Introduction

This research report examines a new type of volatility indicator derived from the securities lending market. The securities lending volatility indicator measures the variation of rates charged to borrow securities; average weighted by the outstanding shares being transacted. After this raw value is aggregated, we apply a proprietary formula to normalize the data.

The underlying securities lending transactional dataset provided to Tidal Markets contains over 16 billion shares of outstanding securities loans daily, spanning over 5,000 securities.

Within this report we examine the securities lending volatility of US equities. We back test securities lending volatility to nearly 8 years of historical stock price data, from January 2014 to October 2021.

We compare securities lending volatility to stock price volatility. We analyze how volatility has changed throughout the years. We assess securities lending volatility against the performance of stock price returns. Finally, we analyze securities lending volatility against stock price returns over varying lengths of time.

Analysis Framework

To begin our analysis, we divided up the nearly 8 years of securities lending volatility data based upon market capitalization. The reason we chose market capitalization was to create palatable datasets for overall classification and analysis.

We used the below definitions for each capitalization tier.

Size	***Market Capitalization***
Large	Over $10 Billion
Medium	Greater than $2 Billion, but less than $10 Billion
Small	Greater than $300 Million, but less than $2 Billion
Micro	Greater than $1 Million, but less than $300 Million

To be clear, we removed all securities with less than a $1 million market cap. We also removed securities with a Day 1 stock price of less than one dollar. The rationale for omitting stocks with these two filters was due to the lack of underlying price and/or securities lending transactional data.

For research purposes we analyzed data in the Top 20%, 5%, 1%, 0.5% and 0.1% most volatile thresholds, per each respective grouping. The total number of instances per security, per capitalization tier and volatility threshold, can be found in the table below.

	Micro	*Small*	*Medium*	*Large*
Total #	1,166,207	2,005,586	1,753,400	1,512,499
Top 20%	233,241	401,117	350,680	302,500
Top 5%	58,310	100,279	87,670	75,625
Top 1%	11,662	20,056	17,534	15,125
Top 0.5%	5,831	10,028	8,767	7,562
Top 0.1%	1,166	2,006	1,753	1,512

Exhibit 1

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After we grouped the data into the four capitalization tiers and their respective thresholds, we calculated the securities lending volatility indicator for every security, for every day, from January 2014 to October 2021. Lastly, we sorted the securities lending volatility value for each security, for each day, from most volatile to least volatile.

Based on the thresholds, and having sorted them in descending order of volatility, we were able to determine the securities lending volatility value within each respective grouping, which is found in the table below.

	Micro	*Small*	*Medium*	*Large*
Top 20%	11.138	8.688	8.122	10.708
Top 5%	16.148	13.786	13.370	16.620
Top 1%	20.312	19.177	18.542	20.138
Top 0.5%	21.675	20.933	20.381	21.756
Top 0.1%	24.551	23.927	24.742	26.339

Exhibit 2

For example, when we refer to the Top 20% of Micro Cap stocks, we refer to all micro capitalization securities that had a securities lending volatility value of 11.138 or above, on any given day, between January 2014 and October 2021. When we refer to the Top 1% of Micro Cap stocks, we narrow that scope to a volatility value of 20.312 or above. The purpose is to compare the behavior of stocks within each threshold, per each tier.

When we do compare the behavior of stocks, we report both mean and median methods of averaging where it is applicable.

Although mean average is the most widely utilized method, the median average can be just as useful, if not more informative. With both methods, the purpose is to assist in determining the central tendency of a dataset. The mean average adds all values together and divides by the total number of occurrences to derive its middle value. This practice is effective when a dataset is normally distributed and does not contain outliers. On the contrary, the median average lists all values in order and looks for the value in the middle. This practice is effective when the dataset is not normally distributed, and outliers exist on either (or both) ends of the spectrum.

We chose to report both numbers because our goal is to establish accuracy in the reporting of central tendency. Technically if an underlying dataset is normally distributed with 50% of the data on the right and the left, then the mean average and median average would be the same – but we found this is not the case and hence why we report both.

The last part of our framework worth clarifying is when we apply time variables to our analysis.

In this report we track the performance of stocks within 3, 7, 15, 30, and 60 day time frames. Meaning, if ABC micro cap security had a securities lending volatility value of 11.138 on 3/4/2021 then it *qualifies* for our Top 20% Micro Cap threshold and we analyze the stocks 3 day performance based on data reported at the close of business on 3/9/2021, the 7 day performance as of 3/15/2021, the 15 day performance as of 3/25/2021, et cetera.

If ABC Micro Cap security had a securities lending volatility value of 10.138 the following day, 3/5/2021; since it is below our 11.138 Top 20% Micro Cap threshold then it would *not qualify* for that day. We of course would still analyze the stock from its original 3/4 appearance.

Nonetheless, if ABC security does creep back above 11.138 on the proceeding day, 3/8/2021, or to be more precise, on any day within the nearly 8 years of data we examined, it would be captured within our dataset for analysis.

The securities lending volatility values within each threshold, per each capitalization tier, and any associated time frame comparison, form the basis of our analysis contained within the remainder of this report.

The 3-Pronged Test

To evaluate securities lending volatility as being any indication of stock market activity, we found ourselves asking three simple questions:

1. Does securities lending volatility equate to stock price volatility?
2. How does securities lending volatility relate to stock price returns?
3. How do stock price returns vary against volatility and time?

We begin our analysis by looking at the first and most basic question.

Does securities lending volatility equate to stock price volatility?

To determine if securities lending volatility equates to stock price volatility, we analyze the top thresholds of securities lending volatility to the volatility in a stock's price.

Since volatility is a term used to describe standard deviation, then stock price volatility is equal to stock price standard deviation. Therefore, we can calculate the standard deviation in the price of a stock over varying time periods and analyze its performance.

Additionally, if we are going to examine volatility throughout various time periods, then we also require a benchmark statistic to compare itself to. For this purpose, we use the average standard deviation of all securities in the respective capitalization tier and time-period.

With that said, the hypothesis we are testing is: (1) do stocks that appear in the securities lending volatility thresholds have a higher price standard deviation than the average; and (2) does higher securities lending volatility equate to higher stock price standard deviation.

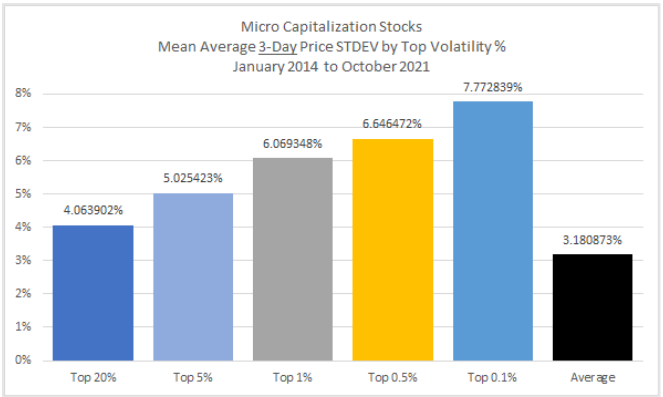


Exhibit 3

Let us walk through one chart example before we show all table illustrations.

In Exhibit 3 we examine Micro Cap Stocks with their mean average 3-day price standard deviation.

Beginning at the left-most side, Top 20%.

In long-winded form, we took all micro cap stocks that had a securities lending volatility value in the Top 20% threshold, thereby 233,241 security instances (Exhibit 1) which had a volatility value of 11.138 or higher (Exhibit 2). We then looked at the stock price of those 233,241 securities on whichever date they appeared, found its

stock price on that day, labeled it as Day 1, found the following Day 2 and Day 3 prices, then applied a sample standard deviation formula to all three of those days to determine it's 3-day price standard deviation. We did this for all 233,241 stocks. Once we had each individual stocks' 3-day price standard deviation, we calculated the mean average across all instances. This resulted in a standard deviation of 4.063902%.

To obtain the average, we repeated the same steps above but for all 1,166,207 micro cap security instances and their 3-day price standard deviation. This resulted in a mean standard deviation of 3.180873%.

