

Trading Russell 2000 5min Bars Using The End Point Fast Fourier Transform With Walk Forward 5 days in-sample and 1 day out-of-sample

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In the working paper entitled “The Discrete Fourier Transform Illusion””, www.meyersanalytics.com/publications2/dft.pdf, we demonstrated the misuses of the mathematical technique called the Fourier Transform as applied to the S&P500 index. There we showed how fitting the Fourier Transform to the S&P500 index data series produced a perfect curve fit on past data giving the illusion that this technique would predict the major turning points of the S&P500 index. Why does this happen? When the FFT went to fit the data, it already knew where all the tops and bottoms were. The FFT mathematics minimizes the error between the curve it generates and the real data points. This error minimization process forces the generated curve to smoothly fit the past data like a glove. As a matter of fact, it’s almost impossible not to get an excellent fit. However, as we demonstrated, when we examined the Fourier Transform on a day-by-day walk forward basis this seemingly wondrous predictive capability disappeared.

Here it will be shown how to use EPFFT technique on a walk forward basis to trade 5-minute bars of the Russell 2000 (TF) futures.

The End Point FFT

In order to avoid the past data curve fit illusion, we will create an indicator that walks forward one bar at a time. This indicator will calculate the noise filtered FFT curve but only save the last point, or end point, of the curve on the day that it is calculated. We will then connect all the generated end points to produce a curve that matches what we would have seen if we performed the noise filtered FFT on the end point dates.

EPFFT Construction Details

Unfortunately constructing the noise filtered FFT of a price data series is not quite as simple as just taking 512 closing prices, and directly plugging them into a FFT algorithm.

The mathematics of the Discrete Fourier Transform(DFT) assumes that the time-domain sample is periodic and that it has captured an integral number of periods. This means that the DFT assumes the end of the sampled series implicitly wraps around to the beginning to start all over again. Thus for 512 sampled data points the DFT assumes that these 512 sampled data points repeat every 512 samples. With real data series this is seldom the case and this creates what is called a wraparound effect in the frequency domain. The wraparound effect creates a lot of distortion on the ends of the price series when the noise filtered FFT is transformed back into prices. Unfortunately the end point of the price series is the very point we wish to estimate. While we can do nothing about the wrap around violation, we can significantly lessen its effects by what is called zero padding.

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, $x(n)$ represent the last point in the data series and $y(i)$ equal to the new endpoint flattened series then:

$$a = x(1) \quad b = (x(n) - x(1)) / (n - 1)$$

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

We can see that when $i=1$ then $y(1)=0$ and when $i=n$ then $y(n)=0$. What we’ve 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.

EPFFT Curve Construction

For this article a sliding time-bar window of 512 5-minute bars of TF continuous futures from 8/6/14 to 12/18/15 will be used.

Step 1 Take the Log_e of the 512 prices to minimize the exponential trend movements of the E-mini. End flatten these 512 log prices using equation (1) above.

Step 2 Take the FFT of these 512 points to create 512 frequency domain complex numbers f_i .

Step 3 Use a Low Pass Threshold filter that zeros out the frequencies whose magnitudes are less than $\text{thres} * F_{\text{max}}$. Thres is the decimal percentage of F_{max} and F_{max} is the maximum frequency amplitude of the spectrum. The Threshold zeros out the frequencies generated by noise. Please see www.meyersanalytics.com/publications2/dft.pdf

Step 4 Do an inverse FFT on the noise filtered spectrum and save the last 2 points. Although it's not obvious yet, we will need the noise filtered point one sample before the endpoint.

Add back the end point flattening of **Step 1** and taking the exponential value to reverse the log_e .

Step 5 Save the filtered end point and the point before. Call the endpoint $ep(k)$ and the point before $ep1(k)$ where k is the order of the sliding window. That is, the first sliding window $k=1$, the second, $k=2$, etc. Slide the 512 bar data window forward one bar, and repeat steps 1 through 4.

