Itarle Scandinavian Stock Analysis

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Calculation

INITIALIZATION, DATA SCRUBBING AND OUTPUT

When initializing the data from the csv file into a pandas dataframe, columns that were not defined by the assignment spec are dropped. Auctions are removed by dropping every row containing a 'UT' condition code as well as any row that contained an update type that was not defined in the specification (1,2 or 3). A list of stock identifiers is created by finding all the unique stock identifier strings within the data frame. This used this list to create temporary dataframes containing all the update rows associated with the label of the currently selected stock in the list. Once all values are calculated they are written into a csv file in the format of results table below.

TRADE AND TICK TIME CALCULATIONS

For each stock trade update (update type 1), the time between trades is calculated by the difference between the timestamp on the current trade and the previous trade. The date of the trades is checked to remove the outliers of the time between trades on different days. The time difference figures are added to a list which is used to calculate the mean and median values. A record of the longest time between trades is calculated by comparing each value inserted into the list against the current largest value inserted.

For calculating time between tick differences, if the trade price increases or decreases compared to the previous trade, the time difference is added to a separate list where the calculations of mean, median and longest time between ticks occur.

BID-ASK SPREAD CALCULATIONS

For each update the bid-ask spread is calculated by subtracting the bid price from the ask price. Crossed values and rows with missing data are removed by checking that the bid-ask spread is greater than zero before adding the value to the list. To avoid duplicates the value is also compared to the previous value to confirm they are not the same. The list of values is then used to calculate the mean and median.

ROUND NUMBER EFFECT

For each trade update (update type 1), the trade value and trade volume are checked individually to see if they end with a zero. These are added to a running total to calculate the percentage frequency of number ending in zero for that stock (numbers end in zero divided by the number of the trade updates for that stock). The percentage growth of the stock is also calculated by subtracting the initial trade price from the last recorded trade price over the initial trade price. Examples of the round number effect are highlighted when the frequency of the trade price or volume ending in zero is 20% or higher and the trade price growth increased by 0.1% or more.

POSSIBLE IMPROVEMENTS

Since the calculations for each stock are self-contained within one for loop, the program could be multithreaded to compute the values for multiple stocks concurrently.

Results

Stock Identifier	Mean Time Between Trades (seconds)	Median Time Between Trades (s)	Longest Time Between Trades (s)	Mean Time Between Ticks (s)	Median Time Between Ticks (s)	Longest Time Between Ticks (s)	Mean Bid-Ask Spread (Currency)	Median Bid-Ask Spread (C)	Round Number Price Frequency (%)	Round Number Volume Frequency (%)	Trade Price Growth (%)	Round Number Effect Correlation Price/ Volume
BBHBEAT Index	nan	nan	0	nan	nan	0	4	4	0	0	0	
ABB SS Equity	10.20776814	0	490	34.50540275	18	487	0.173387873	0.2	12.00202139	38.0443022	-1.000526593	
ALFA SS Equity	5.528354396	0	447	14.24733333	1	445	0.27543877	0.2	15.65479177	20.76814305	-1.953818828	
ASSAB SS Equity	8.393114436	0	537	36.54418605	12	524	0.788652904	1	49.11357341	13.20637119	1.625239006	Price
ATCOA SS Equity	5.801091745	0	349	19.28912402	7	349	0.195029387	0.2	12.45691306	22.91746457	1.555319901	Volume
ATCOB SS Equity	17.7037416	0	611	46.0998448	22	611	0.258153754	0.2	10.25416301	20.30382705	1.097608781	Volume
AZN SS Equity	17.17722955	0	483	50.00444774	26	483	0.788243033	1	53.3937934	34.24968117	2.444987775	Both
BOL SS Equity	6.489688789	0	301	20.8076484	9	255	0.195097714	0.2	14.72179082	25.48599582	4.978354978	Volume
ELUXB SS Equity	4.561596386	0	395	15.93006521	4	395	0.19981876	0.2	11.9635597	14.05661798	5.484861781	
ERICB SS Equity	2.184217653	0	368	7.441440159	1	239	0.116125028	0.1	10.50094774	36.61521798	-7.355679702	
GETIB SS Equity	4.169281585	0	337	10.72254252	1	337	0.302240439	0.2	15.37773497	24.26035503	-7.51419834	
HMB SS Equity	4.406181818	0	227	13.65281553	6	227	0.182453449	0.2	12.06733566	21.72047702	-1.202749141	
INVEB SS Equity	6.67720961	0	246	16.89561587	7	246	0.231360746	0.2	11.76178933	25.44623182	1.745200698	Volume
KINVB SS Equity	7.417896735	0	589	19.87246663	4	589	0.272507444	0.2	13.22637928	16.61870063	-0.20696792	
LUPE SS Equity	7.237173744	0	437	24.3605134	8	403	0.171359177	0.2	10.83776199	22.44581119	1.764705882	Volume