After understanding the methodology used for calculating stock price standard deviation, lets now see the data across all time periods.

Again, the expectation is that stocks that appear in the securities lending volatility thresholds (1) have a higher stock price volatility than the average, and (2) higher volatility thresholds equate to higher volatility.

Note, in this chart series the color green (congruent to our hypothesis) signifies that the value is greater than the Average value, the color orange signifies it is the same value as the Average, and red is below the Average.

Micro Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	4.06%	5.03%	6.07%	6.65%	7.77%	3.18%
	Median	2.39%	2.97%	3.55%	3.96%	4.77%	1.86%
7 Day	*Mean*	4.02%	4.93%	5.78%	6.25%	7.26%	3.14%
	Median	2.90%	3.50%	4.06%	4.45%	5.10%	2.27%
15 Day	*Mean*	4.22%	5.09%	5.75%	6.14%	6.84%	3.29%
	Median	3.22%	3.84%	4.40%	4.76%	5.31%	2.50%
30 Day	*Mean*	4.34%	5.18%	5.71%	6.04%	6.63%	3.36%
	Median	3.42%	4.04%	4.58%	4.87%	5.36%	2.64%
60 Day	*Mean*	4.46%	5.33%	5.80%	6.03%	6.57%	3.54%
	Median	3.58%	4.28%	4.80%	5.00%	5.63%	2.76%

Exhibit 4

Small Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	2.95%	3.59%	4.51%	5.00%	6.63%	2.37%
	Median	1.76%	2.14%	2.60%	2.83%	3.43%	1.46%
7 Day	*Mean*	2.90%	3.53%	4.38%	4.82%	6.47%	2.33%
	Median	2.18%	2.63%	3.14%	3.38%	4.20%	1.73%
15 Day	*Mean*	3.00%	3.62%	4.38%	4.72%	5.97%	2.41%
	Median	2.41%	2.91%	3.39%	3.61%	4.24%	1.88%
30 Day	*Mean*	3.04%	3.66%	4.32%	4.57%	5.57%	2.45%
	Median	2.55%	3.08%	3.52%	3.71%	4.40%	1.96%
60 Day	*Mean*	3.09%	3.70%	4.31%	4.54%	5.51%	2.49%
	Median	2.68%	3.19%	3.65%	3.86%	4.68%	2.04%

Exhibit 5

Medium Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	2.08%	2.28%	2.82%	3.25%	3.93%	1.82%
	Median	1.26%	1.34%	1.50%	1.71%	2.05%	1.16%
7 Day	*Mean*	2.05%	2.25%	2.76%	3.16%	3.84%	1.80%
	Median	1.51%	1.61%	1.88%	2.16%	2.44%	1.37%
15 Day	*Mean*	2.11%	2.32%	2.85%	3.24%	3.82%	1.86%
	Median	1.62%	1.73%	2.01%	2.32%	2.55%	1.47%
30 Day	*Mean*	2.13%	2.33%	2.85%	3.25%	3.80%	1.88%
	Median	1.67%	1.78%	2.07%	2.42%	2.80%	1.52%
60 Day	*Mean*	2.15%	2.34%	2.82%	3.17%	3.61%	1.91%
	Median	1.71%	1.81%	2.13%	2.50%	2.79%	1.56%

Exhibit 6

Large Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	1.48%	1.51%	1.84%	2.14%	3.07%	1.47%
	Median	0.98%	0.97%	1.05%	1.17%	1.45%	0.98%
7 Day	*Mean*	1.46%	1.48%	1.79%	2.09%	2.96%	1.45%
	Median	1.17%	1.15%	1.24%	1.37%	1.65%	1.15%
15 Day	*Mean*	1.50%	1.53%	1.85%	2.15%	2.96%	1.50%
	Median	1.25%	1.23%	1.32%	1.44%	1.69%	1.23%
30 Day	*Mean*	1.51%	1.53%	1.85%	2.12%	2.84%	1.51%
	Median	1.28%	1.27%	1.36%	1.46%	1.70%	1.27%
60 Day	*Mean*	1.53%	1.54%	1.84%	2.10%	2.77%	1.53%
	Median	1.30%	1.29%	1.38%	1.49%	1.81%	1.30%

Exhibit 7

Based on interpretation of the data, we can see that both of our hypotheses were correct.

First, we can infer that stocks that appear in the highest thresholds of securities lending volatility produce more stock price volatility than the average. This advantage exists not only at the shorter 3 or 7 day timeframes, but it also exists within the longer durations, as well.

Second, we are also able to verify that higher securities lending volatility equates to higher stock price volatility. As we can see illustratively, the higher the volatility thresholds go, the higher the % of stock price volatility increases. Stocks that appear in the Top 0.1% of securities lending volatility thresholds are at least 40% more volatile.

There are also other inferences we can make. For instance, we notice that on average the smaller the capitalization of the security, the higher the volatility, and vice versa. Though, this probably doesn't come at any surprise since it is more likely that micro cap stocks are more volatile than large cap stocks due to the innate size of large cap securities and therefore it being more difficult to move the price.

We've also noticed that there are several orange and red values in the 20% and 5% volatility thresholds for Large Cap securities. As noted, orange means the volatility values are the same as the average and red are below average. For the instances where the volatility values are red, they are only off by 1 basis point, a considerably small difference.

So, does securities lending volatility equate to stock price volatility? From the 7 years and 10 months of data we back tested, the answer is yes. Additionally, we were also able to confirm that stocks that appear in higher securities lending volatility thresholds also equate to producing higher stock price volatility.

But how spread out is this volatility?

Due to the nature of stock price volatility, it may leave the reader to question whether the volatility we're examining is evenly dispersed throughout all the years of data we back tested. Afterall, since stock prices were extremely volatile in March and April 2020 due to the onset of the pandemic, it is worth knowing whether the data may be primarily concentrated around 2020, or if the data is scattered throughout. The answer appears to be a little bit of both, but it's worth explaining.

For the following pie charts below, we took all capitalization tiers of data, per their respective thresholds, and sorted the data points based on the year they occurred. The hypothesis here is that if the volatility we're examining was solely from 2020, there would be no other slices of the pie.

Micro Cap

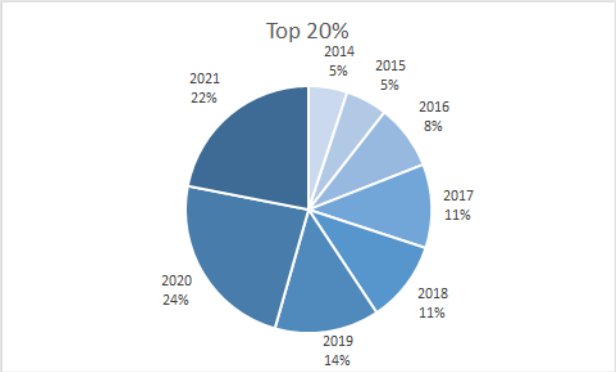
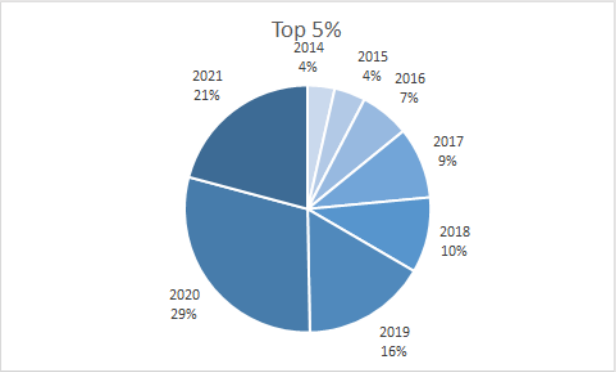


