data and the research method used in this study. Finally, Section IV will present a conclusion and ideas for future research.

II. Data and Methodology

In the interests of consistency, all data for results, graphs, and tables in this paper are from 1989 to 1999 inclusive unless otherwise stated. Although we had most of the data for 2000 it was not complete so we declined to use it.

Data for this study was collected from a number of sources. Standard & Poor's Corporation supplied information on index additions and deletions between 1989 and 2000, including announcement and addition dates. Daily stock volumes and closing prices, as well as index volumes and closing prices were obtained from the Center for Research in Securities Prices (CRSP) for the period from 1989 through 1999. Volume and closing price data, as well as opening prices for all securities were obtained from Bloomberg. The market portfolio for daily returns is considered to be the stocks of the S&P 500, and market share volumes are the sum of NYSE, AMEX, and NASDAQ daily volumes.

From the total sample of 304 additions and 304 deletions, a number of securities had to be removed. First removed were any securities for which data of one form or another could not be found. Five additions and 11 deletions were removed from the sample for this reason. Secondly, there are a number of index changes for which no trading is required by index funds, including name changes and/or replacements due to part of a company spinning off and the child and/or parent remaining in the index. 35 additions and 39 deletions were removed. Third, any company which was mentioned in connection with merger and acquisition activity for three months prior to the announcement of the change. Sources for this information were the Dow Jones News Service, Bloomberg, and the Wall Street Journal Archives. These 85 additions and 194 deletions were removed because index funds often will not need to trade, and they would deaden the results of our sample. Fourth, S&P's policy is that firms are removed from the index immediately after filing for Chapter 11 bankruptcy protection or when a recapitalization plan is approved by shareholders that substantially changes the firm's debt/equity ratio. In these 8 cases, the deleted firm was removed from the sample both because the bankruptcy introduces information issues that may add noise to our results, and because the one-day period between announcement and change is too short. Finally, we removed 67 additions because there were not a sufficient number of trading days between the announcement and change. We require that there be at least one full day of trading between the announcement of the change and the day of the change. Firms that are added in one day for whatever reason are much more like the pre-1989 policy of S&P

and would not yield profits from our trading strategy. The final sample was made up of 112 additions and 52 deletions.

Methodology:

We used an event study methodology (further described in Lynch and Mendenhall 1997) to study additions and deletions from the S&P 500. The two event days were the day of the announcement (AD), and the actual change day (CD). Because the announcement comes after the market close, the first day of trading on the news is AD+1. Similarly, because a stock is officially added to the index as of the close of trading on the change day, CD+1 is the first day of trading after the second event.

Abnormal Return Calculation. Because we wanted to adjust for daily variations in the market relative to individual stock prices, daily abnormal return (AR) of the stock is defined as its raw return minus the raw return of the market. The mean abnormal return (MAR) for each event day in our study is considered to be the average AR of every firm that is represented on that day. However, because of the variation in the length of time between AD and CD, not every stock will be represented on every given day. For example, if stock A has three days between AD and CD and stock B has ten days, stock A will not be represented in the AD+5 row of Table 1 or 2, and the 'N' column will reflect the decreased participation.

Abnormal Volume Calculation. In order to calculate volume increases resulting from the announcement of a firm's addition to or deletion from the S&P 500, we must first calculate a base period. The period used was the 10 trading days prior to the announcement, including the day of the announcement itself, and we establish this base for both the market and the individual security. After the announcement, abnormal volume in the stock was considered to be the firm's percentage volume above the base minus the same fraction for the market overall. For additions (Figure 2) we typically observed a 350% increase on the day immediately after the announcement, and a nearly 1400% increase on the day of the change. The daily averages can be observed in Figure 2 and Tables 3 and 4.

Price release period determination. Rather than attempt to determine a price release period from our own data, we decided to use those determined from an earlier study on the same subject matter by Lynch and Mendenhall (1997). They found there to be significant price release for seven trading days following an addition and 5 days following deletions. This is consistent with our results (Figure 1, Tables 1 and 2) over time, except that we noticed a return to significantly negative returns after the five day price release window for deletions.

Grouping of results for regressions. Pooling all returns by years and trying to regress them would have provided nicely accurate averages, but left us with few data points and would have missed intra-year changes. Instead, we pooled return data by month according to the closing day of the change. Thus, if there were two changes made in March 1990, then the abnormal volume and return numbers used for regressions would be the average of the two. We ignored months for which there were no changes. This method yielded us 71 data points for additions and 33 for deletions.

Significance Tests. Significance tests on MAV and MAR ($_{tc}$(MAR and $_{tc}$(MAV))for the event studies were performed using a cross-sectional variance estimator

(Asquith 1983), known to perform well in testing, given the increase in variance of AR around the event dates. Details can be found in Lynch and Mendenhall (1997).

III. Results

Price Results.

Tables 1 and 2 present numerical data for addition and deletion returns over the range of our study, and are graphically displayed in Figure 1. For each of the 6 event days displayed after AD and before CD in Tables 1 and 2, those companies whose AD and CD are less than seven days apart are steadily removed from the sample. Thus, the number of firms in each sample declines over the event window. In both tables, the AD and CD are shown as zero in the time series. In addition, AD+1 is broken up into the overnight increase between the closing price before the addition and the opening price after addition (CO-MAR) which is not available to traders, and the intra-day return from the open to the close which is available to traders (OC-MAR). The summary of the two, or CC-MAR is also included.

For both additions and deletions, the AD+1 abnormal return is significantly different from zero. We find a close-close average return of 4.34% for additions although, interestingly, all positive return is overnight and any trader that bought on the open would have actually lost a small percentage during the day. On average, however, they would have made up the loss as the price rose significantly by close of trading on the change day.

For additions (deletions) we can see in Figure 3(Figure 4) how the returns have changed over time. As we would have expected, the total percentage change from the AD close to the CD close has risen slightly over time, possibly because of the large increases in indexing, but also explainable by growing liquidity or information effects. However, just as the total change has been increasing, the profit available to traders has fallen slightly because more of this increase is coming between the announcement close and the open the next morning, a period which is not available to traders. This could be explained by the increasing investor attention on the trading possibilities, and we have used CO-MAR as one of our proxies for investor's attention to the risk arbitrage opportunity available.

Figure 1 displays the average price increase from nine days before the announcement day (AD-9) to 10 days after the close (CD+10). Both of these graphs look very similar to the results found by Lynch and Mendenhall in 1997. We do want to point out that because of the variation in trading days between AD and CD, we had to take some liberties with the presentation of the graph. Since every change in our sample has at least one distinct day after announcement and a separate close day, the percentage change for those days are true. However, for presentation's sake we took the average number of days between A+1 and CD (4 days for additions and 3 for deletions) and averaged the remaining return over those days. So for additions, the return for each of the four days will be the total AD to CD return minus the actual AD+1 and CD returns divided by four. You can view the actual average daily returns in Tables 1 and 2.

Volume Results

Tables 3 and 4 present mean abnormal volume (MAV) results over time, while Figure 2 shows a graphical representation. Although the actual windows vary, we only display a maximum six-day window between the announcement and change. Again, you can see in the 'N' column the number of firms that are represented in each day. As expected, we notice the highest levels of abnormal volume on AD+1 and CD, the CD MAV being four to five times that of AD+1 MAV. We consider AD+1 MAV to be an effect of the number of investors who are interested in profiting on the change, as risk arbitrageurs take a position to grab as much of the gain as possible. We use the change in this volume over time (Figure 5 and 6) as our second proxy for investor interest, and found it to be significantly correlated to our first proxy, CO-MAR (Figure 7). Admittedly though, just because the two proxies are correlated this does not mean that either is strongly correlated to investor interest.

Although relatively heavy, the volume on A+1 is dwarfed by that of the change day. This is the day that index managers will typically add or remove a company from their fund to most closely track the index. We use the change in CD volume (CD-MAV) over time (Figure 5 and 6) as our first proxy for the increase in indexing over the period. Figure 5 and 6 also show the increase in both AD+1 and CD volume over time, this is the data used as proxy for investor interest and indexing respectively. In addition, we have displayed the average volumes of the days between AD+1 and CD over time. You can see here that although the volume on these intervening days has also increased, the slope of the increase is much less than that of CD volume. This is further indication that index fund managers are waiting until the change day to update their portfolio, choosing a minimal tracking error over any possible price appreciation.

Other Proxies

In an attempt to develop a second proxy for indexing over time, we obtained the net asset value (NAV) of the Vanguard 500 and the S&P 500 from 1990 to 1999. The Vanguard 500 is one of the largest and most widely held mutual funds in America, and has been both a driver for and a result of the trend toward indexing as a savings vehicle. From 1990 to the end of 1998, the Vanguard 500 went from being a $1.7B fund to nearly $80B, and went as high as $110B in 2000. By contrast, the NAV of the S&P 500 increased from $2300B to $9300B in the same period. As a percentage (Figure 8), the Vanguard 500's ownership of the index rose nearly 11 times from 1990 to 1999.

Figures 7 shows the relationship between the two indexing proxies and the two investor interest proxies, while the third graph of Figure 8 actually shows the high correlation between our investor interest and indexing proxies. In the graphs we can see the few outliers caused by greater than normal volume on either the change or addition day. The relationships found between the variables used as proxies are positive and statistically significant although, again, this does not mean that they are actually correlated to indexing or investor interest.

Regressions

With the four proxies that we developed, two for indexing and two for investor interest, we attempted to determine a significant relationship between indexing, investor interest, and the change in AD+1 open to CD close abnormal return over time (OC-

MAR). Although not successful in presenting a clear relationship between investor interest, indexing, and trading profits (OC-MAR), we present our results here as an aid to future work on our part or others'. In three cases for additions and three cases for deletions we show the linear and quadratic regressions of an indexing and investor interest proxy against OC-MAR. Although we had hoped that combining the additions and deletions into one sample (with a switched sign for the deletion OC-MAR) would aid in finding significance, it did not help so we do not present those results here.

We would expect that OC-MAR would decrease as investor interest represented by either overnight return (CO-MAR) or A+1 volume (A+1 MAV) increased. This was consistently demonstrated in our regressions, occasionally to a statistically significant level. We would also expect that as indexing represented by close day volume (CD-MAV) or Vanguard 500 NAV as a fraction of the S&P 500 NAV (IFM) increased that the trading profits available would also increase. However, this relationship was demonstrated in only one set of regressions, and not to a statistically significant level. We believe that the huge increases in investor interest in the last ten years have so affected OC-MAR that it overpowers the effect of increased indexing. Here we will show the most successful regression, as well as two other combinations that are interesting.

As an aside, we would like to point out that although some graphs labeled quadratic may look linear (Figures 11, 13, 15, and 19), they are quadratic and do have a slightly changing slope over the range. The impression of linearity is a result of the very small coefficients related to the squared term of the indexing proxy term.

OC-MAR vs. C-MAV and A+1 MAV. Figure 9 shows our most successful attempt at regressing a proxy for indexing against trading profits. We can see that in this case, the investor interest (A+1 MAV) relationship to OC-MAR is the usual concave shape in the quadratic and has a negative slope in the linear. However, in this instance the indexing (C-MAV) variable relationship shows a portion on the quadratic graph where the relationship of indexing to profits is positive. Although it returns to the usual negative in the purely linear regression (Figure 10), we were able to find some success in regressing the quadratic relationship shown below.

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OC-MAR = 0.0765 - 0.0197 A+1 MAV + 0.00124 A+1 MAV^2 +0.000510 C MAV
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Predictor	Coef	SE Coef	T	P
Constant	0.07650	0.01476	5.18	0.000
A+1 MAV	-0.019703	0.007583	-2.60	0.012
A+1 MAV^	0.0012423	0.0005119	2.43	0.019
C MAV	0.0005099	0.0009142	0.56	0.580

This indicates to us the possibility of a non-linear relationship between investor interest and trading profits (significant), and a weakly linear relationship between indexing and trading profits (not significant).

OC-MAR vs. C-MAV and CO-MAR, and OC-MAR vs. IFM and CO-MAR. In Figures 11-20 we can see an example of the investor interest variable completely overpowering the indexing proxy. Although the linear regression shows the downward sloping investor interest correlation very well, it also shows how the trading return is negatively related to the amount of indexing going on. Because we cannot find any reasonable explanation for this we believe that it a result of the increase in investor interest over the same time period of the increase in indexing. Because the investor interest variable increased so much, our indexing variable is overwhelmed in the regression, especially with the low volume of data that we have to work with.