MTGB SS Equity	8.907325684	0	420	23.4975168	4	408	0.327045125	0.3	16.35294118	17.94852941	-2.385964912	
NDA SS Equity	5.097245005	0	559	28.61088356	13	559	0.153037519	0.2	11.45969132	31.10727953	3.448275862	Volume
NOKISEK SS Equity	15.33941005	0	528	42.40240412	23	528	0.09154047	0.1	8.566367202	46.8303176	2.633559067	Volume
SAND SS Equity	5.623538147	0	227	19.91349022	10	219	0.081483809	0.1	5.456570156	30.73032665	2.021276596	Volume
SCAB SS Equity	8.678819569	0	559	29.80833333	14	559	0.175234412	0.2	9.989258861	18.63229502	-1.3996139	
SEBA SS Equity	4.620053374	0	387	21.14510128	9	387	0.163295827	0.2	10.41777846	27.82648471	5.054509415	Volume
SECUB SS Equity	16.96246499	0	726	54.734375	18	726	0.193534225	0.2	14.1237402	19.13493841	-0.705329154	
SHBA SS Equity	5.605432419	0	297	17.71133113	7	297	0.222521921	0.2	12.47744622	17.59888966	4.124534327	
SKAB SS Equity	9.172029984	0	370	28.81138488	15	370	0.169388063	0.2	11.11952161	22.83702975	0.053937433	
SKFB SS Equity	3.59771958	0	192	11.56934002	5	163	0.161389578	0.2	12.51113354	20.05522237	2.105263158	Volume
SSABA SS Equity	7.246232057	0	434	16.89565217	4	329	0.042884268	0.04	1.710117197	22.3750299	1.200266726	Volume
SWEDA SS Equity	4.084945729	0	301	17.32883849	9	218	0.156455099	0.2	9.28884395	23.44118638	2.611752888	Volume
SWMA SS Equity	10.391558	0	616	31.75396197	9	616	0.256475479	0.2	12.12692967	17.60720412	2.891933029	
TEL2B SS Equity	5.675003513	0	435	17.30726257	7	435	0.168155376	0.2	11.95504566	27.94193397	6.374881066	Volume
TLSN SS Equity	4.672038244	0	314	18.44672897	9	314	0.076044129	0.1	5.36560922	36.65728713	1.972386588	Volume
VOLVB SS Equity	2.082088525	0	370	7.511241734	2	370	0.139206448	0.1	10.52966685	38.89902258	21.43589744	Volume
MAERSKA DC Equity	17.95331967	0	637	44.02358828	22	383	16.60440551	20	100	1.33963751	0.676691729	Price
MAERSKB DC Equity	8.69076489	0	369	29.06614173	11	343	17.5319006	20	100	3.430662499	0.508351489	Price
CARLB DC Equity	12.41128417	0	862	50.00922509	17	862	0.80594877	1	50.33206315	20.57702776	1.333333333	Price