Exhibit 8



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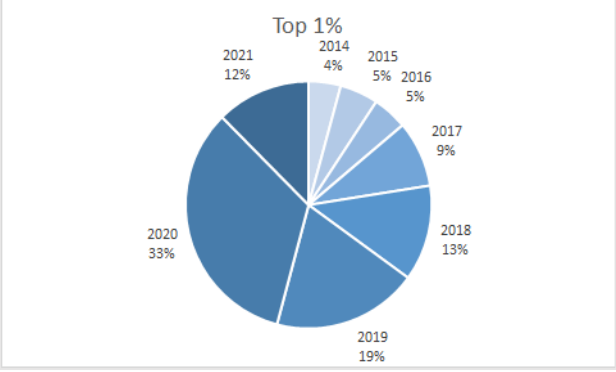

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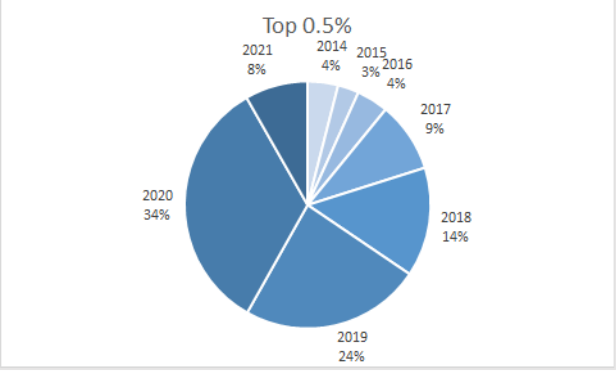
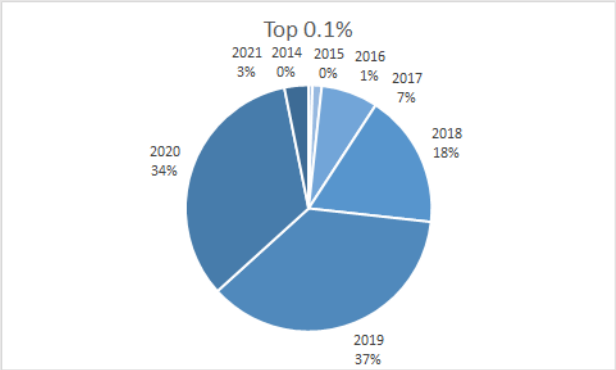


Exhibit 11

Small Cap



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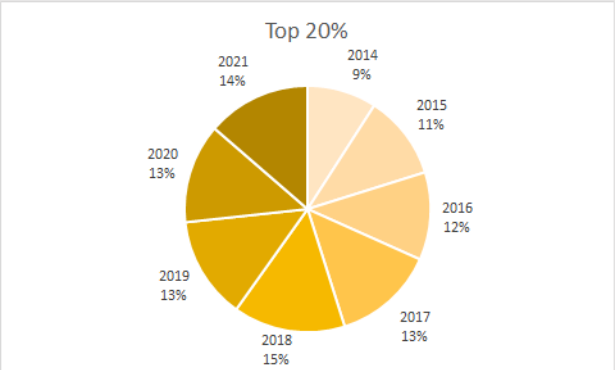

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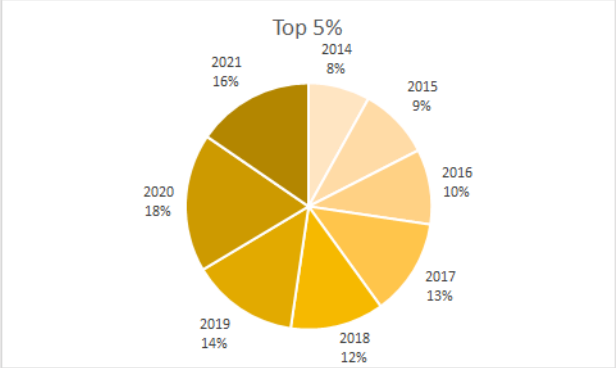

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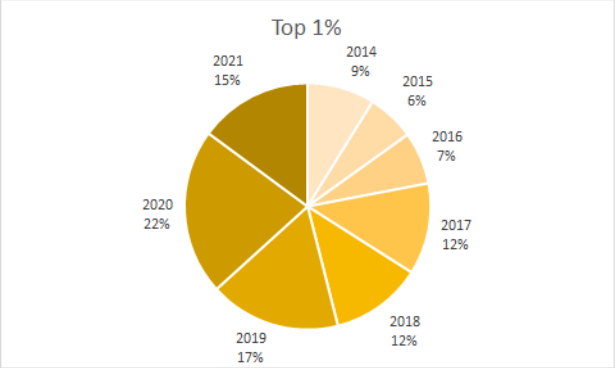

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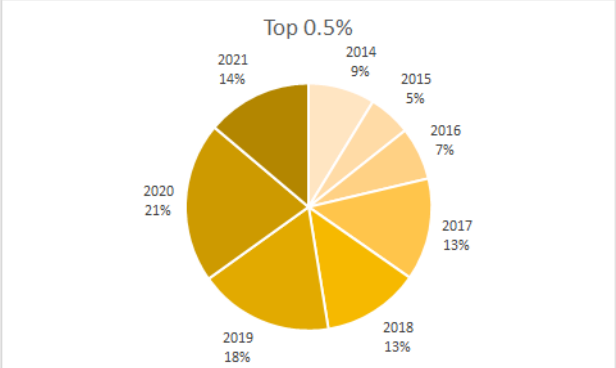

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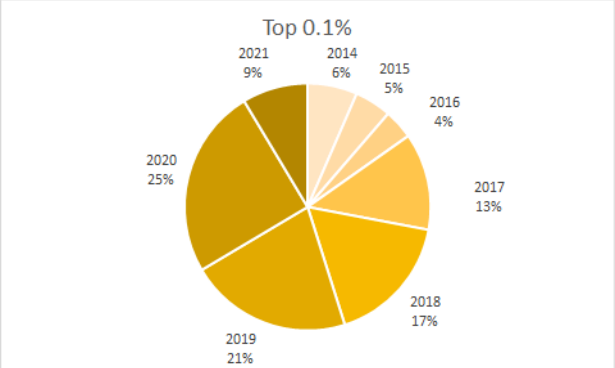
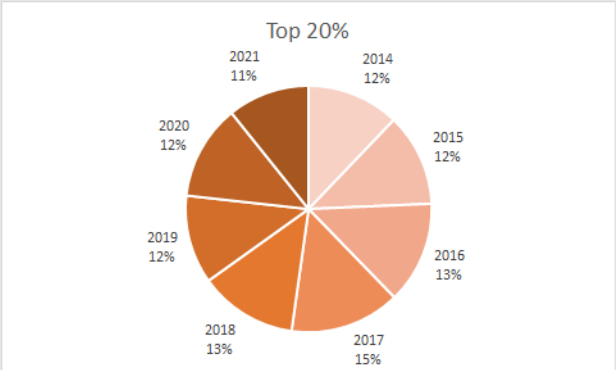


Exhibit 17

Medium Cap



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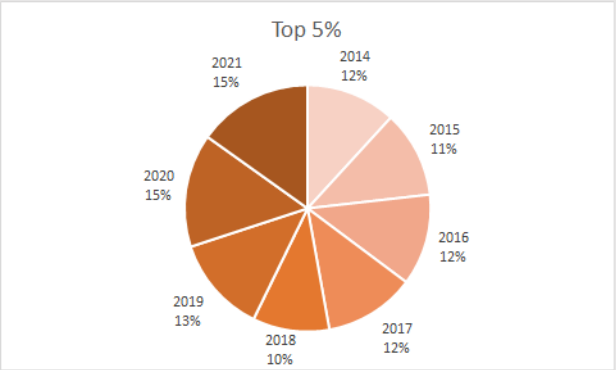

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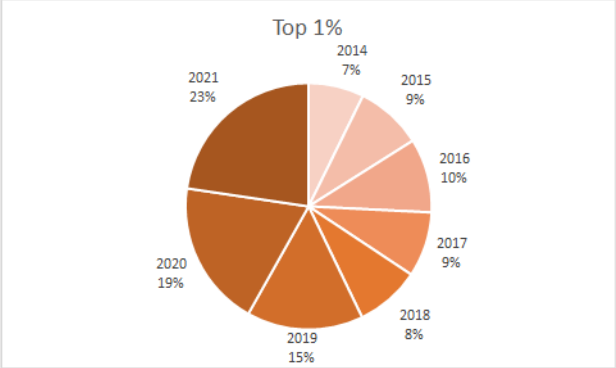

