Effect of news on stocks' liquidity

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Abstract

The aim of the current paper was to investigate the effect of news on liquidity of publicly traded stocks. We implemented our research on FTSE 100 twenty most traded and ten least traded stocks in order to have representative yet manageable dataset. Our trading database consisted of trading information of year 2013 per minute combined from London Stock Exchange and other multilateral trading facilities. Our news database consisted of Thompson Reuters news with their proprietary sentiment analysis indicator. We found that the trading activity increases when the news are released independently of the news sentiment. Specifically, quote count, trade count, volume and executed trades ratio all increase.

1 Introduction

Liquidity There is no clear definition of liquidity but generally it is seen as a market's ability to facilitate the purchase or sale of an asset without causing drastic change in the asset's price[4]. As per definition, this is something difficult to quantify. There are several proxies, that measure liquidity, such as number of participants, frequency of trades, bid-ask spread, trade size, number of trades, trading volume, turnover rate, volatility of turnover, Hui-Heubel liquidity ratio, market efficiency coefficient and others[2].

Importance Liquidity is important for market participants because it translates into costs in either time or money. For instance, if a dealer wants to sell a certain amount of shares and cannot do it at the asked price, then he will have to wait for the market price to change or decrease the ask price. Being able to understand the dynamics of liquidity and eventually predict it's behavior can reduce costs.

News News about financial instruments influence the opinions of market participants about the fair prices. This creates buying and selling pressure and thus also has an influence on the liquidity of financial instruments. For example, if very negative news is published about a certain company then very strong selling pressure reduces liquidity of that stock.

Research objective The aim of the current paper was to investigate the effect of news on liquidity of publicly traded stocks. We wanted to research a range of liquidity indicators, check if they were influenced by news. Additionally the news were grouped by sentiment type. In case of observing any statistically significant effect, we were interested if the indicator increases or decreases. Our null hypothesis was that none of the liquidity indicators that we investigated would be affected by the release of news.

2 Methodology

Environment All the data manipulation and analysis was executed with Python 3.4.1 [3] and Pandas 0.16.1 [1]. Very useful was also package called Shelve which allowed saving and restoring the intermediate phases of the research. This saved time while running very lengthy processes of reading in the base data and pre-processing it.

Databases Our research is based on two databases. Trading database consisted of one minute trading data of FTSE100 constituents. News database was created by Thompson Reuters' feed where the important fields were the sentiment indicator and the relevance indicator. Both fields are calculated by using proprietary algorithm. For our research, we chose twenty most traded and ten least traded stocks. We used average daily volume to make the selection.

Pre-processing For our research, we only had the data available from the year 2013. We looked at the first occurrence of any news item which had more than 25% relevance for the specific stock. From the trading information, we included data from London Stock Exchange as well as from other multilateral trading facilities such as Chi-X. When linking news and trading data, we used the trading information from five minutes before the news was published until 30 minutes after it. Baseline values and correlations between different time lags were calculated over the whole year. After filtering, we were left with 19047 news items (Table 1).