When the data window is moved forward one bar at a time a new data sample is added to the end and the data sample at the beginning is subtracted. This adding and subtracting causes the end point flattening coefficients and the power in the frequency spectrum to jump around creating distortion and jitter in the calculation of the noise filtered end point. This random jumping of the FFT endpoints as the data window slides forward in time adds a random jump to FFT end point curve. Fortunately this jumping can be minimized by creating a new end point curve from the two saved noise filtered end points, $ep(k)$ and $ep1(k)$, above in step 5. Since turning points are of interest rather than magnitude then in **step 5** a new variable will be created called **sumEP** where

$$\text{sumEP}(k) = \text{sumEP}(k-1) + ep(k) - ep1(k)$$

This new curve **sumEP(k)** is the sum of all the changes in the individual $ep(k)$'s from their noise filtered FFT value one sample before. This change series minimizes the magnitude jump problem creating a fairly smooth velocity type EPFFT curve.

The EPFFT System Defined

Even though **sumEP** 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 system, we will use a simple curve following technique on TF 5-minute bars.

Buy Rule:

- **IF sumEP** has moved up by more than the point amount of $pntup$ from the lowest low recorded in **sumEP** while short then buy the TF at the market..

Sell Rule:

- **IF sumEP** has moved down by more than the point amount $pntdn$ from the highest high recorded in **sumEP** while long then sell the TF at the market.

Intraday Bars Exit Rule:

Close the position at 1500 CST (no trades will be carried overnight).

Intraday Bars First Trade of Day Entry Rule:

Ignore all trade signals before **8:30am** CST . For the Buy and Sell rules above we have included a first trade of the day entry rule.

Testing The EPFFT System Using Walk Forward Optimization

There will be three strategy parameters to determine:

1. **thres**, Threshold filter.
2. **pntup**, if **sumEP** has moved up by more than the point amount of **pntup** from the lowest low recorded in **sumEP** while short then issue a buy signal
3. **pntdn**, if **sumEP** has moved down by more than the point amount **pntdn** from the highest high recorded in **sumEP** while long then sell

As mentioned, to test this system we will use five minute bar prices of the mini Russell 2000 index futures contract traded on the Intercontinental Exchange (ICE) and known by the symbol TF for the 339 trading days from August 13, 2014 to December 18, 2015.

We will test the EPFFT strategy with the above TS 5 min bars on a **walk forward basis**, where the in-sample(IS) will be 5 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 TS optimization on a number of different strategy inputs, TS 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 a **in-sample 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 can't 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 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? 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 with no out-of-sample testing cause losses when traded in real time from something that looked great in the in-sample section.

In order to gain confidence that our input parameter selection method 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 day-to-day 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 EPFFT Strategy Parameters Using Walk Forward Optimization

There are three strategy parameters to find *thres*, *pntup* and *pntdn*.

For the test data we will run the TradeStation optimization engine on **TF** 5 min price bars from 8/6/2014 to 12/18/2015 with the following optimization ranges for the EPFFT strategy inputs. This will create **339, 5 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 a exchange holiday or partial days are eliminated. Holidays that fall on a weekday create a 4day IS. All other **IS** periods consist of 5 trading weekdays.

The optimization ranges are:

1. *thres* from 10 to 25 in steps of 5
2. *pntup* from 0.25 to 5 steps of 0.25
3. *pntdn* from 0.25 to 5 in steps of 0.25
4. *pntjup* = 999 not used.
5. *pntjdn* = 999 not used.
6. *djp* = 1 not used
7. *logofcls* = 1
8. *nsamp* = 512
9. *Xn* = 1
10. *myStartTime* = 830
11. *Xopn* = 0
12. *Xtime* = 1500
13. *XonCls* = 0
14. *xmult* = 1
15. *prc* = c

The above *thres*, *pntup* and *pntdn* ranges will produce 1600 different input combinations or cases of the strategy input parameters for each of the 339 in-sample/out-of-sample files for the 16 months of 5 min bar TF data.

