

**Using The Goertzel Cycle Algorithm v2  
To Trade DIA ETF 5min Bars  
With Walk Forward 20 Trading days in-sample and 1 trading day out-of-sample  
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The Goertzel algorithm is not well known in the trading community but is used extensively in communications and frequency detection. As an example, we all are familiar with cellular phones. When you press a button have you ever wondered how the telephone company computers know what button you pushed? The answer is the Goertzel algorithm. This algorithm is built into tiny integrated circuits and immediately detects the tone of the button you pushed.

In a previous working paper entitled “MESA vs Goertzel DFT”, <http://www.meyersanalytics.com/publications2/MesaVsGDFT.pdf> we demonstrated that the Goertzel Algorithm(GZ), a subset of the Discrete Fourier Transform (DFT), has better frequency detection abilities of sine waves imbedded in noise than the MESA algorithm or the Fast Fourier transform when the noise amplitude is equal to or greater than the signal amplitude.

Given the better frequency detection of the GZ we will use the GZ here to find the cycles with the highest amplitudes with their associated phases and create signal curve with those cycles that we will follow to create our strategy buy and sell signals.

**The Goertzel Algorithm.**

The value of the Discrete Fourier Transform (DFT) is that for N input data points, the DFT can find the frequencies, amplitude and phases of the sine waves in the data at the discrete frequency points of  $1/N$ ,  $2/N$ , to  $(N/2)/N$ . For instance, if N, the number of price bars or closes, were equal to 20 we could find the amplitude and phases for the 20-period cycle (20 bars/ cycle), the 10-period cycle, the  $6\frac{2}{3}$  period cycle all the way down to the 2-period cycle. As traders we are more accustomed to thinking of terms of periods like the 3-day cycle (frequency =  $1/3$  cycle/day) or the 10-bar cycle (frequency =  $1/10$  cycles/bar) etc. Unfortunately, the DFT can only calculate equally spaced frequencies of  $1/N$ . In the above example, where  $N=20$ , using the DFT we could only calculate the amplitudes of the periods (periods= $1/\text{frequency}$ ) of 20, 10,  $6\frac{2}{3}$  etc. What if the true signal period was between 20 and 10? The DFT could not find it. That was the advantage of MESA. MESA was not constrained to the  $1/N$  spacing. With MESA any grid of frequencies could be examined. As shown in my previous article, a special subset of the discrete Fourier transform called the Goertzel algorithm is also not constrained to  $1/N$  spacing and can be used to find any frequency in between the  $1/N$  frequency divisions.

Despite the advantage of the Goertzel algorithm frequency detection abilities, it has three drawbacks. One drawback of the Goertzel algorithm is that it is much slower than the Fast Fourier transform. If we had 512 data points and we wanted to look at 128 different frequencies, the FFT computation would be proportional to  $512 \cdot \log_2(512) = 4608$  operations while the Goertzel computation would be proportional  $512 \cdot 128 = 65536$  operations. In other words, in this case, the Goertzel algorithm would take more than 10 times longer than

the FFT to compute. However, as a computation time comparison, Goertzel would take about half the time as MESA to compute those 128 frequencies. The second drawback of the Goertzel algorithm is that in order to find a frequency in Goertzel when the noise amplitude is high you need enough data so that your lowest frequency (largest period) is able to complete at least 3 cycles. This means that if we were examining daily closing prices and we wanted to find periods of 75 days and less than we would need at least  $3 \times 75 = 225$  days of prices in order to detect that period in noisy data. The third drawback of the Goertzel algorithm is that while it can detect the frequency within the  $1/N$  spacing it cannot detect more than one frequency within that spacing. For instance, if  $N=20$ , and we are looking for a frequency between  $1/20$  and  $2/20$ , the Goertzel can detect the frequency anywhere at or between these two frequencies. However, if there were a second frequency in-between these two frequencies, Goertzel could not find it. If there were two frequencies between these two values, Goertzel would produce one frequency as a weighted average of the two. This is where MESA has a clear advantage. On data with a low noise component, Mesa could detect these two closely spaced frequencies. However, if the data is very noisy than MESA would not be able to detect the closely spaced frequencies either.

### **The Goertzel-DFT Strategy.**

The nature of intraday price movements is constantly changing due to current economic surprises, events, and trader sentiment. Also, the time of year changes the nature of intraday markets, such as the seasons, holidays, vacation time, etc. As such, the periods or frequencies found on intraday prices 3 weeks ago may no longer be the same as the frequencies found on today's intraday data. We would expect the frequencies found on intraday data to vary over time.

For this Strategy we will create an indicator that walks forward one price  $n$  bars at a time. The indicator will take a fixed number,  $N$ , of closing prices and use the Goertzel Algorithm (GZ) to find the  $n$  frequencies with the highest amplitudes, where  $n$  is the number of frequencies, we will use to create our new signal curve. Using that frequencies, amplitudes, and phases, we will construct a new price curve that forecasts the price one bar ahead and which filters out a lot of price noise. We keep marching the  $N$  closing price window forward one bar at a time, calculate and save the new forecast point until we reach the end of our data. We will then connect all the generated forecast points to produce a curve that creates the next bar forecast as the cycles used to create the next bar forecast changes slowly over time. Thus, this curve adapts to the closing prices changing cycles and projects one day ahead so that its lag is minimized as things change.

### **Adaptive Goertzel DFT Strategy Construction Details**

Unfortunately constructing the  $n$  cycle DFT of a price data series is not quite as simple as just taking  $N$  closing prices, and directly plugging them into a Goertzel algorithm.

The DFT assumes the time domain sample is periodic and repeats. Suppose a price series starts at 400 and wiggles and wags for 512 data samples ending at the value of 600. The DFT assumes that the price series starts at zero, suddenly jumps to 400, goes to 600 and suddenly jumps down to zero again and then repeats. The DFT must create all kinds of different frequencies in the frequency domain to try and match this type of behavior. These false frequencies created to match the jumps and the high average price completely swamp the amplitudes of any real frequencies making them look like noise. Fortunately, this effect can be almost eliminated by a simple technique called end point flattening.

The calculation of end point flattening coefficients is simple. If  $x(1)$  represents the first price in the sampled data series and  $x(N)$  represents the last point in the data series and if we let  $y(i)$  equal to the new endpoint flattened series, then:

$$a = x(1), b=(x(N)-x(1))/(N-1)$$

$$y(i) = x(i) - [a + b*(i-1)] \quad \text{for } i=1 \text{ to } N \quad (1)$$

We can see that when  $i=1$  then  $y(1)=0$  and when  $i=N$  then  $y(n)=0$ . What we have done is subtract the beginning value of the time series to make the first value equal to zero and then rotate the rest of the time series such that the end point is now zero. This technique reduces the endpoint distortion but introduces a low frequency artifact into the Fourier Frequency spectrum. Fortunately, we won't be looking for frequencies in that range so this distortion will have minimal impact.

### **n Cycle Goertzel-DFT Curve Construction**

Before we start, we have to determine the largest period we will be looking to include in the  $n$  cycle Goertzel DFT construction. For intraday data the 5-day, 3-day and 1-day cycles are very important. In this paper we will use 5-minute bars of the Dow Jones ETF stock (DIA). The DIA ETF trades on the NYSE 6.5 hours a day. For our study we look at the trading session from 9:30am to 4pm EST, Monday through Friday. Each day consists of 78 5min bars a day. Thus the 1-day cycle would need 78 bars. In order to detect the 5-day cycles and lower we need the maximum cycle to repeat at least three times. The 5-day cycle consists of  $5*78=390$  5-min bars. In order to detect the 5-day cycle and lower cycles using the Goertzel algorithm we need at least  $3*390=1170$  5min bars for the GZ calculations. However, for this paper, to make sure we have more than enough bars to detect the 5-day cycle, we will use a minimum of  $4*390=1560$  bars.

There is a small trick we can use to reduce the number GZ cycle calculation times as the  $N$  Day window moves forward in time. The cycles, amplitudes and phases change very slowly when we advance the  $N$  bar window one bar at a time. So, if at bar  $N$  we save the GZ calculated cycles, amplitudes and phases and use those to predict bars  $N+1$ ,  $N+2$ ,  $N+3$  and then at bar  $N+3$ , we use the past  $N$  bars from that point to find new cycles, amplitudes and phases and use those for bars  $N+4$  to  $N+6$ , and etc. We have skipped the GZ cycle calculation every 3 bars, saved calculation time, and the curve will mostly be the exact same because the cycles do not change that fast over a 3-bar 15min period for 5 min bars in this example.

We will use the Goertzel algorithm described to determine the top  $n$  frequencies with the highest amplitudes and their phases.

**Step 1** End flatten the 1560 5min prices using equation (1) above.

**Step 2** Use the Goertzel algorithm to calculate the amplitudes and phases for the cycles of 390 bars/cycle down to 4 bars/cycle. We are scanning for periods because as traders we think in terms of periods not frequencies. That is, the 390-bar cycle, the 20-bar cycle etc. Thus, here we are scanning for cycles of 390 bars/cycle to 4 bars/cycle. The frequencies of 3 bars/cycle down to 2 bars/cycle move to fast with 5min bars to take advantage trading these cycles.

**Step 3** Find the  $n$  frequencies with the highest amplitudes. Calculate the phases of these frequencies and save these  $n$  amplitudes ( $a[i]$ ), phases ( $\phi[i]$ ) and frequencies ( $f[i]$ ). Where  $[i]$  are one of the  $n$  highest amplitudes found.

**Step 4** Calculate the forecast next bar signal value using the above frequencies, amplitudes, and phases of the top  $n$  cycles.

**Step 5** Save the calculated forecast next bar point. Call the forecast next point **fp(k)** where k denotes the order of the sliding window. That is, the first sliding window k=1, the second, k=2, etc. Slide the 1560 5-min bars bar data window forward one 5min bar and repeat steps 1 through 4.

Each fp(k) point is the sum of the *n* cycles, amplitudes and phases found by the GZ. In order to create a curve that we can follow all the fp(k) that we calculate for the number of bars on the chart. As an example, for 2 years of 5 min bars there are ~ 39000 bars

**fp(k) k=1 to # of bars on the chart.**

### The *n* Cycle Goertzel-DFT Strategy Defined

Even though **fp(k)** is a fairly smooth curve, it still has a number of short-term wiggles preventing us from simply going long when the curve turns up and going short when the curve turns down. To create a Strategy, we will use a simple curve following technique on **fp(k)** curve.