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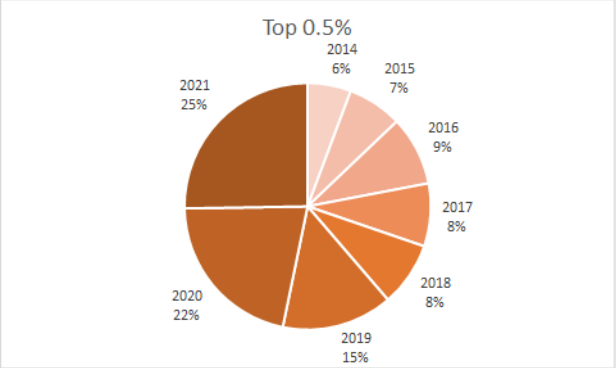
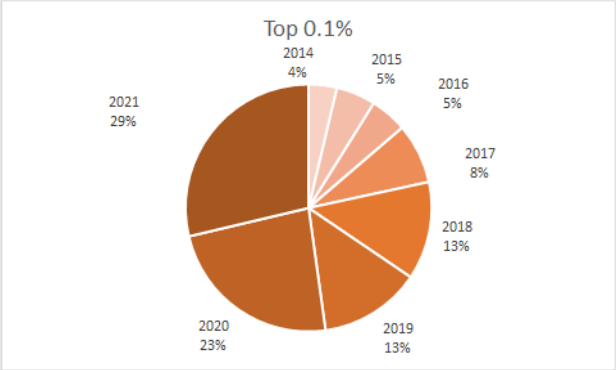


Exhibit 21

Large Cap



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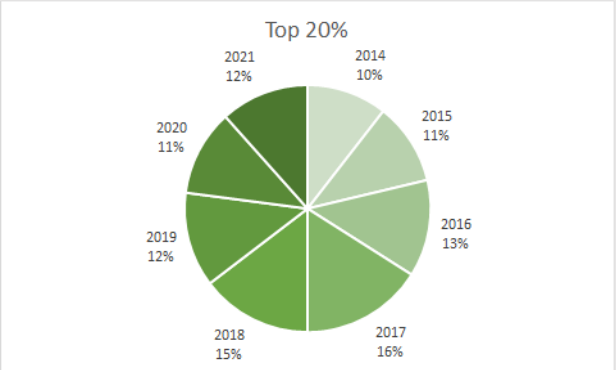

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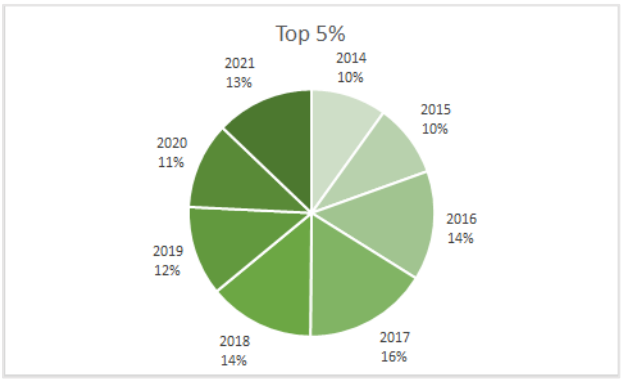

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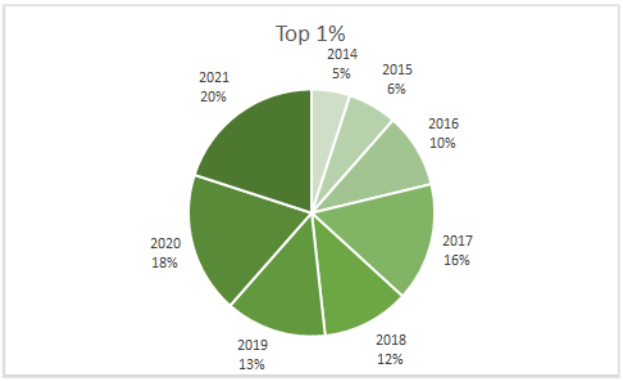

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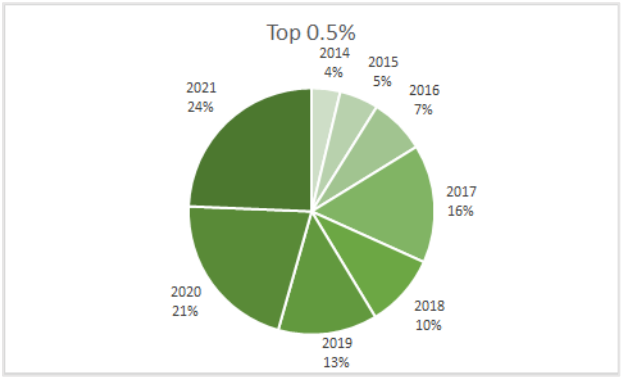

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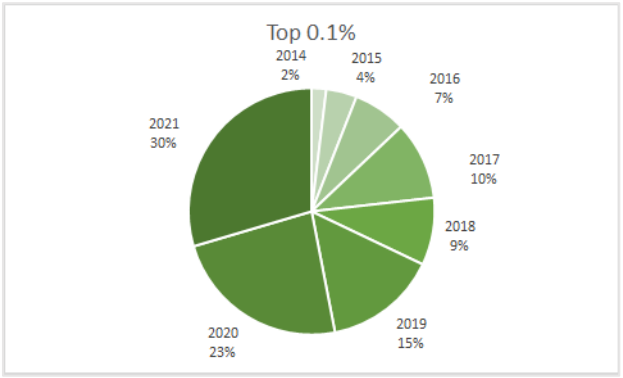


Exhibit 27

Throughout all market capitalization tiers we can see that volatility occurs, irrespective of the year. Although it is true that certain market capitalizations experience higher volatility in certain years versus others, we can conclude that the data isn't at least concentrated into one particular year. For example, if we solely examine the Top 20% thresholds for all market capitalizations (Exhibits 8, 13, 18, 23), we can see that the volatility data is nearly evenly spread out.

Nonetheless, when we focus in on each market capitalization tier there are several points we can infer.

Beginning with the micro caps, in the Top 20% we can see that volatility is low in 2014 and 2015, doubles in the number of appearances in 2017 and 2018, and doubles again within 2020 and 2021. As we move further along into higher volatility thresholds, we can see that the makeup of volatility decreases in the years 2014 through 2018, and 2021, while the volatility within years 2019 and 2020 increases. This is evident to the point where years 2019 and 2020 combined make up more than seventy percent of the Top 0.1% of securities lending volatility for micro cap stocks.

When we look at small caps, we see a similar story to the micro caps. First, within the Top 20% we can see that volatility is nearly equally distributed throughout all years. As we move along the volatility thresholds, we start to see years 2014, 2015, 2016, and 2021, the values get halved. Meanwhile, in years 2018, 2019 and 2020, we see volatility increase, with 2017 remaining at 13% throughout. So unlike in the micro caps where the years 2019 and 2020 makeup over seventy percent of the Top 0.1%, here we see in the small caps that seventy percent of the data spans over four years, from 2017 through 2020, albeit with a larger majority weighing in 2019 and 2020.

Next when analyzing the medium caps, we can similarly infer that volatility within the Top 20% is equally distributed. As we shift the scope to higher securities lending volatility, we see volatility in the older years decrease in 2014 through 2016, whereas volatility ramps up in 2020 and 2021. This is interesting to note, that contrary to the micro and small cap stocks having volatility persist mostly in 2019 and 2020, here we begin to see volatility in 2020, but moreso in 2021. Additionally, it's worthy to remind our reader that our dataset ends on October 31st, 2021 – so the 2021 slice of the pie is especially large, considering it is not accounting for two additional months of data. Theoretically including those two months, the makeup of 2021 would be even larger.

