Wolverine Earnings Analysis

Volatility Around Earnings

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November 07, 2018

Volatility and Earnings

This is an analysis of equity volatility around earnings reports. In particular, we will address the following questions:

1. If the actual move after an earnings report is greater than or less than the market-implied expected move, what does this predict for realized volatility after the earnings report.
2. Is relationship #1 different when the actual move is a gain vs. loss.
3. Is the relationship in #1 different when stock price performance has been positive or negative in the run-up to the earnings report.
4. Is the relationship in #1 different when realized volatility has been high or low (relative to implied volatility) in the run-up to the earnings report?

Data & Methodology

The data in question consists of daily returns for a number of stocks from late 2015 to mid August 2018. This is in addition to data on earnings days for the same stocks. Specifically, aside from date, there is actual returns for that day and the expected standard deviation (move) for those returns. To make the data usable we removed all of the missing data and limited it to Quarter 2, 2018 and earlier, as mentioned previously. *Term Definitions* below details the values we calculated and leveraged in our analysis.

Term Definitions:

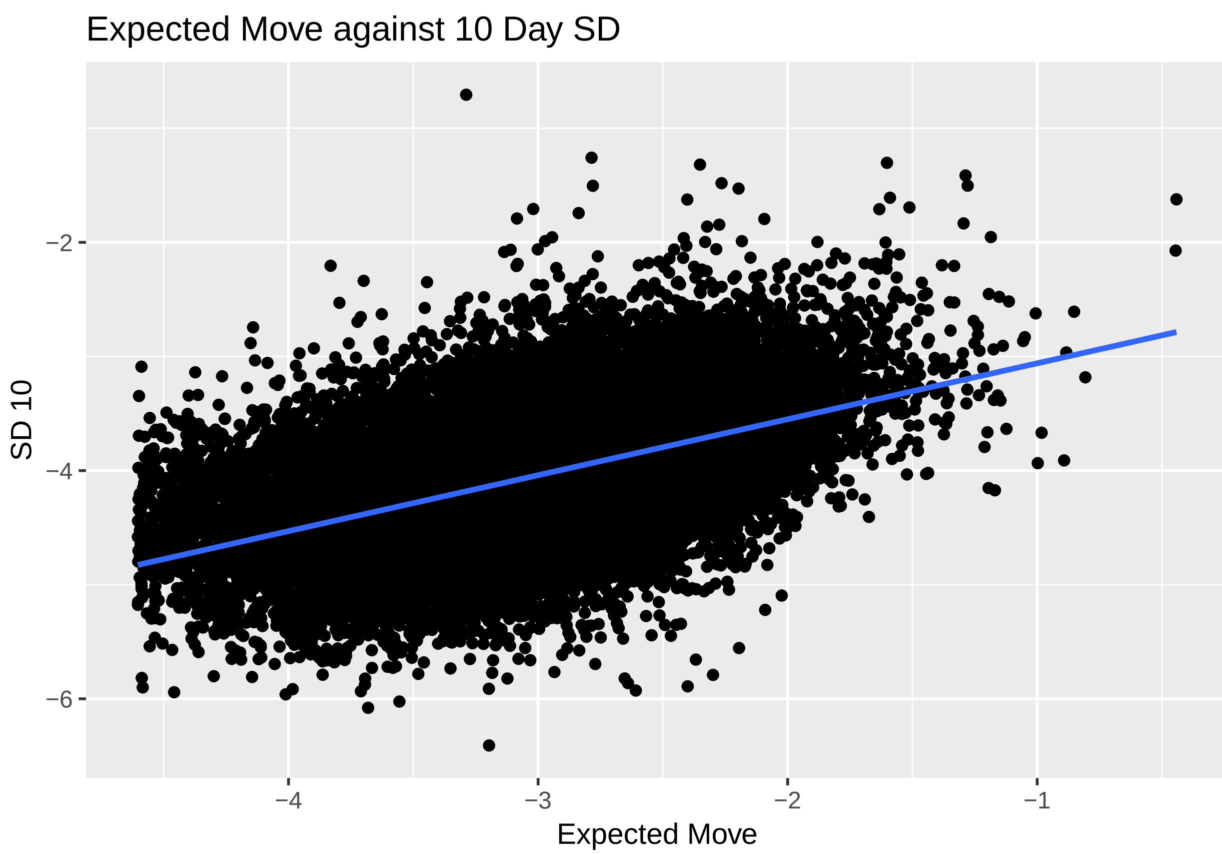
- **Move Ratio:**
  To calculate move ratio we first removed the direction of change for each stock on a corresponding earnings day. We then simply divided by the expected move for that earnings day. This allowed us to both have a comparable measure regardless of stock and a comparison between the stocks' actual perfomance vs expected performance.