Ticker	Name	Group	Average daily volume	Negative news	Neutral news	Positive news
AAL.L	ANGLO AMERICAN	Top 20	5230910.0	260	126	206
ARM.L	ARM HLDGS.	Top 20	4197890.0	79	15	216
AZN.L	ASTRAZENECA	Top 20	2352480.0	132	71	175
BARC.L	BARCLAYS	Top 20	40793300.0	497	781	1385
BATS.L	BR.AMER.TOB.	Top 20	2582700.0	44	41	91
BLT.L	BHP BILLITON	Top 20	8391920.0	168	56	146
BNZL.L	BUNZL	Bottom 10	602810.0	15	5	93
BRBY.L	BURBERRY GRP	Bottom 10	201321.0	57	28	120
CCH.L	COCACOLA HBC AG	Bottom 10	543613.0	18	3	9
DGE.L	DIAGEO	Top 20	3992300.0	52	38	225
GFS.L	G4S	Bottom 10	4051620.0	148	79	67
GLEN.L	GLENCORE	Top 20	29885400.0	301	396	2563
GSK.L	GLAXOSMITHKLINE	Top 20	8736710.0	370	156	404
HSBA.L	HSBC HLDGS.UK	Top 20	23187300.0	882	924	733
III.L	3I GRP.	Bottom 10	1596267.0	25	21	124
IMT.L	IMP.TOBACCO GRP	Top 20	2063130.0	51	5	48
LLOY.L	LLOYDS GRP.	Top 20	117700000.0	432	199	513
MGGT.L	MEGGITT	Bottom 10	2014790.0	27	32	81
PRU.L	PRUDENTIAL	Top 20	3255510.0	112	112	200
RIO.L	RIO TINTO	Top 20	4591440.0	398	91	268
RMG.L	ROYAL MAIL	Bottom 10	2889170.0	28	21	32
SAB.L	SABMILLER	Top 20	2230750.0	94	96	241
SDR.L	SCHRODERS	Bottom 10	353732.0	36	66	461
SHP.L	SHIRE	Top 20	2442390.0	88	40	192
SPD.L	SPORTSDIRECT	Bottom 10	1345500.0	9	5	36
STAN.L	STAND.CHART.	Top 20	8284770.0	295	183	259
TPK.L	TRAVIS PERKINS	Bottom 10	633784.0	24	5	112
ULVR.L	UNILEVER	Top 20	2667190.0	130	31	149
VOD.L	VODAFONE GRP.	Top 20	69826800.0	406	203	540
WPP.L	WPP	Top 20	3870300.0	45	77	229

Table 1: Stocks included in the research and their news' counts per sentiment type

Indicators Our analysis included the the following indicators taken directly from the trades database: spread, trade count, quote count and volume. We also investigated three calculated indicators. Firstly, executed trades ratio, calculated as trade count divided by quote count. Secondly, not executed trades, calculated as quote count minus trade count. Thirdly, market sides imbalance, calculated as total ask size minus total bid size. All

indicators measured activity in a particular minute for a specific stock. All the indicators with their baseline means across the year are shown in Table 2 and the matching standard deviations in Table 3.

Ticker	Spread	Executed Trades Ratio	Not Executed Trades	Market Sides Imbalance	Trade Count	Quote Count	Volume
AAL.L	0.932	0.094	291.556	9555.823	32.235	302.191	9189.955
ARM.L	0.866	0.087	245.024	20506.305	23.952	226.242	13764.134
AZN.L	1.006	0.099	297.221	38047.197	32.195	310.728	5654.447
BARC.L	0.114	0.133	351.128	228722.976	56.131	401.193	107376.738
BATS.L	1.034	0.119	261.633	208.579	36.518	288.221	6217.102
BLT.L	0.771	0.067	643.389	40402.357	45.766	672.616	15057.989
BNZL.L	1.612	0.089	112.541	-449.093	10.906	80.278	2404.262
BRBY.L	1.455	0.091	163.052	9180.716	17.157	139.719	4917.656
CCH.L	3.370	0.288	26.008	-5365.871	7.311	22.045	1186.304
DGE.L	0.779	0.091	321.426	15721.040	31.031	332.061	9875.848
GFS.L	0.197	0.150	90.782	45793.990	16.848	84.400	16835.896
GLEN.L	0.113	0.143	307.371	-18781.874	50.687	351.703	47357.019
GSK.L	0.694	0.089	343.353	53686.076	36.649	354.062	16758.392
HSBA.L	0.171	0.109	449.014	-10977.883	55.150	498.370	47767.908
III.L	0.292	0.158	67.527	21435.446	10.981	56.991	7633.296
IMT.L	1.374	0.086	233.518	-7980.975	24.944	220.591	6286.344
LLOY.L	0.024	0.161	251.117	260889.177	47.804	292.766	301286.478
MGGT.L	0.604	0.140	76.347	3628.590	11.228	63.750	5222.454
PRU.L	1.186	0.085	208.399	-42186.263	21.084	190.454	12203.085
RIO.L	1.057	0.113	458.043	-12366.406	54.752	504.990	10484.848
RMG.L	0.959	0.211	50.381	15157.181	8.785	39.863	12031.121
SAB.L	1.125	0.123	221.240	1739.801	31.101	237.167	5178.297
SDR.L	2.178	0.100	104.782	355.471	10.913	86.835	1317.872
SHP.L	1.440	0.089	230.729	-23826.367	22.605	213.405	5160.556
SPD.L	0.953	0.170	56.433	-5342.696	7.491	41.128	2546.728
STAN.L	0.775	0.090	320.231	-17016.029	32.819	329.935	11910.282
TPK.L	1.715	0.119	101.986	-10052.833	12.557	83.827	2665.785
ULVR.L	1.341	0.054	383.860	18338.312	21.979	367.651	6750.737
VOD.L	0.070	0.106	410.227	908204.729	53.230	445.580	209285.105
WPP.L	1.217	0.074	216.677	-167045.827	19.112	191.705	9506.360