The question we are attempting to answer statistically is which best performance metric or combination of best performance metrics (which we will call a ***filter***) applied to the in-sample section will produce in-sample strategy inputs that produce statistically valid profits in the out-of-sample section. In other words we wish to find a

performance metric *filter* that we can apply to the in-sample section that can give us strategy inputs that will produce, on average, good trading results in the future.

When TS does an optimization routine over many combinations of inputs, it creates output page that has as its rows each strategy input combination and as its columns various trading performance measures such as Profit Factor, Total Net Profits, etc. An example of a simple filter would be to choose the strategy input optimization row in the in-sample section that had the highest Net Profit or perhaps a row that had the best Profit Factor with their associated strategy inputs. Unfortunately it was found that this type of simple metric performance filter very rarely produces good out-of-sample results. More complicated metric filters can produce good out-of-sample results minimizing spurious price movement biases in the selection of strategy inputs.

Here is a combination *filter* that is used in this paper with good out-of-sample results. High profit factors (PF) in the in-sample section usually mean poor performance in the out-of-sample-section. This is a kind of reversion to the mean. So in the in-sample section we eliminate all strategy input rows that have a $PF > 2$. In addition we wish to limit the number losing trades in a row in the 5 day IS period to 4 or less ($LR < 4$). The PWFO generates the metric **eq2b1**. This metric is the in-sample **Slope Of the Equity 2nd Order Polynomial Line** where **Equity 2nd Order Line** $= b_0 + b_1 * t + b_2 * t^2$. For this metric we take the trades in the in-sample section and fit a 2nd order polynomial to the in-sample trade equity curve and find the value of b_1 . Let us choose the 20 rows that contain the Largest(Top) **eq2b1** values from the rows that are left from the $PF - LR$ elimination. This particular filter will now leave 20 cases or rows in the in-sample section that satisfy the above filter conditions. . Suppose for this filter, within the 20 in-sample rows that are left, we want the row that has the maximum PWFO metric $\%P$ in the in-sample section. $\%P = \% \text{ Profitable Trades in the In-Sample Section}$. Thus we would want the $\%P$ to be as large as possible and we find the row that has the highest $\%P$ column. This would produce a filter named **t20eq2b1|p<2|lr4-%P**. This in-sample filter leaves only one row in the PWFO in-sample section with its associated strategy inputs and out-of-sample net profit in the out-of-sample section. This particular **t20eq2b1|p<2|lr4-%P** filter finds the strategy inputs parameters in each of the 339 in-sample sections and applies these inputs to the out-of-sample section. Using the filter in-sample strategy inputs on the 339 out-of-sample sections, the average out-of-sample performance is calculated. In addition many other important out-of-sample performance statistics for this filter are calculated and summarized. **Figure 3** shows such a filter computer run along with a small sample of other filter combinations that are constructed in a similar manner. **Row 3** of the sample output in **Figure 3** shows the results of the filter discussed above. A total of 20181 different metric filters were examined. More on this below on how that number of filters combinations effect the probability that the filter chosen was or was not due to chance.