Lastly when we look at the large caps, we see a comparable story to the medium caps. Beginning with the Top 20%, we see the annual makeup is evenly dispersed. Furthermore, moving to higher volatility thresholds, we see volatility in earlier years decrease, whereas volatility increases in 2020 and 2021. Again, we see a stronger amount of volatility in 2021 than 2020, despite the two month deficit of data included in our analysis.

Overall, we're able to conclude that our litmus-test of volatility data being concentrated in one year is not true, and rather, it is dispersed throughout our eight years of analysis. However, despite the data appearing in each year, there is undoubtedly a lesser concentration of volatility in the earlier years of 2014 through 2016, and a greater amount of volatility between 2019 and 2021. Extrapolating on that point, we see that micro and small cap securities experienced peak volatility in 2019 and 2020, whereas medium and large cap securities were most volatile in 2020 and 2021.

How does securities lending volatility relate to stock price returns?

Now that we have determined that securities lending volatility equates to stock price volatility, and that this volatility is scattered throughout the years of our back tested data, we now want to examine stock price returns.

Generally, stock price volatility tends to produce negative returns. Thereby, we wonder if that theory may hold true for securities lending volatility.

Therefore, the hypothesis here is that higher securities lending volatility equals lower stock prices. So we are exploring if stocks that appear in securities lending volatility thresholds (1) have a lower stock price than the average, and (2) higher volatility thresholds equate to even lower stock prices.

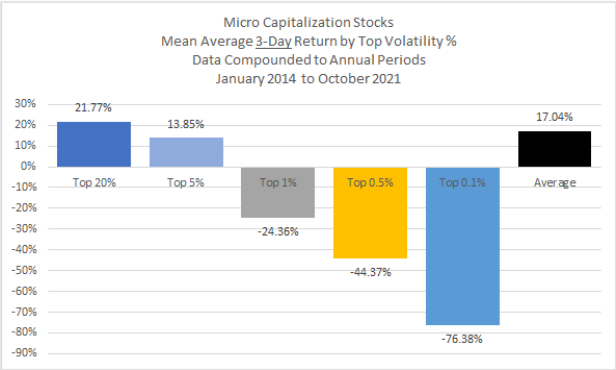


Exhibit 28

To answer these questions, we utilize the same methodology that was conducted when testing the stock price volatility.

Let us walk through one chart example before we show all table illustrations.

In Exhibit 28 we examine Micro Cap Stocks with their mean average 3-day percentage annualized return.

Beginning at the left-most side, Top 20%.

In long-winded form, we took all micro cap stocks that had a securities lending volatility value in the Top 20% threshold, thereby, 233,241 micro cap stock instances (Exhibit 1) which had a volatility value of 11.138 or higher (Exhibit 2). We then looked at the stock price of those 233,241 securities on whichever date they appeared, found its stock price on that day, labeled it as Day 1, found the Day 3 price, and calculated the 3-day price return. We did this for all 233,241 stocks. Once we had each individual stocks' 3-day price return, we calculated the mean average across all instances. This resulted in a mean average 3-day compounded annualized return of 21.77%.

To obtain the average, we repeated the same steps above but for all 1,166,207 micro cap security instances and their 3-day price return. This resulted in a return of 17.04%.

After understanding the methodology used for calculating stock price return, lets now see the data across all time periods.

Note, in this chart series the color green signifies (congruent to our hypothesis) that the value is *less* than the Average value, the color orange signifies it is the *same* value as the Average, and red is *above* the Average.

Micro Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	21.77%	13.85%	-24.36%	-44.37%	-76.38%	17.04%
	Median	-8.23%	-24.87%	-44.81%	-59.15%	-79.32%	0.00%
7 Day	*Mean*	29.97%	17.39%	-29.09%	-53.91%	-79.25%	24.34%
	Median	-13.73%	-30.06%	-55.89%	-68.57%	-85.72%	0.00%
15 Day	*Mean*	29.69%	17.71%	-30.28%	-50.57%	-75.15%	22.84%
	Median	-11.07%	-25.56%	-49.28%	-62.56%	-80.53%	0.00%
30 Day	*Mean*	27.44%	18.79%	-22.02%	-38.49%	-63.90%	21.63%
	Median	-8.24%	-22.11%	-45.97%	-58.73%	-72.00%	0.42%
60 Day	*Mean*	25.14%	14.71%	-16.28%	-31.09%	-61.70%	20.20%
	Median	-7.04%	-21.07%	-40.07%	-50.33%	-71.80%	1.71%

Exhibit 29

Small Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	5.11%	2.20%	-7.95%	-19.46%	-54.29%	7.73%
	Median	0.00%	-5.84%	-15.12%	-22.29%	-45.41%	1.77%
7 Day	*Mean*	6.81%	1.32%	-15.16%	-30.50%	-62.87%	12.15%
	Median	-2.85%	-10.34%	-22.13%	-29.89%	-54.78%	4.00%
15 Day	*Mean*	7.51%	1.32%	-21.16%	-36.81%	-68.53%	12.44%
	Median	-2.14%	-9.88%	-24.60%	-35.16%	-60.39%	5.26%
30 Day	*Mean*	7.87%	1.11%	-22.39%	-33.79%	-68.45%	12.44%
	Median	-2.17%	-10.46%	-27.60%	-40.93%	-61.33%	5.69%
60 Day	*Mean*	7.54%	0.74%	-22.63%	-33.06%	-58.95%	11.87%
	Median	-2.13%	-11.35%	-27.41%	-38.58%	-60.26%	5.14%

Exhibit 30

Medium Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	4.23%	2.41%	-4.30%	-7.87%	-15.00%	4.70%
	Median	2.69%	0.00%	0.00%	-1.97%	-5.05%	5.97%
7 Day	*Mean*	8.84%	6.61%	-3.58%	-9.73%	-30.89%	8.71%
	Median	5.69%	2.33%	0.00%	-4.89%	-14.79%	9.15%
15 Day	*Mean*	8.59%	6.39%	-2.88%	-10.19%	-35.22%	9.07%
	Median	5.91%	3.27%	-0.99%	-3.81%	-9.30%	9.09%
30 Day	*Mean*	8.56%	5.62%	-2.33%	-5.64%	-24.96%	9.23%
	Median	5.81%	3.40%	-0.82%	-3.14%	-6.47%	8.64%
60 Day	*Mean*	7.84%	5.07%	-4.52%	-8.57%	-21.35%	8.77%
	Median	5.18%	3.21%	-1.83%	-4.35%	-10.07%	7.49%

Exhibit 31

Large Cap							
Most Volatile		20%	5%	1%	0.5%	0.1%	Avg.
3 Day	*Mean*	1.25%	-0.51%	-6.50%	-9.76%	-27.42%	3.39%
	Median	2.23%	1.38%	0.00%	-0.77%	-11.06%	5.73%
7 Day	*Mean*	4.26%	1.65%	-7.31%	-11.59%	-30.18%	7.33%
	Median	4.96%	3.78%	0.00%	-1.53%	-15.48%	9.29%
15 Day	*Mean*	4.90%	2.69%	-6.53%	-11.18%	-28.17%	7.84%
	Median	5.71%	4.61%	0.00%	-3.41%	-11.30%	9.39%
30 Day	*Mean*	5.15%	3.81%	-3.95%	-8.04%	-24.70%	8.01%
	Median	5.39%	4.93%	1.67%	-0.78%	-9.38%	8.76%
60 Day	*Mean*	4.92%	3.97%	-2.00%	-6.33%	-17.89%	7.64%
	Median	4.92%	4.61%	2.39%	0.33%	-7.56%	7.73%

Exhibit 32

From running the data, we can consistently see almost evenly across all market capitalizations that securities lending volatility equates to negative stock price returns, and that higher volatility thresholds result in more negative returns.

But to begin with the most pressing question first – what happened to the Micro Cap stocks within the Top 20% threshold, where mean average return is red, signifying that it failed our hypothesis and the returns were higher than the Average…

Seeing that these returns were approximately 5.59% higher than the Average, it indeed appears off-putting. But when we review the median average return of -8.23%, (again, the median identifies the 50th percentile of the data), we see that this test does in fact hold, and more likely than not, the underlying data is skewed (more on this later).

