

Thresholds in Securities Lending Metrics

Threshold analysis of Markit Securities Finance metrics / September 2015

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Thresholds in Securities Lending Metrics

Over the years, academic evidence has suggested that securities with relatively high levels of short interest should underperform securities with low levels of short interest as short sellers who are typically informed traders target overvalued securities. In this research document, using different securities lending metrics available from Markit's Securities Finance, we identify metric thresholds in different regions beyond which a security becomes highly likely to underperform other securities in the following month.

For our analysis we have used four universes: *Markit US Large Cap (USLC)*, *Markit US Small Cap (USSC)*, *Markit Developed Europe (EUR)* and *Markit Developed Pacific (APAC)*. These universes along with historical constituents and their total returns are maintained by Markit Research Signals. We review a monthly sample for the period January 2007 - March 2015 to assess different thresholds for eight Markit Securities Finance metrics commonly used: *Utilization*, *Active Utilization*, *Indicative Fee*, *Demand Supply Ratio*, *Short Interest as % of Shares**, *Lendable Supply as % of Shares*, *Days to Cover**¹ and *DCBS*. As previously identified in our earlier research papers, we again find a significant coverage (more than 90%) for all our metrics across the four universes.

Threshold Analysis : Procedure

We implemented the following steps to identify thresholds for different Markit Securities Finance metrics:

- As the aim is to find thresholds beyond which a stock becomes highly likely to underperform, we start by defining *Relative Underperformance* - an event where one month forward total returns of the stock fall below the 25th percentile of the cross sectional one month forward universe total return.
- We created buckets for each of our metrics that remain fixed over the sample period. These buckets are created at time t and one month forward total returns are observed between t and $t+1$.
- We then accumulated the Relative Underperformance events over the sample period for each bucket and report them as % of total occurrence. This becomes our observed distribution for each bucket.
- We also know that the expected distribution of Relative Underperformance events for each bucket is 25% as 25% of the stocks will have return below the 25th percentile and 75% of the stocks will have return above the 25th percentile.
- Once we had our observed and the expected distribution of Relative Underperformance events for our buckets, we ran a Chi-Square test to check the differences of association between the buckets and a Relative Underperformance event. We checked for statistical significance at 5% and 1% alpha level i.e. 95% and 99% confidence interval.

¹ We used MSF proprietary Short Loan Quantity in order to calculate Short Interest as % of Shares and Days to Cover for our Developed Pacific and Developed Europe universe instead of Quantity on Loan as stock loans in Asia Pacific and Europe include dividend related borrowing around dividend months and not driven by short sentiment. Short Loan Quantity, on the other hand, removes dividend related borrowing by applying the proprietary algorithm.

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- We also reported the Cohort relative risk measure for each bucket which measures the % of a Relative Underperformance event in a particular bucket relative to all other buckets for the metric.

Threshold Analysis : Result Summary

In this section we present our findings on the threshold analysis of Markit Securities Finance metrics.

Metrics associated with stock borrow relative to lendable supply

Active Utilization

Active Utilization measures the percentage of shares lent by custodians relative to the amount held by them in their lendable inventory pool. It uses Markit Securities Finance algorithm to remove certain buffers that custodian lenders might have in place to give a more realistic picture of the lendable supply. A relatively high Active Utilization reflects negative sentiment towards a stock. Active Utilization threshold statistics are presented in Table 1 below.

Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk
<= 10%	64,013	23.0%	0.83	74,739	21.5%	0.81	59,031	23.3%	0.87	98,544	22.8%	0.83
> 10% & <= 20%	18,262	25.2%	1.01	43,963	23.3%	0.92	21,154	24.6%	0.98	22,602	24.7%	0.99
> 20% & <= 30%	9,708	27.6%	1.11	25,252	24.9%	1.00	11,231	25.2%	1.00	12,093	26.4%	1.06
> 30% & <= 40%	5,693	28.5%	1.15	16,642	25.6%	1.04	6,943	26.7%	1.07	7,682	27.0%	1.08
> 40% & <= 50%	3,490	28.6%	1.15	10,982	27.0%	1.09	4,410	25.6%	1.02	5,140	28.7%	1.15
> 50% & <= 60%	2,186	32.3%	1.30	6,778	28.3%	1.15	3,031	27.5%	1.10	4,121	29.5%	1.19
> 60% & <= 70%	1,137	32.5%	1.31	4,454	31.0%	1.25	2,217	28.0%	1.12	3,431	30.0%	1.21
> 70% & <= 80%	789	37.8%	1.52	3,752	33.3%	1.35	1,746	30.2%	1.21	3,296	30.5%	1.23
> 80% & <= 90%	986	36.6%	1.47	4,536	35.6%	1.45	1,685	33.1%	1.33	3,300	32.0%	1.29
> 90% & <= 100%	1,587	35.7%	1.44	13,255	35.7%	1.48	10,844	30.9%	1.26	28,967	28.3%	1.16