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 100 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 100 files. We repeat this random picking in each of the 100 files 5000 times. Each of the 5000 mirror filters will choose a random row's OSNP of their own in each of the 100 files.. At the end, each of the 5000 mirror filters will have 100 *random* OSNP's picked from the rows of the 100 files. The sum of the 100 random OSNP picks for each mirror filter will generate a random total out-of-sample net profit (tOnpNet) or final random equity. The average and standard deviation of the 5000 mirror filter's different random tOnpNet's will allow us to calculate the chance probability of our above chosen filter's tOnpNet. Thus given the mirror filter's bootstrap random tOnpNet average and standard deviation, we can calculate the probability of obtaining our chosen filter's tOnpNet by pure chance alone. Figure 3 lists the 5000 mirror filter's bootstrap average for our 339 out-of-sample files of **(\$7038)** with a bootstrap standard deviation of **\$14072**. The probability of obtaining our filters net profit of **\$50,200** is 2.37×10^{-5} which is **4.08** standard deviations from the bootstrap average. For our filter, in row 3 in Figure 3, the expected number of cases that we could obtain by pure chance that would match or exceed the **\$50200** is $20181 \times 2.37 \times 10^{-5} = 0.48$ where **20181** is the total number of different filters we looked at in this run. This number is 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 339 days ending 8/13/14 – 12/18/15 (note the starting date 8/6/14 was part of the first 5 day in-sample period plus the number of MaxBarsBack and the OOS weekday after the 5 trade day in-sample was 8/13/14). The equity curves is plotted from Equity and

Net Equity columns in Table 1. Plotted on the equity curves is the 2nd 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 black line is the TF Daily Closing prices superimposed on the Equity Chart.

Figure 2 presents a plot of the EPFFT Strategy buy/sells and the EPFFT Indicator on the TF 5min bars for 12/16-2015 - 12/18/20115.

Table 1 below presents a table of the 339 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 3 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 25 days for this filter. This means that 25 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=53% and the ave oos winning trade to the ave oos losing trade ratio(oW|oL) was 1.29

To see the effect of walk forward analysis, take a look at **Table 1**. Notice how the input parameters *thres*, *pntrup*, *pntrdn* take sudden jumps from high to low and back. This is the walk forward process quickly adapting to changing volatility conditions in the in-sample sample. In addition, notice how often *thres* changes from 10 to 25. When the data gets very noisy with a lot of spurious price movements, the threshold, *thres*, has to be higher. During other times when the noise level is not as much *thres* can be lower to get onboard a trend faster.

In Figure 1, which presents a graph of the equity curve using the filter on the 339 trading days of out-of-sample data, notice how the equity curve follows the 2nd order polynomial trend line with an R² of 0.98. This R² only dropped to 0.97 for the net equity curve. In addition sharp drops of the Daily TF did not produce sharp drops in the equity except for the loss of -\$5050 on 8/24/15. Further big drops of TF in the last week of September 2015 did not produce big drops in equity. In comparing the equity curve to TF price moves both up and down the EPFFT strategy handled both up and down moves of TF with relatively smooth and consistent up trending equity curve profits.

Using this filter, the strategy was able to generate \$50,200 net equity after commissions and slippage of \$20 trading one TF contract for 339 days. This period of time from 8/13/14 to 12/18/15 was a volatile market. Yet the EPFFT strategy was able to adapt quite well. From Figure 3 and Table 1, the largest losing OOS trade was -\$2650 and the largest losing day was -\$5050 on the Monday of 8/24/15. The largest drawdown was -\$6280 from the day ending on 8/20/15 to 8/24/15. However this drawdown only lasted 2 trading days and completely recovered and made a new equity high in 4 trading days. The longest time between new equity highs was 25 days.

In observing Table 1 we can see that this strategy and filter made trades from a low of 0 or no trades/day to a high of 6 trades/day with an average of 1.7 trades/day with a medium of 1 trade/day. For the no trade days, the inputs found by the filter in the in-sample section generated no trades in the out-of-sample section.

Given 23 hour trading of the TS, restricting the strategy to trade only from 830am to 3:00pm CT caused the strategy to miss many profitable trends opportunities when Asia and then Europe opened trading in the early morning. Further research will include the A.M. time zones.

Disclaimer

The strategies, methods and indicators presented here are given purely for educational purposes and to facilitate the research and study of trading methods in the financial markets. **Hypothetical out-of-sample test results are no guarantee of future profits.** Please be aware that the positive performance presented here is based upon hypothetical trading and can in no way give any assurances or claim that the strategy and methods presented here will produce profits in the future and in fact may create financial losses.