Furthermore, looking past the Top 20%, we find negative returns throughout the remaining micro cap thresholds, and increasingly moreso at the highest thresholds. These returns aren't a menial twenty to fifty basis points difference than the average, or even twenty to fifty basis points from each threshold, but rather hundreds of basis points of a difference. This is very surprising data to uncover.

To put this into context, of the 233,241 securities (Exhibit 1) that appeared in the Top 20% threshold for micro cap securities, the median average return was -8.23% within 3 days, on an annualized basis.

In other words, the 50th percentile was -8.23%, whereby half of the data performed better, while the other half performed worse.

If we zoom into higher volatility thresholds, of the 11,662 stocks that appeared in securities lending volatility Top 1% threshold, their mean average 3-day annualized stock price return was -24.36% and their median average return was -44.81%. These are extremely negative returns.

These negative returns persist not only throughout the various 3 through 60 day periods we observed, but they persist across all thresholds and tiers.

When we move on to examining the small, medium, and large cap tier performances - we find the same type of results found in the micro cap tier. Spanning across all thresholds and day periods, regardless of capitalization tier, we find returns that become increasingly negative as the volatility threshold is narrowed.

To put this into layman's terms from a forward looking perspective; if a security ever appeared in the Top 0.1% of securities lending volatility, it has a strong probability of stock price decline. In fact, even if it breaches the wider-scoped Top 1% of volatility, there is still a strong probability of decline. The number of times in the 7 years, 10 months of data analyzed where a stock breached the Top 1% of securities lending volatility occurred 64,377 times.

This is no coincidence, and the data shows us that securities lending volatility is a direct indication of negative stock price movement.

How do stock price returns vary against volatility and time?

With conclusive evidence that securities lending volatility is associated with stock price decline, it would be prudent to delve further into this assessment since a multitude of questions arise.

Does *every* stock decline? How do distributions alter between Day 3 returns versus Day 60 returns? How do returns change when we look at differing volatility levels?

We approach these questions by examining the distributions of returns for all securities within each capitalization tier and their thresholds, across time.

Note, to be concise for our audience we are only showing the Top 20% and Top 0.1% thresholds, the two ends of our volatility spectrum, within the 3, 30, and 60 Day periods within each capitalization tier. These charts are sufficient at highlighting the inferences necessary to perform our analysis.

Micro Cap, 3 Day

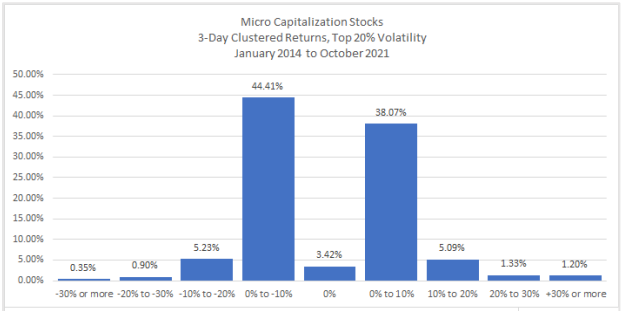


Exhibit 33

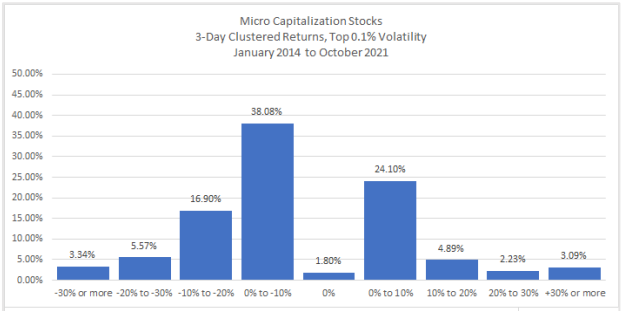


Exhibit 34

Micro Cap, 30 Day

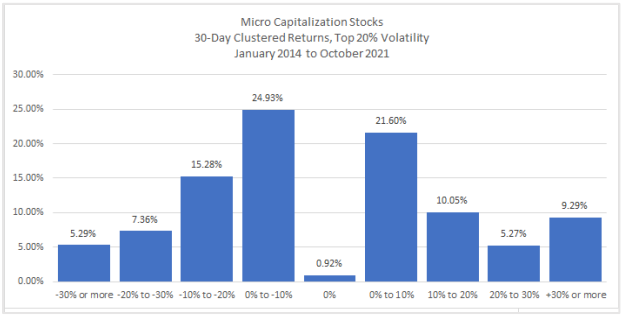


Exhibit 35

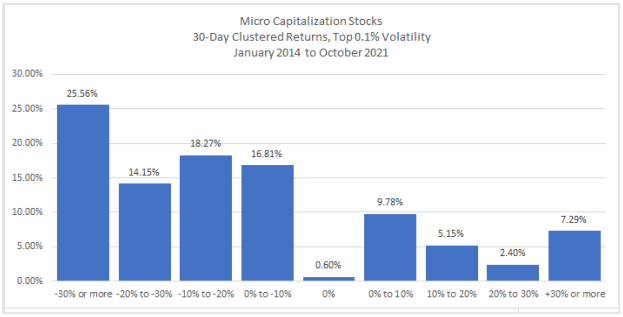
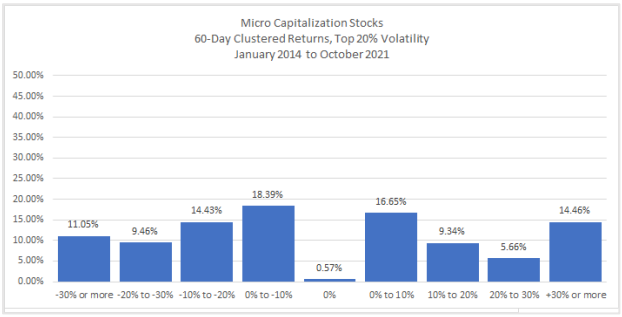


Exhibit 36

Micro Cap, 60 Day



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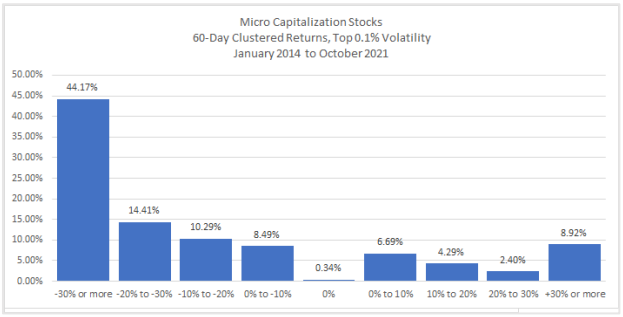
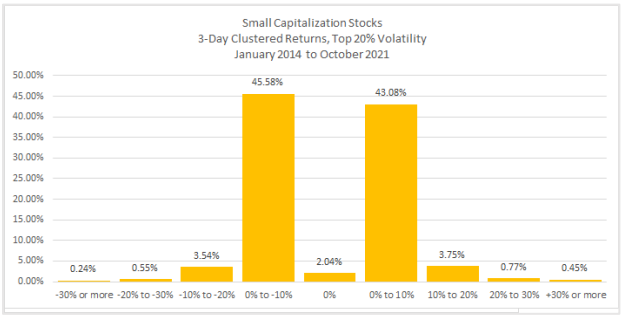