Table 1: Active Utilization statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval

We divided the Active Utilization metric in 10 buckets. Buckets where the percentage of Relative Underperformance events are less than 25% are less likely than expectation/chance to have Relative Underperformance. For USLC, stocks in the bucket >70% & <=80% are most likely to have a Relative Underperformance event in the following month as 37.8% (compared to the expected 25%) of the total 789 occurrences over the sample period had a Relative Underperformance. Stocks in this bucket are also 1.52 times more likely than other stocks to have a Relative Underperformance event as measured by the Cohort relative risk. The results in this bucket are statistically significant at the 1% alpha level (blue font). For USSC, bucket >90% & <=100% is most likely to have a Relative Underperformance event with 35.7% of the occurrences having a Relative Underperformance. For EUR and APAC, bucket >80% & <=90% had the highest percentage of Relative Underperformance events.

Demand Supply Ratio

Demand Supply Ratio (DSR) measures the aggregate amount of stock borrowed in the market reported by both custodian agents and brokers (net of double counting) relative to the lendable inventory. This metric is not directly available to Markit Securities Finance clients but can be easily calculated by dividing total loans by lendable inventory. It is different from Active Utilization as this metric not only includes the stock lent by custodians but also the amount borrowed reported by prime brokers thereby giving a complete picture of the

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stock borrow demand. A relatively high DSR implies negative sentiment towards a stock. DSR threshold statistics are presented in Table 2 below .

Universe	USLC			USSC			EUR			APAC		
	% of Rel			% of Rel			% of Rel			% of Rel		
	Total Occurrence	Under Perf. Events	Cohort Relative Risk	Total Occurrence	Under Perf. Events	Cohort Relative Risk	Total Occurrence	Under Perf. Events	Cohort Relative Risk	Total Occurrence	Under Perf. Events	Cohort Relative Risk
<= 0.1	57,114	22.8%	0.83	61,985	21.5%	0.81	50,540	23.4%	0.89	81,401	22.1%	0.81
> 0.1 & <= 0.2	19,424	25.2%	1.01	45,320	23.1%	0.91	22,560	24.5%	0.98	30,978	24.8%	1.00
> 0.2 & <= 0.3	10,805	25.8%	1.04	26,835	24.1%	0.96	12,755	25.6%	1.03	17,271	26.0%	1.05
> 0.3 & <= 0.4	6,681	28.5%	1.15	18,304	25.4%	1.02	8,014	25.8%	1.04	11,376	26.8%	1.08
> 0.4 & <= 0.5	4,233	27.9%	1.12	13,181	26.3%	1.06	5,595	26.1%	1.05	7,845	27.5%	1.11
> 0.5 & <= 0.6	2,830	30.1%	1.21	9,398	28.2%	1.14	4,158	25.9%	1.04	5,750	28.2%	1.13
> 0.6 & <= 0.7	1,998	30.6%	1.23	7,370	29.6%	1.20	2,987	26.3%	1.06	4,458	28.8%	1.16
> 0.7 & <= 0.8	1,334	34.8%	1.40	5,345	31.8%	1.29	2,340	29.1%	1.17	3,634	30.1%	1.21
> 0.8 & <= 0.9	972	36.2%	1.45	4,319	33.2%	1.34	1,689	29.0%	1.17	2,771	30.1%	1.21
> 0.9 & <= 1	677	38.8%	1.56	3,435	35.2%	1.43	1,379	31.6%	1.27	2,182	31.6%	1.27
> 1	1,574	36.0%	1.45	8,045	38.5%	1.58	4,683	32.1%	1.30	10,140	34.0%	1.39

Table 2: Demand Supply Ratio statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval

The DSR metric is divided into 11 buckets. We get a better monotonic distribution of Relative Underperformance events and also a higher percentage of Relative Underperformance in the highest bucket with DSR when compared to Active Utilization. For USLC, stocks in the bucket >0.9 & <=1 are most likely to have a Relative Underperformance event with 38.8% of the occurrences having a Relative Underperformance in the following month. For USSC, EUR and APAC stocks in the bucket >1 are most likely to have a Relative Underperformance event, with 38.5%, 32.1% and 34% of the occurrences having a Relative Underperformance and a relative risk of 1.58, 1.30 and 1.39 (statistically significant at 1% alpha level) respectively.