#### Buy Rule:

IF **fp(k)** has moved up by more than the point amount of *jup* from **fp(k) jbars bars ago** ( $fp(k) - fp(k-jbars) > jup$ ) then buy **DIA** at the market.

#### Sell Rule:

- IF **fp(k)** has moved down by more than the point amount of *jdn* from **fp(k) jbars bars ago**
- ( $fp(k) - fp(k-jbars) < jdn$ ) then short **DIA** at the market.

#### Intraday Bars Exit Rule:

Close the position at 1555 EST (no trades will be carried overnight).

### Testing The Adaptive N Cycle Goertzel-DFT (GZ) Strategy Using Walk Forward Optimization

There will be five strategy parameters to determine:

1. *ncy*, Number of Cycles (for this study we will only look at the top 1,3,5 cycles from 390 bars/cycle down to 4bars/cycle).
2. *jup*, fp(k) higher by point amount of *jup* from fp(k) *jbars* ago.
3. *jdn*, fp(k) lower by point amount of *jdn* from fp(k) *jbars* ago.
4. *Jbars*, The number of bars distance for each fp(k-jbars) comparison
5. *skip*, The number of 5 min bars to skip for each new GZ frequencies, amplitudes and phases calculation.

As mentioned, to test this Strategy we will use five-minute bar prices of the Dow Jones ETF traded on the NYSE and known by the symbol DIA for the 399 trading days from December 9, 2019 to July 9, 2021.

We will test the GZ strategy with the above DIA ETF 5 min bars on a **walk forward basis**, where the in-sample (**IS**) will be 20 trading weekdays and the out-of-sample (**OOS**) will be the next trading weekday following as will be described below.

### What Is a Walk Forward Optimization with In-Sample Section and Out-Of-Sample Sections?

Whenever we do a TradeStation or Multicharts (TSMC) optimization on many different strategy inputs, TSMC generates a report of performance metrics (total net profits, number of losing trades, etc.) vs these different strategy inputs. If the report is sorted on say the total net profits(**tnp**) performance metric column then the highest **tnp** would correspond to a certain set of inputs. This is called an **in-sample (IS) section**. If we choose a

set of strategy inputs from this report based upon some performance metric, we have no idea whether these strategy inputs will produce the same results on future price data or data they have not been tested on. Price data that is not in the in-sample section is defined as **out-of-sample data**. Since the performance metrics generated in the in-sample section are mostly due to “curve fitting” or “data mining” it is important to see how the strategy inputs chosen from the in-sample section perform on out-of-sample data.

What do we mean by “**curve fitting**” or **data mining**? As a simple example, suppose you were taking a subway to work. In the subway car you are in, suppose you counted the number of blond women in that car and suppose the percent of blond women vs all other women hair colors was 80%. Being that you cannot observe what is in the other subway cars, you would assume that all the other subway cars and perhaps all women had the same percentage of blond hair. This observation was due to chance. That is an example of curve fitting. The same goes for combinatorial searches. You are observing results from a finite sample of data without knowing the data outside the sample you examined.

Walk forward analysis attempts to minimize the curve fitting of price noise by using the law of averages from the Central Limit Theorem on the out-of-sample performance. In walk forward analysis the data is broken up into many in-sample and out-of-sample sections. Usually for any strategy, one has some performance metric selection procedure, which we will call a **filter**, used to select the strategy input parameters from the optimization run. For instance, a **filter** example might be all cases that have a profit factor (PF) greater than 1 and less than 3. For the number of cases left, we might select the cases that had the best percent profit. This procedure would leave you with one case in the in-sample section output and its associated strategy input parameters. Now suppose we ran our optimization on each of our many in-sample sections and applied our **filter** to each in-sample section output. We would then use the strategy input parameters found by the **filter** in each in-sample section on the out-of-sample section immediately following that in-sample section. The input parameters found in each in-sample section and applied to each out-of-sample section would produce independent net profits or losses for each of the out-of-sample sections. Using this method, we now have “x” number of independent out-of-sample section profit and losses from our **filter**. If we take the average of these out-of-sample section net profits and losses, then we will have an estimate of how our strategy will perform on average. Due to the Central Limit Theorem, as your sample size increases, the spurious noise results in the out-of-sample section performance tend to average out to zero in the limit, leaving us with what to expect from our strategy and filter. **Mathematical note: This assumption assumes that the out-of-sample returns are from probability distributions that have a finite variance.**

Why use the walk forward technique? Why not just perform an optimization on the whole price series and choose the input parameters that give the best total net profits or profit factor or some other performance metric? Surely the price noise cancels itself out with such a large number of in-sample prices and trades. Unfortunately, nothing could be farther from the truth! Optimization is a misnomer and should really be called combinatorial search. As stated above, whenever we run a combinatorial search over many different combinations of input parameters on noisy data on a fixed number of prices, **no matter how many**, the best performance parameters found are guaranteed to be due to “**curve fitting**” the noise and signal. The price series that we trade consists of random spurious price movements, which we call noise, and repeatable price patterns (*if they exist*). When we run, for example, 5000 different inputs parameter combinations, the best performance parameters will be from those strategy input variables that are able to produce profits from the price pattern **and** the random spurious movements. While the price patterns will repeat, the same spurious price movements will not. If the spurious price movements that were captured by a certain set of input parameters were a large part of the total net profits, as they are in real intraday price series, then choosing these input parameters will produce losses when traded on future data. These losses occur because the spurious price movements will not be repeated in the same way. This is why strategy optimization or

combinatorial searches, also called back testing, with no out-of-sample testing cause losses when traded in real time from something that looked great in the in-sample section.

To gain confidence that our input parameter selection method or filter, using the optimization output of the in-sample data, will produce profits, we must test the input parameters we found in the in-sample section on out-of-sample data. In addition, we must perform the in-sample/out-of-sample analysis many times. Why not just do the out-of-sample analysis once or just 10 times? Well just as in Poker or any card game, where there is considerable variation in luck from hand to hand, walk forward out-of-sample analysis give considerable variation in out-of-sample profit “luck”. That is, by pure chance we may have chosen some input parameter set that did well in the in-sample section data **and** the out-of-sample section data. In order to minimize this type of “luck”, statistically, we must repeat the walk forward out-of-sample (**OOS**) analysis over many (>50) in-sample/out-of-sample sections and take an average over all out-of-sample sections. This average gives us an expected out-of-sample return and a standard deviation of out-of-sample returns which allows us to statistically estimate the expected equity and its range for N out-of-sample periods in the future

### Finding The GZ Strategy Parameters Using Walk Forward Optimization

There are five strategy parameters to find, *ncy, jup, jdn, jbars, and skip*.

For the test data we will run the TS or MC optimization engine on **DIA** 5 min price bars from 12/9/2019 to 7/9/2021 with the following optimization ranges for the GZ strategy inputs. This will create **399, 20 weekday in-sample periods each followed by a 1 day out-of-sample period** (See Figure 1 for the in-sample/out-of-sample periods). The days are weekdays only. Weekdays where the OOS falls on an exchange holiday or partial days are eliminated. Holidays that fall on a weekday create a 19-day **IS**. All other **IS** periods consist of 20 trading weekdays.

The optimization ranges are:

1. **ncy= 1,3,5**
2. **jup from 0.05 to 4 steps of 0.05**
3. **jdn from 0.05 to 4 in steps of 0.05**
4. **jbars from 2 to 7 in steps of 1**
5. **Skip from 3bars to 12bars in steps 9bars**
6. **MaxBarCycle=390 (5days of 5min bars)**
7. **Xtime = 1555 EST (exit time, no trades carried overnight)**
8. **prc = close**

The above ncy, jup, jdn, jbars, and skip ranges will produce 2304 different input combinations or cases of the strategy input parameters for each of the 399 in-sample/out-of-sample files for the 19 months of 5 min bar DIA data.

### Finding the Best Set of Strategy Inputs to use with an in-sample Metric Filter.

The PWFO generates a number of performance metrics in the in-sample section. (Please see <http://meyersanalytics.com/Walk-Forward-Optimization.html> for a listing of these performance metrics).The question we are attempting to answer statistically, is which performance metric or combination of performance metrics (which we will call a **filter**) applied to a given set of strategy inputs in the **in-sample** section will produce statistically valid profits in the sum of all out-of-sample sections. In other words, we wish to find the best set of strategy inputs **with a metric filter applied** in each **in-sample** section that gives the “best” total out-of-sample results over all out-of-sample sections. This means if we applied our **metric filter** to the strategy inputs chosen in the in-sample section, we would **only trade using those set of strategy inputs** in

the next out-of-sample section if the in-sample **metric filter** satisfied our criteria. **Else no trades would be made** in the next out-of-sample section.

### The Walk Forward Strategy – Strategy Inputs with Metric Filters Explorer.

We wish to find **one** set of strategy inputs that we can trade in every out-of-sample section, but we will only trade that set of strategy inputs in the out-of-sample section if and only if they satisfy our in-sample **metric-filter**. Else we will not trade the next out-of-sample section. In this paper the in-sample section is 20 trading days, and the out-of-sample section is the next trading day. After running the PWFO on the in-sample data, we examine the in-sample metric filter that we chose. If the strategy inputs we selected satisfy the in-sample metric filter requirements then we use those strategy inputs to trade the next day. If the strategy inputs do not satisfy the in-sample metric filter we do not trade the next day.

Let us define the in-sample **metric-filter** we will use here: (1) in-sample Profit Factor ( $PF \leq x$  and/or Lowers in a row ( $lr \leq y$ , equity curve straight line correlation coefficient  $r^2(R2) \leq z$ ). That is  **$PF \leq x$  and/or  $lr \leq y$  and/or  $R2 \leq z$** .

