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Qualifying Exam Write-up
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Introduction and Problem Statement

Every weekday night at 6:00PM, 9:00PM, and 12:00AM (also 4:00AM on Fridays) E.S.T., CNBC airs a television show named Mad Money. The show's host, Jim Cramer, dispenses stock advice. Each featured stock is given either a “thumbs up” if it is considered a “good” stock (one the host believes will make money) or a “thumbs down” if he believes the stock will lose money. During the show, a stock may also be given a special mention or be featured during the “lightning round” in which Cramer gives advice about stocks picked by members of the audience.

In this paper, a determination is made as to whether Cramer's predictions are associated with higher opening prices when compared with the previous day's closing price. Having established this, a determination is made whether Cramer has a skill for picking stocks that will have a high opening price the next day or if it is more likely that his predictions are causing the increase in price. Finally, given a new understanding of the relationship between Cramer's predictions and stocks prices, an after hours trading strategy is evaluated based on Jim's advice.

The Association Between Prediction and Opening/Closing Price: An Initial Look

The initial data collected from this analysis was scraped from the Mad Money Recap website [2]. This site has been created by fans and it documents by show date which stocks were mentioned, whether the stock was given a special mention, if the stock was given a thumbs up or thumbs down, and whether the stock was mentioned during the lightning round.

Data was scraped from the site for every available date which included Tuesday 11/01/05 through Monday 12/05/05 and massaged into a data frame for each day including the information described above. In particular, the table below shows the variables stored and their formats.

<i>Data Frame Member</i>	<i>Format</i>
Stock Symbol	Character String
Closing Price that Day	double
Opening Price the Next Day	double
Thumbs Up/Down	Factor (2 levels)
Special Mention	Factor (2 levels)
Lightning Round	Factor (2 levels)

Table 1: Initial Variables and their Formats

Because the variation between stock prices has the potential to be large, a new variable was added to the data frame for each day which indicated the percent change between the closing and opening price. This addition allows for a more direct comparison in price changes between stocks. This could have also been accomplished by taking the difference between the logs of the opening and closing prices, but it was decided that a comparison between percentages is more intuitive.

Since a stock is either given a special mention or is featured during a lightning round (never both), two linear models were constructed to get an initial understanding of the data. The first models the percent change as a function of thumbs up/down and special mention while the second models percent change as a function of thumbs up/down and if it was mentioned during the lightning round. Both models include second-order interactions. The summary for the first model with variable p=percent change, sm=special mention, ud=thumbs up/down, and l=lightning round is as follows:

```
> summary(m00)

Call:
lm(formula = p ~ (sm + ud)^2, data = upDf1)

Residuals:
    Min       1Q   Median       3Q      Max
-0.6559984 -0.0064053 -0.0005582  0.0051350  0.2949891

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.0019194  0.0022430  -0.856   0.3924
sm1          0.0002588  0.0051557   0.050   0.9600
ud1          0.0068251  0.0029683   2.299   0.0217 *
sm1:ud1      0.0131375  0.0062669   2.096   0.0363 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.038 on 894 degrees of freedom
Multiple R-Squared:  0.03388,    Adjusted R-squared:  0.03064
F-statistic: 10.45 on 3 and 894 DF,  p-value: 9.208e-07
```

And the summary for the second model looks like:

```
> summary(m01)

Call:
lm(formula = p ~ (l + ud)^2, data = upDf1)

Residuals:
    Min       1Q   Median       3Q      Max
-0.6540755 -0.0063697 -0.0007241  0.0050186  0.2969120

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.705e-06  3.498e-03   0.001 0.998927
l1          -2.813e-03  4.285e-03  -0.656 0.511707
```

```

ud1          1.637e-02  4.365e-03   3.751 0.000187 ***
l1:ud1       -9.450e-03  5.433e-03  -1.739 0.082323 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.038 on 894 degrees of freedom
Multiple R-Squared:  0.03363,    Adjusted R-squared:  0.03039
F-statistic: 10.37 on 3 and 894 DF,  p-value: 1.032e-06

```

In the first model, we see that if a stock is given a thumbs up its opening price will be about 0.6% higher than its closing price. If it is also given a special mention, it will open at about 2.0% higher than its closing price.