IV. Conclusion

This article analyses price and volume data for firms added to or deleted from the S&P 500 from October 1989 through December 1999. Because of the time difference between the announcement and the actual change in the index, we have an opportunity to observe the market react to significant demand changing information.

For both additions and deletions the data reveals a distinct pattern of price and volume movements. For additions we find that the stock exhibits significant increases from the announcement through the change day, and then a decline from the change day through the release-ending period when the price steadied approximately 8% above its pre-announcement price. The effect on deletions is more extreme, as the stock generally settles about 14% below its pre-announcement price. There is also a difference in that deletions do not exhibit a sustained price increase after the change day, instead showing a slight increase as selling pressure abates before resuming the decline.

The information that we have developed for both the overnight change after announcement and the change available as trading profits from the open after announcement to the close on the change day is statistically significant for both additions and deletions. Although our longer term addition data is not statistically significant, the data for deletions indicates a permanent price change which can only be explained by the downward sloping demand hypothesis, and adds to the body of work that has pointed out a downward slope in the demand curve for securities. The information and liquidity effects discussed earlier can explain the initial overnight change, and the price pressure hypothesis can explain the increase in price on the change day. However, only the downward sloping demand curve can explain a permanent increase (decrease) in the price of securities that are added to (deleted from) the S&P 500.

For volumes, we continue to see the heavy spikes in market-adjusted volume on the day after the announcement and the day of the change. This indicates that although there is a demonstrated increased return for investors that buy earlier, most index fund managers still chose to track the index as closely as possible, minimizing the possible tracking error. We also find evidence of increased steady state trading volumes after the change for both additions and deletions. This is consistent with studies by Lynch and Mendenhall, and could be a permanent or slowly waning effect of each stock's renewed publicity. We leave it to future studies to determine if daily volumes decline back to historical levels or remain elevated for an extended period.

Perhaps the most significant contribution of this study is the evidence of an increase in market efficiency over time. We have taken the overnight return after announcement (CO-MAR) as a proxy for investor interest, and found that this proxy has increased significantly over time, thus lowering the possible trading profit available to risk arbitrageurs. We believe that this is the first study that has shown such a relationship, although future work should focus on evaluating the actual relationship between available abnormal returns, investor interest in this trade, and indexing based on the S&P 500.

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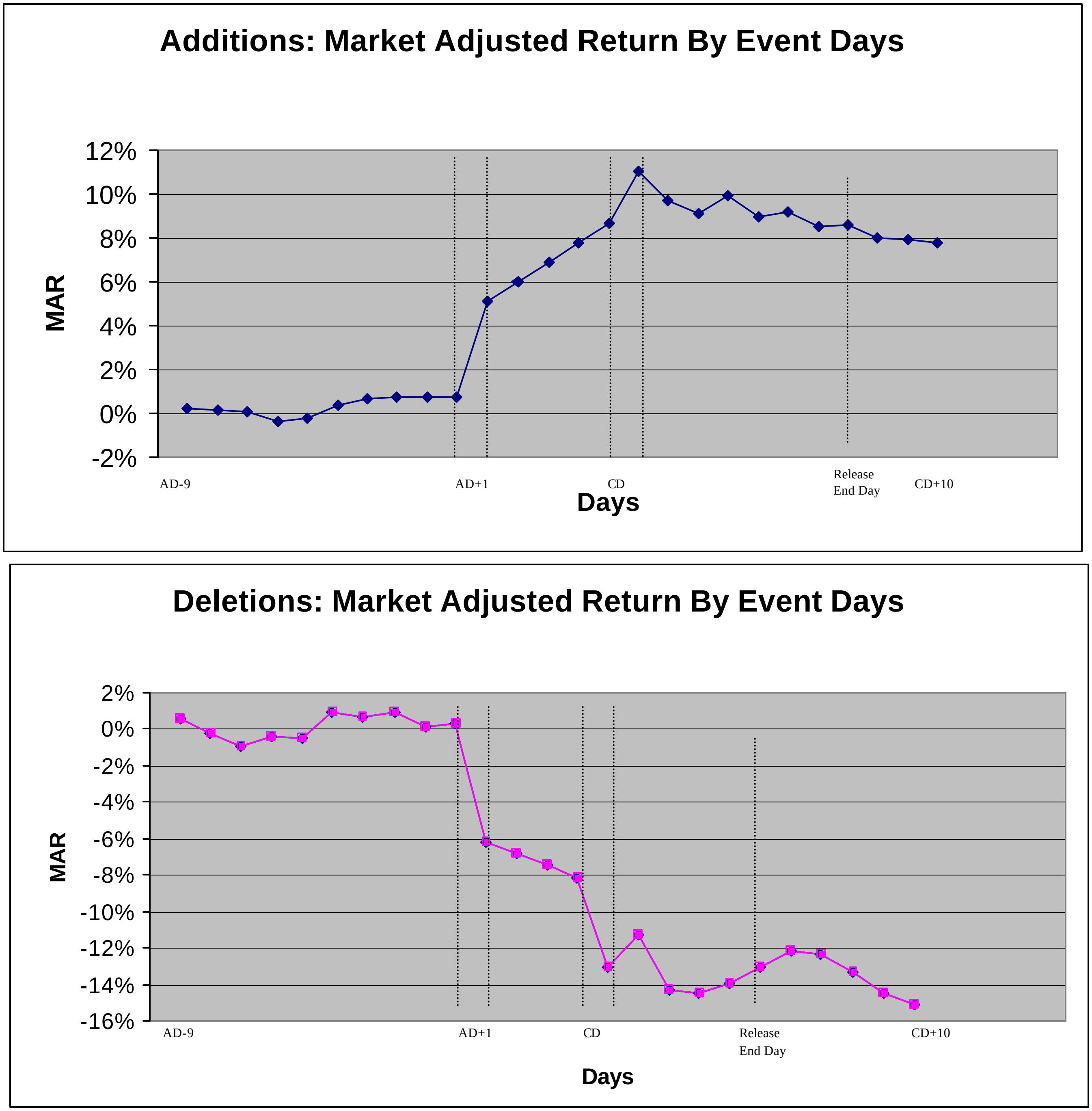
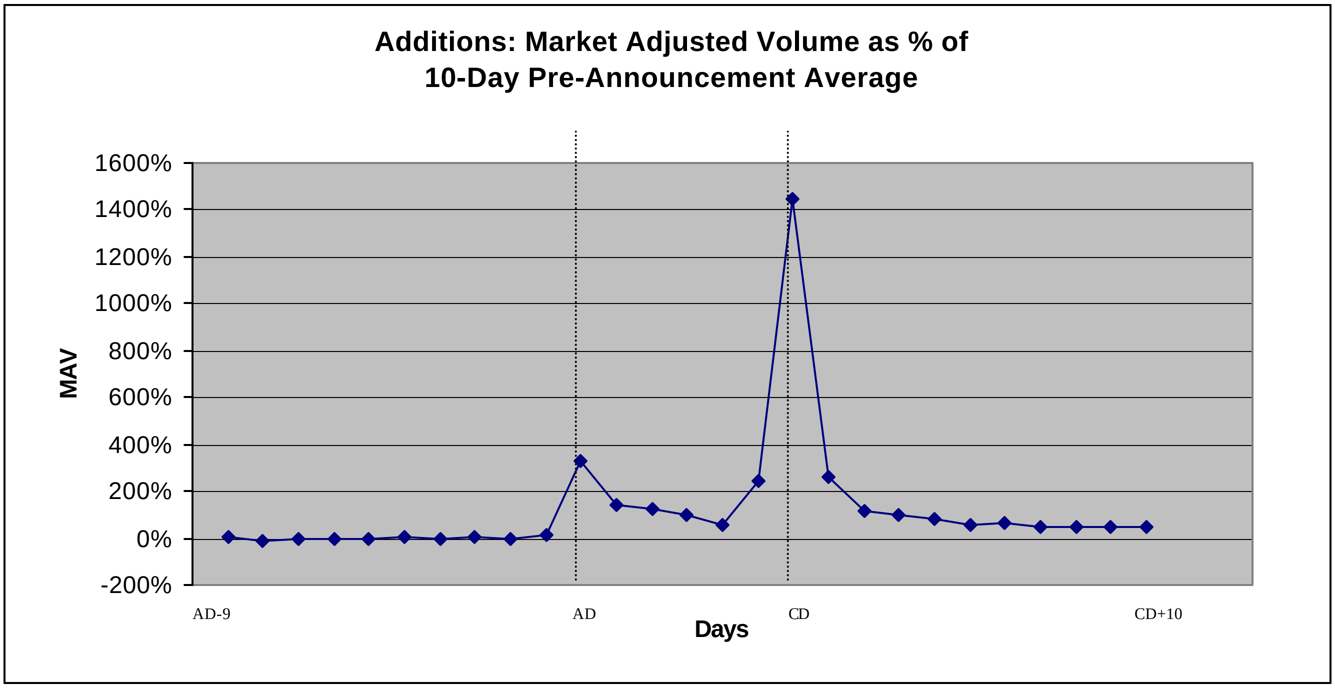
10.

Figure 1. Average Return From Event Days.



Note: Although Table 1 and 2 show the opening prices for the AD+1 and CD+1, they are not displayed here.