Figure 1 Graph of EPFFT Strategy Equity Applying the Walk Forward Filter Each Day on the in-sample section On TF 5min Bar Prices 8/13/2014 to 12/18/2015

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 black line is the TF Daily Closing prices superimposed on the Equity Chart.

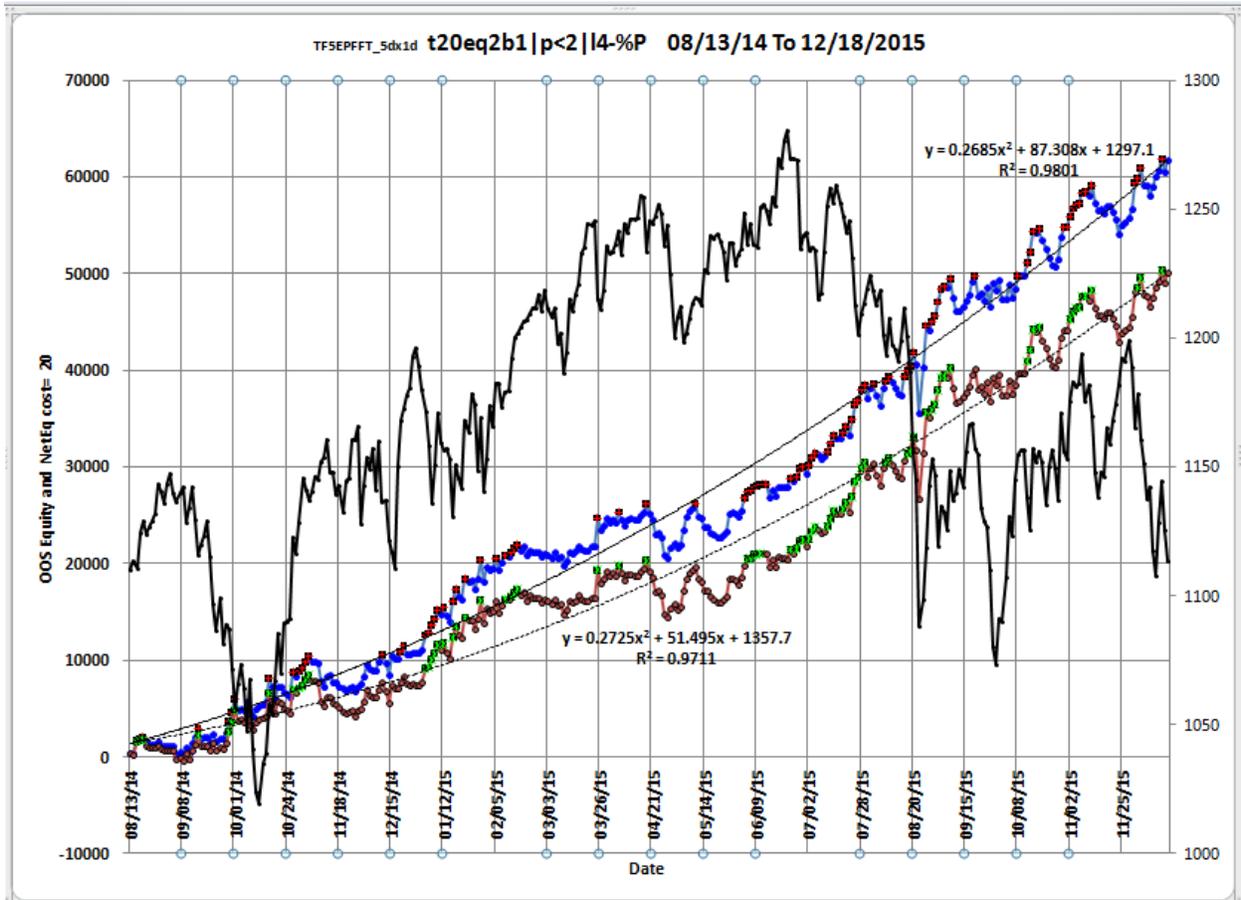


Figure 2 Plot of the EPFFT Strategy and Indicator



**Figure 3 Partial output of the Walk Forward Metric Explorer (WFME)
TF 5 min bars using the End Point Fast Fourier Transform Strategy**