CHR DC Equity	12.10609121	0	671	30.8681073	6	671	0.330112025	0.3	12.77228775	14.31303793	-1.118963486	
COLOB DC Equity	14.16606498	0	705	46.55918367	17	705	0.842318346	1	51.21313923	20.44295135	1.716350497	Both
DANSKE DC Equity	5.275493193	0	347	19.27479264	9	347	0.169382158	0.2	13.95499583	24.67358089	4.137931034	Volume
DSV DC Equity	8.291278393	0	724	25.26993865	5	724	0.215445831	0.2	11.62299854	17.33624454	-1.469278718	
FLS DC Equity	9.544159544	0	500	24.20805369	4	500	0.326409601	0.3	16.72809516	18.19400235	-2.789115646	
GEN DC Equity	14.02635468	0	586	36.08452192	12	586	1.076083815	1	53.40965042	17.33136386	3.039215686	Price
GN DC Equity	16.67881716	0	1006	46.78951256	17	922	0.195564701	0.2	8.002926116	21.93123628	0	
ISS DC Equity	15.38368785	0	990	42.96134663	7	812	0.386397543	0.3	14.69194313	14.28571429	3.592276605	
JYSK DC Equity	10.7691944	0	479	28.73394115	11	479	0.245883993	0.2	15.30245747	18.37429112	6.293485136	
NDA DC Equity	32.74676631	0	970	80.02872928	47	970	0.105832613	0.1	7.723227103	43.84151593	3.976608187	
NOVOB DC Equity	2.501854901	0	178	6.590425532	2	178	0.207697154	0.2	11.60473233	26.44043987	2.332361516	Volume
NZYMB DC Equity	4.95935773	0	315	11.91316676	3	315	0.28320802	0.2	16.67174244	18.35109854	-0.78835658	
PNDORA DC Equity	5.859574249	0	430	18.76955671	6	430	0.880504231	1	54.13325108	22.254781	3.949329359	Both
TDC DC Equity	19.17848123	0	805	83.49285714	38.5	805	0.085169946	0.1	7.908463739	16.06932526	-1.154956689	
TRYG DC Equity	12.90775159	0	580	42.50075529	15.5	580	0.853766334	1	52.4580879	17.78432261	0.193923723	
VWS DC Equity	4.750677394	0	196	11.51509826	4	183	0.226805636	0.2	14.63760263	26.66611095	0.429042904	
WDH DC Equity	33.18022747	0	1759	111.1319444	51	1759	1.030112721	1	55.81124381	11.12729391	-0.79435128	
AMEAS FH Equity	14.92733777	0	636	37.1341197	5	636	0.050126466	0.04	1.171393342	20.11097411	9.618104668	Volume
CGCBV FH Equity	17.14249328	0	593	38.03075031	6	593	0.051612823	0.04	1.781926177	17.39499364	1.980810894	