Figure 2. Average Volume from Event Days



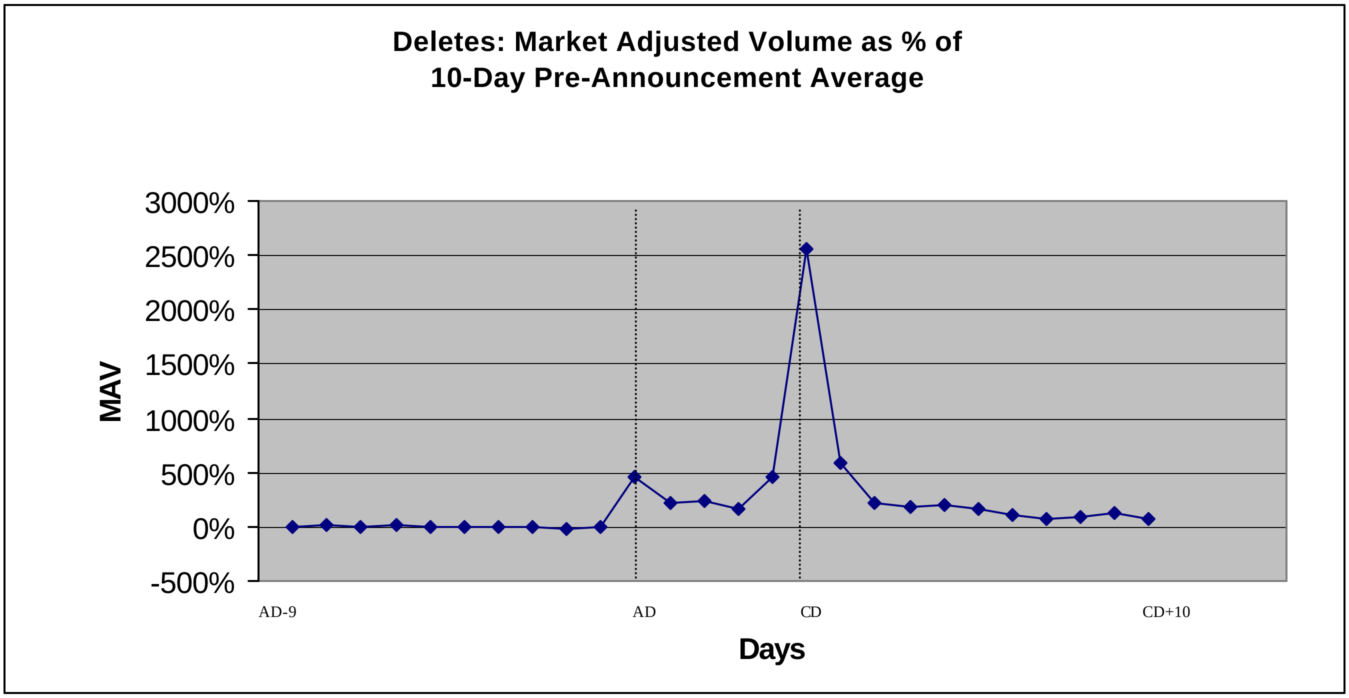
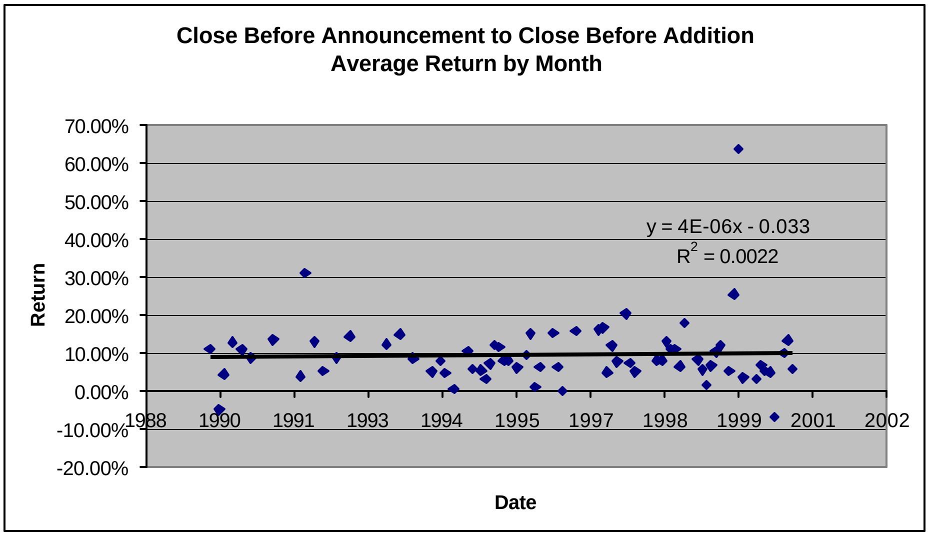
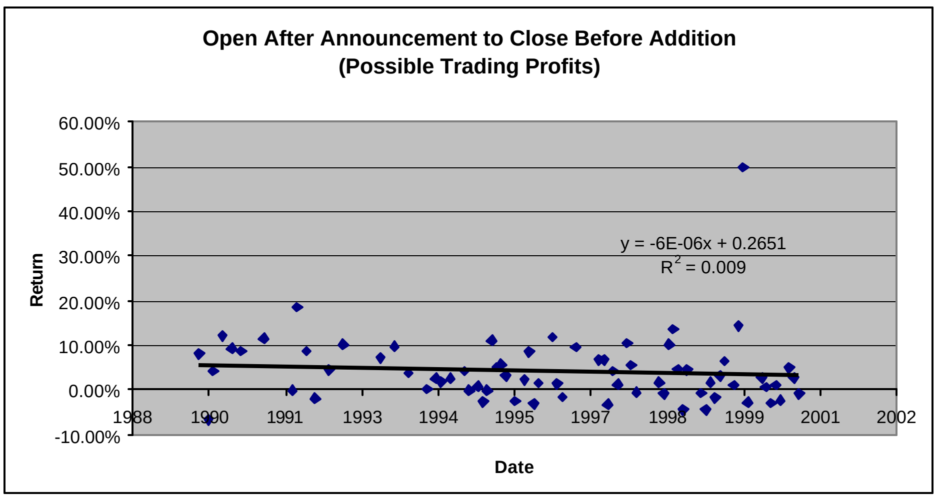


Figure 3. Additions: Returns By Date





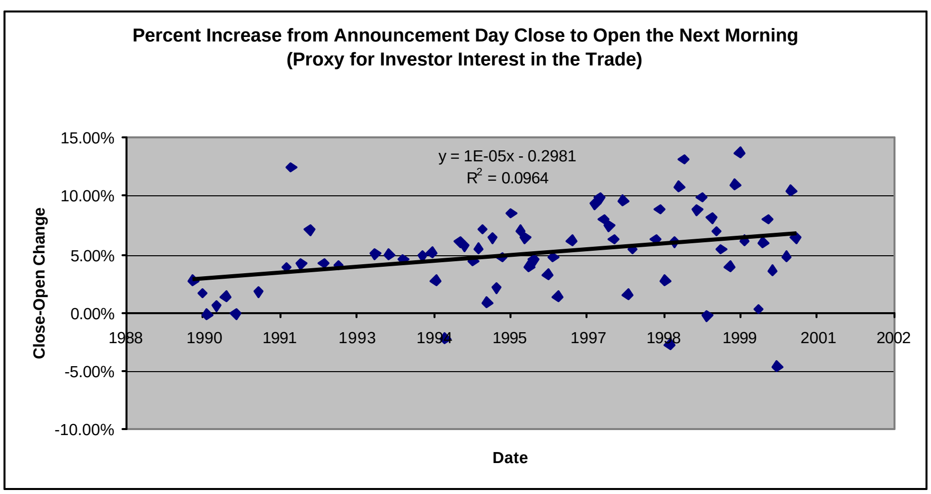


Table 1. Additions: Above Market Returns

Event Day	N	MAR	tc(MAR)	%N>0
A. AD = 0:				
-9	112	0.24%	1.01	48%
-8	112	-0.12%	(0.52)	44%
-7	112	-0.06%	(0.21)	46%
-6	112	-0.43%	(0.79)	41%
-5	112	0.13%	0.54	50%
-4	112	0.59%	2.48	58%
-3	112	0.29%	1.24	52%
-2	112	0.07%	0.24	54%
-1	112	0.04%	0.16	44%
0	112	0.01%	0.03	48%
*1	112	4.79%	15.78	39%
**1	112	-0.46%	(1.73)	94%
***1	112	4.34%	13.16	93%
2	103	0.54%	1.82	54%
3	85	1.05%	3.19	65%
4	64	0.89%	2.62	61%
5	29	0.62%	1.15	66%
6:10	25			
B. CD = 0:				
-10:-6	25			
-5	29	0.69%	0.96	59%
-4	64	2.29%	5.11	78%
-3	85	2.22%	6.07	69%
-2	103	1.30%	4.24	65%
-1	112	1.83%	5.24	71%
0	112	2.36%	5.08	71%
1	112	-1.32%	(2.49)	34%
2	112	-0.58%	(2.03)	45%
3	112	0.81%	0.80	46%
4	112	-0.95%	(1.86)	40%
5	112	0.25%	1.06	46%
6	112	-0.68%	(1.61)	47%
****7	112	0.04%	0.14	48%
8	112	-0.54%	(2.00)	41%
9	112	-0.12%	(0.42)	43%
10	112	-0.16%	(0.64)	0%
A+1 Open to CD Close	112	5.45%	5.74	75%
AD+1 Open to Release	112	3.12%	0.02	62%

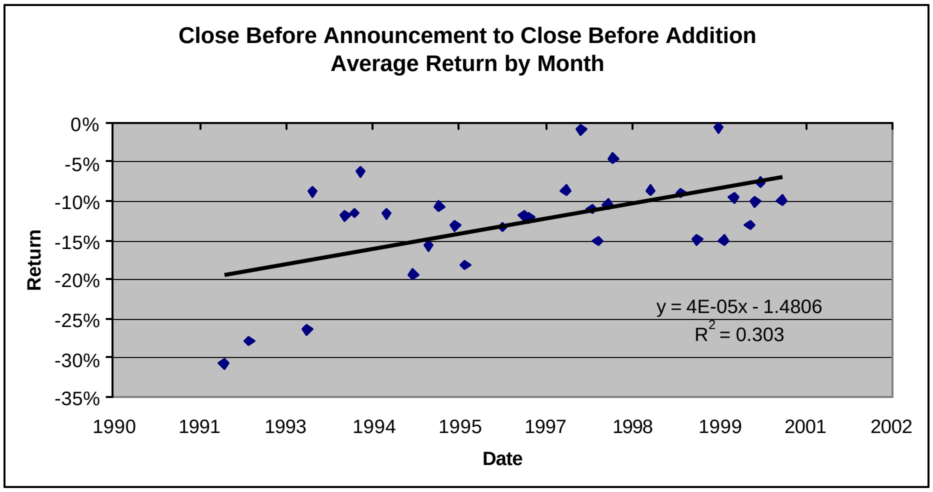
* This is the Percent Change Overnight. It cannot be captured by traders.

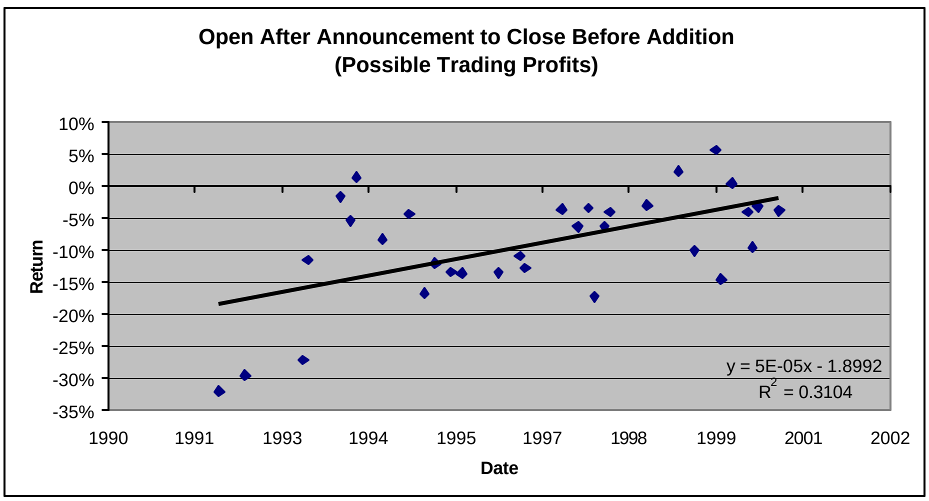
** This is the Percent Change during the day. This is the trading profit of the first day from the Open Price.

*** This is the total of the above two, the Close to Close return.

**** This is the release ending day (Lynch and Mendenhall 1997).

Figure 4. Deletions: Returns By Date





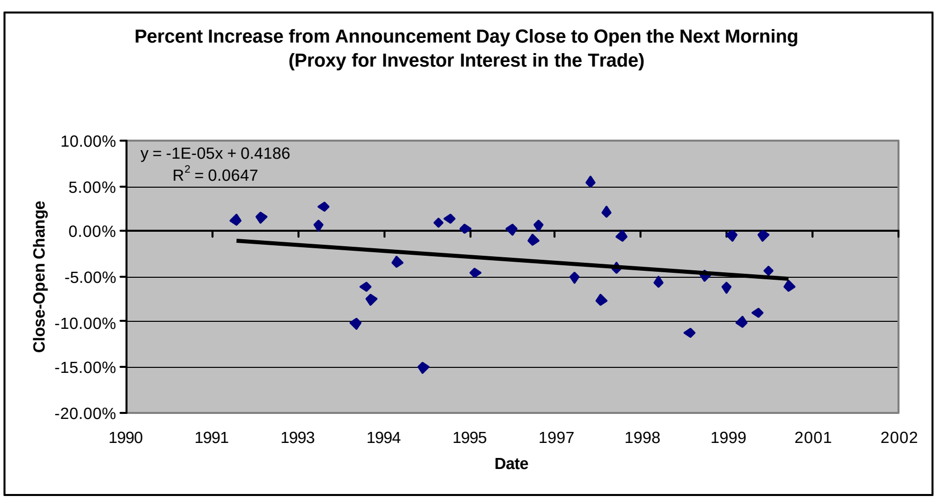


Table 2. Deletions: Above Market Returns

Event Day	N	Actual Above-Market Return	tc(MAV)	%N<0
A. AD=0:				
-9	52	0.54%	1.21	38%
-8	52	-0.76%	(1.86)	44%
-7	52	-0.75%	(1.98)	38%
-6	52	0.56%	0.84	33%
-5	52	-0.09%	(0.22)	31%
-4	52	1.45%	1.94	31%
-3	52	-0.24%	(0.62)	44%
-2	52	0.25%	0.63	37%
-1	52	-0.82%	(2.41)	33%
0	52	0.20%	0.37	37%
*1	52	-3.26%	(3.65)	71%
**1	52	-3.25%	(3.32)	71%
***1	52	-6.51%	(10.20)	62%
2	47	-1.10%	(3.00)	36%
3	46	-0.44%	(1.11)	41%
4	43	-2.01%	(4.17)	42%
5	26	0.26%	0.46	12%
6:10	23			
B. CD=0:				
-10:-6	23			
-5	26	-2.27%	(5.54)	27%
-4	43	-4.22%	(8.45)	49%
-3	46	-1.14%	(2.98)	37%
-2	47	-1.02%	(2.35)	40%
-1	52	-3.12%	(4.25)	48%
0	52	-4.94%	(5.69)	52%
1	52	1.76%	1.51	12%
2	52	-2.98%	(1.50)	40%
3	51	-0.17%	(0.22)	25%
4	51	0.55%	1.18	37%
****5	51	0.87%	2.73	16%
6	51	0.85%	1.67	29%
7	51	-0.17%	(0.32)	39%
8	51	-0.93%	(2.17)	37%
9	51	-1.18%	(4.13)	49%
10	51	-0.63%	(1.61)	0%
A+1 Open to CD Close	51	-10.15%	(6.80)	70%
AD+1 Open to Release End	51	-10.13%	(2.43)	77%