- **SD #:**
  SD in this analysis is simply short for standard deviation. We calculated 8 different SD metrics which we are using as measures of realized volatility. Specifically, our 8 SDs correspond to 4 different time windows both before and after the earnings date. That is, 3, 5, 7, and 10 days leading up to and after earnings. For reference, we are using negative days to refer to the lead up. So, SD 3 would be the standard deviation for the three days after earnings and SD -3 would be the same but for the three days leading up to earnings.

- **Return #:**
  Return for our purposes are the stock movement over a number of days as compared to earnings days. In this case we used the same time intervals as SD, but only for the lead up to earnings instead of both (-3/-5/-7/-10). So Return -3, as we are calling it, would be the the stock movement for 3 days leading up to and earnings day.

Move-Ratio vs Subsequent Realized Volatility

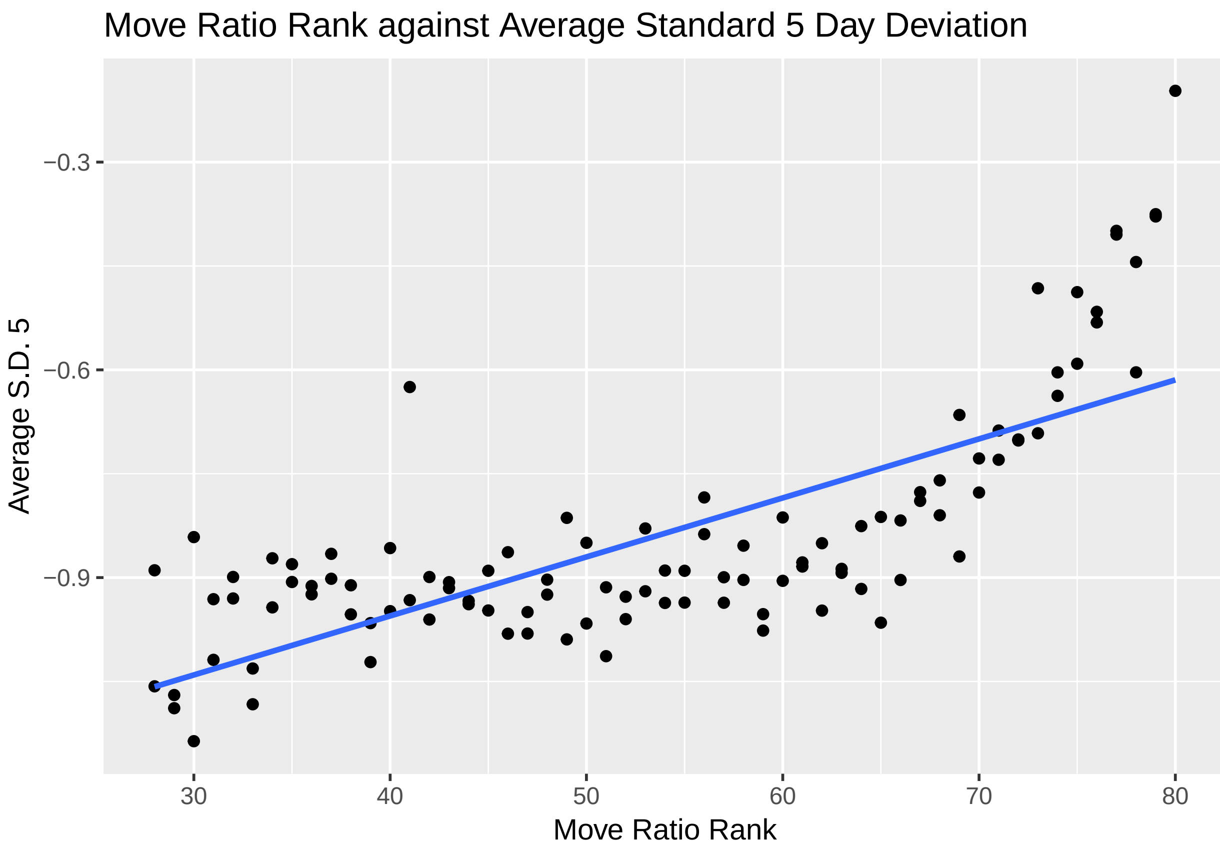
The following graph represents the “raw” data graphed at face value. Specifically, it is the expected move graphed against the 10 day standard deviations (SD 10). In order to make the graph more readable, however, each axis is scaled with a logarithm. As you can see the data is widely distributed in the y direction, and to a lesser extent in the x. This is in part due to the differing underlying prices that naturally have a large effect on the calculated standard deviations. Expected move varies to a lesser degree given that this is already a measure of SD. Having such a wide distribution will make it difficult to discern any concrete meaning from a graph given the amount of noise; this example is no exception. At first glance it is easy to see that there is indeed a positive correlation between the two. However, we cannot draw any conlcusions on if it is truely a correlation or a result of the noise.