The second model again shows that if a stock is given a thumbs up its next-day opening price will be higher, in this case by about 1.6%. However, Jim does not do quite as well evaluating stocks during the lightning round. If he give a thumbs up during the lightning round, the stock will generally open slightly lower than if he had not looked at during the lightning round. The reason for this may be that lightning round stocks are selected within less than an hour of airing Cramer's show. As a result, there may be little to no time to analyze the stock and Jim's predictions suffer slightly.

Although we have been able to show that Cramer's thumbs up/down is a good indicator as to whether or not the opening price will be higher than the closing price, we have not really shown that he is causing this difference. In fact, the initial analysis doesn't even establish an association between Cramer's predictions and stocks that do exceptionally well.

The Association Between Prediction and Opening/Closing Price: An Indication of Pumping

In thinking about proving that stock prices are being influenced by Cramer's predictions, it has been realized that the companies whose stocks are being picked differ in size and income. Generally, smaller companies with stocks that are worth less are more volatile. They are more susceptible to change, and are more affected by news which concerns it. Stocks for these companies are more susceptible to “pump and dump” strategies where a stock price is artificially inflated, through promotion or buying, in order to sell at an inflated price.

To test for “pumping” a new variable was added to the model. This new variable, the market capitalization (“cap”), refers to “the aggregate value of a firms outstanding shares” [5]. It should be noted that market cap is “a function of the price of a firm's stock and may not accurately reflect intrinsic value because of varying future expectations held by investors”[5]. If Cramer's predictions do influence the opening price of a stock for the next day, it is reasonable to think that this would be more pronounced in stocks

corresponding to companies with smaller market caps as they are generally more sensitive to pumping.

Market cap information was scraped from Yahoo's finance page [1] for each of the stocks listed at Cramer's fan site. Below is a scatter plot which shows percent increase versus market cap for stocks given a thumbs up:

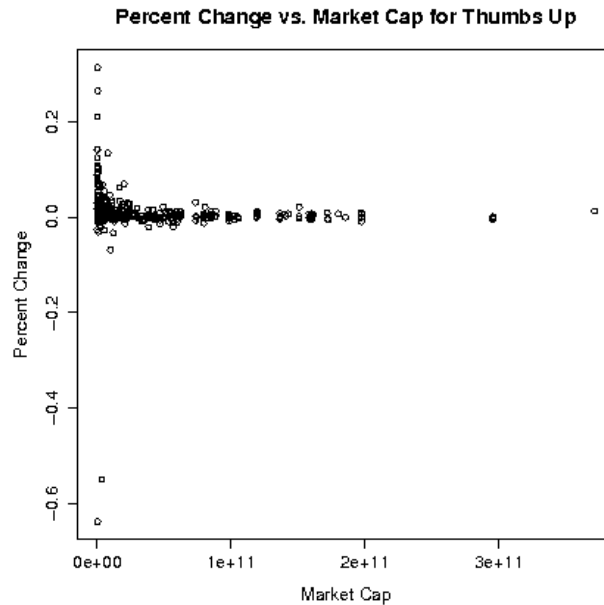


Figure 1: Percent Change vs. Market Cap Given Thumbs Up

And for a thumbs down:

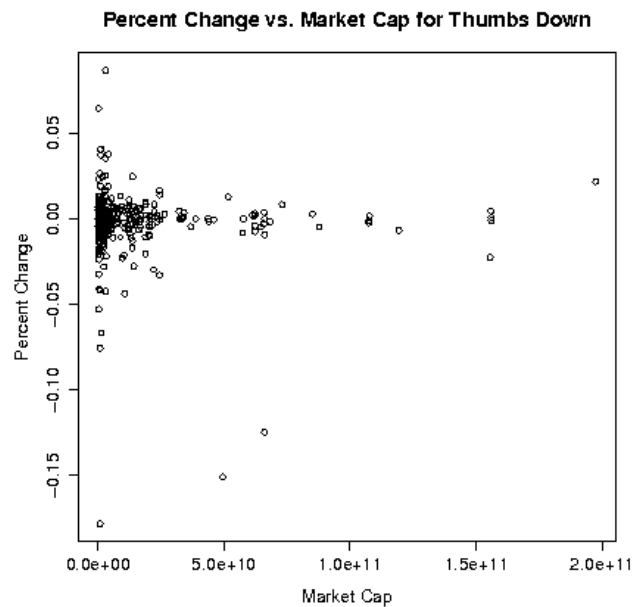


Figure 2: Percent Change vs. Market Cap Given Thumbs Down

As predicted, there is much more volatility for stocks corresponding to companies with lower market caps. The graphs also show a slight skew toward a positive percent change for thumbs up and a negative percent change for thumbs down. This is more pronounced at lower market caps.