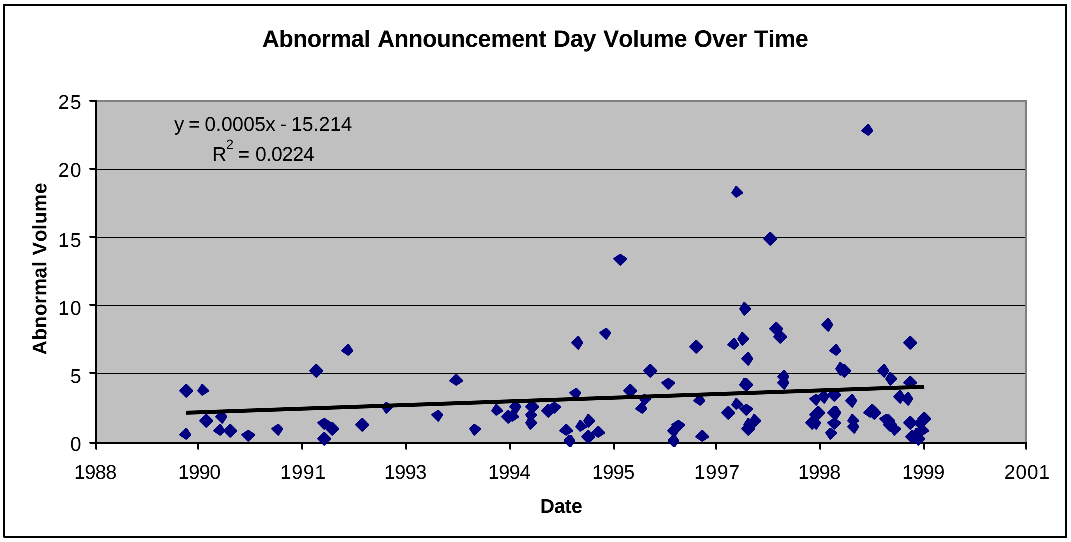
* This is the Percent Change Overnight. It cannot be captured by traders.

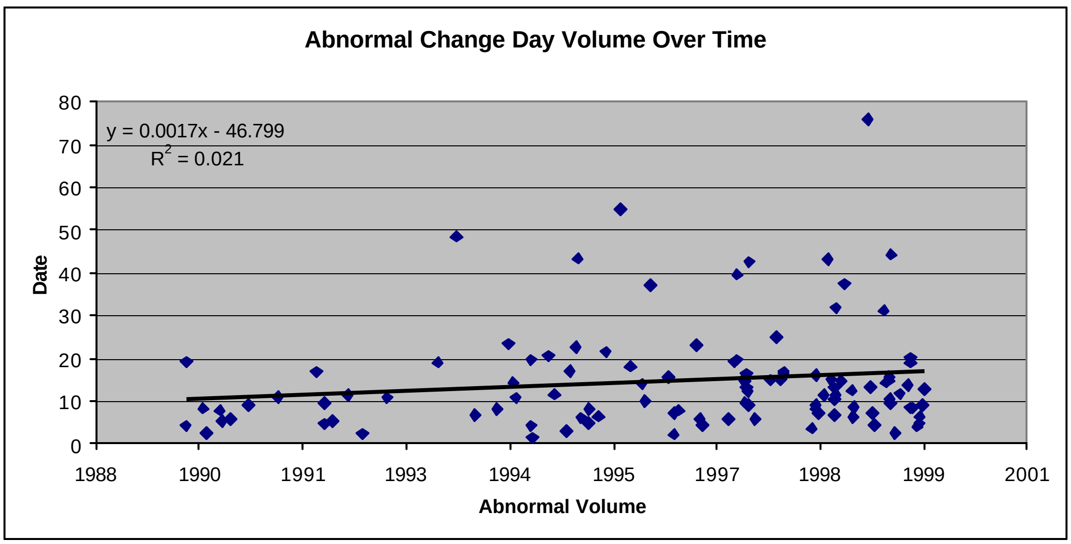
** This is the Percent Change during the day. This is the trading profit of the first day from the Open Price.

*** This is the total of the above two, the Close to Close return.

*** This is the release ending day (Lynch and Mendenhall 1997).

Figure 5. Additions: Average Volumes between A+1 and Close





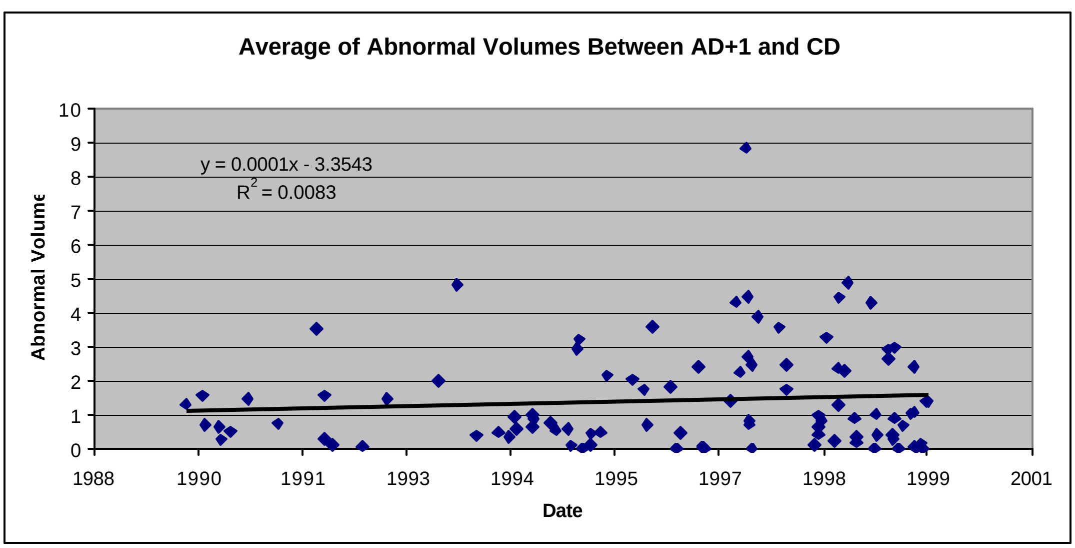
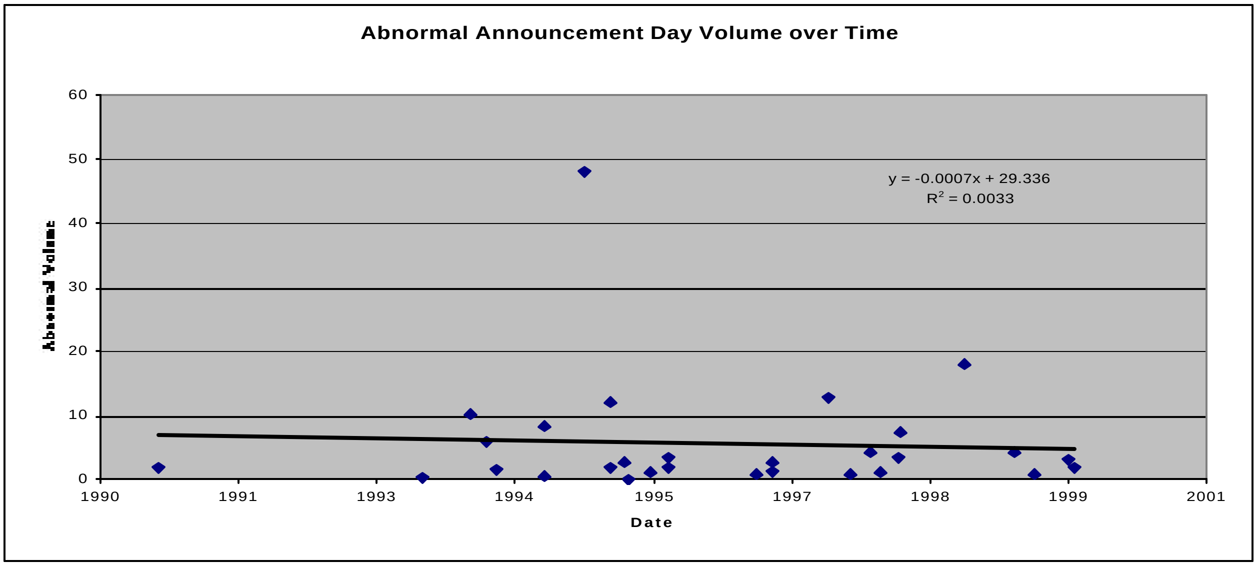


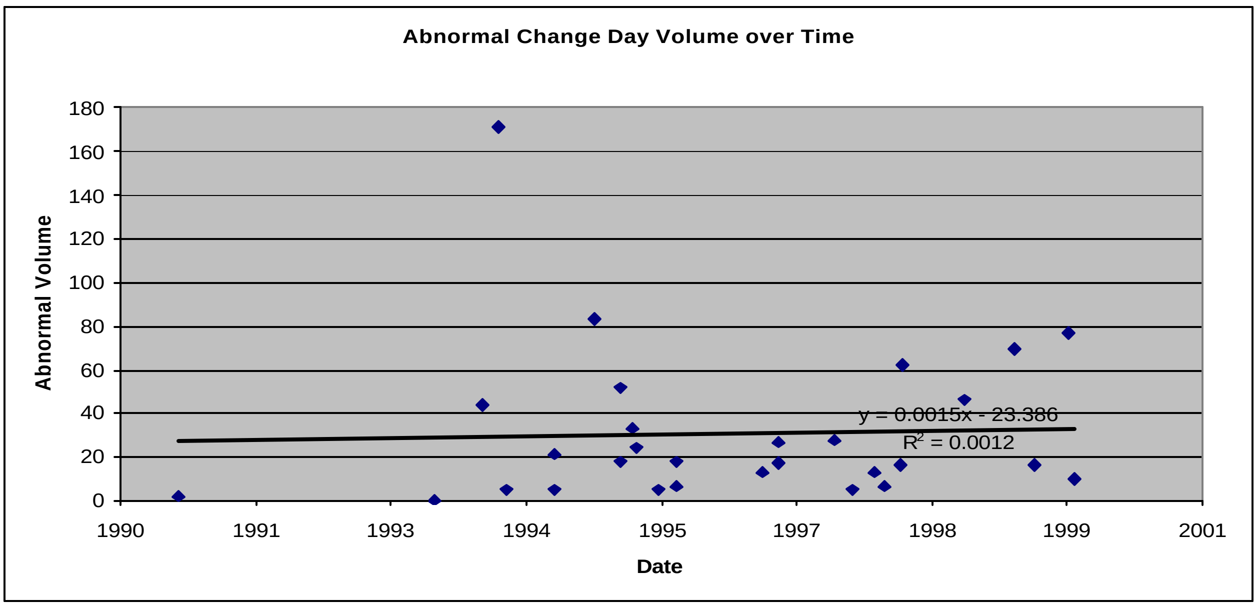
Table 3. Additions: Market Adjusted Volume