ELI1V FH Equity	11.65893562	0	540	32.26011102	9	495	0.023773703	0.02	1.038961039	23.54978355	5.775193798	Volume
FUM1V FH Equity	8.256046876	0	343	26.708742	12	343	0.017400689	0.02	1.219262993	26.08132961	-4.117647059	
HUH1V FH Equity	14.01227989	0	950	29.75078098	4	496	0.053248354	0.04	2.709587772	19.9282075	0.166168162	
KCR1V FH Equity	27.86283084	0	796	60.33561644	9	796	0.06447447	0.05	0.873764084	14.99195217	0.263244488	
KESBV FH Equity	13.7353909	0	537	32.99894589	7	537	0.047231154	0.04	1.49710786	12.44187365	-0.387596899	
KNEBV FH Equity	3.875759708	0	465	8.624003495	1	465	0.045167756	0.03	4.532079575	23.32565726	-4.897765097	
KRA1V FH Equity	34.43874644	0	929	92.44253633	48	929	0.029794989	0.02	2.361980649	26.03870233	-3.785211268	
MEO1V FH Equity	7.519240318	0	415	17.78304292	2	415	0.039221392	0.03	1.203772648	20.71854058	-7.406056184	
NDA1V FH Equity	21.68725385	0	575	58.17890295	34	575	0.016289741	0.02	0	50.80500894	3.038194444	Volume
NES1V FH Equity	9.003939642	0	385	19.74621038	2	385	0.034671137	0.03	2.994723935	24.48539793	3.38573156	Volume
NOK1V FH Equity	2.201307783	0	238	7.969635311	3	167	0.007659717	0.01	0	35.85426542	2.816901408	Volume
NRE1V FH Equity	7.923625188	0	284	17.10306059	4	284	0.026309055	0.02	4.51068837	25.24678041	1.933216169	Volume
ORNBV FH Equity	23.72773737	0	937	53.05472933	16	747	0.037686173	0.03	1.649970536	15.43901002	-1.541284404	
OTE1V FH Equity	20.09603583	0	754	52.51323829	19	754	0.012083404	0.01	4.193601856	22.64213492	-4.556752278	
OUT1V FH Equity	5.013576159	0	322	11.50707405	2	322	0.012745977	0.01	1.278761794	36.18192352	-7.79494382	
SAMAS FH Equity	7.417186926	0	323	20.18436293	8	323	0.023686468	0.02	2.111124709	19.14698323	-2.823374918	
STERV FH Equity	8.106516794	0	471	22.94592536	5	471	0.018218855	0.02	2.227424749	23.71237458	-4.170616114	
TIE1V FH Equity	23.90377396	0	1031	59.23098792	11	1031	0.03214538	0.03	5.330700888	28.07502468	-3.71559633	
TLS1V FH Equity	31.18959299	0	652	70.87654321	40	652	0.008413098	0.01	0	54.94081318	1.467889908	Volume

UPM1V FH Equity	7.278592023	0	349	22.83315038	9	269	0.017791909	0.02	2.522219553	25.3122748	-1.4570966	
VALMT FH Equity	24.73581053	0	810	62.7706422	20	810	0.02588755	0.02	0.530395757	20.99143207	-4.632867133	
WRT1V FH Equity	9.666932652	0	524	20.99335929	2	524	0.052474636	0.04	0.733886407	18.93746011	0.539906103	
YTY1V FH Equity	35.28729604	0	658	78.13478692	32	658	0.012844467	0.015	0.029103609	33.17811409	-0.479233227	
AKA NO Equity	51.2925072	0	1454	105.4785714	14.5	1255	0.137042073	0.08	2.540747843	21.66826462	-7.330154946	
AKSO NO Equity	19.05481164	0	807	36.96310935	4	807	0.253158429	0.2	1.78412132	18.19803747	-5.983772819	
BWLPG NO Equity	25.58933718	0	854	60.89956332	15	854	0.46124634	0.2	8.325335893	17.7303263	-3.277494538	
DETNOR NO Equity	18.0070922	0	635	41.32723239	8	584	0.227467626	0.15	12.63921701	27.33715829	-1.488616462	
DNB NO Equity	5.514714994	0	557	23.66241713	10	557	0.635082658	0.2	10.56163535	29.9194714	3.407407407	Volume
DNO NO Equity	7.664064738	0	594	20.72207486	3	594	0.051404439	0.03	2.147766323	30.67010309	11.11111111	Volume
FOE NO Equity	26.63532053	0	1081	57.57545839	8	903	0.358156736	0.25	6.478943434	29.45427361	5.219364599	Volume
GJF NO Equity	15.55388873	0	979	53.71486762	23	979	0.536472484	0.2	13.08588064	15.56040757	-1.488306166	
MHG NO Equity	7.578077332	0	464	25.46615253	6	464	0.298570553	0.1	6.922476771	26.27136676	-1.001053741	
NAS NO Equity	9.024859597	0	2518	18.43407927	1	2518	1.118067969	0.6	30.96928666	27.93097754	1.419176186	Both
NHY NO Equity	3.341215066	0	922	8.816086066	1	922	0.047449693	0.03	5.044097168	28.80705555	-6.753914466	
OPERA NO Equity	7.707287157	0	515	18.99682356	3	515	0.279144192	0.15	8.201096365	28.48384305	0.068493151	
ORK NO Equity	12.33257584	0	1719	43.72422464	14	883	0.262266562	0.1	7.904599659	22.94151051	-1.382113821	