Taking the first linear model from above and including the log of the market cap, we get a model with the following summary:

```
> summary(m1)
```

Call:
lm(formula = p ~ (log(cap) + sm + ud)^2, data = upDf1)

Residuals:

	Min	1Q	Median	3Q	Max
	-6.746e-01	-5.807e-03	9.189e-05	6.403e-03	2.709e-01

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-0.0214391	0.0279273	-0.768	0.442884
log(cap)	0.0008916	0.0012716	0.701	0.483402
sm1	0.1347520	0.0358424	3.760	0.000181 ***
ud1	0.0735888	0.0342296	2.150	0.031835 *
log(cap):sm1	-0.0061029	0.0016110	-3.788	0.000162 ***
log(cap):ud1	-0.0029376	0.0015249	-1.926	0.054370 .
sm1:ud1	0.0147710	0.0062792	2.352	0.018871 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03735 on 891 degrees of freedom
Multiple R-Squared: 0.06966, Adjusted R-squared: 0.06339
F-statistic: 11.12 on 6 and 891 DF, p-value: 5.522e-12

The summary clearly shows significant interaction between the market cap and a special mention; the market cap and a thumbs up/down; and that the effect on stock price for a large cap is less than that for a small cap.

Taking the second linear model from above and including the log of market cap, we get a model with the following summary:

```
> summary(m2)
```

Call:
lm(formula = p ~ (log(cap) + l + ud)^2, data = upDf1)

Residuals:

	Min	1Q	Median	3Q	Max
	-0.6714881	-0.0057429	0.0004977	0.0061725	0.2746929

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.086046	0.035100	2.451	0.014420 *

```

log(cap)      -0.003887    0.001578   -2.463  0.013959  *
l1            -0.113451    0.033293   -3.408  0.000685  ***
ud1           0.092040    0.034219    2.690  0.007286  **
log(cap):l1   0.005014    0.001499    3.345  0.000857  ***
log(cap):ud1 -0.003247    0.001522   -2.134  0.033147  *
l1:ud1        -0.011598    0.005505   -2.107  0.035394  *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.03739 on 891 degrees of freedom
Multiple R-Squared: 0.06747,    Adjusted R-squared: 0.06119
F-statistic: 10.74 on 6 and 891 DF,  p-value: 1.474e-11

```

Again we see significant interaction between market cap and thumbs up/down where the negative coefficient indicates that the effect is smaller for companies with larger market caps. In fact, we see that the percent return for stocks discussed during the lightning round is smaller in general for companies with large market caps. The interaction term between the market cap and the lightning round is slightly confusing. It shows that stocks mentioned during the lightning round with large market caps open higher (in terms of percentage) than stocks with smaller market caps. This may be explained by larger cap companies' stock prices increasing more consistently as their respective industries increase. This possibility will be explored in the next section.

Given the two alternatives, that Cramer's predictions influence the next day's opening price and it does not, it has clearly been shown that his predictions do influence price. The assumption that stocks corresponding to companies with smaller market caps are more sensitive to pumping/deflating was introduced and we were able to show that Cramer's prediction (influence) is more pronounced for companies with smaller market caps. This indicates that his prediction is influencing stock prices.

“Correlation Does Not Imply Causation”

Given the two alternatives:

1. Cramer's predictions influence next day's opening prices
2. Cramer's predictions do not influence next day's opening prices

the former accounts for the data. However, causation was not shown. We do not know that Cramer's predictions influence stock price as opposed to stock market information influencing his prediction. Could it be that Jim is skilled at picking stocks? The efficient market hypothesis asserts, “prices on traded assets, e.g. stock prices, already reflect all known information and therefore are accurate in the sense that they reflect the collective beliefs of all investors about future prospects.” [5] However, we know that all information is not known and beliefs change. This is part of the reason that strategies like “pump and dump” occasionally work.