(as % of pre-announcement 10 day average)

Event Day	N	MAV	tc(MAV)	%N>0
A. AD = 0:				
-9	112	4.93%	0.76	40%
-8	112	-10.06%	(2.86)	38%
-7	112	-3.15%	(0.73)	38%
-6	112	-3.84%	(0.76)	38%
-5	112	-2.46%	(0.55)	41%
-4	112	1.88%	0.42	44%
-3	112	-3.05%	(0.71)	39%
-2	112	6.72%	1.15	42%
-1	112	-1.18%	(0.25)	37%
0	112	10.21%	1.90	52%
1	112	325.27%	9.56	96%
2	103	137.18%	7.98	90%
3	85	120.62%	6.55	80%
4	64	96.61%	5.66	77%
5	29	59.95%	2.68	59%
6:10	25	42.06%	2.25	60%
B. CD = 0:				
-6	112	16.10%	2.12	41%
-5	112	27.01%	3.09	52%
-4	112	101.94%	6.19	68%
-3	112	127.01%	7.59	78%
-2	112	136.99%	7.53	82%
-1	112	239.45%	8.09	90%
0	112	1445.83%	12.42	99%
1	112	256.47%	10.24	93%
2	112	117.35%	8.89	83%
3	112	99.38%	7.64	79%
4	112	82.51%	7.46	74%
5	112	52.74%	6.69	68%
6	112	61.10%	5.78	72%
7	112	46.09%	3.57	63%
8	112	43.60%	4.42	56%
9	112	46.07%	5.37	66%
10	112	48.67%	4.04	61%

Figure 6. Deletions: Average Volumes between A+1 and Close





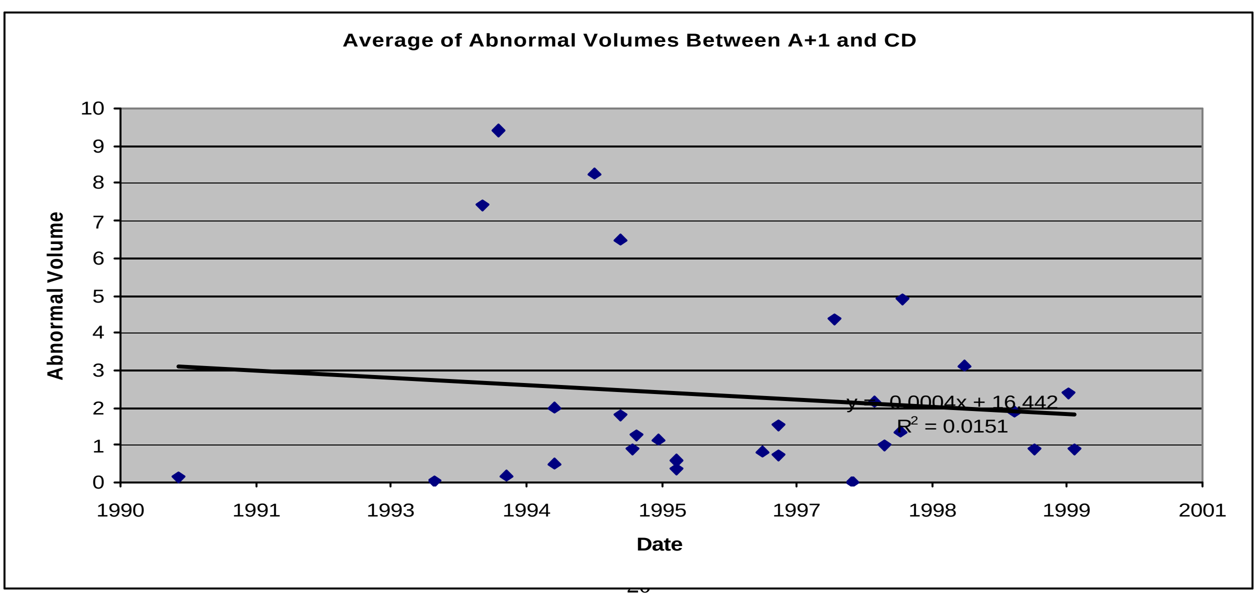
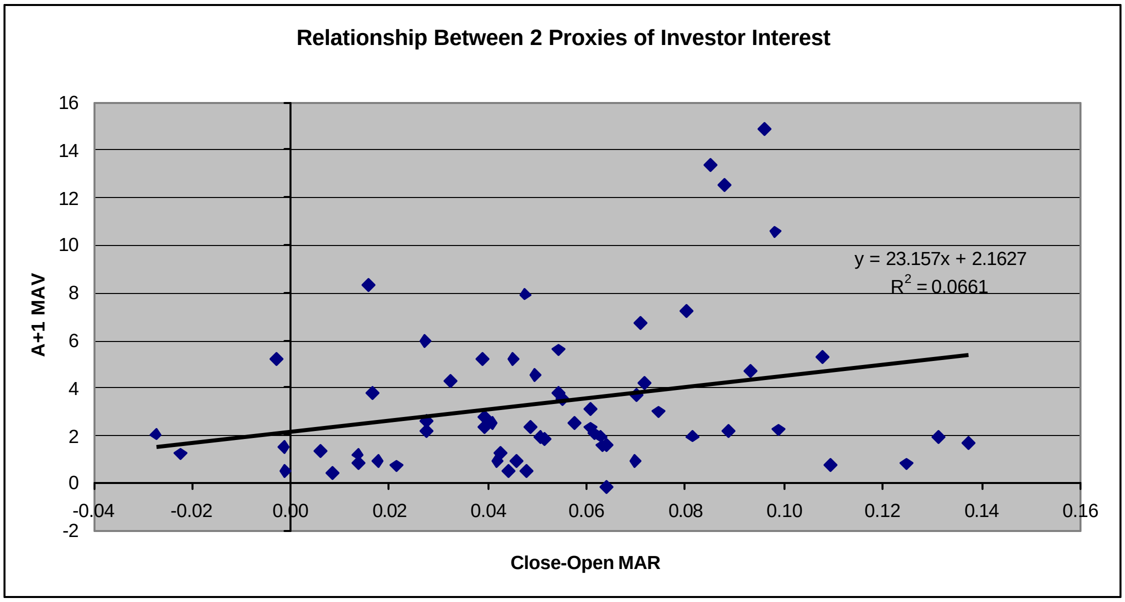


Table 4. Deletions: Market Adjusted Volume

(as % of pre-announcement 10 day average)

Event Day	N	Market Adjusted Volume %	tc(MAV)	%N>0
A. AD=0:				
-9	52	3.36%	0.53	37%
-8	52	13.55%	1.96	37%
-7	52	-5.72%	(1.05)	27%
-6	52	9.78%	1.37	37%
-5	52	-0.55%	(0.11)	21%
-4	52	-3.69%	(0.70)	29%
-3	52	-2.44%	(0.35)	25%
-2	52	-0.91%	(0.18)	31%
-1	52	-13.38%	(3.07)	15%
0	52	0.00%	0.00	35%
1	52	308.11%	3.08	58%
2	47	140.14%	2.83	49%
3	46	144.00%	2.39	46%
4	43	100.18%	3.08	42%
5	26	20.64%	1.56	19%
6	23	18.61%	1.82	22%
B. CD=O:				
-6	52	7.57%	0.88	35%
-5	52	2.95%	0.41	27%
-4	52	98.71%	3.12	52%
-3	52	83.80%	3.16	42%
-2	52	162.94%	3.15	46%
-1	52	309.60%	2.90	54%
0	52	1720.13%	4.28	60%
1	52	396.52%	3.86	56%
2	52	148.36%	3.20	46%
3	52	118.16%	3.10	44%
4	52	129.65%	2.99	42%
5	52	111.48%	3.69	44%
6	52	67.50%	3.03	44%
7	52	48.13%	2.90	38%
8	52	64.94%	2.73	48%
9	52	80.56%	3.31	42%
10	52	49.07%	2.46	35%

Figure 7. Proxies for Investor Interest and Indexing.



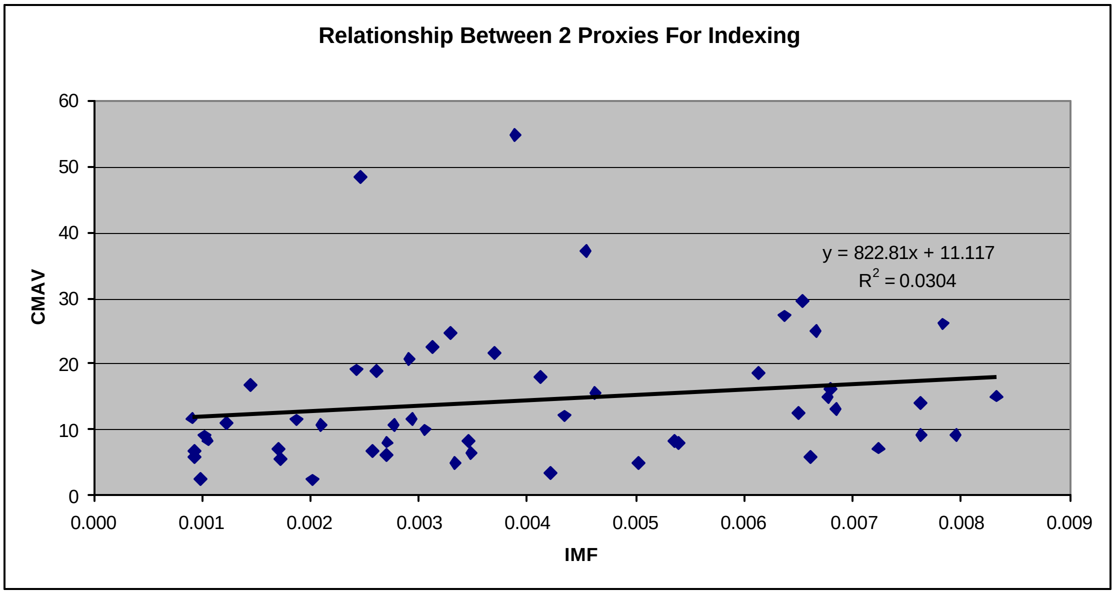
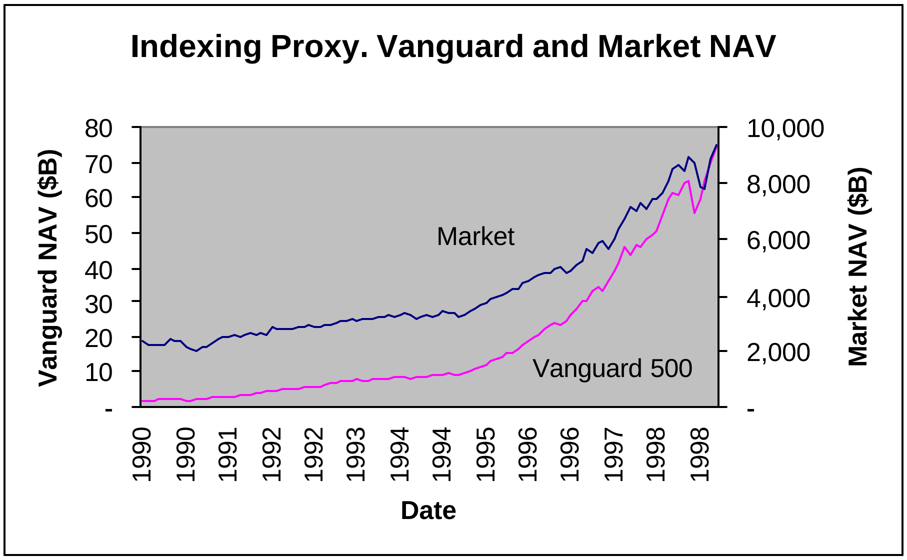
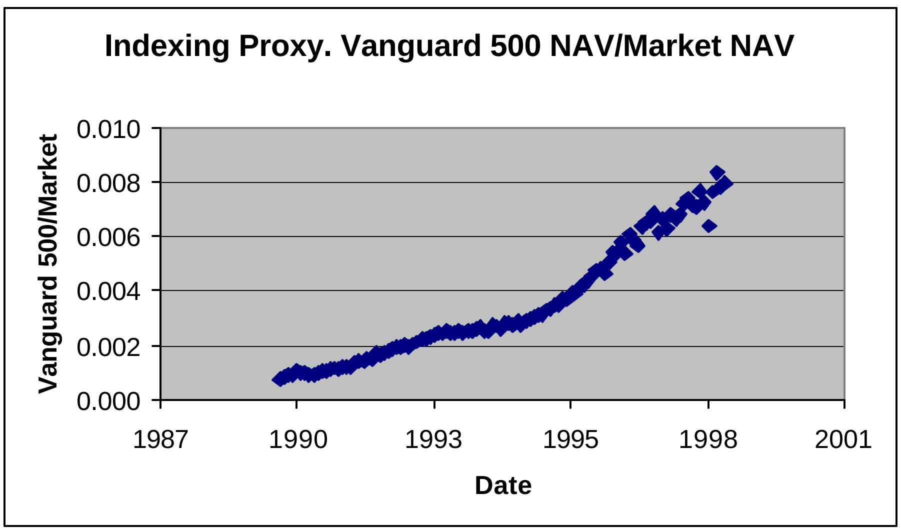


Figure 8. Proxies over Time and Correlation of Investor Interest and Indexing.