What we are going to do here is look at every combination in the in-sample section of each **strategy input** with

**$PF \leq x$  and/or  $LR < y$  and/or  $R2 \leq z$** . This will produce seven **strategy input|metric-filter** combinations:

1. **strategy input |  $PF \leq x, LR \leq y, R2 \leq z$  |**
2. **strategy input |  $PF \leq x, LR \leq y$  |**
3. **strategy input |  $PF \leq x, R2 \leq z$  |**
4. **strategy input |  $LR \leq y, R2 \leq z$  |**
5. **strategy input |  $LR \leq x$  |**
6. **strategy input |  $R2 \leq z$  |**
7. **strategy input – we also examine inputs with no filter**

If the **strategy input|metric-filter** satisfies the **metric-filter** condition in the in-sample section, then we will use those strategy inputs to trade in the out-of-sample section. If not, then there will be no trades in the out-of-sample section.

We will look at all **metric-filter** combinations of  **$PF \leq 2$  to 6 step 1,  $LR \leq 2,5$  step1 and  $R2 \leq 50$  to 90 step 10**. We will also look at the strategy input with no metric-filter. With 3456 different strategy input combinations this will give us 345,600 **strategy input|metric-filter** combinations. Each one of these 345,600 **strategy input|metric-filter** combinations will be applied to each in-sample section and their out-of-sample performance will be tabulated for all 399 PWFO files.

Below is a snippet of the output from a run of all 345,600 combinations sorted by **tkr|bl**  **$= (100 * t * Ktau * eqR2 / Blw / BE)$** . The column definitions are defined in Figure 3 below. This example shows a partial output file from the WFINP program run on the PWFO files generated with the Goertzel Cycle Algorithm that was run on 100 shares of DIA ETF 5-minute bars 399 days from 12/9/2019 to 7/9/2021. The in-sample (IS) period is 20 trading days and the out-of-sample (OOS) period is 1 trading day. This strategy traded between 9am to 1600pm Exchange Time (EST).

From this run, we chose the filter on row 7 of the Figure above. That is,

**1|0.10|0.35|5|390|12|0|1555|pf<3|lr<4|r2<80**. This is constructed as follows. For the strategy inputs **1|0.10|0.35|5|390|12|0|1555|** only those in-sample sections that have a **pf  $\leq 3$  and  $lr \leq 4$  and  $r2 \leq 80$**  is used to

trade in the following out-of-sample sections. If the in-sample pf > 3 and or lr>4 and or r2>80 then the out-of-sample section following the in-sample section is not traded.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
1	DIA5m20x1d	s12/09/19	e07/09/21	#399	AnyTnp						ISnt2			a4.1	s10.3	f345599					c-\$4						
2	ncyljup jdn bars MxPer Skip xop xt <PF<LR<R2	toGP	tONP	aoGP	aoTr	ao#T	std	skew	kur	t	oW ol	%Wtr	%P	LlTr	LlP	eqDD	wpr	lpr	#	V20	Dev^2	KTau	eqR2	Blw	BE	tkr bl	Prob
3	5 0.1 0.4 5 390 12 0 1555 pf<4 r2<80	16288	13364	48	22.3	2.2	230	0.379	5.31	3.86	1.21	55	59	-537	-655	-1538	13	6	338	13	1170	91	95	41	113	718	2.95E-04
4	5 0.1 0.4 5 390 12 0 1555 pf<6 r2<80	16237	13297	48	22.1	2.2	229	0.381	5.31	3.84	1.21	55	59	-537	-655	-1538	13	6	341	13	1176	91	95	41	114	704	3.58E-04
5	5 0.1 0.4 5 390 12 0 1555 r2<80	16237	13297	48	22.1	2.2	229	0.381	5.31	3.84	1.21	55	59	-537	-655	-1538	13	6	341	13	1176	91	95	41	114	704	3.58E-04
6	5 0.1 0.4 5 390 12 0 1555 pf<5 r2<80	16237	13297	48	22.1	2.2	229	0.381	5.31	3.84	1.21	55	59	-537	-655	-1538	13	6	341	13	1176	91	95	41	114	704	3.58E-04
7	5 0.1 0.35 5 390 12 0 1555 pf<3 lr<4r2<80	15273	13209	68	29.6	2.3	241	0.83	5.42	4.23	1.24	57	62	-521	-655	-1287	9	4	224	17	1061	92	95	55	94	718	5.24E-08
8	5 0.1 0.35 5 390 12 0 1555 pf<3 r2<80	16156	13152	49	21.5	2.3	232	0.516	5.54	3.83	1.21	55	60	-537	-655	-1609	9	6	331	12	1043	91	96	55	115	529	2.75E-04
9	5 0.1 0.4 5 390 12 0 1555 pf<3 r2<80	15828	12912	47	21.7	2.2	229	0.385	5.35	3.76	1.2	55	59	-537	-655	-1538	13	6	336	12	1199	90	94	41	118	658	4.37E-04
10	5 0.1 0.35 5 390 12 0 1555 pf<4 lr<4r2<80	14941	12857	66	28.7	2.3	247	0.637	5.48	4.02	1.22	57	62	-576	-758	-1287	9	4	227	17	1073	92	95	55	104	610	1.77E-07
11	5 0.1 0.35 5 390 12 0 1555 pf<5 lr<4r2<80	14941	12857	66	28.7	2.3	247	0.637	5.48	4.02	1.22	57	62	-576	-758	-1287	9	4	227	17	1073	92	95	55	104	610	1.77E-07
12	5 0.1 0.35 5 390 12 0 1555 lr<4r2<80	14941	12857	66	28.7	2.3	247	0.637	5.48	4.02	1.22	57	62	-576	-758	-1287	9	4	227	17	1073	92	95	55	104	610	1.77E-07



## Bootstrap Probability of Filter Results.

Using modern "Bootstrap" techniques, we can calculate the probability of obtaining our filter's total out-of-sample **net** profits by chance. Here is how the bootstrap technique is applied. Suppose as an example, we have 500 files of in-sample/out-of-sample data. A mirror random filter is created. Instead of picking an out-of-sample net profit (OSNP) from a filter row as before, the mirror filter picks a **random** row's OSNP in each of the 500 files. We repeat this random picking in each of the 500 files 5000 times. Each of the 5000 mirror filters will choose a random row's OSNP of their own in each of the 500 files. At the end, each of the 5000 mirror filters will have 500 **random** OSNP's picked from the rows of the 500 files. The sum of the 500 random OSNP picks for each mirror filter will generate a random total out-of-sample net profit (toNP) or final random equity. The average and standard deviation of the 5000-mirror filter's different random toNPs will allow us to calculate the chance probability of our above chosen filter's toNP. Thus, given the mirror filter's bootstrap random toNP average and standard deviation, we can calculate the probability of obtaining our chosen filter's toNP by pure chance alone. Figure 3 lists the 5000-mirror filter's bootstrap average for our 399 out-of-sample files of **\$4.1** with a bootstrap standard deviation of **\$10.3**. (Side Note. The average is the average per out-of-sample period. So, the average for the random selection would be the random toNP/399 and the average for the filter would be the filter toNP/# of OOS periods traded or  $13209/224=58.97$ ). The probability of obtaining our filters average daily net profit of **58.97** is  $5.24 \times 10^{-8}$  which is **5.327** standard deviations from the bootstrap average. For our filter, in row 7 above, the expected number of cases that we could obtain by pure chance that would match or exceed **\$58.7** is  $[1 - (5.24 \times 10^{-8})^{345600}] \sim 345600 \times 5.24 \times 10^{-8} = 0.018$  where **3453600** is the total number of different filters we looked at in this run. This number is much less than one, so it is improbable that our result was due to pure chance.

## Results

**Figure 1** presents a graph of the equity curve generated by using the filter on the 399 days from 12/9/19 to 7/9/21. The equity curves are plotted from Equity and Net Equity columns in Table 1. Plotted on the equity curves is the 2<sup>nd</sup> Order Polynomial curve. The blue line is the equity curve without commissions and the red dots on the blue line are new highs in equity. The brown line is the equity curve with commissions and the green dots are the new highs in net equity. The grey line is the DIA Daily Closing prices superimposed on the Equity Chart.

**Figure 2** presents a plot of the GZ Strategy buy/sells and the GZ Indicator on the DIA 5min bars for 6/23/2021 - 7/9/2021.

**Table 1** below presents a table of the 399 in-sample and out-of-sample windows, the **Filter** selected in-sample strategy inputs and the daily out-of-sample profit/loss results using the filter described above.

## Discussion of Strategy Performance

In Figure 3, Row 7 of the spreadsheet filter output are some statistics that are of interest for our filter. An interesting statistic is **Blw**. **Blw** is the maximum number of days the OSNP equity curve failed to make a new high. **Blw** is **55** days for this filter. This means that 55 trading days was the longest time that the equity for this strategy failed to make a new equity high. **%Wtr** is the percentage of all OOS trades that were wins or positive. For this filter, the **%Wtr=57%**. **%P** is the % winning oos days, **%P=62%**. The average oos winning trade to the average oos losing trade ratio (**oW|oL**) was **1.24**. **wpr=9** is the maximum number of consecutive winning oos periods(days) in a row and **lpr=4** is the maximum number of consecutive losing oos periods(days) in a row. The Largest losing trade in the whole period was **(\$521)** and the largest losing day was **(\$655)**.

In Figure 1, which presents a graph of the equity curve using the filter on the 399 trading days of out-of-sample data, notice how the equity curve follows the 2<sup>nd</sup> order polynomial trend line with an R<sup>2</sup> of 0.97. The R<sup>2</sup> only dropped to 0.96 for the net equity curve.

Using this filter, the strategy was able to generate \$13,209 net equity after commissions of \$0 (no commissions) and slippage of \$4 trading 100 DIA ETF shares for 399 days. This period of time from 2/20/20 to 4/30/20 was a volatile down then up market. Yet the GZ strategy was able to adapt quite well. .

In observing Table 1 we can see that this strategy and filter made trades from a low of no trades/day to a high of 7 trades/day with an average of 2.3 trades/day. For the no trade days, the strategy input|filter in the in-sample section generated no trades in the out-of-sample section or there was only one trade in the in-sample section so trading in the oos section was skipped.