PGS NO Equity	7.133671854	0	1630	16.25580068	1	1630	0.101703487	0.07	7.291666667	22.81777426	-0.945732943	
RCL NO Equity	12.11635827	0	1402	30.25067751	4	1402	2.047976833	1	56.40531034	27.23249745	-5.383360522	
REC NO Equity	11.56216158	0	669	27.36741835	5	640	0.011100837	0.006	0	40.22515696	-1.461187215	
SCH NO Equity	12.67299929	0	847	25.97804955	2	847	1.055241056	0.5	13.61262758	14.7400902	0.510412413	
SDRL NO Equity	4.146479748	0	350	12.35505973	2	350	0.12263815	0.1	6.301688992	47.83925451	-1.112288136	
STB NO Equity	11.26305242	0	525	28.59027529	4	525	0.09435675	0.04	1.402214022	20.12651555	-0.642054575	
STL NO Equity	3.480109471	0	332	14.90393142	4	332	0.411383684	0.2	13.54203994	35.5865394	-0.320512821	
SUBC NO Equity	6.329876748	0	639	17.33176912	2	639	0.204555485	0.1	6.800947867	29.91113744	0.543150272	
TEL NO Equity	9.110485453	0	549	33.46750903	14	549	1.230844763	0.2	11.57356077	26.55863539	3.147268409	
TGS NO Equity	10.86193916	0	879	30.32904884	3	879	0.615066036	0.2	23.61435981	28.94335401	2.903405918	Both
YAR NO Equity	6.573366896	0	380	17.41084165	3	380	0.645793996	0.3	13.43604223	16.45592929	-0.600961538	