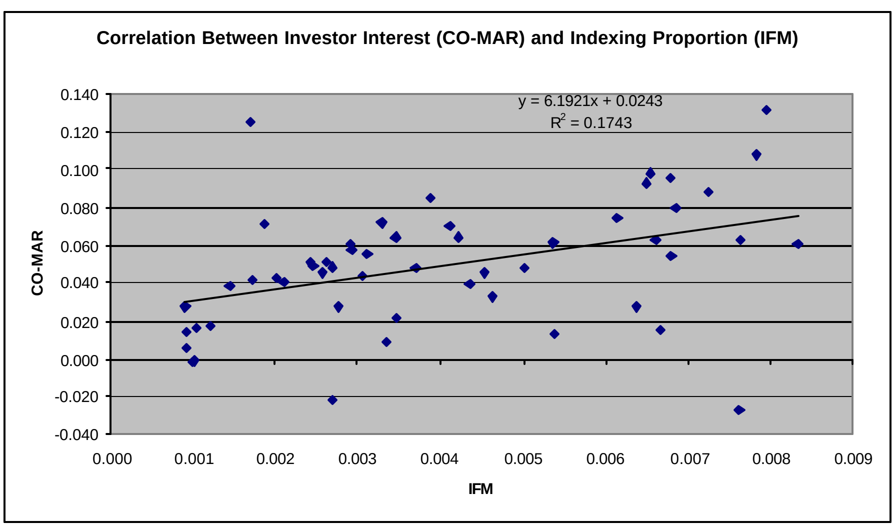
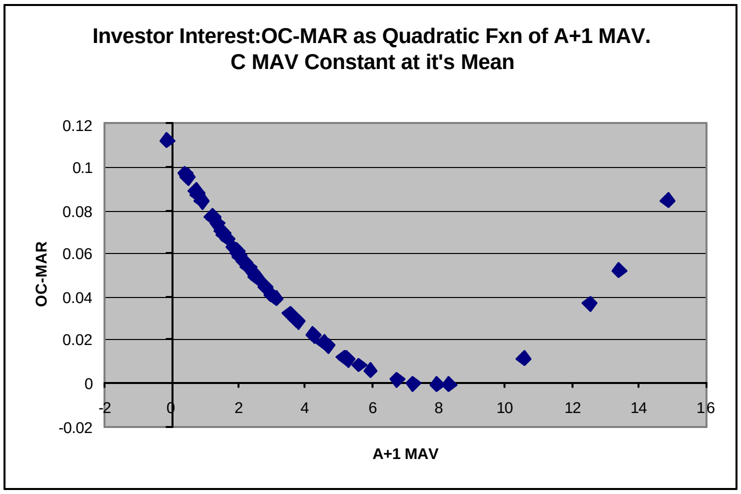
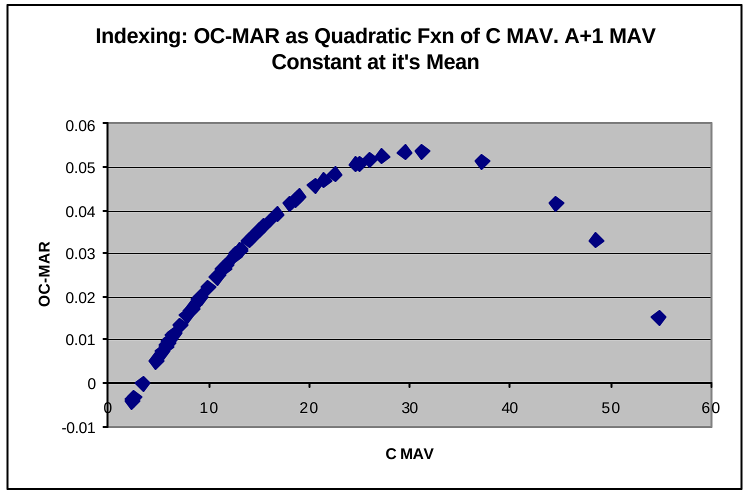


Figure 9. Additions

OC-MAR = 0.0593 - 0.0276 A+1 MAV + 0.00175 A+1 MAV^2 + 0.00432 C MAV-0.000069 C-MAV^2

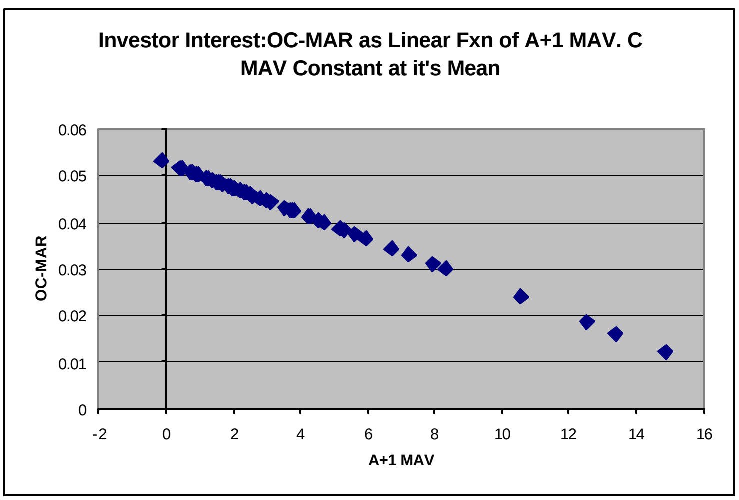


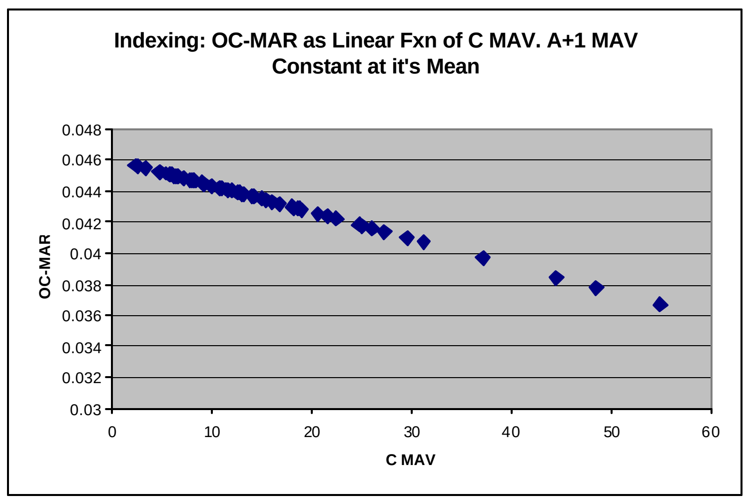


Predictor	Coef	SE Coef	T	P
Constant	0.05933	0.01896	3.13	0.003
A+1 MAV	-0.027557	0.009322	-2.96	0.005
A+1 MAV^	0.0017531	0.0006213	2.82	0.007
C MAV	0.004318	0.002829	1.53	0.134
C-MAV^2	-0.00006916	0.00004868	-1.42	0.162

S = 0.05000 R-Sq = 17.3% R-Sq(adj) = 10.4%

Figure 10. Additions OC-MAR = 0.0553 - 0.00273 A+1 MAV -0.000171 C MAV



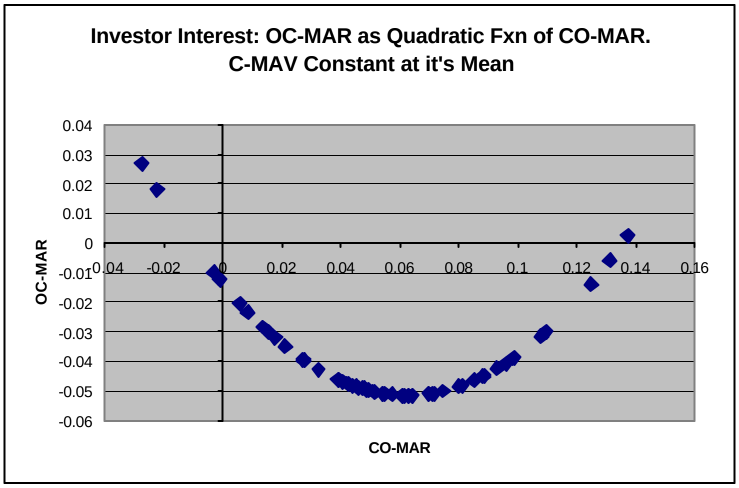


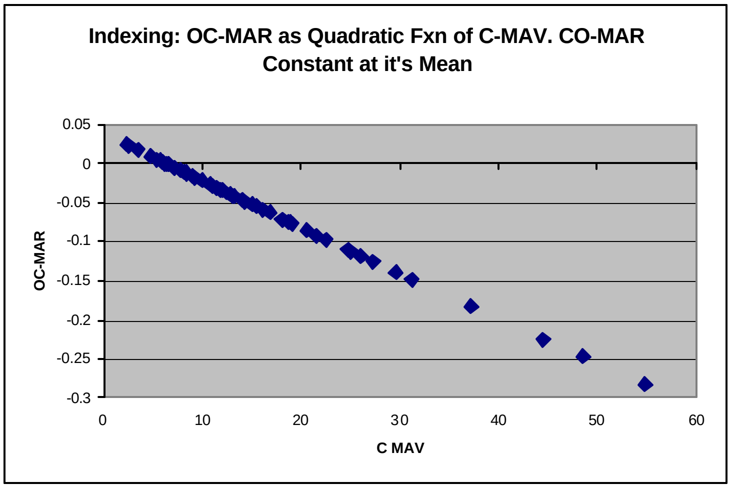
Predictor	Coef	SE Coef	T	P
Constant	0.05530	0.01247	4.43	0.000
A+1 MAV	-0.002734	0.003076	-0.89	0.378
C MAV	-0.0001714	0.0009116	-0.19	0.852