Exhibit 38

Small Cap, 3 Day



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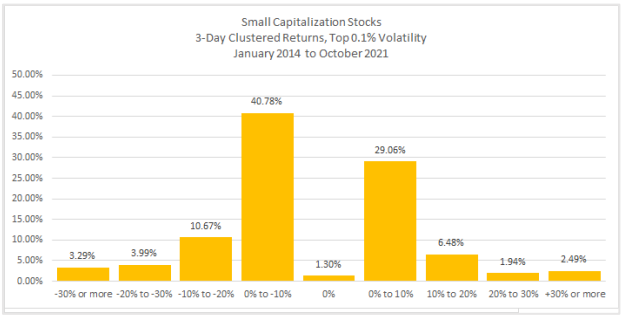
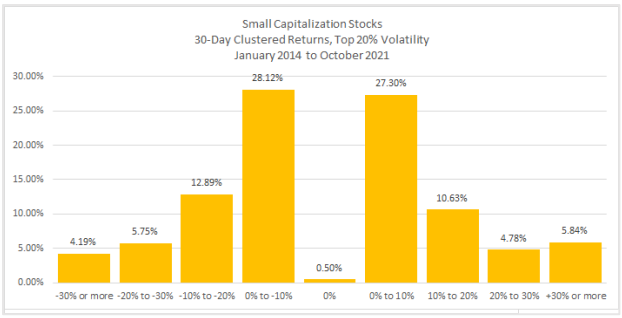


Exhibit 40

Small Cap, 30 Day



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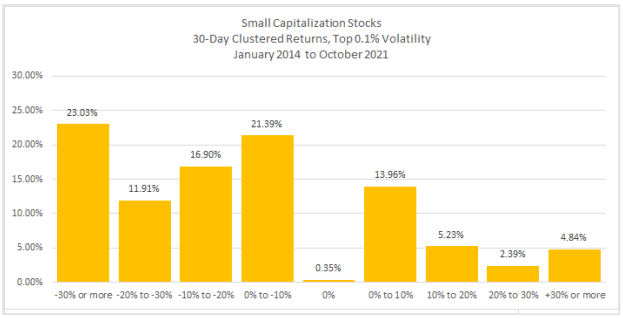