Code Appendix

```
import pandas as pd
import numpy as np
import csv

column_names = ['name', 2, 'bid_price', 'ask_price', 'trade_price', 'bid_vol', 'ask_vol', 'trade_vol',
'update_type',
                10, 'date', 'time', 'opening_price', 14, 'code', 16]

df = pd.read_csv("scandi.csv", names=column_names)
df = df.drop([2, 10, 14, 16], axis=1)
df = df.loc[~(df.code.str.contains('UT', na=False))]
df = df.loc[((df.update_type == 1) | (df.update_type == 2) | (df.update_type == 3))]

stocks = df.name.unique()
# codes = df.code.unique()
# update = df.update_type.unique()
# print(codes)
# print(update)
# print(stocks)
# print(len(stocks))
# crosslist=list()
with open('results.csv', 'w', newline='') as result_file:
    wr = csv.writer(result_file, quoting=csv.QUOTE_NONE)
    wr.writerow(['Stock Identifier', 'Mean Time Between Trades', 'Median Time Between Trades',
                 'Longest Time Between Trades', 'Mean Time Between Ticks', 'Median Time Between Ticks',
                 'Longest Time Between Ticks', 'Mean Bid-Ask Spread', 'Median Bid-Ask Spread',
                 'Round Number Price Probability', 'Round Number Volume Probability', 'Trade Price
Growth'])
    for x in stocks:
        time_trades = list()
        time_ticks = list()
        bid_ask_spread = list()
        current_stock = df.loc[(df['name'] == x)]
        first_loop = True
        longest_time_trade = 0
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```
        longest_time_tick = 0
        cross_count = 0
        round_price_count = 0
        round_volume_count = 0
        current_trades = current_stock.loc[(current_stock['update_type'] == 1)]
        no_of_trades = len(current_trades)

        prev_bid_ask_spread = 0.0

        for i in current_stock.itertuples(index=False):
            if i.update_type == 1:
                if first_loop is True:
                    first_loop = False

                elif i.date == temp.date:
                    time_diff = i.time - temp.time
                    tick_diff = i.trade_price - temp.trade_price
                    # if time_diff != 0:
                    # if i.bid_price > i.ask_price:
                    # crosslist.append(i)
                    # cross_count = cross_count+1
                    time_trades.append(time_diff)
                    if time_diff > longest_time_trade:
                        longest_time_trade = time_diff
                    if tick_diff != 0:
                        time_ticks.append(time_diff)
                        if time_diff > longest_time_tick:
                            longest_time_tick = time_diff
                # else: print("skipped")
                if str(i.trade_price).endswith('0'):
                    round_price_count = round_price_count + 1
                if str(i.trade_vol).endswith('0'):
                    round_volume_count = round_volume_count + 1
                temp = i

            current_bid_ask_spread = i.ask_price - i.bid_price
            if (current_bid_ask_spread > 0) & (current_bid_ask_spread != prev_bid_ask_spread):
                bid_ask_spread.append(current_bid_ask_spread)
```

```
            prev_bid_ask_spread = current_bid_ask_spread

    # print(cross_count)
    # f=open('listfile1.txt', "w")
    # for listitem in crosslist:
    #    f.write('%s\n' % str(listitem))
    time_trades.sort()
    mean_time_trade = np.mean(time_trades)
    print(repr(x) + ' Mean Time Between Trades = ' + repr(mean_time_trade))
    median_time_trade = np.median(time_trades)
    print(repr(x) + ' Median Time Between Trades = ' + repr(median_time_trade))
    print(repr(x) + ' Longest Time Between Trades = ' + repr(longest_time_trade) + '\n')
    time_ticks.sort()
    mean_time_tick = np.mean(time_ticks)
    print(repr(x) + ' Mean Time Between Ticks = ' + repr(mean_time_tick))
    median_time_tick = np.median(time_ticks)
    print(repr(x) + ' Median Time Between Ticks = ' + repr(median_time_tick))
    print(repr(x) + ' Longest Time Between Ticks = ' + repr(longest_time_tick) + '\n')
    if round_price_count == 0:
        round_price = 0
        print(repr(x) + ' Round Number Effect Price = 0%')
    else:
        round_price = (round_price_count / no_of_trades) * 100
        print(repr(x) + ' Round Number Effect Price = ' + repr(round_price) + '%')
    if round_volume_count == 0:
        round_volume = 0
        print(repr(x) + ' Round Number Effect Volume = 0%\n')
    else:
        round_volume = (round_volume_count / no_of_trades) * 100
        print(repr(x) + ' Round Number Effect Volume = ' + repr(round_volume) + '%\n')
    if len(current_trades) != 0:
        first_trade_price = current_trades['trade_price'][current_trades.index[0]]
        last_trade_price = current_trades['trade_price'][current_trades.index[-1]]
        trade_growth = ((last_trade_price - first_trade_price) / first_trade_price) * 100
        print(repr(x) + ' Value Growth Percentage = ' + repr(trade_growth) + '%\n')
    else:
        trade_growth = 0
        print(repr(x) + ' Value Growth Percentage = 0%\n')
```

```
        bid_ask_spread.sort()
        mean_bid_ask_spread = np.mean(bid_ask_spread)
        print(repr(x) + ' Mean Bid Ask Spread = ' + repr(mean_bid_ask_spread))
        median_bid_ask_spread = np.median(bid_ask_spread)
        print(repr(x) + ' Median Bid Ask Spread = ' + repr(median_bid_ask_spread) + '\n')
        wr.writerow([i.name, mean_time_trade, median_time_trade, longest_time_trade,
                     mean_time_tick, median_time_tick, longest_time_tick, mean_bid_ask_spread,
                     median_bid_ask_spread, round_price, round_volume, trade_growth])
```