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**Figure 1 Graph of GZ Strategy Equity Applying the Walk Forward Filter  
Each Day on the in-sample section On DIA 5min Bar Prices 12/9/2019 to 7/9/2020**

**Note: The blue line is the equity curve without commissions and the red dots on the blue line are new highs in equity.  
The brown line is the equity curve with commissions and the green dots are the new highs in net equity  
The grey line is the DIA Daily Closing prices superimposed on the Equity Chart.**

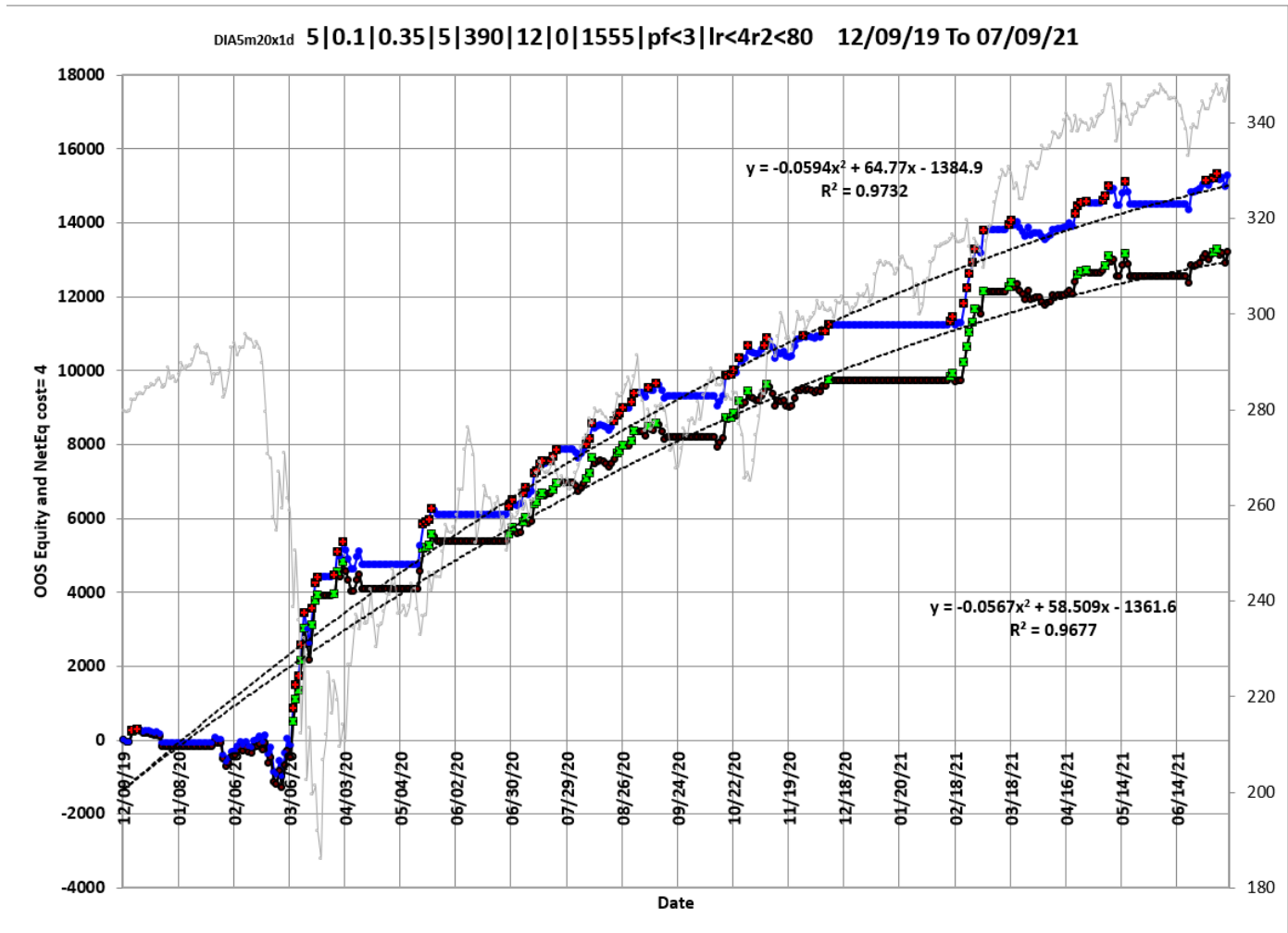
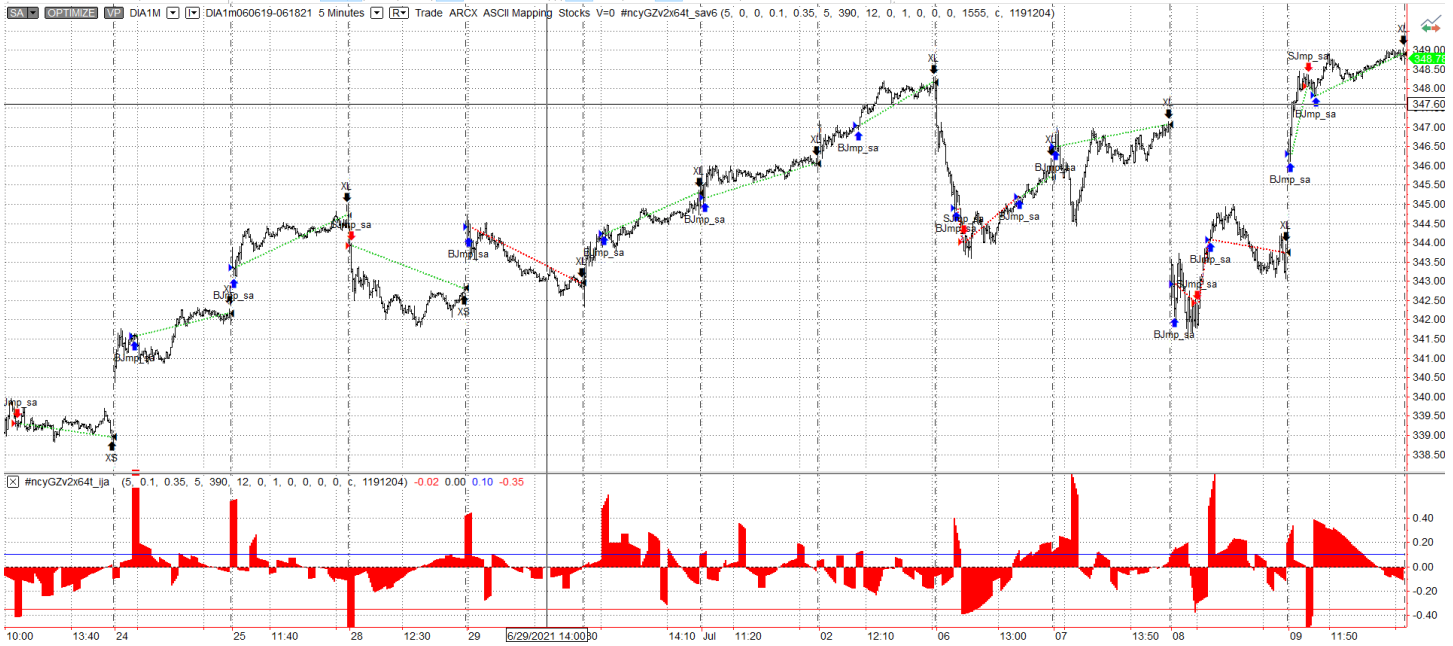


Figure 2 DIA GZ Strategy 5-minute bar chart from 6/23/21-7/9/21



**Figure 3 Partial output of the Walk Forward Strategy Inputs with Metric Filters (WFINP)  
DIA ETF 5 min bars Using The Goertzel DFT Strategy**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	DIA5m20x1d	s12/09/19	e07/09/21	#399	AnyTnp						ISnt2			a4.1	s10.3	f345599				
2	ncy jup jdn jbars MxPer Skip xop xt <PF<LR<R2	toGP	tONP	aoGP	aoTr	ao#T	std	skew	kur	t	oW oL	%Wtr	%P	LLtr	LLp	eqDD	wpr	lpr	#	V20
3	5 0.1 0.4 5 390 12 0 1555 pf<4 r2<80	16288	13364	48	22.3	2.2	230	0.379	5.31	3.86	1.21	55	59	-537	-655	-1538	13	6	338	13
4	5 0.1 0.4 5 390 12 0 1555 pf<6 r2<80	16237	13297	48	22.1	2.2	229	0.381	5.31	3.84	1.21	55	59	-537	-655	-1538	13	6	341	13
5	5 0.1 0.4 5 390 12 0 1555 r2<80	16237	13297	48	22.1	2.2	229	0.381	5.31	3.84	1.21	55	59	-537	-655	-1538	13	6	341	13
6	5 0.1 0.4 5 390 12 0 1555 pf<5 r2<80	16237	13297	48	22.1	2.2	229	0.381	5.31	3.84	1.21	55	59	-537	-655	-1538	13	6	341	13
7	5 0.1 0.35 5 390 12 0 1555 pf<3 lr<4r2<80	15273	13209	68	29.6	2.3	241	0.83	5.42	4.23	1.24	57	62	-521	-655	-1287	9	4	224	13
8	5 0.1 0.35 5 390 12 0 1555 pf<3 r2<80	16156	13152	49	21.5	2.3	232	0.516	5.54	3.83	1.21	55	60	-537	-655	-1609	9	6	331	13
9	5 0.1 0.4 5 390 12 0 1555 pf<3 r2<80	15828	12912	47	21.7	2.2	229	0.385	5.35	3.76	1.2	55	59	-537	-655	-1538	13	6	336	13
10	5 0.1 0.35 5 390 12 0 1555 pf<4 lr<4r2<80	14941	12857	66	28.7	2.3	247	0.637	5.48	4.02	1.22	57	62	-576	-758	-1287	9	4	227	13
11	5 0.1 0.35 5 390 12 0 1555 pf<5 lr<4r2<80	14941	12857	66	28.7	2.3	247	0.637	5.48	4.02	1.22	57	62	-576	-758	-1287	9	4	227	13
12	5 0.1 0.35 5 390 12 0 1555 lr<4r2<80	14941	12857	66	28.7	2.3	247	0.637	5.48	4.02	1.22	57	62	-576	-758	-1287	9	4	227	13

**The WFINP Filter Output Columns are defined as follows: OOS=out-of-sample**

**Row 1** DIA5GZ-20d1d is the PWFO output files abbreviation, First OOS Day End Date (12/09/19), Last OOS Day End Date (07/09/21), **Number of days**(#399) **a**=average of bootstrap random picks. **s**= standard deviation of bootstrap random picks. **f**=number of different filters examined. **c**= slippage and round-trip trade cost(c=\$4).