S = 0.05293 R-Sq = 3.5%

Figure 11. Additions

OC-MAR= 0.0763-0.0062*C MAV+ 0.000006*C MAV^2 - 1.21*CO-MAR + 9.68*CO-MAR^2

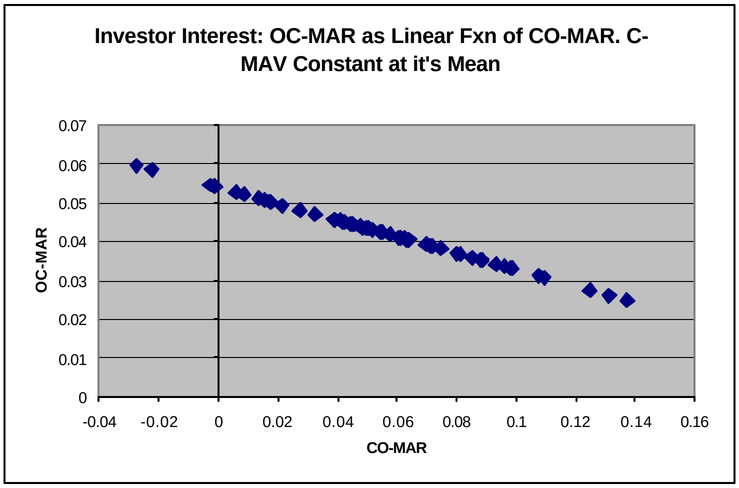


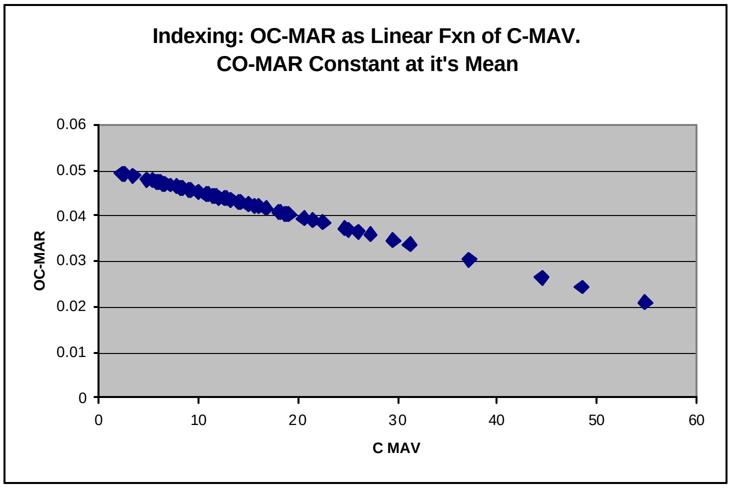


Predictor	Coef	SE Coef	T	P
Constant	0.07631	0.02122	3.60	0.001
C MAV	-0.000618	0.002117	-0.29	0.772
C-MAV^2	0.00000574	0.00004064	0.14	0.888
CO-MAR	-1.2121	0.5190	-2.34	0.024
CO-MAR^2	9.680	4.506	2.15	0.037

S = 0.05151   R-Sq = 12.3%

Figure 12. Additions OC-MAR= 0.0618-0.000541*C MAV- 0.211*CO-MAR

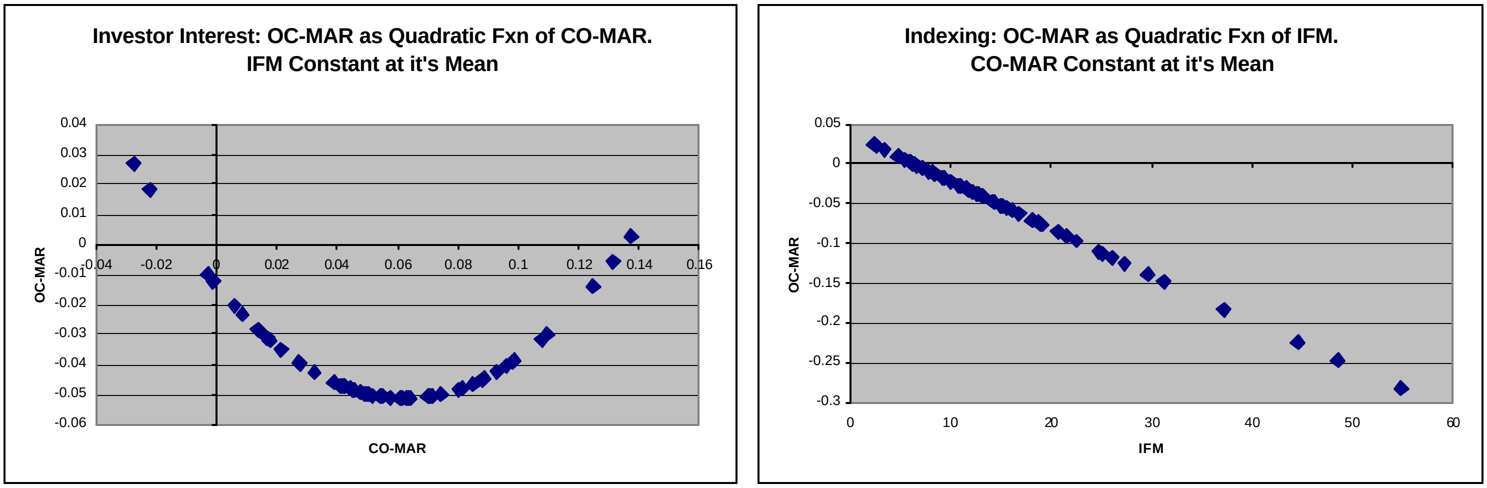




Predictor	Coef	SE Coef	T	P
Constant	0.06178	0.01508	4.10	0.000
C MAV	-0.0005411	0.0007117	-0.76	0.451
CO-MAR	-0.2108	0.2265	-0.93	0.356

S = 0.05289   R-Sq = 3.6%

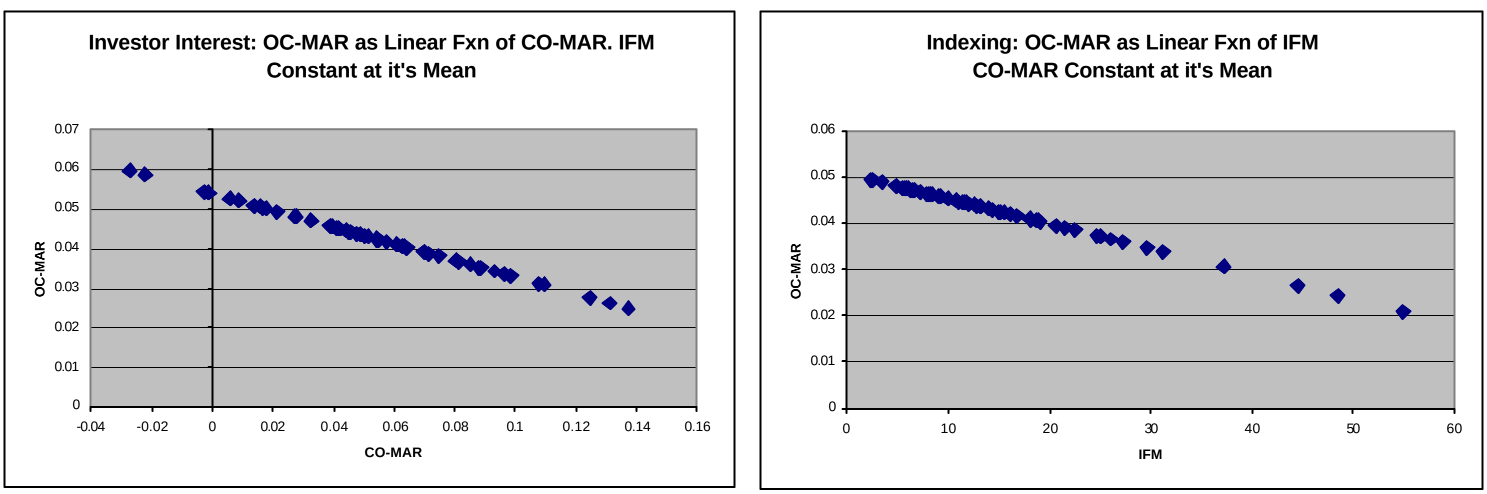
Figure 13. Additions
OC-MAR= 0.0836 - 4.5 IFM+77IFM^2-1.25 CO-MAR+10.8 CO-MAR^2



Predictor	Coef	SE Coef	T	P
Constant	0.08359	0.02764	3.02	0.004
IFM	-4.53	16.04	-0.28	0.779
IFM^2	77	1797	0.04	0.966
CO-MAR	-1.2503	0.5454	-2.29	0.026
CO-MAR^2	10.834	4.948	2.19	0.033

S = 0.05101 R-Sq = 13.9%

Figure 14. Additions OC-MAR= 0.0620 - 2.27 IFM - 0.188 CO-MAR

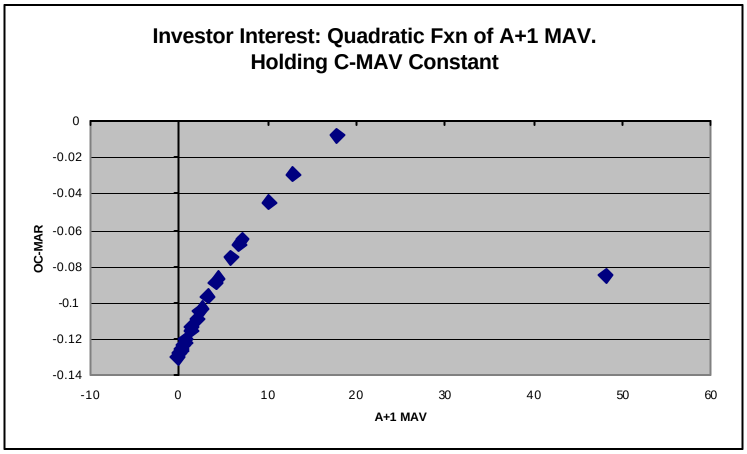


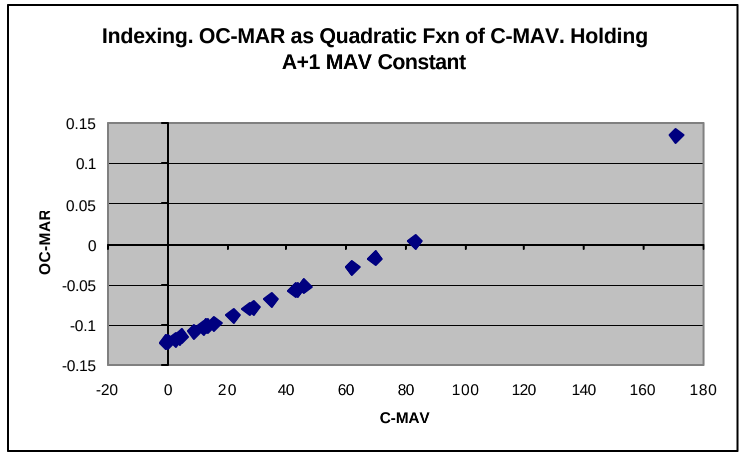
Predictor	Coef	SE Coef	T	P
Constant	0.06198	0.01612	3.84	0.000
IFM	-2.274	3.602	-0.63	0.531
CO-MAR	-0.1883	0.2423	-0.78	0.441

S = 0.05298 R-Sq = 3.3%

Figures 15. Deletions

OC-MAR = - 0.170+0.0102 A+1 MAV -0.000193 A+1 MAV^2 + 0.00150 C MAV-0.000007 C-MAV^2

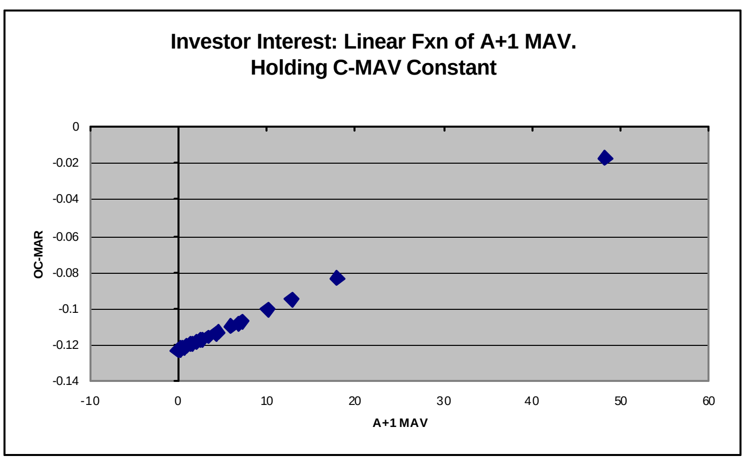


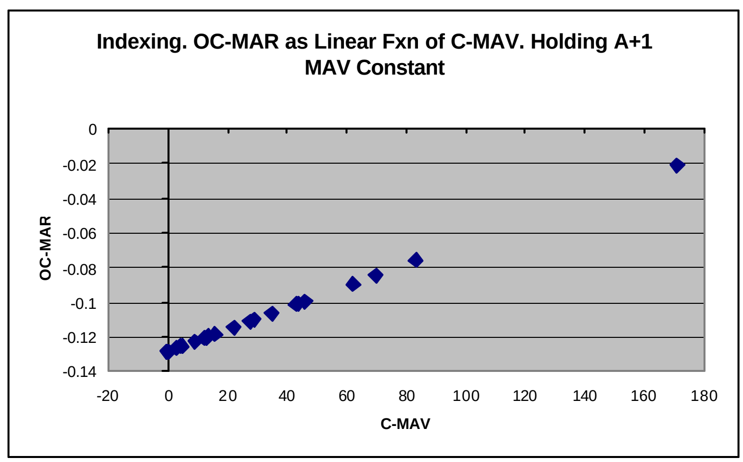


Predictor	Coef	SE Coef	T	P
Constant	-0.16955	0.02666	-6.36	0.000
A+1 MAV	0.010198	0.008487	1.20	0.246
A+1 MAV^	-0.0001932	0.0001478	-1.31	0.208
C MAV	0.001502	0.002363	0.64	0.534
C-MAV^2	-0.00000677	0.00001279	-0.53	0.603