Metrics associated with cost to borrow

DCBS

DCBS is Markit Daily Cost of Borrow Score; which is a score between 1 and 10 indicating the cost to borrow the security in the securities lending market, where 1 represents a general collateral stock and 10 represents a special stock. The DCBS score is based on the Markit Securities Finance proprietary Benchmark Fee². Threshold statistics for DCBS are presented in Table 3 below .

² Benchmark Fee gives an indication of the fee charged in the wholesale market by custodian banks for lending a stock to the prime brokers. It uses a proprietary algorithm that removes certain transactions and is weighted by loan value and time.

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Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk
1	103,096	24.6%	0.71	176,415	23.4%	0.68	82,617	23.5%	0.82	106,623	23.0%	0.82
2	1,891	31.2%	1.25	9,215	31.0%	1.26	14,690	26.3%	1.06	24,371	24.9%	1.00
3	1,076	34.4%	1.38	5,828	31.8%	1.29	7,762	27.4%	1.11	20,248	27.2%	1.10
4	621	33.3%	1.34	3,980	35.6%	1.44	6,783	31.1%	1.27	18,131	30.2%	1.24
5	307	37.5%	1.50	2,338	36.0%	1.46	2,511	30.7%	1.24	5,907	33.1%	1.34
6	226	41.2%	1.65	1,773	37.1%	1.50	1,136	32.2%	1.30	1,444	37.5%	1.51
7	205	45.9%	1.84	1,594	41.5%	1.68	607	39.2%	1.58	537	34.5%	1.38
8	223	44.4%	1.78	814	41.5%	1.67	342	47.4%	1.90			
9				857	42.1%	1.70						
10				817	48.2%	1.95						

Table 3 DCBS statistics, Jan 2007 –Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval. Last bucket in USLC and EUR includes DCBS 8, 9 and 10 and in APAC includes 7, 8, 9 and 10

We see a monotonic pattern across all our universes where stocks in higher DCBS buckets are more likely to have a Relative Underperformance event in comparison to the lower buckets. The results are statistically significant at the 1% alpha level for almost all the buckets and universes. For USSC, we see that 48.2% of the occurrences were Relative Underperformances in DCBS bucket 10. Stocks in this bucket are also 1.95 times more likely than other stocks to have a Relative Underperformance. For other universes as well we see a high percentage of Relative Underperformance events in higher DCBS buckets. Please note that we had to combine some of the higher DCBS buckets in other universes due to lack of occurrences over the sample period.

Indicative Fee

Indicative Fee measures the cost of borrowing a stock and gives an indication of the fee charged by Prime Brokers from the buy-side participants to lend the stock. Indicative fee is derived using Markit Securities Finance proprietary algorithm that adds a spread to its Benchmark Fee³. Indicative Fee is available in the Markit Securities Finance Buyside Analytics Feed, Excel Add-in and Web Platform. A relatively high Indicative Fee implies high borrow demand or low lendable inventory for the stock. Indicative Fee threshold statistics are presented in Table 4 below.

Stocks in our USLC and USSC universes are less likely to have Relative Underperformance in comparison to expectation/chance and other stocks as long as the Indicative Fee is less than or equal to 50 basis points (% Relative Underperformance < 25%). Beyond this threshold, the likelihood of a Relative Underperformance event rises monotonically. In EUR, this threshold extends to 87.5 basis points and 162.5 basis points in APAC. However, in APAC there is an exception in the bucket $\leq 0.250\%$ where we see 27.5% of the total 867 occurrence in the Relative Underperformance category.

³ The spread added to Benchmark Fee is based on a statistical model and also uses the fee paid by buy-side participants to borrow the stock from their Prime Brokers.

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In all our universes, the most expensive bucket has the highest likelihood of a Relative Underperformance event and is statistically significant at the 1% alpha level. Comparing the Indicative Fee thresholds with DCBS, we get a slightly lower percentage of Relative Underperformance events in the higher buckets. However, the results using Indicative Fee are more powerful as you get more occurrences in the higher buckets and much higher Chi-Square values when compared to DCBS. The thresholds are also more granular as we have more buckets with Indicative Fee.

Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk
<= 0.250%	8,599	24.0%	0.96	11,331	22.8%	0.91	381	21.8%	0.87	867	27.5%	1.10
> 0.250% & <= 0.375%	79,918	24.4%	0.91	122,380	22.5%	0.79	24,615	23.4%	0.92	12,109	21.8%	0.87
> 0.375% & <= 0.500%	11,828	24.9%	1.00	31,519	25.0%	1.01	33,915	23.0%	0.89	50,861	22.7%	0.88
> 0.500% & <= 0.875%	2,717	30.1%	1.21	11,046	29.5%	1.20	23,374	24.3%	0.97	42,203	23.6%	0.93
> 0.875% & <= 1.250%	709	31.2%	1.25	3,092	31.0%	1.25	6,009	25.9%	1.04	9,861	24.1%	0.96
> 1.250% & <= 1.625%	466	33.9%	1.36	2,457	31.5%	1.27	5,423	26.1%	1.05	8,756	24.8%	0.99
> 1.625% & <= 2.000%	501	29.3%	1.17	2,493	30.6%	1.24	2,213	28.0%	1.12	3,632	26.9%	1.08
> 2.000% & <= 3.500%	941	31.9%	1.28	5,007	31.0%	1.25	6,214	26.4%	1.06	13,995	26.3%	1.06
> 3.500% & <= 5.000%	544	36.2%	1.45	3,029	33.8%	1.37	4,647	29.6%	1.19	13,515	28.1%	1.14
> 5.000% & <= 8.000%	616	34.1%	1.37	4,236	35.7%	1.45	6,905	30.8%	1.25	17,263	31.2%	1.28
> 8.000% & <= 15.000%	806	43.1%	1.73	3,814	37.6%	1.53	2,247	34.1%	1.38	4,199	35.5%	1.44
> 15.000% & <= 25.000%				1,716	41.7%	1.69	505	46.1%	1.86			
> 25.000%				1,511	46.1%	1.87						

Table 4: Indicative Fee statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval. Last bucket in USLC and APAC is > 8%, in USSC is > 25% and in EUR is > 15%

Metrics associated with stock borrow relative to market data

Short Interest as % of Shares Outstanding

Short Interest as % of Shares Outstanding (SI) measures the total quantity of stock borrowed in the market relative to total shares outstanding. A relatively high SI implies negative sentiment towards a stock. SI threshold statistics are presented in Table 5 below.

Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk
<= 5%	80,233	23.7%	0.83	126,836	23.5%	0.87	101,664	24.6%	0.87	170,319	24.7%	0.78
> 5% & <= 10%	16,509	27.2%	1.11	40,566	25.9%	1.05	10,641	27.3%	1.10	6,077	31.1%	1.26
> 10% & <= 15%	6,005	29.8%	1.20	18,398	27.4%	1.11	2,183	31.2%	1.25	1,026	33.5%	1.34
> 15% & <= 20%	2,663	32.6%	1.31	8,960	29.4%	1.19	582	35.1%	1.40	290	38.6%	1.55
> 20% & <= 25%	1,207	32.0%	1.28	4,311	29.0%	1.17	290	33.4%	1.34			
> 25% & <= 30%	758	35.1%	1.41	2,048	29.6%	1.19						
> 30% & <= 35%				936	32.8%	1.32						
> 35%				735	33.2%	1.34						

Table 5: Short Interest as % of Shares Outstanding statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval. Last bucket in USLC is > 25%, in USSC is > 35%, in EUR is > 20% and in APAC is > 13%.

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In all our universes except EUR, we get the highest percentage of Relative Underperformance events in the highest SI bucket. For both USLC and USSC, it is better to use the DSR (stock borrow relative to lendable supply) thresholds as we get a higher % of Relative Underperformance events and also more occurrences in the higher buckets. For EUR and APAC, using the higher SI buckets gives a better hit rate in terms of Relative Underperformance events but the number of occurrences is much higher for DSR.

Days to Cover

Days to Cover (DTC) measures the number of days it would take to buy back the shares borrowed based on the average volume traded in the last 30 trading days. DTC threshold statistics are presented in Table 6 below. For USSC, we get a monotonic pattern as higher DTC buckets are more likely to experience a Relative Underperformance event than lower DTC buckets. For other universes, there is no systematic pattern in the buckets and the results are also not statistically significant at both 5% and 1% alpha level.

Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk
<= 5	78,343	24.5%	0.93	88,797	24.5%	0.98	62,167	25.1%	1.01	138,176	24.9%	0.98
> 5 & <= 10	17,186	26.3%	1.06	56,775	24.9%	1.00	26,601	24.8%	0.99	23,356	24.8%	0.99
> 10 & <= 15	6,049	27.2%	1.09	27,479	24.6%	0.99	11,975	24.8%	0.99	8,207	25.6%	1.03
> 15 & <= 20	2,401	26.8%	1.08	13,308	25.3%	1.02	5,883	24.5%	0.98	3,567	26.8%	1.08
> 20 & <= 25	1,219	24.6%	0.98	6,645	24.7%	0.99	3,342	24.4%	0.98	1,653	26.1%	1.05
> 25 & <= 30	656	27.6%	1.11	3,484	25.2%	1.01	1,813	25.9%	1.03	877	23.8%	0.95
> 30 & <= 35	421	24.7%	0.99	1,977	26.8%	1.08	1,066	27.3%	1.09	453	32.2%	1.29
> 35 & <= 40	252	25.4%	1.02	1,126	27.7%	1.12	588	26.4%	1.05	295	26.4%	1.06
> 40 & <= 45	150	28.0%	1.12	643	31.1%	1.25	397	22.2%	0.89	183	30.6%	1.23
> 45	499	23.2%	0.93	1,670	30.5%	1.23	1,112	27.1%	1.08	439	26.2%	1.05

Table 6: Days to Cover statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval

Combining different metrics

Indicative Fee Overlay on Demand Supply Ratio

In this section, we overlaid our DSR buckets with Indicative Fee by filtering out stocks with a fee greater than 500 bps. This overlay is useful for long-short managers as stocks with a high borrow demand from short sellers generally attract high fees and it may not be profitable to short them. We want to see whether our higher DSR buckets are still statistically significant in terms of having Relative Underperformance events even after removing expensive names.

We see a similar pattern in Table 7 below even after removing expensive stocks in all our universes except EUR where bucket >0.9 & <=1 sees the highest % of Relative Underperformance events (29.2%) compared to the >1 bucket earlier. We also note that the % of Relative Underperformance events for high DSR buckets have reduced in comparison to the un-filtered universes but are still statistically significant. We do not see much change in the lower DSR buckets. This shows that DSR can be used in predicting a Relative Underperformance event even after avoiding expensive names.

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Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk	Total Occurrence	% of Rel Under Perf. Events	Cohort Relative Risk
DSR Buckets: Stocks > 500 bps excluded												
<= 0.1	57,083	22.8%	0.84	61,680	21.4%	0.85	45,982	22.9%	0.90	75,310	21.8%	0.84
> 0.1 & <= 0.2	19,411	25.2%	1.02	45,092	23.0%	0.95	21,772	24.3%	1.00	28,954	24.5%	1.03
> 0.2 & <= 0.3	10,798	25.9%	1.05	26,573	24.0%	1.00	12,216	25.3%	1.05	15,880	25.4%	1.07
> 0.3 & <= 0.4	6,677	28.5%	1.16	18,039	25.3%	1.06	7,629	25.4%	1.05	10,117	25.9%	1.09
> 0.4 & <= 0.5	4,216	27.9%	1.13	12,814	26.2%	1.09	5,279	25.7%	1.06	6,730	26.6%	1.11
> 0.5 & <= 0.6	2,797	30.1%	1.22	8,868	27.7%	1.16	3,864	25.3%	1.04	4,708	26.7%	1.12
> 0.6 & <= 0.7	1,936	30.4%	1.23	6,582	28.7%	1.20	2,722	25.8%	1.06	3,533	27.5%	1.15
> 0.7 & <= 0.8	1,208	34.1%	1.38	4,373	30.2%	1.26	2,073	28.0%	1.16	2,667	28.5%	1.19
> 0.8 & <= 0.9	789	35.2%	1.42	3,089	30.9%	1.29	1,383	27.8%	1.15	1,975	27.3%	1.14
> 0.9 & <= 1	461	37.1%	1.50	2,010	32.2%	1.34	1,091	29.2%	1.21	1,429	29.5%	1.23
> 1	846	32.9%	1.33	3,208	34.6%	1.45	3,085	27.3%	1.13	5,323	30.4%	1.28

Table 7. Demand Supply Ratio, Indicative Fee overlay statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. 0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval

Ranking the metrics

In this section, we present the top four Markit Securities Finance metrics. We do this by first finding out the best bucket from each metric for our four universes i.e. the one that gives the highest % of Relative Underperformance events. Then we take the best buckets identified above and rank them based on percentage of Relative Underperformance events in the following month (higher is better), average annual excess return (lower is better) and Chi-Square values obtained from our tests (higher is better). This gives us the best metrics within each universe which are presented in Table 8 below.