Table 2: Baseline values calculated across the year

Ticker	Spread	Executed trades ratio	Not executed trades	Market sides imbalance	Trade count	Quote count	Volume
AAL.L	0.354	0.056	210.830	657649.698	34.703	238.952	12841.206
ARM.L	0.747	0.061	212.241	2170298.751	30.589	227.527	22380.614
AZN.L	0.410	0.061	254.900	603984.250	37.791	281.463	9979.581
BARC.L	0.152	0.066	257.061	6964377.387	55.966	301.280	144650.710
BATS.L	2.308	0.066	186.669	395362.135	34.741	215.361	10835.338
BLT.L	0.331	0.055	440.437	2019562.989	45.689	472.494	19407.489
BNZL.L	0.550	0.069	104.762	451244.044	14.266	101.138	4531.272
BRBY.L	0.654	0.065	159.082	927696.432	22.359	162.393	8770.350
CCH.L	4.538	0.342	37.421	186080.703	11.221	36.950	3066.523
DGE.L	0.324	0.068	279.089	2050854.731	33.704	301.328	17524.025
GFS.L	0.119	0.096	91.460	1302911.031	23.629	103.613	32604.226
GLEN.L	0.063	0.080	247.254	2977810.551	52.064	285.575	67513.072
GSK.L	0.250	0.060	264.499	3378499.749	41.800	297.792	32344.649
HSBA.L	0.147	0.065	321.631	3877290.842	51.717	361.178	97207.773
III.L	0.180	0.118	73.348	406743.938	12.966	77.514	12851.234
IMT.L	0.455	0.060	181.140	1006926.515	31.143	201.363	10729.842
LLOY.L	0.014	0.714	287.117	17990737.934	212.426	233.084	432322.311
MGGT.L	0.346	0.109	102.026	586235.852	14.433	101.242	10468.006
PRU.L	0.608	0.067	178.833	2940296.670	26.791	190.254	22971.361
RIO.L	0.536	0.083	369.979	683046.483	54.221	405.446	13717.581
RMG.L	0.620	0.190	76.769	1120239.094	12.803	70.716	27033.882
SAB.L	0.463	0.079	186.772	302639.986	33.110	211.458	8140.057
SDR.L	0.801	0.077	84.079	100336.740	12.785	86.890	2038.432
SHP.L	0.532	0.067	240.214	1028841.232	30.324	252.547	9552.585
SPD.L	0.718	0.257	78.042	232413.512	10.370	73.529	5177.483
STAN.L	0.270	0.059	255.399	5179126.732	36.619	281.440	19321.585
TPK.L	0.721	0.089	103.110	336002.691	15.581	103.198	4547.666
ULVR.L	0.463	0.046	291.681	2528030.904	25.587	305.191	10835.297
VOD.L	0.066	0.064	341.216	51150029.285	62.953	391.056	376553.970
WPP.L	0.531	0.058	184.380	3051832.460	26.090	190.846	17176.810