The next graph is the result of “cleaning up” the graphed data and the sacles of the plot. Here we are still listing standard deviation in the y direction, albeit modified, but now the x axis is move ratio instead of expected move. As described in the *Data & Methodology* section, move ratio is the actuale move scaled using the expected move. Here, however, we went one step further and cut the data into 100 equal width ranks. Given that there are more than 100 stocks present in the data, multiple stocks are represented by each rank. Separating the move ratios into discrete ranks allowed us to gather more readability out of a large amout of data. What this left us with was distinct veritcle lines of standard deviations corresponding to each rank.

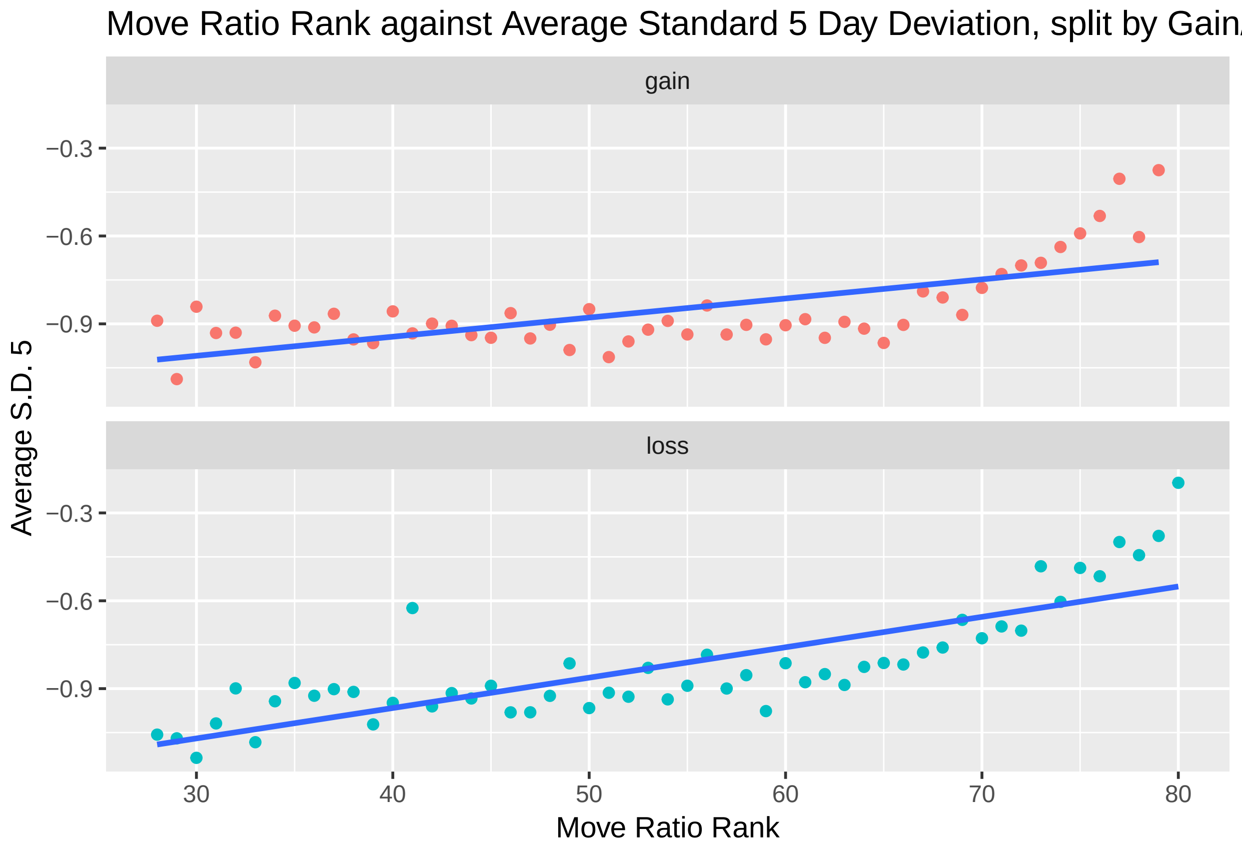
On the y axis the standard deviation is also scaled using expected move, in order to create an equivalent scaled on both axes. We also applied a logarithm as stated before in addition to averaging on the “vertical lines” mentioned in the previous paragraph. By averaging these lines it allowed up to display only the center point of each line.

Finally, what we are left with is a graph with the noise removed. In addition, we can definitively say that there is a positive correlation between the move ratio and the standard deviation. The other three SD measures (3/7/10) are displayed in the appendix as each shows a similar relationship. In short, this graph details the fact that, yes a large move or "jump" will be followed by continued jumps. And naturally the opposite it true, if the volatility starts low, it its likely to stay low.



Gain vs Loss

With a clear and readable graph the next step was to look at how the correlation might differ depending on whether there was a gain or loss on earnings day. Following is a similar looking graph as the previous section but split by the direction of the actual move on earnings day. As you can see both gain and loss have a similar shape to the data. The distinction between the two being that loss has a steeper fit; more positive correlation than gain. So, in essence, if a stock experiences a loss on earnings day, then it will followed by higher volatility and is more likely to experience a large move as time progreses than compared to a gain.