Universe	USLC		USSC		EUR		APAC	
	Metric	Best Bucket	Metric	Best Bucket	Metric	Best Bucket	Metric	Best Bucket
Rank 1	Indicative Fee	> 8%	Indicative Fee	> 25%	Indicative Fee	> 15%	DCBS	6
Rank 2	DCBS	7	DCBS	10	DCBS	8,9,10	Short Interest	> 15%
Rank 3	Utilization	> 70% & <= 80%	Utilization	> 90% & <= 100%	Utilization	> 80% & <= 90%	Indicative Fee	> 8%
Rank 4	DSR	> 0.9 & <= 1	Active Utilization	> 90% & <= 100%	DSR	> 1	DSR	> 1

Table 8. Top 4 Markit Securities Finance metrics, Jan 2007 – Mar 2015

The top four metrics identified in USLC, USSC and EUR are almost identical with Indicative Fee being the best metric in all three universes and DCBS taking the second place. Utilization and DSR takes the third and the fourth spots respectively in USLC and EUR and share the third place in USSC where Active Utilization is the fourth best ranked metric. In APAC, DCBS is the best metric with bucket 6 that gives the best combination of high percentage of Relative Underperformances, low average annual excess return and high Chi-Square values. Short Interest as % of Shares Outstanding, Indicative Fee and DSR takes the second, third and fourth spots respectively.

Real World Application

In this section, we look at whether we can successfully implement the thresholds identified above in an investment strategy. We focus on DSR and Indicative Fee and analyse the average annual excess return in the higher buckets of both the metrics to determine whether stocks in these buckets should be avoided or underweighted by a long-only fund manager and whether these can also be successfully shorted by a fund manager taking short positions. DSR performance statistics are presented in Table 9 below.

Universe	USLC		USSC		EUR		APAC	
DSR Buckets	Average Annual Excess Return	Average Annual Fee	Average Annual Excess Return	Average Annual Fee	Average Annual Excess Return	Average Annual Fee	Average Annual Excess Return	Average Annual Fee
<= 0.1	0.71%	0.39%	6.19%	0.52%	1.26%	1.63%	2.24%	1.59%
> 0.1 & <= 0.2	0.59%	0.40%	2.71%	0.49%	0.45%	1.06%	0.09%	1.47%
> 0.2 & <= 0.3	0.06%	0.41%	1.20%	0.63%	-0.98%	1.15%	-0.32%	1.68%
> 0.3 & <= 0.4	-2.05%	0.43%	-0.51%	0.79%	-0.98%	1.34%	0.33%	1.95%
> 0.4 & <= 0.5	0.51%	0.52%	-2.01%	1.10%	-2.26%	1.48%	-2.07%	2.34%
> 0.5 & <= 0.6	-5.95%	0.75%	-2.51%	1.53%	1.57%	1.69%	-1.32%	2.76%
> 0.6 & <= 0.7	3.76%	1.03%	-5.53%	2.49%	-3.00%	2.02%	-6.01%	3.09%
> 0.7 & <= 0.8	0.63%	1.88%	-13.86%	3.95%	-4.68%	2.54%	-6.63%	3.63%
> 0.8 & <= 0.9	-5.88%	3.30%	-4.93%	5.65%	-7.81%	3.50%	-4.19%	4.04%
> 0.9 & <= 1	-9.47%	5.35%	-9.54%	8.31%	-9.12%	4.03%	-5.07%	4.45%
> 1	-9.33%	9.03%	-18.62%	12.83%	-13.64%	6.21%	-11.58%	5.42%

Table 9 Demand Supply Ratio, Bucket performance statistics, Jan 2007 – Mar 2015. Average annual return < 0% signifies profitable bucket for underweighting stocks. 0.00% signifies profitable bucket for shorting stocks after incorporating shorting fees.

We present the average annual excess returns and average annual Indicative Fee (as a measure of shorting costs) for all the DSR buckets in our four universes. We focus our analysis on stocks with DSR > 0.5 and see whether they can be successfully underweighted i.e. *negative average annual excess return* and whether they can be successfully shorted i.e. *absolute value of negative average annual excess return > average annual fee*.