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X |
|---|----------------------|-----------|-----------|-------|--------|-----|-----|-------|------|------|-----|---------|--------|--------|----|-----|-------|-------|------|--------|-----|-------|---------|----------|
| 1 | TF5EPFFT-5dx1d | s08/13/14 | e12/18/15 | #339 | AnyTnp | | | | | | | a(7038) | s14072 | f20181 | | | | | | c=\$20 | | | | |
| 2 | Filter-Metric | toGP | aoGP | aoTr | ao#T | aoW | aoL | oW oL | %Wtr | t | std | LLtr | LLp | eqDD | lr | # | eqTrn | eqV^2 | eqR2 | Dev^2 | Blw | BE | tOnpNet | Prob |
| 3 | t20eq2b1 p<2 4-%P | 61800 | 185 | 106.6 | 1.7 | 640 | 497 | 1.29 | 53 | 3.46 | 979 | -2650 | -5050 | -6280 | 5 | 334 | 179 | 269 | 96 | 3404 | 25 | 111.9 | 50200 | 2.37E-05 |
| 4 | t20mWT LT p<1.5 -tnp | 54750 | 162 | 78.3 | 2.1 | 579 | 439 | 1.32 | 51 | 3.05 | 978 | -4130 | -4900 | -6870 | 5 | 337 | 174 | 165 | 98 | 2137 | 34 | 144.9 | 40770 | 3.40E-04 |
| 5 | t20eq2b1 p<2 3-%P | 51210 | 152 | 85.8 | 1.8 | 623 | 494 | 1.26 | 52 | 2.9 | 965 | -2650 | -5050 | -6840 | 5 | 336 | 147 | 264 | 94 | 3569 | 63 | 160.3 | 39270 | 4.99E-04 |
| 6 | t20eq2b1 p<2 %P | 50280 | 151 | 85.1 | 1.8 | 618 | 507 | 1.22 | 53 | 2.82 | 977 | -2650 | -5050 | -6280 | 5 | 334 | 145 | 263 | 93 | 3809 | 52 | 168.5 | 38460 | 6.12E-04 |
| 7 | t20mKr p<2 3-mWT LT | 49010 | 145 | 79.4 | 1.8 | 648 | 484 | 1.34 | 50 | 2.7 | 987 | -3540 | -3230 | -7490 | 6 | 339 | 143 | 304 | 89 | 4948 | 41 | 186.3 | 36670 | 9.48E-04 |

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

Row 1 TF5EPFFT-5dx1d is the PWFO output files abbreviation, First OOS Day End Date(8/13/14), Last OOS Day End Date(12/18/15), Number of days(#339) 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=\$20).

Filter = The filter that was run. Row 3 filter t20eq2b1|p<2||4-%P

t20eq2b1|p<2||4-%P filter produced the following average 339 day statistics on row 3.

toGP = Total out-of-sample(oos) Gross profit for these 339 days.

aoGP = Average 1 day oos gross profit for the 339 days

aoTr = Average oos profit per trade

ao#T = Average number of oos trades per day

aoW = Average of the oos winning trades

aoL = Average of the oos losing trades

oW|oL = aoW/aoL the ratio of the winning oos trades to losing oos trades.