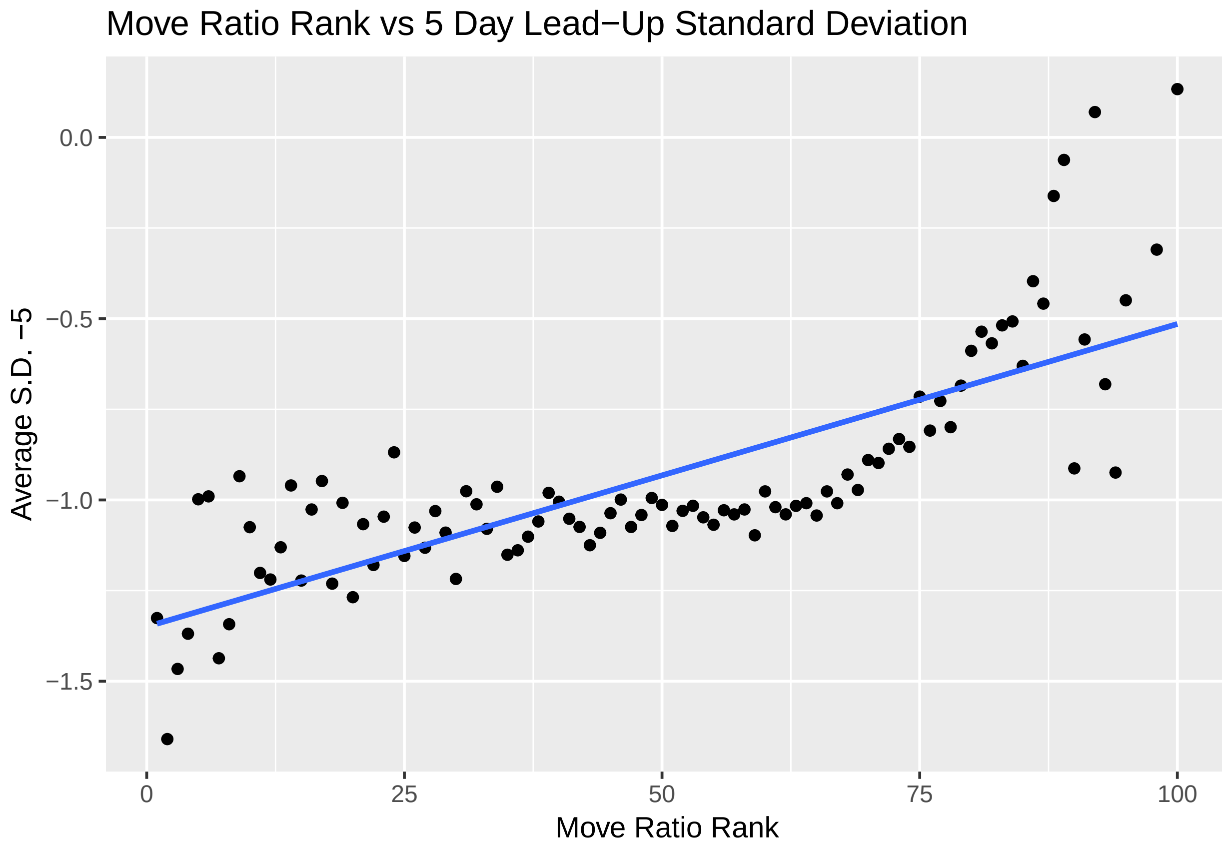
Positive and Negative Stock Performce Before Earnings

section placeholder

Price Volatility Before Earnings

In a similar fashion to the *Move-Ratio vs Subsequent Realized Volatility* section, we compared the same Move Ratio Rank to the average standard deviation leading up to earnings day. Recall that the standard deviation for 5 days before we called S.D -5 as detailed in the *Terms and Definitions* section above. The graph included in this section is for the 5 day lead-up S.D whereas the other three graphs (-3/-7/-10) are again indcluded in the appendix.

At first glance the graph is very similar to that of the post earnings volatility graphs. Indeed the shape of the data is similar but there are a key differences that greatly affect the conclusions that can be drawn from the data. The biggest distinction is in the extreme of rank; specifically withing the top 25%. Here the data greatly divegerges from the tight grouping seen in the lower ranks. This divergences that S.D is more randomly ditributed in the associated Move Ratios. So, a high move ratio on earnings day is not predicted by the standard deviation leading up. In addition, the large distribution skews the fit line upwards by a large amount. The results is what appears to be a positive correlation whereas it should be trended more towards zero; as depicted by the tight and flat distribution of means in the lower ranks. Overall, a high move ratio on earnings is more associated with a random distribution of volatility leading up to that day, and a less than large ratio is barely correlated, if at all.