S = 0.07988   R-Sq = 36.8%

Figures 16. Deletions OC-MAR = - 0.140 + 0.00218 A+1 MAV +0.000627 C MAV



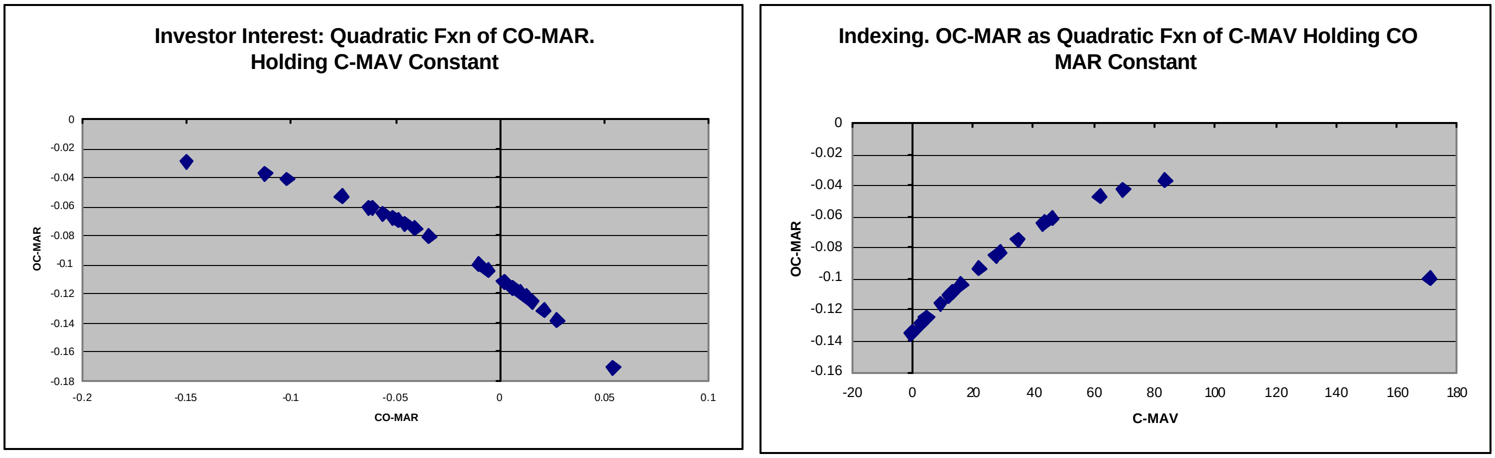


Predictor	Coef	SE Coef	T	P
Constant	-0.13993	0.02145	-6.52	0.000
A+1 MAV	0.002183	0.001939	1.13	0.274
C MAV	0.0006274	0.0005212	1.20	0.243

S = 0.08265   R-Sq = 20.7%

Figure 17. Deletions

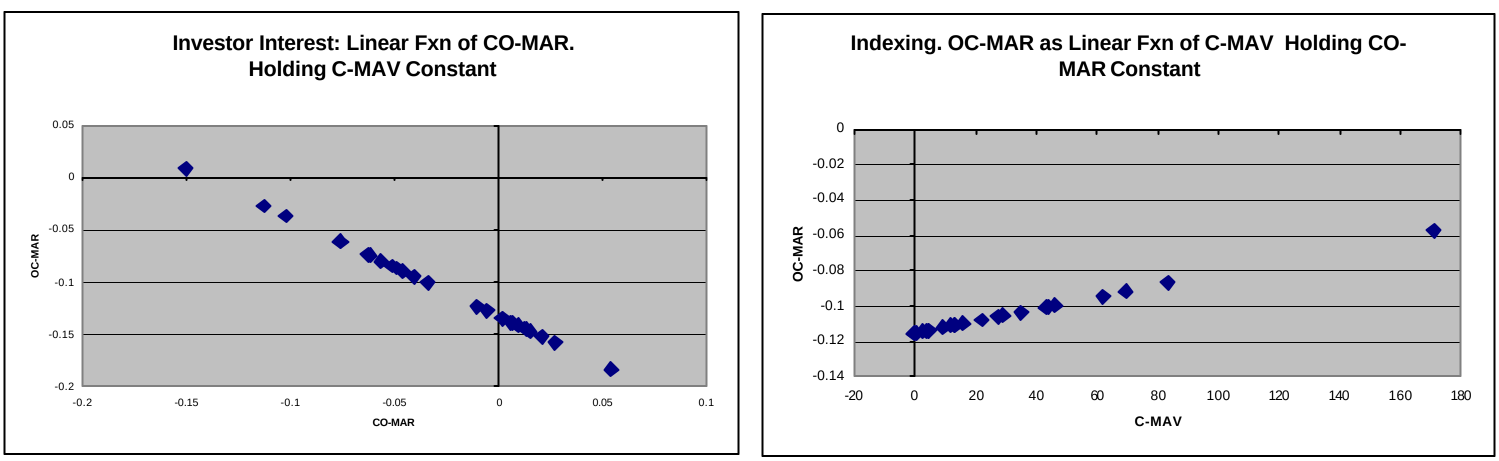
OC-MAR= - 0.159 - 0.968*CO-MAR-2.88*CO-MAR^2+0.00208*C-MAV-0.000011*C-MAV^2



Predictor	Coef	SE Coef	T	P
Constant	-0.15879	0.02493	-6.37	0.000
CO-MAR	-0.9680	0.6237	-1.55	0.139
CO-MAR^2	-2.878	5.772	-0.50	0.624
C MAV	0.002077	0.001435	1.45	0.166
C-MAV^2	-0.00001062	0.00000830	-1.28	0.218

S = 0.07673   R-Sq = 41.7%

Figure18. Deletions OC-MAR=-0.142-0.942*CO-MAR + 0.000340*C-MAV

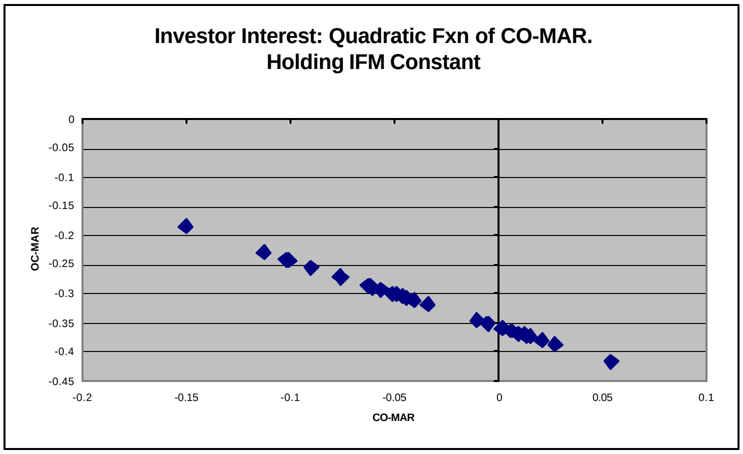


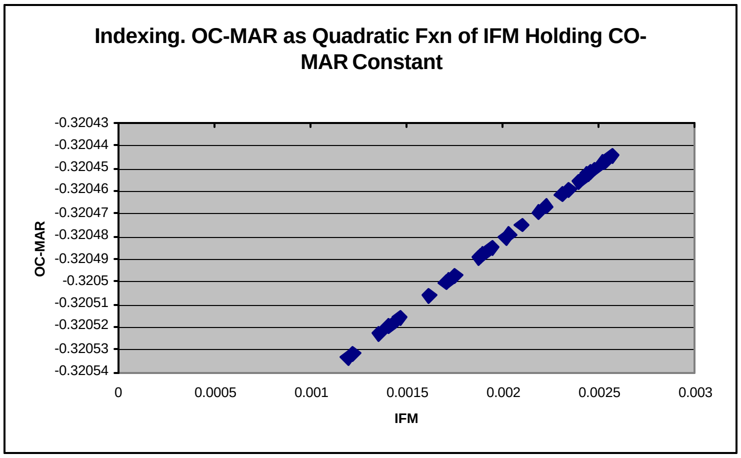
Predictor	Coef	SE Coef	T	P
Constant	-0.14204	0.01906	-7.45	0.000
CO-MAR	-0.9424	0.3742	-2.52	0.020
C MAV	0.0003400	0.0004689	0.73	0.477

S = 0.07426   R-Sq = 36.0%

Figure 19. Deletions

OC-MAR= - 0.357 + 0.0647 IFM - 0.00389 IFM^2 - 1.12 CO-MAR + 0.19 CO-MAR^2

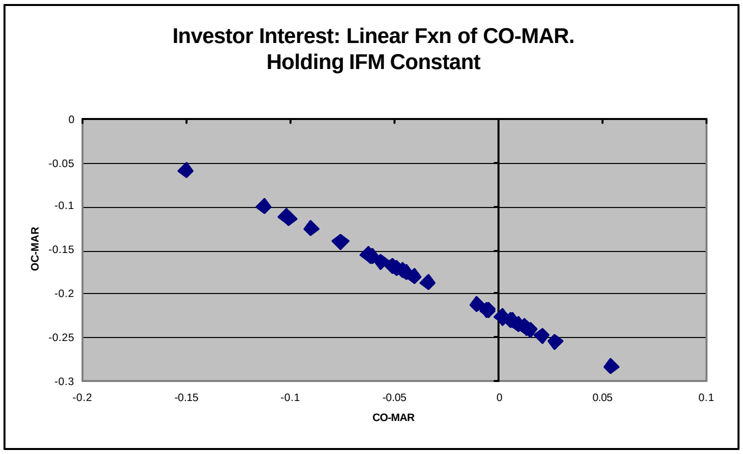


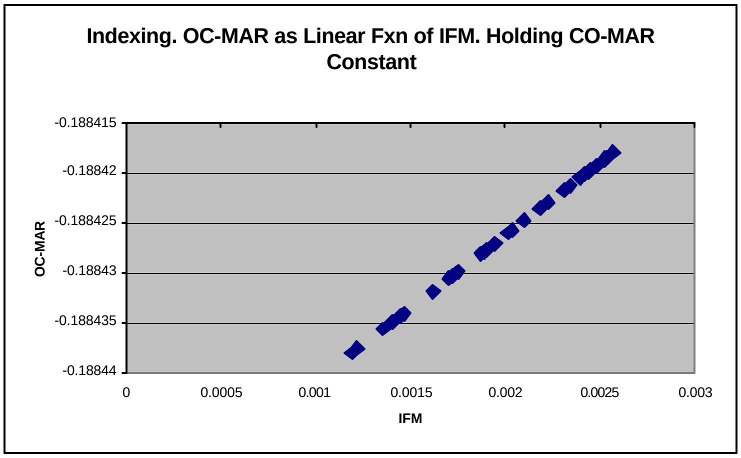


Predictor	Coef	SE Coef	T	P
Constant	-0.35740	0.09949	-3.59	0.002
IFM	0.06467	0.03583	1.80	0.088
IFM^2	-0.003887	0.002768	-1.40	0.177
CO-MAR	-1.1175	0.4921	-2.27	0.036
CO-MAR^2	0.186	4.755	0.04	0.969

S = 0.06249 R-Sq = 59.2%

Figure 20. Deletions OC-MAR= - 0.224 + 0.0146 IFM - 1.10 CO-MAR





Predictor	Coef	SE Coef	T	P
Constant	-0.22405	0.03276	-6.84	0.000
IFM	0.014638	0.004891	2.99	0.007
CO-MAR	-1.1014	0.2762	-3.99	0.001

S = 0.06252 R-Sq = 54.6%.