In looking at Jim's stock picks and performance over the last month we see that for pi , the percent increase from the closing price on given day to the opening price the next day:

$$P(pi > 0 | thumbs\ up) = 0.7095588$$

and

$$P(pi < 0 | thumbs\ down) = 0.4576271$$

These percentages do not look spectacular, especially considering the graph of the S&P 500 over the same amount of time. If he were able to influence stock prices wouldn't Jim do a better job?

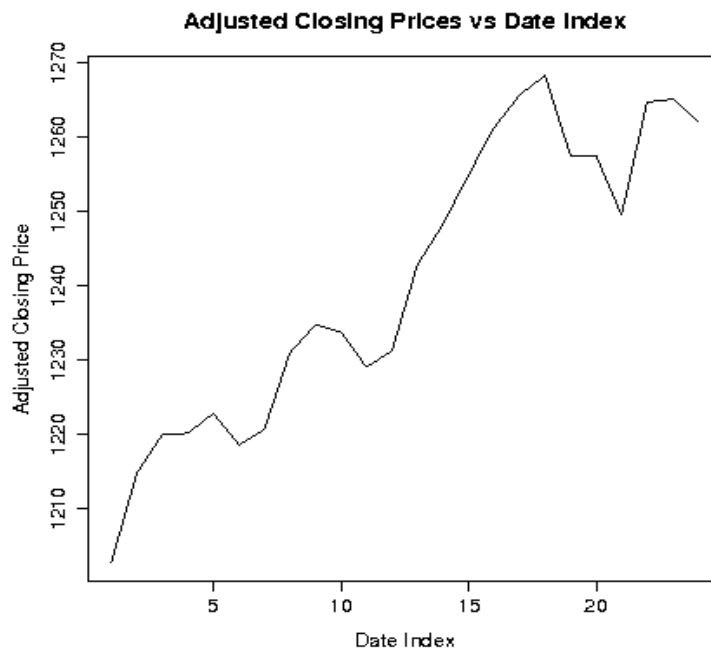


Figure 3: Adjusted Closing Prices for the S&P 500 for the Last Month

If Jim Cramer was simply predicting “good” stocks and not influencing them, he would not only consistently pick stocks that make money, but he would also pick stocks that outperform other stocks in a given industry. It is not enough to see that a given sector of the market is performing better. Yahoo finance[1], Microsoft Money Central [3], and other websites show which industries outperform the rest of the market. An exceptional stock not only outperforms the market, which half of all stocks do, but it also outperforms its competitors.

To test if Jim Cramer is skilled at picking stocks that consistently outperform competitors, a new variable was added to the model. This model takes the average

percent change between closing and opening price for competitors' stocks listed on Cramer's site for given dates.

Competitors' stock symbols and their opening and closing prices were scraped from Yahoo Finance [1]. It should be noted that Friday close to Monday open information was not included since it presented significant computational difficulty. Also, there is not a reason to think it would provide more information when compared with differences from the five other days. Percent changes from one day's closing price to the next day's opening prices were calculated for each competitor and averaged. This calculation was performed for all stocks listed on the Mad Money Recap page.

A new response variable was chosen as the difference between the percent change in the stocks recommended by Cramer minus the average percent changes of the companies' competitors. If Cramer is able to pick exceptional stocks which not only beat the market but also beat competitor stocks, we expect the model characteristics will be similar to the model where percent change was the response. Performing this regression yields a model with the following summary:

```
> summary(m3)

Call:
lm(formula = (p - compDiff) ~ (log(cap) + sm + ud)^2, data = upDf2)

Residuals:
    Min       1Q   Median       3Q      Max
-0.7507207 -0.0023962 -0.0001103  0.0052591  0.5005755

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   0.038087   0.039231   0.971   0.3320
log(cap)      -0.001808   0.001788  -1.011   0.3125
sm1           -0.085723   0.049911  -1.718   0.0864 .
ud1           -0.031568   0.048669  -0.649   0.5168
log(cap):sm1   0.003803   0.002236   1.701   0.0895 .
log(cap):ud1   0.001628   0.002166   0.751   0.4527
sm1:ud1        -0.014765   0.008762  -1.685   0.0924 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.04448 on 633 degrees of freedom
Multiple R-Squared: 0.02136,    Adjusted R-squared: 0.01209
F-statistic: 2.303 on 6 and 633 DF,  p-value: 0.03303
```

It should be noted that the lightning round model was not included since, in this portion of the show, Cramer did not have control over which stocks were selected.