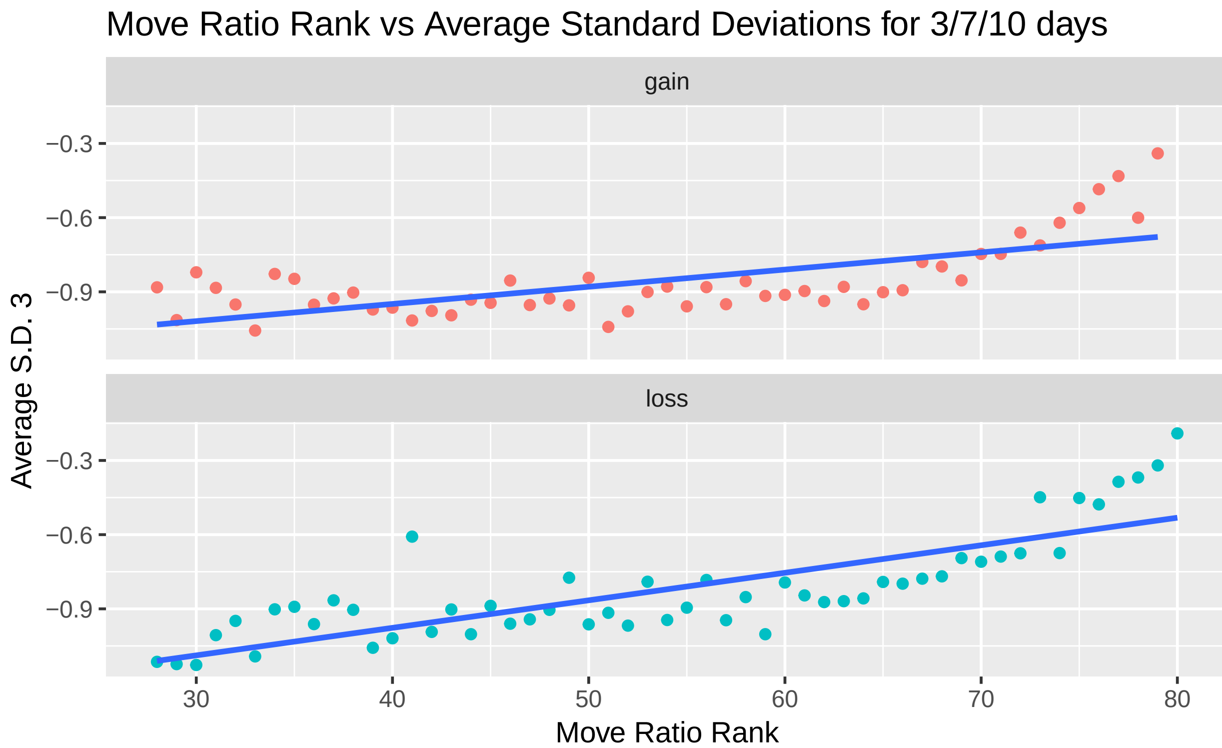
Next Steps

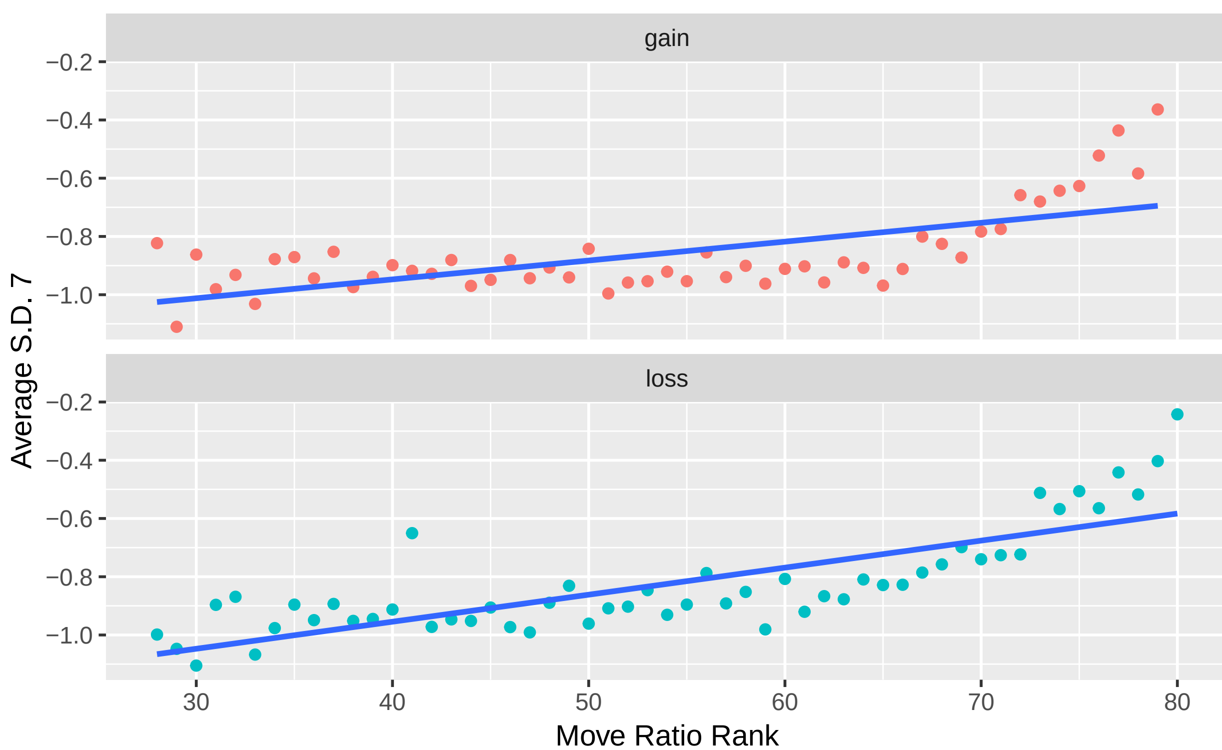
For the most part, this analysis simply reveals the well-known phenomenon of volatility clustering: high volatility begets high volatility. However, our analysis isolates this around earnings dates, and also normalizes the notion of high volatility by market implied volatility. It is also worth noting, as previously stated, that the correlation more positive for loss vs. gain. Meaning large downward jumps are more strongly correlated with further jumps.