%Wtr = The percentage of oos trades that were profitable

t = The student t statistic for the 339 daily oos profits. The higher the t statistic the higher the probability that this result was not due to pure chance

std = The standard deviation of the 339 daily oos profits

LLtr = The largest losing oos trade in the whole period

LLp = The largest losing oos period(day)

eqDD = The oos equity drawdown

lr = The largest number of losing oos days in a row

= The number of days this filter produced a daily result. Note for some days there can be no strategy inputs that satisfy a given filter's criteria.

eqTrn = The straight line trend of the oos gross profit equity curve in \$/day.

eqV^2 = The ending velocity of 2nd order polynomial that is fit to the equity curve

eqR2 = The correlation coefficient(r²) of a straight line fit to the equity curve

Dev² = A measure of equity curve smoothness. The square root of the average [(equity curve minus a straight line)²]

Blw = The maximum number of days the oos equity curve failed to make a new high.

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

tOnpNet = Total out-of-sample net profit(tOnpNet) minus the total trade cost.

$$tOnpNet = tOnp - (\text{Number of trade days}) * aOnT * \text{Cost.}$$

Prob = the probability that the filter's tOnpNet was due to pure chance.

**Table 1 Walk Forward Out-Of-Sample Performance Summary for
TF End Point Fast Fourier Transform System**

TF-5 min bars 8/13/2014 - 12/18/2015. The input values *thres*, *pntup*, *pntdn* are the values found from applying the filter to the in-sample section optimization runs.

Filter: t20eq2b1|p<2|l4-%P PF<=2, LR<=4 then top 20 eq2b1, maximum %P

osnp = Daily Out-of-sample net profit from strategy inputs chosen by In-sample Section filter

ont = The number of trades in the out-of-sample day from strategy inputs chosen by In-sample Section filter.

NOnp\$20 = Osnp-ont*\$20

NetEq = running sum of daily out-of-sample net

ollt = Largest losing trade in the out-of-sample section

odd = Largest drawdown in the out-of-sample section.

Thres,pntup,pntdn = the EPFFT inputs found by the filter in the in-sample section and used on the out-of-sample section