**The WFINP AVE File Output Cols are defined as follows**

- **Row 2 to Last Row Columns: A through AA**

**Col A: The Strategy Input/Filter Names**

Row 7: 5|0.1|0.35|5|390|12|0|1555|pf<3|lr<4|r2<80: The inputs 5|0.1|0.35|5|390|12|0|1555 for all in-sample files that have PF<3 and/or lr<4 and/or R2 <=60.

**Col B: toGP** Total out-of-sample(oos) gross profit for these 288 oos periods (for this run periods = weeks).

**Col C: toNP** Total out-of-sample(oos) Net profit (toGP-Number Of Trade Weeks\*cost) for the 288 oos periods.

**Col D: aoGP** Average oos gross profit for the 288 oos periods

**Col E: aoTr** Average oos profit per trade

**Col F: ao#T** Average number of oos trades per week

**Col G: std** The standard deviation of the 288 oos period profits and losses

**Col H: skew** The Skew statistic of the 288 oos period profits and losses

**Col I: kur** The kurtosis statistic of the 288 oos period profits and losses

**Col J: t** The student t statistic for the 288 oos periods. The higher the t statistic the higher the probability that this result was not due to pure chance

**Col K: oW|oL** Ratio of average oos winning trades divided by average oos losing trades.

**Col L: %Wtr** The percentage if oos winning trades

**Col M: %P** percent of all oos periods that were profitable.

**Col N: LLtr** The largest losing oos trade in all oos periods

**Col O: LLp** The largest losing oos period

**Col P: eqDD** The oos equity drawdown

**Col Q: wpr** The largest number of winning oos periods (weeks) in a row.

**Col R: lpr** The largest number of losing oos periods in a row

**Col S: #** The number of oos periods this filter produced any profit or loss. Note for some oos periods there can be no strategy inputs that satisfy a given filters criteria and no trades will be made during that period.

**Col T: v20** The straight-line trend of the oos equity curve for the last 20 bars.

**Col U: Dev^2** A measure of equity curve smoothness. The square root of the average (equity curve minus a straight line)^2)

**Col V: Ktau** The Kendall rank coefficient is often used as a test statistic in a statistical hypothesis test to establish whether two variables may be regarded as statistically dependent. This test is non-parametric, as it does not rely on any assumptions on the distributions of X or Y or the distribution of (X,Y)

**Col W: eqR2** The correlation coefficient(R^2) of a straight line fit to the equity curve.

**Col X: Blw** The maximum number of oos periods the oos equity curve failed to make a new high.

**Col Y: BE** Break even in oos periods. Assuming the average and standard deviation are from a normal distribution, this is the number of oos periods you would have to trade to have a 98% probability that your oos equity is above zero.

**Col Z: tkr/bl** =100\*t\*Ktau\*eqR2/Blw/BE. This is measure of the best equity curve.

**Col AA: Prob** The probability that the filters oos toNP was due to pure chance. Row 1 lists the random bootstrap average for the 399 out-of-sample files of (\$4.16) with a bootstrap standard deviation of \$10.3. (Note. The average for the random selection is computed as the Average Random toNP/399) The average net weekly for the filter would be the filter toNP/ (# of OOS) periods traded or 13209/224=58.97. The probability of obtaining our filters average weekly net profit of 58.97 is  $5.24 \times 10^{-8}$  which is 5.8 standard deviations from the bootstrap average. For our filter, in row 7, the expected number of cases that we could obtain by pure chance that would match or exceed \$58.97 is  $[1 - (1 - 5.24 \times 10^{-8})^{345600}] \approx 345600 \times 5.24 \times 10^{-8} = 0.018$  where 345600 is the total number of different filters we looked at in this run. This number is much less than one, so it is improbable that our result was due to pure chance

**Table 1 Walk Forward Out-Of-Sample Performance Summary for the  
DIA 5-min Goertzel Strategy**

**DIA-5 min bars 12/9/2019 - 7/9/2021.**

Filter: 5|0.1|0.35|5|390|12|0|1555| |pf<3|lr<4|r2<80: The inputs 5|0.1|0.35|5|390|12|0|1555 for all in-sample files that have PF≤3 and/or lr≤4 and/or R2 ≤60.

are used to trade in the following out-of-sample sections.

**IS-pf = In-sample pf**

**IS-lr = in-sample losers in a row(lr)**

**IS-r2 = in-sample equity r2**

**osnp = Daily out-of-sample gross profit in \$**

**NOnp\$4 = Daily out-of-sample net profit in \$ = osnp-ont\*4.**

**ont = The number of trades in the out-of-sample day**

**ownp = winning profits in the out-of-sample day.**

**ownt = number of winning trades in the out-of-sample day**

**ollt = The largest losing trade in the out-of-sample day in \$.**

**odd = The drawdown in the out-of-sample day in \$.**

**EQ=Equity = Running Sum of daily out-of-sample gross profits \$**

**NetEq=Net Equity = running sum of the daily out-of-sample net profits in \$**

**Note:** Blank rows indicate that no out-of-sample trades were made that day

Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
12/9/2019	0.3	2	-	0	0	0	0	0	0	0	0	0
12/10/2019	0.3	2	-	(54)	(58)	1	0	0	-54	-54	(54)	(58)
12/11/2019	0.21	2	-	3	(1)	1	3	1	0	0	(51)	(59)
12/12/2019	0.23	2	-	298	294	1	298	1	0	0	247	235
12/13/2019	1.75	2	23	(5)	(9)	1	0	0	-5	-5	242	226
12/16/2019	1.71	2	46	58	50	2	59	1	-1	-1	300	276
12/17/2019	1.99	2	68	(38)	(42)	1	0	0	-38	-38	262	234
12/18/2019	1.68	2	70	(33)	(41)	2	0	0	-28	-33	229	193
12/19/2019	1.47	3	66	2	(2)	1	2	1	0	0	231	191
12/20/2019	1.48	3	63	3	(1)	1	3	1	0	0	234	190
12/23/2019	1.49	3	60	(25)	(37)	3	2	1	-14	-27	209	153
12/24/2019	1.36	3	50	(23)	(27)	1	0	0	-23	-23	186	126
12/26/2019	1.17	4	37	25	13	3	41	1	-16	-16	211	139
12/27/2019	1.23	4	32	(45)	(49)	1	0	0	-45	-45	166	90
12/30/2019	1.09	4	26	(238)	(254)	4	0	0	-	-	(72)	(164)
12/31/2019	0.69	5	-1	0	0	0	0	0	0	0	(72)	(164)
1/2/2020	0.59	7	-9	0	0	0	0	0	0	0	(72)	(164)
1/3/2020	1.06	7	-	0	0	0	0	0	0	0	(72)	(164)
1/6/2020	0.87	7	-	0	0	0	0	0	0	0	(72)	(164)
1/7/2020	0.87	7	-	0	0	0	0	0	0	0	(72)	(164)
1/8/2020	0.97	7	-	0	0	0	0	0	0	0	(72)	(164)
1/9/2020	1.24	7	-	0	0	0	0	0	0	0	(72)	(164)
1/10/2020	0.81	7	-	0	0	0	0	0	0	0	(72)	(164)
1/13/2020	0.82	7	-	0	0	0	0	0	0	0	(72)	(164)
1/14/2020	0.73	7	-	0	0	0	0	0	0	0	(72)	(164)
1/15/2020	0.78	7	-	0	0	0	0	0	0	0	(72)	(164)
1/16/2020	0.62	7	-	0	0	0	0	0	0	0	(72)	(164)
1/17/2020	0.56	7	-	0	0	0	0	0	0	0	(72)	(164)
1/21/2020	0.62	7	-7	0	0	0	0	0	0	0	(72)	(164)
1/22/2020	0.58	7	-7	0	0	0	0	0	0	0	(72)	(164)
1/23/2020	0.58	7	-	0	0	0	0	0	0	0	(72)	(164)
1/24/2020	0.9	7	-	0	0	0	0	0	0	0	(72)	(164)
1/27/2020	0.64	6	-	0	0	0	0	0	0	0	(72)	(164)
1/28/2020	0.73	4	-	148	144	1	148	1	0	0	76	(20)
1/29/2020	0.94	4	-	(76)	(80)	1	0	0	-76	-76	0	(100)
1/30/2020	0.88	4	-	0	0	0	0	0	0	0	0	(100)
1/31/2020	0.7	4	-	(408)	(412)	1	0	0	-	-	(408)	(512)

Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
2/3/2020	0.55	4	-	(195)	(199)	1	0	0	-	-	(603)	(711)
2/4/2020	0.48	4	-	91	83	2	91	2	0	0	(512)	(628)
2/5/2020	0.53	4	-	175	171	1	175	1	0	0	(337)	(457)
2/6/2020	0.52	4	-	39	35	1	39	1	0	0	(298)	(422)
2/7/2020	0.53	4	-	129	125	1	129	1	0	0	(169)	(297)
2/10/2020	0.61	4	-	108	104	1	108	1	0	0	(61)	(193)
2/11/2020	0.68	4	-	(85)	(93)	2	8	1	-93	-93	(146)	(286)
2/12/2020	0.64	4	-	98	94	1	98	1	0	0	(48)	(192)
2/13/2020	0.79	4	-	(136)	(148)	3	0	0	-66	-	(184)	(340)
2/14/2020	0.77	4	-	(20)	(24)	1	0	0	-20	-20	(204)	(364)
2/18/2020	0.73	4	-	167	147	5	222	3	-35	-55	(37)	(217)
2/19/2020	0.88	4	-	52	48	1	52	1	0	0	15	(169)
2/20/2020	0.94	4	-4	66	50	4	113	2	-34	-34	81	(119)
2/21/2020	0.77	4	11	(122)	(134)	3	0	0	-83	-	(41)	(253)
2/24/2020	0.96	4	27	175	167	2	182	1	-7	-7	134	(86)
2/25/2020	1.18	4	45	(511)	(531)	5	233	2	-	-	(377)	(617)
2/26/2020	0.76	4	13	158	150	2	185	1	-27	-27	(219)	(467)
2/27/2020	0.88	4	9	(655)	(675)	5	289	1	-	-	(874)	(1142)
2/29/2020	0.69	4	-8	(46)	(58)	3	98	2	-	-	(920)	(1200)
3/2/2020	0.8	4	-	367	359	2	687	1	-	-	(553)	(841)
3/3/2020	1.02	4	-	(434)	(450)	4	81	2	-	-	(987)	(1291)
3/4/2020	0.85	4	-	636	616	5	660	4	-24	-24	(351)	(675)
3/5/2020	1	4	-	376	368	2	376	2	0	0	25	(307)
3/6/2020	1.1	4	-	(163)	(179)	4	233	1	-	-	(138)	(486)
3/9/2020	1.01	4	-	995	983	3	995	3	0	0	857	497
3/10/2020	1.26	4	-5	618	602	4	1177	2	-	-	1475	1099
3/11/2020	1.4	4	1	248	240	2	524	1	-	-	1723	1339
3/12/2020	1.41	4	7	835	823	3	835	3	0	0	2558	2162
3/13/2020	1.65	3	20	886	870	4	1403	2	-	-	3444	3032
3/16/2020	1.78	3	35	(435)	(455)	5	781	2	-	-	3009	2577
3/17/2020	1.54	3	48	(400)	(416)	4	538	1	-	-	2609	2161
3/18/2020	1.39	3	59	961	941	5	1481	3	-	-	3570	3102
3/19/2020	1.49	3	67	682	674	2	682	2	0	0	4252	3776
3/20/2020	1.57	3	75	151	131	5	1098	3	-	-	4403	3907
3/23/2020	1.55	3	82	0	0	0	0	0	0	0	4403	3907
3/24/2020	1.52	3	86	0	0	0	0	0	0	0	4403	3907
3/25/2020	1.51	3	90	0	0	0	0	0	0	0	4403	3907
3/26/2020	1.49	3	91	0	0	0	0	0	0	0	4403	3907
3/27/2020	1.46	3	88	0	0	0	0	0	0	0	4403	3907
3/30/2020	1.37	3	79	49	29	5	342	2	-	-	4452	3936
3/31/2020	1.34	4	64	635	619	4	635	4	0	0	5087	4555
4/1/2020	1.48	4	53	(136)	(152)	4	37	1	-	-	4951	4403
4/2/2020	1.38	4	38	411	407	1	411	1	0	0	5362	4810
4/3/2020	1.39	4	33	(234)	(250)	4	204	1	-	-	5128	4560
4/6/2020	1.38	4	21	(226)	(234)	2	211	1	-	-	4902	4326
4/7/2020	1.23	4	12	(263)	(291)	7	594	3	-	-	4639	4035
4/8/2020	1.13	4	0	(7)	(15)	2	290	1	-	-	4632	4020
4/9/2020	1.11	4	-4	321	305	4	321	4	0	0	4953	4325
4/13/2020	0.96	4	-	154	142	3	175	2	-21	-21	5107	4467
4/14/2020	1.03	4	-	(348)	(372)	6	85	1	-	-	4759	4095
4/15/2020	1.03	5	-	0	0	0	0	0	0	0	4759	4095
4/16/2020	0.83	8	-	0	0	0	0	0	0	0	4759	4095
4/17/2020	0.8	8	-	0	0	0	0	0	0	0	4759	4095
4/20/2020	0.75	8	-	0	0	0	0	0	0	0	4759	4095
4/21/2020	0.79	8	-	0	0	0	0	0	0	0	4759	4095
4/22/2020	0.8	8	-	0	0	0	0	0	0	0	4759	4095
4/23/2020	0.76	8	-7	0	0	0	0	0	0	0	4759	4095
4/24/2020	0.94	8	-6	0	0	0	0	0	0	0	4759	4095
4/27/2020	1.11	8	-6	0	0	0	0	0	0	0	4759	4095
4/28/2020	1.09	8	-	0	0	0	0	0	0	0	4759	4095
4/29/2020	0.82	8	-	0	0	0	0	0	0	0	4759	4095
4/30/2020	0.91	8	-	0	0	0	0	0	0	0	4759	4095
5/1/2020	0.81	8	-	0	0	0	0	0	0	0	4759	4095
5/4/2020	0.9	8	-3	0	0	0	0	0	0	0	4759	4095
5/5/2020	0.98	8	0	0	0	0	0	0	0	0	4759	4095
5/6/2020	1.13	8	-2	0	0	0	0	0	0	0	4759	4095
5/7/2020	1.12	8	0	0	0	0	0	0	0	0	4759	4095
5/8/2020	1.01	8	3	0	0	0	0	0	0	0	4759	4095



Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
5/11/2020	1	8	5	0	0	0	0	0	0	0	4759	4095
5/12/2020	1.05	8	17	0	0	0	0	0	0	0	4759	4095
5/13/2020	1.16	4	62	495	483	3	495	3	0	0	5254	4578
5/14/2020	1.65	4	66	596	592	1	596	1	0	0	5850	5170
5/15/2020	1.69	4	62	59	47	3	161	2	-	-	5909	5217
5/18/2020	1.78	4	64	47	39	2	157	1	-	-	5956	5256
5/19/2020	1.68	4	69	319	311	2	319	2	0	0	6275	5567
5/20/2020	2.27	4	75	(65)	(69)	1	0	0	-65	-65	6210	5498
5/21/2020	2.11	4	75	(115)	(127)	3	0	0	-66	-	6095	5371
5/22/2020	1.91	4	81	0	0	0	0	0	0	0	6095	5371
5/26/2020	1.92	4	88	0	0	0	0	0	0	0	6095	5371
5/27/2020	3.08	4	90	0	0	0	0	0	0	0	6095	5371
5/28/2020	2.85	4	91	0	0	0	0	0	0	0	6095	5371
5/29/2020	3.35	4	92	0	0	0	0	0	0	0	6095	5371
6/1/2020	2.83	4	94	0	0	0	0	0	0	0	6095	5371
6/2/2020	3.14	4	93	0	0	0	0	0	0	0	6095	5371
6/3/2020	3.02	4	94	0	0	0	0	0	0	0	6095	5371
6/4/2020	3.72	4	95	0	0	0	0	0	0	0	6095	5371
6/5/2020	3.36	4	95	0	0	0	0	0	0	0	6095	5371
6/8/2020	3.74	4	95	0	0	0	0	0	0	0	6095	5371
6/9/2020	3.39	4	95	0	0	0	0	0	0	0	6095	5371
6/10/2020	4.1	4	93	0	0	0	0	0	0	0	6095	5371
6/11/2020	2.52	4	93	0	0	0	0	0	0	0	6095	5371
6/12/2020	2.07	4	94	0	0	0	0	0	0	0	6095	5371
6/15/2020	1.92	4	87	0	0	0	0	0	0	0	6095	5371
6/16/2020	1.87	4	87	0	0	0	0	0	0	0	6095	5371
6/17/2020	1.76	4	86	0	0	0	0	0	0	0	6095	5371
6/18/2020	1.92	3	86	0	0	0	0	0	0	0	6095	5371
6/19/2020	2.06	3	84	0	0	0	0	0	0	0	6095	5371
6/22/2020	1.64	3	83	0	0	0	0	0	0	0	6095	5371
6/23/2020	1.69	3	82	0	0	0	0	0	0	0	6095	5371
6/24/2020	1.61	3	81	0	0	0	0	0	0	0	6095	5371
6/25/2020	1.66	3	81	0	0	0	0	0	0	0	6095	5371
6/26/2020	1.5	3	83	0	0	0	0	0	0	0	6095	5371
6/29/2020	1.33	4	73	212	208	1	212	1	0	0	6307	5579
6/30/2020	1.32	4	70	179	167	3	276	2	-97	-97	6486	5746
7/1/2020	1.34	4	65	(110)	(114)	1	0	0	-	-	6376	5632
7/2/2020	1.2	4	64	(39)	(59)	5	158	2	-	-	6337	5573
7/6/2020	1.14	4	43	56	48	2	76	1	-20	-20	6393	5621
7/7/2020	1.13	4	38	283	275	2	283	2	0	0	6676	5896
7/8/2020	1.22	4	41	146	138	2	146	2	0	0	6822	6034
7/9/2020	1.43	4	37	(177)	(193)	4	120	3	-	-	6645	5841
7/10/2020	1.26	4	36	79	71	2	224	1	-	-	6724	5912
7/13/2020	1.27	4	28	485	469	4	584	2	-56	-99	7209	6381
7/14/2020	1.44	4	35	74	66	2	338	1	-	-	7283	6447
7/15/2020	1.38	4	39	185	169	4	186	3	-1	-1	7468	6616
7/16/2020	1.37	4	54	76	68	2	76	2	0	0	7544	6684
7/17/2020	1.37	4	63	(74)	(78)	1	0	0	-74	-74	7470	6606
7/20/2020	1.64	4	62	71	59	3	134	2	-63	-63	7541	6665
7/21/2020	1.6	4	66	22	10	3	179	2	-	-	7563	6675
7/22/2020	1.54	4	72	106	98	2	106	2	0	0	7669	6773
7/23/2020	1.5	4	78	194	186	2	264	1	-70	-70	7863	6959
7/24/2020	1.58	3	91	0	0	0	0	0	0	0	7863	6959
7/27/2020	2.12	2	92	0	0	0	0	0	0	0	7863	6959
7/28/2020	2.06	2	93	0	0	0	0	0	0	0	7863	6959
7/29/2020	1.82	2	94	0	0	0	0	0	0	0	7863	6959
7/30/2020	1.99	2	94	0	0	0	0	0	0	0	7863	6959
7/31/2020	1.61	3	85	0	0	0	0	0	0	0	7863	6959
8/3/2020	1.74	4	78	(77)	(89)	3	30	2	-	-	7786	6870
8/4/2020	1.64	4	73	(150)	(154)	1	0	0	-	-	7636	6716
8/5/2020	1.39	4	67	97	93	1	97	1	0	0	7733	6809
8/6/2020	1.37	4	62	129	121	2	153	1	-24	-24	7862	6930
8/7/2020	1.59	4	48	145	141	1	145	1	0	0	8007	7071
8/10/2020	1.68	4	43	148	144	1	148	1	0	0	8155	7215
8/11/2020	1.51	4	29	421	413	2	433	1	-12	-12	8576	7628
8/12/2020	1.87	4	29	(138)	(146)	2	0	0	-85	-	8438	7482
8/13/2020	1.57	4	30	54	50	1	54	1	0	0	8492	7532
8/14/2020	1.55	4	33	31	23	2	64	1	-33	-33	8523	7555

Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
8/17/2020	1.64	4	40	(21)	(25)	1	0	0	-21	-21	8502	7530
8/18/2020	1.59	4	39	(36)	(48)	3	26	2	-62	-62	8466	7482
8/19/2020	1.59	4	49	(97)	(109)	3	52	1	-90	-97	8369	7373
8/20/2020	1.39	4	51	111	107	1	111	1	0	0	8480	7480
8/21/2020	1.35	4	54	137	125	3	164	2	-27	-27	8617	7605
8/24/2020	1.43	4	60	163	159	1	163	1	0	0	8780	7764
8/25/2020	1.47	4	68	66	62	1	66	1	0	0	8846	7826
8/26/2020	1.7	4	76	134	130	1	134	1	0	0	8980	7956
8/27/2020	1.75	4	82	0	0	0	0	0	0	0	8980	7956
8/28/2020	2.22	2	82	0	0	0	0	0	0	0	8980	7956
8/31/2020	2.06	2	78	151	143	2	151	2	0	0	9131	8099
9/1/2020	2.47	2	76	257	253	1	257	1	0	0	9388	8352
9/2/2020	3.41	2	77	0	0	0	0	0	0	0	9388	8352
9/3/2020	3.86	2	74	0	0	0	0	0	0	0	9388	8352
9/4/2020	3.8	2	70	0	0	0	0	0	0	0	9388	8352
9/8/2020	1.52	2	61	(107)	(115)	2	31	1	-	-	9281	8237
9/9/2020	1.15	2	52	237	233	1	237	1	0	0	9518	8470
9/10/2020	1.42	2	51	(48)	(64)	4	320	1	-	-	9470	8406
9/11/2020	1.28	2	53	(26)	(30)	1	0	0	-26	-26	9444	8376
9/14/2020	1.25	3	50	193	189	1	193	1	0	0	9637	8565
9/15/2020	1.37	3	50	(46)	(54)	2	44	1	-90	-90	9591	8511
9/16/2020	1.36	3	45	(150)	(154)	1	0	0	-	-	9441	8357
9/17/2020	1.33	3	28	(205)	(213)	2	0	0	-	-	9236	8144
9/18/2020	1.14	4	12	62	50	3	168	2	-	-	9298	8194
9/21/2020	1.1	5	-1	0	0	0	0	0	0	0	9298	8194
9/22/2020	1.2	5	0	0	0	0	0	0	0	0	9298	8194
9/23/2020	1.21	5	0	0	0	0	0	0	0	0	9298	8194
9/24/2020	0.95	5	-1	0	0	0	0	0	0	0	9298	8194
9/25/2020	0.87	5	-	0	0	0	0	0	0	0	9298	8194
9/28/2020	0.93	5	-	0	0	0	0	0	0	0	9298	8194
9/29/2020	0.88	5	-	0	0	0	0	0	0	0	9298	8194
9/30/2020	0.84	5	-	0	0	0	0	0	0	0	9298	8194
10/1/2020	0.75	5	-	0	0	0	0	0	0	0	9298	8194
10/2/2020	0.79	5	-	0	0	0	0	0	0	0	9298	8194
10/5/2020	0.93	5	-	0	0	0	0	0	0	0	9298	8194
10/6/2020	1.01	5	-	0	0	0	0	0	0	0	9298	8194
10/7/2020	0.87	5	-	0	0	0	0	0	0	0	9298	8194
10/8/2020	0.76	5	-	0	0	0	0	0	0	0	9298	8194
10/9/2020	0.76	5	-	0	0	0	0	0	0	0	9298	8194
10/12/2020	0.78	5	-	0	0	0	0	0	0	0	9298	8194
10/13/2020	0.75	5	-	0	0	0	0	0	0	0	9298	8194
10/14/2020	0.76	4	-	(258)	(266)	2	0	0	-	-	9040	7928
10/15/2020	0.73	3	-	119	107	3	178	2	-59	-59	9159	8035
10/16/2020	0.83	3	-	142	126	4	185	3	-43	-43	9301	8161
10/19/2020	0.85	3	-	550	546	1	550	1	0	0	9851	8707
10/20/2020	0.91	3	-	(14)	(18)	1	0	0	-14	-14	9837	8689
10/21/2020	0.88	3	-	42	34	2	52	1	-10	-10	9879	8723
10/22/2020	1.08	3	-7	125	121	1	125	1	0	0	10004	8844
10/23/2020	1.48	3	-3	(83)	(87)	1	0	0	-83	-83	9921	8757
10/26/2020	1.24	3	-1	424	416	2	424	2	0	0	10345	9173
10/27/2020	1.5	3	2	(95)	(99)	1	0	0	-95	-95	10250	9074
10/28/2020	1.39	3	9	66	46	5	302	1	-93	-	10316	9120
10/29/2020	1.31	3	32	342	322	5	392	3	-26	-26	10658	9442
10/30/2020	1.41	3	59	(157)	(169)	3	102	2	-	-	10501	9273
11/2/2020	1.47	3	70	(16)	(20)	1	0	0	-16	-16	10485	9253
11/3/2020	1.34	3	77	(54)	(70)	4	202	2	-	-	10431	9183
11/4/2020	1.68	3	82	0	0	0	0	0	0	0	10431	9183
11/5/2020	1.68	3	77	125	117	2	132	1	-7	-7	10556	9300
11/6/2020	1.72	3	74	117	113	1	117	1	0	0	10673	9413
11/9/2020	1.8	3	69	222	214	2	284	1	-62	-62	10895	9627
11/10/2020	1.85	3	69	(76)	(84)	2	26	1	-	-	10819	9543
11/11/2020	1.76	3	69	(180)	(188)	2	0	0	-	-	10639	9355
11/12/2020	1.84	3	64	(316)	(324)	2	0	0	-	-	10323	9031
11/13/2020	1.52	4	51	147	143	1	147	1	0	0	10470	9174
11/16/2020	1.53	4	35	(21)	(29)	2	55	1	-76	-76	10449	9145
11/17/2020	1.24	4	27	50	34	4	176	3	-	-	10499	9179
11/18/2020	1.25	4	19	(124)	(148)	6	149	3	-	-	10375	9031
11/19/2020	1.16	4	2	(13)	(29)	4	99	2	-66	-66	10362	9002

Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
11/20/2020	1.1	4	0	38	22	4	91	3	-53	-53	10400	9024
11/23/2020	1.15	4	-6	252	236	4	274	3	-22	-22	10652	9260
11/24/2020	1.08	4	-4	192	184	2	192	2	0	0	10844	9444
11/25/2020	1.2	4	-1	15	3	3	30	2	-15	-15	10859	9447
11/27/2020	1.04	4	3	70	58	3	70	3	0	0	10929	9505
11/30/2020	1.17	4	12	(40)	(52)	3	83	2	-	-	10889	9453
12/1/2020	1.15	4	20	39	31	2	40	1	-1	-1	10928	9484
12/2/2020	1.22	4	22	(31)	(43)	3	117	1	-	-	10897	9441
12/3/2020	1.29	4	23	(43)	(47)	1	0	0	-43	-43	10854	9394
12/4/2020	1.18	4	25	68	64	1	68	1	0	0	10922	9458
12/7/2020	1.15	4	30	(22)	(30)	2	11	1	-33	-33	10900	9428
12/8/2020	1	4	43	156	144	3	156	3	0	0	11056	9572
12/9/2020	1.16	4	63	6	(6)	3	172	1	-94	-	11062	9566
12/10/2020	1.28	3	76	173	161	3	173	3	0	0	11235	9727
12/11/2020	1.77	3	81	0	0	0	0	0	0	0	11235	9727
12/14/2020	1.45	3	83	0	0	0	0	0	0	0	11235	9727
12/15/2020	1.34	5	79	0	0	0	0	0	0	0	11235	9727
12/16/2020	1.42	5	81	0	0	0	0	0	0	0	11235	9727
12/17/2020	1.53	5	74	0	0	0	0	0	0	0	11235	9727
12/18/2020	1.6	5	66	0	0	0	0	0	0	0	11235	9727
12/21/2020	1.22	5	37	0	0	0	0	0	0	0	11235	9727
12/22/2020	1.17	5	16	0	0	0	0	0	0	0	11235	9727
12/23/2020	0.87	5	1	0	0	0	0	0	0	0	11235	9727
12/24/2020	0.79	7	-	0	0	0	0	0	0	0	11235	9727
12/28/2020	0.89	7	-	0	0	0	0	0	0	0	11235	9727
12/29/2020	0.97	7	-	0	0	0	0	0	0	0	11235	9727
12/30/2020	1	7	-	0	0	0	0	0	0	0	11235	9727
12/31/2020	1	7	-	0	0	0	0	0	0	0	11235	9727
1/4/2021	1.13	7	-	0	0	0	0	0	0	0	11235	9727
1/5/2021	1.23	7	-	0	0	0	0	0	0	0	11235	9727
1/6/2021	1.21	7	-2	0	0	0	0	0	0	0	11235	9727
1/7/2021	1.26	7	0	0	0	0	0	0	0	0	11235	9727
1/8/2021	1.12	7	6	0	0	0	0	0	0	0	11235	9727
1/11/2021	1.33	7	28	0	0	0	0	0	0	0	11235	9727
1/12/2021	1.56	7	43	0	0	0	0	0	0	0	11235	9727
1/13/2021	1.53	7	55	0	0	0	0	0	0	0	11235	9727
1/14/2021	1.6	7	71	0	0	0	0	0	0	0	11235	9727
1/15/2021	1.37	7	79	0	0	0	0	0	0	0	11235	9727
1/19/2021	1.48	7	84	0	0	0	0	0	0	0	11235	9727
1/20/2021	1.79	5	81	0	0	0	0	0	0	0	11235	9727
1/21/2021	2.24	5	64	0	0	0	0	0	0	0	11235	9727
1/22/2021	2.07	5	58	0	0	0	0	0	0	0	11235	9727
1/25/2021	1.98	5	59	0	0	0	0	0	0	0	11235	9727
1/26/2021	2.35	5	62	0	0	0	0	0	0	0	11235	9727
1/27/2021	2.29	5	63	0	0	0	0	0	0	0	11235	9727
1/28/2021	1.88	5	62	0	0	0	0	0	0	0	11235	9727
1/29/2021	1.83	5	62	0	0	0	0	0	0	0	11235	9727
2/1/2021	2.29	5	67	0	0	0	0	0	0	0	11235	9727
2/2/2021	2.6	5	61	0	0	0	0	0	0	0	11235	9727
2/3/2021	2.45	5	67	0	0	0	0	0	0	0	11235	9727
2/4/2021	2.18	5	71	0	0	0	0	0	0	0	11235	9727
2/5/2021	2.28	5	75	0	0	0	0	0	0	0	11235	9727
2/8/2021	2.03	5	78	0	0	0	0	0	0	0	11235	9727
2/9/2021	1.98	5	81	0	0	0	0	0	0	0	11235	9727
2/10/2021	1.97	5	86	0	0	0	0	0	0	0	11235	9727
2/11/2021	2.05	4	89	0	0	0	0	0	0	0	11235	9727
2/12/2021	1.79	3	84	0	0	0	0	0	0	0	11235	9727
2/16/2021	2.15	3	77	105	93	3	105	3	0	0	11340	9820
2/17/2021	2.38	3	74	98	86	3	159	2	-61	-61	11438	9906
2/18/2021	2.28	3	69	(212)	(224)	3	32	1	-	-	11226	9682
2/19/2021	1.85	3	49	59	51	2	67	1	-8	-8	11285	9733
2/22/2021	1.83	3	41	(8)	(20)	3	158	1	-	-	11277	9713
2/23/2021	1.44	3	33	529	513	4	529	4	0	0	11806	10226
2/24/2021	1.84	3	36	433	421	3	473	2	-40	-40	12239	10647
2/25/2021	2.58	3	40	392	380	3	451	2	-59	-59	12631	11027
2/26/2021	2.71	3	47	282	266	4	440	2	-	-	12913	11293
3/1/2021	2.35	3	55	380	372	2	380	2	0	0	13293	11665
3/2/2021	2.59	3	61	0	0	0	0	0	0	0	13293	11665

Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
3/3/2021	2.6	2	66	(118)	(126)	2	10	1	-	-	13175	11539
3/4/2021	2.51	2	71	624	600	6	819	5	-	-	13799	12139
3/5/2021	2.73	2	82	0	0	0	0	0	0	0	13799	12139
3/8/2021	2.1	2	85	0	0	0	0	0	0	0	13799	12139
3/9/2021	2.15	2	88	0	0	0	0	0	0	0	13799	12139
3/10/2021	1.96	2	90	0	0	0	0	0	0	0	13799	12139
3/11/2021	2.04	3	91	0	0	0	0	0	0	0	13799	12139
3/12/2021	2.29	3	90	0	0	0	0	0	0	0	13799	12139
3/15/2021	2.17	3	87	0	0	0	0	0	0	0	13799	12139
3/16/2021	1.87	3	84	0	0	0	0	0	0	0	13799	12139
3/17/2021	1.8	3	74	140	136	1	140	1	0	0	13939	12275
3/18/2021	1.84	3	70	118	110	2	150	1	-32	-32	14057	12385
3/19/2021	2.05	3	64	(121)	(125)	1	0	0	-	-	13936	12260
3/22/2021	1.93	3	60	68	64	1	68	1	0	0	14004	12324
3/23/2021	2.03	3	53	(148)	(160)	3	51	2	-	-	13856	12164
3/24/2021	1.68	3	42	(97)	(101)	1	0	0	-97	-97	13759	12063
3/25/2021	1.45	3	30	(146)	(158)	3	130	1	-	-	13613	11905
3/26/2021	1.22	3	7	259	247	3	259	3	0	0	13872	12152
3/29/2021	1.22	3	-2	(211)	(227)	4	139	2	-	-	13661	11925
3/30/2021	1	3	-7	50	34	4	120	3	-70	-70	13711	11959
3/31/2021	1.01	3	-	11	7	1	11	1	0	0	13722	11966
4/1/2021	1.06	3	-	7	3	1	7	1	0	0	13729	11969
4/5/2021	0.97	3	-	(91)	(103)	3	0	0	-53	-91	13638	11866
4/6/2021	0.79	3	-	(97)	(105)	2	0	0	-92	-97	13541	11761
4/7/2021	0.81	4	-	56	52	1	56	1	0	0	13597	11813
4/8/2021	0.74	4	-	56	52	1	56	1	0	0	13653	11865
4/9/2021	0.78	4	-	162	158	1	162	1	0	0	13815	12023
4/12/2021	0.84	4	-	5	(3)	2	5	1	0	0	13820	12020
4/13/2021	1	4	-	16	8	2	36	1	-20	-20	13836	12028
4/14/2021	1.03	4	-	13	9	1	13	1	0	0	13849	12037
4/15/2021	0.93	4	-	11	7	1	11	1	0	0	13860	12044
4/16/2021	0.85	4	-7	43	39	1	43	1	0	0	13903	12083
4/19/2021	0.97	4	-2	86	78	2	86	2	0	0	13989	12161
4/20/2021	0.99	4	0	(88)	(108)	5	145	2	-90	-	13901	12053
4/21/2021	1.04	4	27	336	332	1	336	1	0	0	14237	12385
4/22/2021	1.42	4	34	207	203	1	207	1	0	0	14444	12588
4/23/2021	1.97	4	34	102	98	1	102	1	0	0	14546	12686
4/26/2021	1.78	4	42	(28)	(36)	2	21	1	-49	-49	14518	12650
4/27/2021	2.53	4	71	58	54	1	58	1	0	0	14576	12704
4/28/2021	2.77	4	75	(58)	(66)	2	0	0	-36	-58	14518	12638
4/29/2021	2.45	4	81	0	0	0	0	0	0	0	14518	12638
4/30/2021	2.11	4	85	0	0	0	0	0	0	0	14518	12638
5/3/2021	1.77	4	83	0	0	0	0	0	0	0	14518	12638
5/4/2021	1.97	3	81	0	0	0	0	0	0	0	14518	12638
5/5/2021	1.86	4	68	69	65	1	69	1	0	0	14587	12703
5/6/2021	1.87	4	63	120	116	1	120	1	0	0	14707	12819
5/7/2021	1.95	4	60	290	286	1	290	1	0	0	14997	13105
5/10/2021	2.11	4	62	(152)	(156)	1	0	0	-	-	14845	12949
5/11/2021	1.77	4	58	62	54	2	62	2	0	0	14907	13003
5/12/2021	1.84	4	56	(440)	(452)	3	90	1	-	-	14467	12551
5/13/2021	1.22	4	39	(5)	(9)	1	0	0	-5	-5	14462	12542
5/14/2021	1.21	4	28	320	312	2	320	2	0	0	14782	12854
5/17/2021	1.4	4	22	328	312	4	328	4	0	0	15110	13166
5/18/2021	1.56	4	29	(270)	(282)	3	0	0	-	-	14840	12884
5/19/2021	1.43	4	9	(330)	(342)	3	53	1	-	-	14510	12542
5/20/2021	0.99	5	0	0	0	0	0	0	0	0	14510	12542
5/21/2021	1.02	5	0	0	0	0	0	0	0	0	14510	12542
5/24/2021	0.92	5	0	0	0	0	0	0	0	0	14510	12542
5/25/2021	0.93	5	1	0	0	0	0	0	0	0	14510	12542
5/26/2021	0.86	5	0	0	0	0	0	0	0	0	14510	12542
5/27/2021	0.87	5	0	0	0	0	0	0	0	0	14510	12542
5/28/2021	0.86	5	0	0	0	0	0	0	0	0	14510	12542
6/1/2021	0.9	5	-2	0	0	0	0	0	0	0	14510	12542
6/2/2021	0.97	5	-	0	0	0	0	0	0	0	14510	12542
6/3/2021	0.86	5	-	0	0	0	0	0	0	0	14510	12542
6/4/2021	0.84	5	-	0	0	0	0	0	0	0	14510	12542
6/7/2021	0.69	5	-	0	0	0	0	0	0	0	14510	12542
6/8/2021	0.7	5	-	0	0	0	0	0	0	0	14510	12542

Date	IS-pf	IS-lr	IS-r2	osnp	NOnp\$4	ont	ownp	ownt	ollt	odd	EQ	NetEq
6/9/2021	0.73	5	-	0	0	0	0	0	0	0	14510	12542
6/10/2021	0.93	5	-	0	0	0	0	0	0	0	14510	12542
6/11/2021	0.82	5	-	0	0	0	0	0	0	0	14510	12542
6/14/2021	0.7	5	-	0	0	0	0	0	0	0	14510	12542
6/15/2021	0.62	5	-	0	0	0	0	0	0	0	14510	12542
6/16/2021	0.76	5	-	0	0	0	0	0	0	0	14510	12542
6/17/2021	0.82	5	-	0	0	0	0	0	0	0	14510	12542
6/18/2021	0.59	4	-	(152)	(164)	3	0	0	-80	-	14358	12378
6/21/2021	0.57	4	-	458	454	1	458	1	0	0	14816	12832
6/22/2021	0.87	4	-	1	(7)	2	65	1	-64	-64	14817	12825
6/23/2021	0.94	4	-	35	31	1	35	1	0	0	14852	12856
6/24/2021	0.99	4	-5	59	55	1	59	1	0	0	14911	12911
6/25/2021	1.07	4	-1	136	132	1	136	1	0	0	15047	13043
6/28/2021	1.2	4	0	109	105	1	109	1	0	0	15156	13148
6/29/2021	1.28	4	3	(144)	(148)	1	0	0	-	-	15012	13000
6/30/2021	1.15	4	8	107	103	1	107	1	0	0	15119	13103
7/1/2021	1.34	4	15	87	83	1	87	1	0	0	15206	13186
7/2/2021	1.34	4	22	111	107	1	111	1	0	0	15317	13293
7/6/2021	1.6	4	34	(157)	(169)	3	50	1	-	-	15160	13124
7/7/2021	1.31	4	49	57	53	1	57	1	0	0	15217	13177
7/8/2021	1.41	4	57	(249)	(261)	3	0	0	-	-	14968	12916
7/9/2021	1.37	4	57	305	293	3	305	3	0	0	15273	13209