Table 3: Baseline standard deviations calculated across the year

Statistics As the first step in the analysis, we averaged each liquidity indicator grouped by sentiment type and volume group by calculating the mean

$$\bar{S}_{k,t} = \frac{1}{n_{k,t}} \sum_{j=1}^{n_{k,t}} S_{k,t,j},$$

where k is the stock counter within volume group, t is the time from the news event, $n_{k,t}$ is the number of news events for the indicator, sentiment type and volume group. Next we normalized the means

$$T_{k,t} = \frac{\bar{S}_{k,t} - \mu_k}{\sigma(\bar{S}_{k,t})}$$

where μ_k is the mean of the indicator across the year and the standard deviation of the mean calculated as

$$\sigma(\bar{S}_{k,t}) = \frac{\sigma(S_{k,t})}{\sqrt{n_{k,t}}}.$$

Next we averaged the normalized means over time.

$$\bar{T}_k = \frac{1}{35} \sum_{t=-5}^{30} \bar{T}_{k,t}$$

Due to the fact that each $T_{k,t}$ has standard deviation 1 and there is an average correlation ρ_k between the time lags, we could calculate the standard deviation of $\bar{T}_k$.

$$\sigma(\bar{T}_k) = \sqrt{\frac{1}{35} + \frac{34}{35}\rho_k}$$

This gave us an opportunity to normalize again.

$$\bar{\bar{T}}_k = \frac{\bar{T}_k}{\sigma(\bar{T}_k)} = \frac{\bar{T}_k}{\sqrt{\frac{1}{35} + \frac{34}{35}\rho_k}}$$

Under null hypothesis $\bar{\bar{T}}_k \sim N(0,1)$ and we could execute t-test in order to check if there is any effect of news on the liquidity indicator.

3 Results

T-test results We ran the t-test for each of the liquidity indicators in each of the groups. The results were mixed. In the low volume group, for most of the indicators, null hypotheses were not rejected. There was one exception, namely the executed trades ratio. In the high volume group, for most indicators, null hypotheses were rejected. This means that there was significant change in the indicator when news were released. Specifically, the affected indicators were executed trades ratio, quote count, trade count and volume. Table 4 shows the detailed results of t-tests and Table 5 gives a general overview.

Volume group	Sentiment	Indicator	T	Two-tailed p-value
Bottom 10	Negative	Executed trades ratio	10.786	0.000
		Market sides imbalance	0.811	0.438
		Not executed trades	-0.977	0.354
		Quote count	1.834	0.100
		Spread	0.798	0.445
		Trade count	1.872	0.094
		Volume	2.095	0.066
	Neutral	Executed trades ratio	10.970	0.000
		Market sides imbalance	0.980	0.353
		Not executed trades	-1.420	0.189
		Quote count	-0.420	0.685
		Spread	-4.533	0.001
		Trade count	-0.443	0.668
		Volume	-0.671	0.519
	Positive	Executed trades ratio	9.511	0.000
		Market sides imbalance	1.854	0.097
		Not executed trades	-3.243	0.010
		Quote count	2.654	0.026
		Spread	0.890	0.397
		Trade count	1.369	0.204
		Volume	0.613	0.555
Top 20	Negative	Executed trades ratio	11.605	0.000
		Market sides imbalance	-0.847	0.408
		Not executed trades	-0.295	0.771
		Quote count	4.459	0.000
		Spread	5.364	0.000
		Trade count	6.633	0.000
		Volume	5.514	0.000
	Neutral	Executed trades ratio	6.706	0.000
		Market sides imbalance	0.034	0.973
		Not executed trades	0.620	0.543
		Quote count	4.120	0.001
		Spread	-0.285	0.779
		Trade count	4.251	0.000
		Volume	3.101	0.006
	Positive	Executed trades ratio	7.090	0.000
		Market sides imbalance	-1.230	0.234
		Not executed trades	0.482	0.635
		Quote count	3.455	0.003
		Spread	0.935	0.361
		Trade count	3.141	0.005
		Volume	2.141	0.045

Table 4: Results of t-tests

	Bottom 10			**Top 20**		
Indicator	**Negative**	**Neutral**	**Positive**	**Negative**	**Neutral**	**Positive**
Executed trades ratio	+	+	+	+	+	+
Quote count			+	+	+	+
Trade count				+	+	+
Volume				+	+	+
Not executed trades			-			
Spread		-		+		
Market sides imbalance						

Table 5: Results of t-tests with significance level 0.05 where "+" indicates positive effect and "-" negative effect.