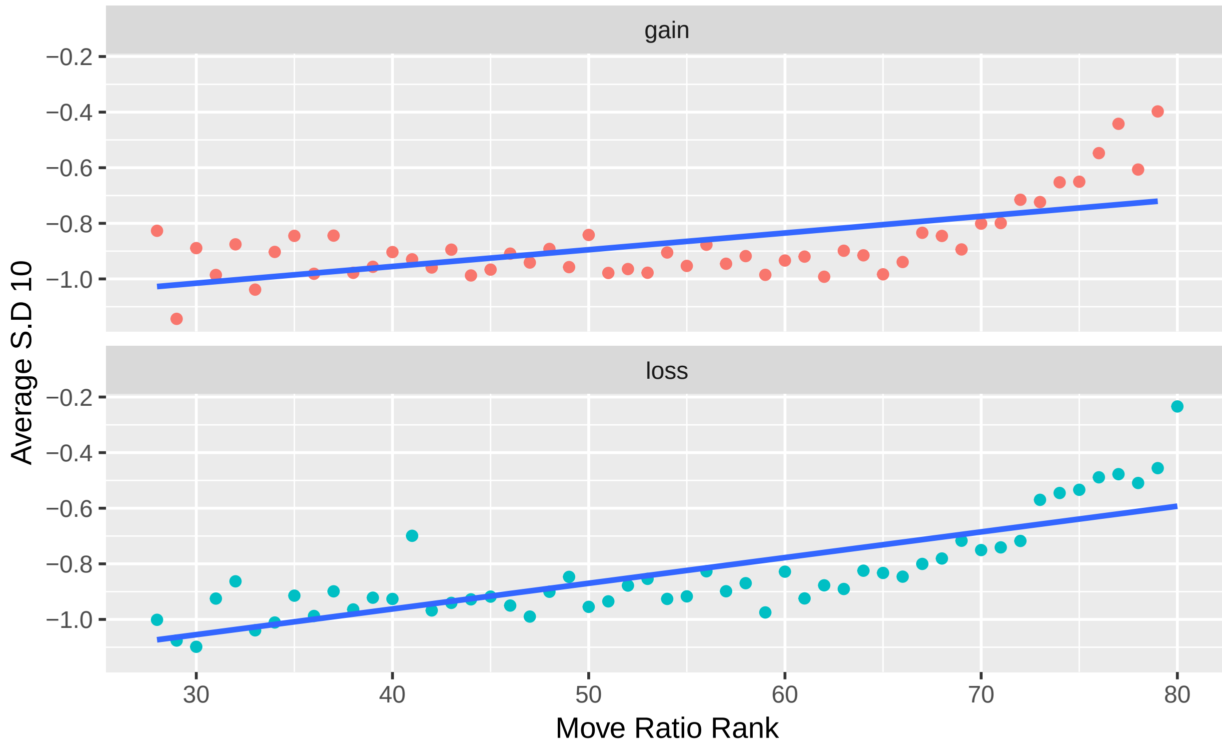
For further analysis, we would like to compare the current, and future, results against non-earnings data (a control group). Doing so will let us see that our findings do not hold outside of earnings and are indeed a result of the earnings release. Specifically, expected and actual move for non and earnings dates this will give us a baseline for what a pronounced or larger-than-normal jump is.