Exhibit 42

Small Cap, 60 Day

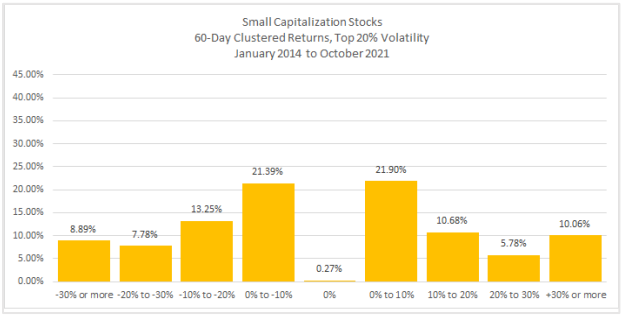


Exhibit 43

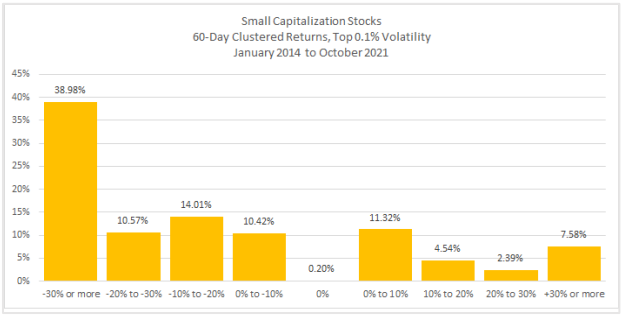


Exhibit 44

Medium Cap, 3 Day

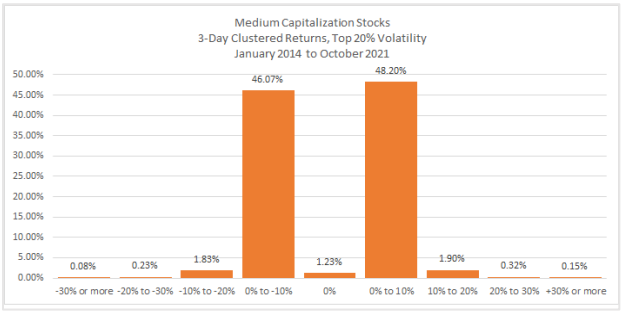


Exhibit 45

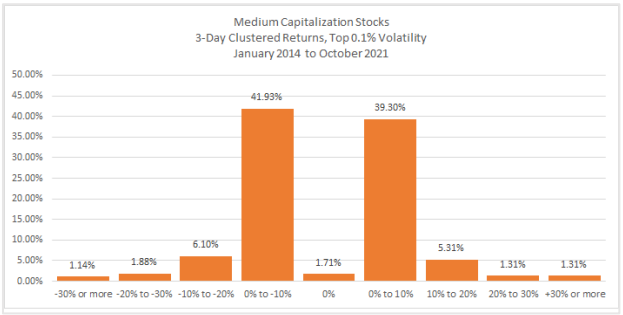


Exhibit 46

Medium Cap, 30 Day

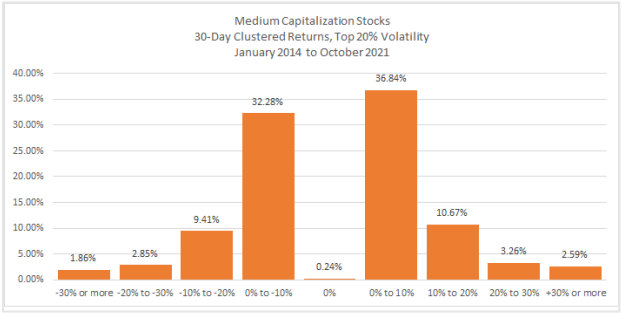


Exhibit 47

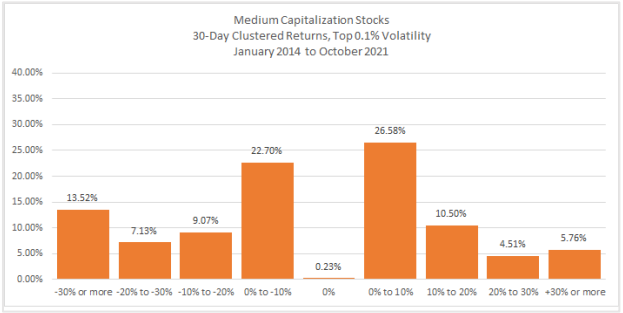


Exhibit 48

Medium Cap, 60 Day

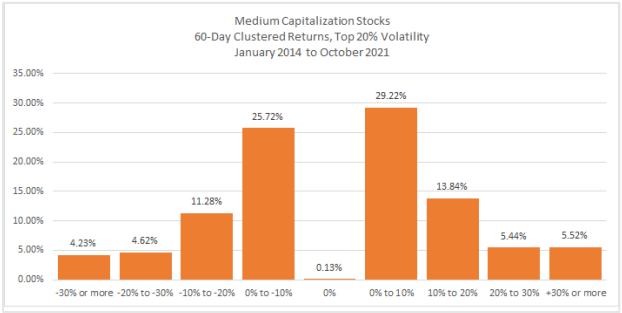


Exhibit 49

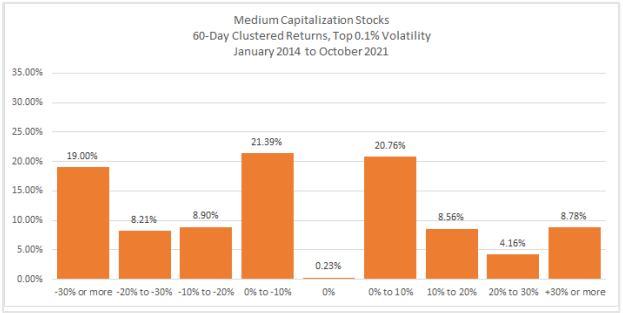


Exhibit 50

Large Cap, 3 Day

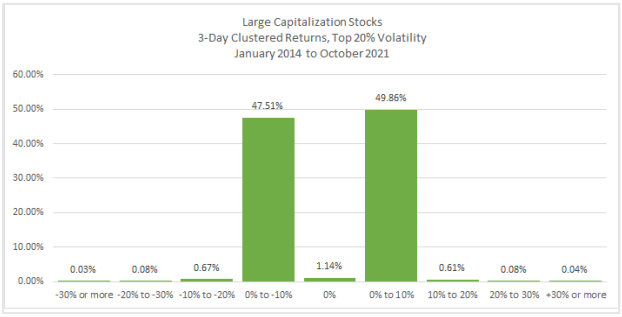


Exhibit 51

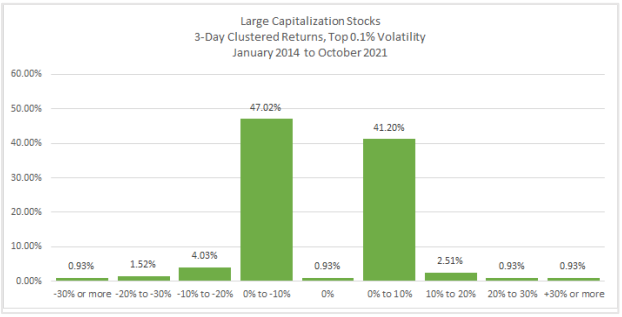
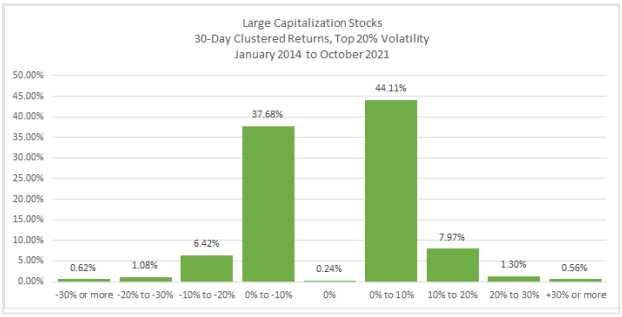


Exhibit 52

Large Cap, 30 Day



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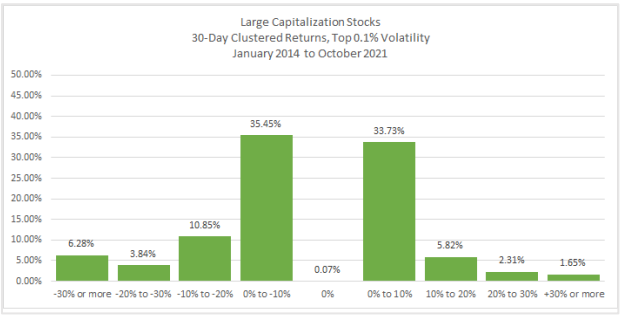

Exhibit 54

Large Cap, 60 Day

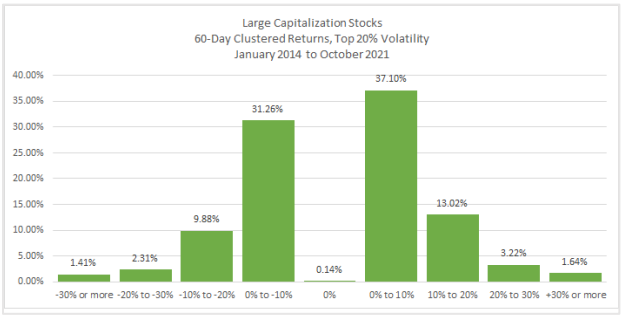

Exhibit 55

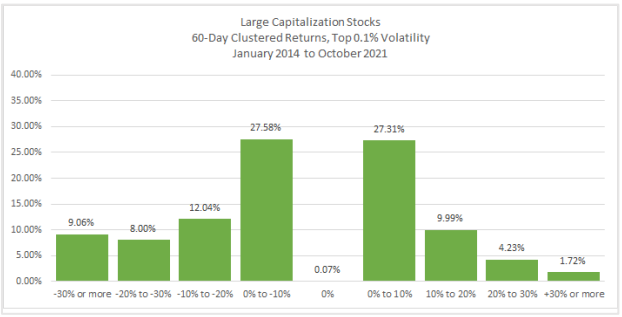

Exhibit 56

Analyzing the data, we notice commonalities between all capitalization tiers.

All 3-Day returns are primarily concentrated in the 0 to 10%, and 0 to -10% buckets (Exhibits 33, 34, 39, 40, 45, 46, 51, 52). This comes at little surprise since it is not common to find returns in excess of +/- 10% within a 3 day time horizon.

When time shifts from 3-Day returns to 30 and 60-Day returns, the data starts to shift left – indicating more negative returns. It is most prominent in the micro and small cap stocks (compare Exhibit 34 to 38, 40 to 44), but also viewed in the medium and large cap stocks (compare Exhibit 46 to 50, 52 to 56)

Higher securities lending volatility equates to more negative returns, especially when more time is factored in.

For instance, when we look at the Top 20% vs. Top 0.1% for small cap stocks in a 3-day timeframe (Exhibit 39 and 40) we see a shift in the data, going from the two pillars of data in the 0 to 10%, and 0 to -10% buckets (Exhibit 39) to where it starts to noticeably shift left (Exhibit 40) in becoming more negative.

If you were to sum up the total amount of securities that were negative (everything less than 0) in the Top 20%, 49.91% of the data is negative (Exhibit 39), but if you do the same for the Top 0.1%, then 58.72% of the data is negative (Exhibit 40).

In other words, Top 20% versus Top 0.1% thresholds resulted in 8% of the data becoming more negative. That is just within a 3-day timeframe. When we performed this same test but for longer durations of time lapsed, we find the results are greater.

If you were to sum up the total amount of securities that were negative in the 60-day period for small caps, 51.31% of the stocks are negative (Exhibit 43) in the Top 20%, whereas 73.98% of the stocks are negative (Exhibit 44) in the Top 0.1%. This is a 22.67% increase in negative stocks when we apply the higher volatility threshold filters.

If we were to flip this into a forward looking inference, then based on nearly 8 years of historically back tested data, if you have a small capitalization stock that appeared in the Top 0.1% of securities lending volatility, there is a 73.98% chance the stock will be negative within 60 days.

Further, not only will the stock price return be negative, but the mean and median annualized return is -58.95% and -60.26% (Exhibit 30), respectively.

So, for a small cap stock in the Top 0.1% threshold, you have almost a 3 out of 4 chance the stock will be negative, and the expected return will be less than -50% on average.

Conclusion

Utilizing our 3-Pronged test, we found ourselves asking three basic questions:

1. Does securities lending volatility equate to stock price volatility?
2. How does securities lending volatility relate to stock price returns?
3. How do stock price returns vary against volatility and time?

From our research, we were able to identify and answer each question.

From the 7 years and 10 months of data we back tested, we were able to confirm that yes, securities lending volatility equates to stock price volatility. Additionally, we were also able to confirm that stocks that appear in higher securities lending volatility thresholds equate to producing higher stock price volatility.

When we moved on to examining all securities in their respective capitalization tiers - we found that across all thresholds and time durations, stock returns became increasingly negative as volatility increases. Therefore, securities lending volatility is a direct indicator of negative stock price movement.

Lastly, we examined the distributions of these same returns, and the data further cemented the fact that higher securities lending volatility equates to more negative returns, especially when more time is factored in.

Therefore, out of conclusion of our analysis, we can definitively say securities lending volatility relates to downstream retail equity markets. Securities lending volatility signifies stock price volatility. Stocks that appear in the upper thresholds of securities lending volatility perform negatively. And stocks that portray higher volatility in the securities lending markets produce greater negative returns.

About the Author

Christopher Sappo is Managing Principal at Tidal Markets LLC. He holds a M.S. in Finance from Boston College and a B.S. in Management Information Systems from Rochester Institute of Technology. He specializes in systems and data analysis, concentrating on securities lending volatility.

About Tidal Markets LLC

Tidal Markets LLC is a data research firm focused on securities lending volatility. As a research practice, we amalgamate securities lending volatility data and study its correlation to stock market activity. Our research and data service offering enables hedge funds, asset managers, and equity traders with a unique perspective to interpret stock market volatility and its implications. Tidal Markets research is available on a request basis only, unless publicly disclosed at the discretion of the company. Tidal Markets also provides end-of-day and intraday data file offerings on a subscription basis. For more information, please contact info@tidalmarkets.com.