In USSC and APAC, stocks in DSR buckets >0.5 & <=0.6 and above can be underweighted as the average annual excess returns are negative for all the six buckets. In USSC, all the buckets except >0.8 & <=0.9 can be shorted as stocks in this bucket give an excess return of -4.93% on an annual basis but the fee for shorting stocks in this bucket is 5.65% on an annual basis. In APAC, all the buckets except >0.5 & <=0.6 are profitable for shorting. In USLC, all the buckets (as seen in the highlighted region) are profitable for both short sellers and long-only managers except stocks in bucket >0.6 & <=0.7 and >0.7 & <=0.8. In EUR, stocks beyond DSR > 0.6 are profitable to underweight and short.

Next, we focus on the performance statistics of Indicative Fee which are presented in Table 10. For USLC and USSC, stocks in all the buckets in the highlighted region can be underweighted by long-only managers. For USSC, all the buckets are also profitable to the short sellers (bold font) as the average annual fee is lower than the absolute value of the average annual excess returns. For EUR, the last 4 buckets are profitable for both long-only managers and short sellers. Another interesting point to note here is that the most expensive bucket in each region has the biggest gross and net annual excess returns implying that most expensive to borrow names can be profitably short sold. Also, the net alpha in the highest bucket is much higher than what we get in the highest DSR bucket for all our universes except APAC.

Thresholds in Securities Lending Metrics

Universe	USLC		USSC		EUR		APAC	
	Average Annual Excess Return	Average Annual Fee	Average Annual Excess Return	Average Annual Fee	Average Annual Excess Return	Average Annual Fee	Average Annual Excess Return	Average Annual Fee
<= 0.250%	-0.26%	0.25%	10.08%	0.25%	17.14%	0.25%	12.18%	0.25%
> 0.250% & <= 0.375%	0.18%	0.37%	3.53%	0.37%	1.07%	0.37%	1.00%	0.37%
> 0.375% & <= 0.500%	2.63%	0.50%	2.21%	0.50%	1.86%	0.50%	0.05%	0.50%
> 0.500% & <= 0.875%	3.89%	0.70%	-0.51%	0.71%	3.13%	0.69%	1.44%	0.68%
> 0.875% & <= 1.250%	-10.08%	1.10%	-4.15%	1.11%	-0.41%	1.09%	2.42%	1.09%
> 1.250% & <= 1.625%	-0.72%	1.50%	0.84%	1.50%	0.11%	1.52%	0.51%	1.53%
> 1.625% & <= 2.000%	-4.54%	1.86%	-12.19%	1.87%	0.08%	1.87%	-1.78%	1.86%
> 2.000% & <= 3.500%	-0.08%	2.97%	-3.87%	2.97%	1.13%	2.98%	2.41%	3.03%
> 3.500% & <= 5.000%	-7.70%	4.46%	-12.41%	4.47%	-7.34%	4.53%	3.34%	4.51%
> 5.000% & <= 8.000%	-1.01%	6.99%	-15.33%	7.05%	-9.29%	7.04%	-5.14%	6.99%
> 8.000% & <= 15.000%	-24.49%	18.49%	-21.57%	11.29%	-16.09%	11.17%	-16.29%	11.01%
> 15.000% & <= 25.000%			-32.25%	20.46%	-39.07%	27.19%		
> 25.000%			-60.37%	43.88%				

Table 10: Indicative Fee, Bucket performance statistics, Jan 2007 – Mar 2015. Average annual return < 0% signifies profitable bucket for underweighting stocks. 0.00% signifies profitable bucket for shorting stocks after incorporating shorting fees.

Summary

This research identifies a unique way of using MarKit Securities Finance metrics. These metrics can be used by fund managers to predict Relative Underperformance events and depending upon the characteristics of their fund can put up alerts in their stock selection process to avoid, underweight or even short sell stocks when a stock crosses a particular metric threshold. We looked at several securities lending metrics and found that generally stocks in higher buckets are more likely to have Relative Underperformance events as compared to the stocks in lower buckets as stocks in higher buckets have more negative sentiment than the lower buckets. We also used Indicative Fee as an overlay on the Demand Supply Ratio buckets to avoid stocks that are expensive to short and found that the likelihood of a Relative Underperformance event reduced in higher buckets. However, the results were still statistically significant at the 1% alpha level. We also identified Indicative Fee, DCBS, Demand Supply Ratio and Utilization as the best and the most consistent metrics across our universes to have high percentage of Relative Underperformance events and low average annual excess returns in the following month.

We applied our threshold analysis in a real world simulation and found that stocks in the higher Demand Supply Ratio and Indicative Fee buckets have underperformed their respective universe over the sample period. These stocks can either be avoided or underweighted by long-only managers. We also found that significant net alpha remains for short sellers even after accounting for borrowing costs using MarKit Securities Finance Indicative Fee metric.