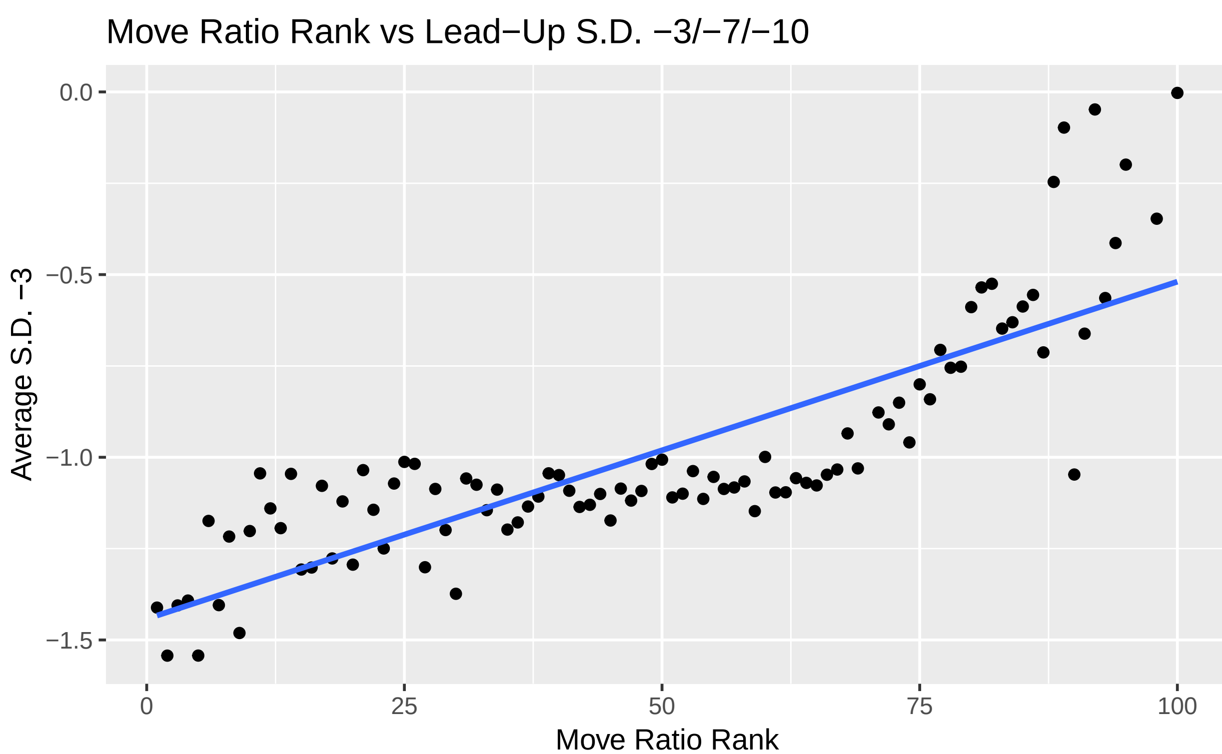
If possible, would you be able to send us non-earnings options data, so that we can analyze a control group and provide more thorough results?