The model above clearly shows that the effect of a thumbs up/down is insignificant except when it is accompanied by a special mention in which case it performs worse than the average of its competitors. The only case where a special mention is associated with a higher percent increase is when the market cap is large. This is unsurprising since large

market cap companies are often easily distinguished from their competitors (for a example compare AAPL and MSFT).

From this model, we can conclude that although he may know which sectors of the market are increasing as a whole, Jim Cramer is not particularly adept at identifying which companies in a specific sector will outperform its competitors. This conclusion, along with the conclusion of the last section, indicates that Cramer's predictions do in fact influence the opening stock price.

But Can it Make Me Money?

There is still an issue of the effectiveness of a strategy based on Cramer's stock recommendations. As stated earlier, Mad Money airs first at 6:00PM. This is after markets close, but if a broker allowed for after hours trading and an investor bought the stocks recommended on Cramer's show and sold them the next opening day, how much would the investor have made? The graph below shows the percent return for Cramer's picks (solid line) vs. the S&P 500 (circles) for dates included on the Mad Money Recap website [2]. For simplicity, the graph assumes an initial one dollar investment. It also assumes that the after hours price at the end of Cramer's show is approximately the closing price and it does not take into account trading prices.

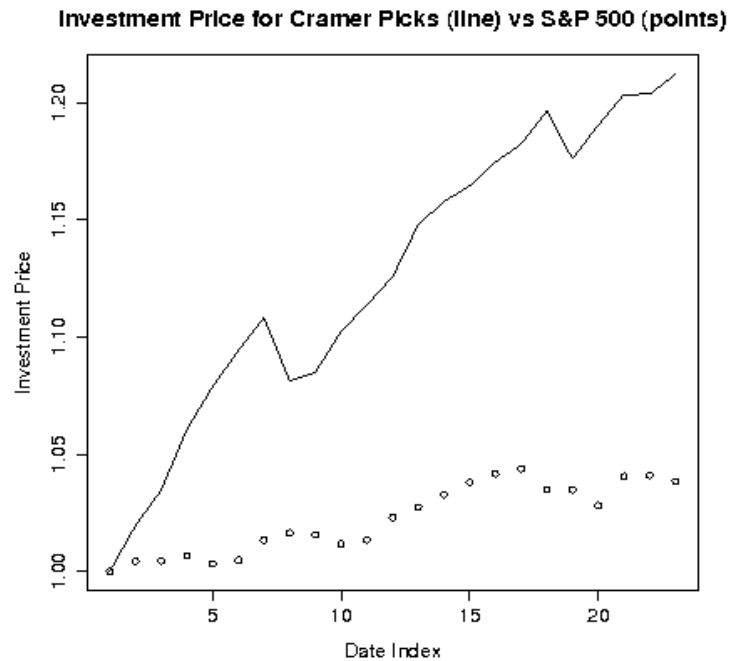


Figure 4: Investment Price for Cramer's Picks vs. S&P 500

Figure 4 supports the proposed strategy and clearly shows that if we had started following it a month ago, our return would have been 20% as opposed to about 3% from the S&P500. Based on the analysis from previous sections, it stands to reason that a greater return could be made if we looked at companies with smaller market caps. We can therefore conclude that if the expense of trading after hours is not too great and if the change in price for a given stock at the market close is approximately the same as its price after Cramer's show, his advice will yield a return greater than that of the S&P 500.

References:

[1] <http://finance.yahoo.com>

[2] <http://madmoneyrecap.com/>

[3] <http://moneycentral.msn.com>

[4] http://moneycentral.msn.com/content/CNBCTV/TV_Info/P108231.asp

[5] <http://www.wikipedia.org>