Appendix

Utilization

Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel		Total Occurrence	% of Rel		Total Occurrence	% of Rel		Total Occurrence	% of Rel	
Under Perf. Events		Cohort Relative Risk	Under Perf. Events		Cohort Relative Risk	Under Perf. Events		Cohort Relative Risk	Under Perf. Events		Cohort Relative Risk	
Utilization Buckets												
<= 10%	64,207	23.1%	0.83	75,849	21.6%	0.81	68,389	23.8%	0.90	117,364	23.2%	0.83
> 10% & <= 20%	18,354	25.2%	1.01	44,691	23.4%	0.93	22,132	25.0%	1.00	27,219	25.6%	1.03
> 20% & <= 30%	9,751	27.5%	1.11	26,258	25.1%	1.01	11,703	25.8%	1.03	14,878	27.4%	1.11
> 30% & <= 40%	5,801	28.5%	1.15	17,870	26.1%	1.06	7,234	26.9%	1.08	9,446	28.6%	1.15
> 40% & <= 50%	3,628	28.7%	1.16	12,607	27.8%	1.13	4,554	26.7%	1.07	6,433	30.2%	1.22
> 50% & <= 60%	2,499	33.1%	1.33	8,932	30.2%	1.23	3,076	29.6%	1.19	4,881	29.8%	1.20
> 60% & <= 70%	1,664	35.6%	1.43	6,908	32.6%	1.33	2,295	30.0%	1.20	3,695	31.7%	1.28
> 70% & <= 80%	1,109	37.9%	1.52	5,738	36.7%	1.50	1,637	33.8%	1.36	2,798	32.9%	1.32
> 80% & <= 90%	628	37.4%	1.50	3,903	37.2%	1.51	954	38.9%	1.56	1,817	33.8%	1.36
> 90% & <= 100%	210	33.8%	1.35	1,597	40.0%	1.62	318	34.3%	1.37	645	32.9%	1.32

Table 11: Utilization statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. *0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval*

Lendable Supply as % of Shares Outstanding

Universe	USLC			USSC			EUR			APAC		
	Total Occurrence	% of Rel		Total Occurrence	% of Rel		Total Occurrence	% of Rel		Total Occurrence	% of Rel	
Under Perf. Events		Cohort Relative Risk	Under Perf. Events		Cohort Relative Risk	Under Perf. Events		Cohort Relative Risk	Under Perf. Events		Cohort Relative Risk	
Lendable Supply as % of Shares Outstanding Buckets												
<= 5%	4,904	26.2%	1.05	15,949	27.2%	1.11	33,339	27.0%	1.10	91,351	26.2%	1.10
> 5% & <= 10%	4,185	30.7%	1.24	20,818	28.6%	1.18	23,917	26.0%	1.05	59,457	24.3%	0.96
> 10% & <= 15%	5,175	27.2%	1.09	26,413	26.8%	1.09	19,311	25.2%	1.00	26,128	22.9%	0.90
> 15% & <= 20%	12,857	24.9%	1.00	28,591	25.8%	1.05	16,378	24.1%	0.95	8,716	23.3%	0.93
> 20% & <= 25%	26,009	23.2%	0.91	29,150	24.5%	0.98	14,486	22.9%	0.90	2,212	23.0%	0.92
> 25% & <= 30%	29,311	24.5%	0.97	29,166	23.1%	0.92	9,888	22.0%	0.87	761	28.8%	1.15
> 30% & <= 35%	17,164	25.0%	1.00	26,350	21.7%	0.86	2,846	24.3%	0.97			
> 35% & <= 40%	5,481	27.0%	1.09	16,016	22.6%	0.90	470	23.6%	0.94			
> 40% & <= 45%	1,676	28.9%	1.16	7,196	22.5%	0.90	342	24.0%	0.95			
> 45%	706	30.3%	1.21	3,567	23.1%	0.93						

Table 12: Lendable Supply as % of Shares Outstanding statistics, Jan 2007 – Mar 2015. Cohort relative risk > 1 signifies stocks in the bucket are more likely to have a Relative Underperformance than other stocks and Cohort relative risk < 1 signifies stocks in the bucket are less likely to have a Relative Underperformance than other stocks. *0.00 fonts in the Cohort relative risk column signifies statistical significance at 99% confidence interval, 0.00 fonts signifies statistical significance at 95% confidence interval, 0.00 fonts signifies no statistical significance at either 99% or 95% confidence interval. Last bucket in EUR is > 40% and in APAC is > 25%.*