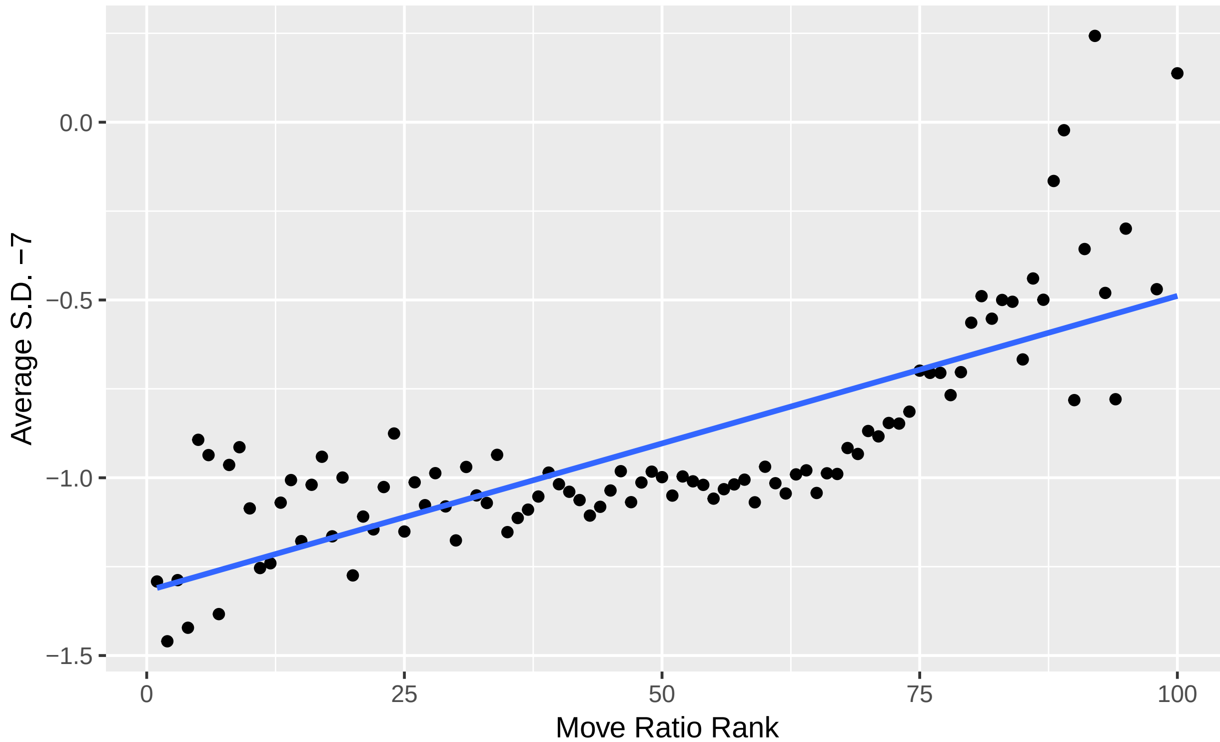
Appendix

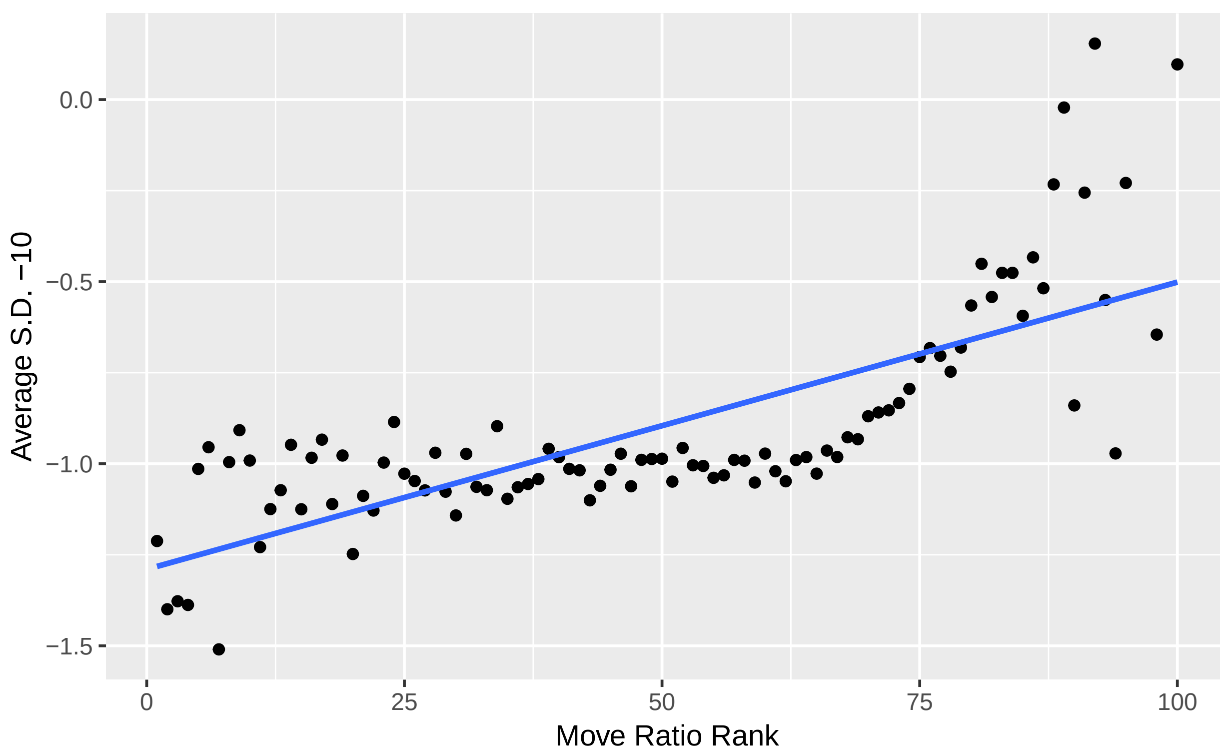

Move Ratio Rank vs Average Standard Deviations for 3/7/10 days
gain
loss
Average S.D. 3
−0.3
−0.6
−0.9
30
40
50
60
70
80
Move Ratio Rank


gain
loss
Average S.D. 7
−0.2
−0.4
−0.6
−0.8
−1.0
30
40
50
60
70
80
Move Ratio Rank


gain
loss
Average S.D 10
Move Ratio Rank
−0.2
−0.4
−0.6
−0.8
−1.0
30
40
50
60
70
80


Move Ratio Rank vs Lead−Up S.D. −3/−7/−10
Average S.D. −3
Move Ratio Rank
0.0
−0.5
−1.0
−1.5
0
25
50
75
100


0.0
−0.5
−1.0
−1.5
Average S.D. −7
0
25
50
75
100
Move Ratio Rank


0.0
−0.5
−1.0
−1.5
Average S.D. −10
0
25
50
75
100
Move Ratio Rank