Comparison After analyzing which indicators had statistically significant effect from news, we compiled Table 6. It shows the indicator mean values over the whole year compared to mean values close to news. We wanted to see how large is the effect in absolute and percentual terms. It is interesting to see that most indicators ,with the exception of not executed trades, have large percentual change close to news. Yet we observe that null hypotheses were not rejected in many cases. That is due to large variability in the baseline measures.

Volume group	Sentiment	Indicator	Baseline	Close to news	Percentage	Two-tailed p-value	Significant
Bottom 10	Negative	Executed trades ratio	0.152	0.554	264.474	0.000	True
		Market sides imbalance	7434.090	31942.152	329.671	0.438	False
		Not executed trades	84.984	84.709	-0.324	0.354	False
		Quote count	69.883	101.264	44.905	0.100	False
		Spread	1.334	1.645	23.313	0.445	False
		Trade count	11.418	18.274	60.046	0.094	False
		Volume	5676.137	13433.452	136.665	0.066	False
	Neutral	Executed trades ratio	0.152	0.582	282.895	0.000	True
		Market sides imbalance	7434.090	7723.136	3.888	0.353	False
		Not executed trades	84.984	82.467	-2.962	0.189	False
		Quote count	69.883	98.578	41.061	0.685	False
		Spread	1.334	1.739	30.360	0.001	True
		Trade count	11.418	16.908	48.082	0.668	False
		Volume	5676.137	9681.846	70.571	0.519	False
	Positive	Executed trades ratio	0.152	0.573	276.974	0.000	True
		Market sides imbalance	7434.090	44752.861	501.995	0.097	False
		Not executed trades	84.984	74.020	-12.901	0.010	True
		Quote count	69.883	86.325	23.528	0.026	True
		Spread	1.334	1.577	18.216	0.397	False
		Trade count	11.418	14.405	26.160	0.204	False
		Volume	5676.137	8540.562	50.464	0.555	False
Top 20	Negative	Executed trades ratio	0.101	0.167	65.347	0.000	True
		Market sides imbalance	64792.037	-23826.092	-136.773	0.408	False
		Not executed trades	322.258	320.580	-0.521	0.771	False
		Quote count	336.582	368.699	9.542	0.000	True
		Spread	0.804	0.887	10.323	0.000	True
		Trade count	36.487	48.898	34.015	0.000	True
		Volume	42853.581	60107.893	40.263	0.000	True
	Neutral	Executed trades ratio	0.101	0.144	42.574	0.000	True
		Market sides imbalance	64792.037	-5079.279	-107.839	0.973	False
		Not executed trades	322.258	328.016	1.787	0.543	False
		Quote count	336.582	371.911	10.496	0.001	True
		Spread	0.804	0.842	4.726	0.779	False
		Trade count	36.487	45.080	23.551	0.000	True
		Volume	42853.581	54425.536	27.003	0.006	True
	Positive	Executed trades ratio	0.101	0.156	54.455	0.000	True
		Market sides imbalance	64792.037	-17283.849	-126.676	0.234	False
		Not executed trades	322.258	327.699	1.688	0.635	False
		Quote count	336.582	373.908	11.090	0.003	True
		Spread	0.804	0.870	8.209	0.361	False
		Trade count	36.487	47.044	28.934	0.005	True
		Volume	42853.581	58173.091	35.748	0.045	True

Table 6: Comparison of indicator values

4 Discussion

Additional research We tried to make the current research paper as complete as possible and provide some results that could be useful in practice. Due to limitations of scope and time restrictions, we could not investigate several other interesting ideas. We will provide a list of ideas and elaborate on them.

Time window In the current implementation, the time window which defines time to be close to news was defined as 5 minutes before the news item to 30 minutes after the news item. Using this definition of the time window, we calculated the results of our current research. The choice of that specific time window was arbitrary and it would be very interesting to run the program used in this researach on different time windows and compare the results.

Expansion of scope Naturally, our list of seven indicators is somewhat limited. Other indicators could be easily added to current ones. Furthermore, it would be interesting to research if other markets and/or instruments show similar properties as found for stocks in the London Stock Exchange.

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