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

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|-----------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 08/06/14 | To | 08/12/14 | 8/13/2014 | 450 | 1 | 430 | 430 | 0 | 0 | 15 | 0.25 | 2 | 830 | 1500 | 1110.1 |
| 08/07/14 | To | 08/13/14 | 8/14/2014 | (40) | 4 | (120) | 310 | -80 | -80 | 10 | 0.25 | 0.25 | 830 | 1500 | 1113.3 |
| 08/08/14 | To | 08/14/14 | 8/15/2014 | 1290 | 3 | 1230 | 1540 | -530 | -530 | 10 | 0.75 | 0.5 | 830 | 1500 | 1110.7 |
| 08/11/14 | To | 08/15/14 | 8/18/2014 | 200 | 2 | 160 | 1700 | -260 | -260 | 25 | 1.5 | 0.75 | 830 | 1500 | 1124.6 |
| 08/12/14 | To | 08/18/14 | 8/19/2014 | 160 | 2 | 120 | 1820 | 0 | 0 | 25 | 2 | 1.5 | 830 | 1500 | 1128.8 |
| 08/13/14 | To | 08/19/14 | 8/20/2014 | (560) | 2 | (600) | 1220 | -390 | -560 | 25 | 0.75 | 1.5 | 830 | 1500 | 1124.1 |
| 08/14/14 | To | 08/20/14 | 8/21/2014 | (200) | 1 | (220) | 1000 | -200 | -200 | 15 | 5 | 1.5 | 830 | 1500 | 1126.8 |
| 08/15/14 | To | 08/21/14 | 8/22/2014 | | | | 1000 | | | 25 | 3.5 | 3.5 | 830 | 1500 | 1129.2 |
| 08/18/14 | To | 08/22/14 | 8/25/2014 | 10 | 1 | (10) | 990 | 0 | 0 | 25 | 3.75 | 5 | 830 | 1500 | 1132.1 |
| 08/19/14 | To | 08/25/14 | 8/26/2014 | 260 | 1 | 240 | 1230 | 0 | 0 | 25 | 2 | 5 | 830 | 1500 | 1143.6 |
| 08/20/14 | To | 08/26/14 | 8/27/2014 | (350) | 1 | (370) | 860 | -350 | -350 | 25 | 2 | 5 | 830 | 1500 | 1140.8 |
| 08/21/14 | To | 08/27/14 | 8/28/2014 | (80) | 1 | (100) | 760 | -80 | -80 | 25 | 1.25 | 4.25 | 830 | 1500 | 1136.2 |
| 08/22/14 | To | 08/28/14 | 8/29/2014 | 20 | 2 | (20) | 740 | -270 | -270 | 20 | 0.75 | 4.5 | 830 | 1500 | 1143.3 |
| 08/26/14 | To | 09/01/14 | 9/2/2014 | 20 | 1 | 0 | 740 | 0 | 0 | 10 | 4 | 5 | 830 | 1500 | 1147.5 |
| 08/27/14 | To | 09/02/14 | 9/3/2014 | (20) | 2 | (60) | 680 | -550 | -550 | 20 | 3.25 | 1.25 | 830 | 1500 | 1140 |
| 08/28/14 | To | 09/03/14 | 9/4/2014 | (900) | 3 | (960) | (280) | -830 | -1130 | 15 | 0.25 | 4 | 830 | 1500 | 1136.5 |
| 08/29/14 | To | 09/04/14 | 9/5/2014 | 210 | 2 | 170 | (110) | -240 | -240 | 20 | 0.25 | 3.75 | 830 | 1500 | 1139.9 |
| 09/01/14 | To | 09/05/14 | 9/8/2014 | (270) | 1 | (290) | (400) | -270 | -270 | 25 | 3.25 | 3 | 830 | 1500 | 1142.5 |
| 09/02/14 | To | 09/08/14 | 9/9/2014 | 810 | 1 | 790 | 390 | 0 | 0 | 25 | 3 | 1.25 | 830 | 1500 | 1128.3 |
| 09/03/14 | To | 09/09/14 | 9/10/2014 | (580) | 1 | (600) | (210) | -580 | -580 | 10 | 4.5 | 1 | 830 | 1500 | 1134.2 |
| 09/04/14 | To | 09/10/14 | 9/11/2014 | 960 | 1 | 940 | 730 | 0 | 0 | 10 | 4.25 | 3.25 | 830 | 1500 | 1142.5 |
| 09/05/14 | To | 09/11/14 | 9/12/2014 | 620 | 2 | 580 | 1310 | -220 | -220 | 20 | 1.25 | 0.25 | 830 | 1500 | 1129.7 |
| 09/08/14 | To | 09/12/14 | 9/15/2014 | 940 | 1 | 920 | 2230 | 0 | 0 | 25 | 1.75 | 3.75 | 830 | 1500 | 1116.1 |
| 09/09/14 | To | 09/15/14 | 9/16/2014 | (1100) | 2 | (1140) | 1090 | -820 | -1100 | 15 | 4.5 | 5 | 830 | 1500 | 1119.6 |
| 09/10/14 | To | 09/16/14 | 9/17/2014 | 160 | 1 | 140 | 1230 | 0 | 0 | 20 | 1.25 | 3.5 | 830 | 1500 | 1123.4 |
| 09/11/14 | To | 09/17/14 | 9/18/2014 | | | | 1230 | | | 10 | 3.5 | 1.75 | 830 | 1500 | 1129.3 |
| 09/12/14 | To | 09/18/14 | 9/19/2014 | (500) | 2 | (540) | 690 | -1140 | -1140 | 15 | 4.25 | 1.25 | 830 | 1500 | 1115.3 |
| 09/15/14 | To | 09/19/14 | 9/22/2014 | 860 | 1 | 840 | 1530 | 0 | 0 | 15 | 2 | 3 | 830 | 1500 | 1097.2 |
| 09/16/14 | To | 09/22/14 | 9/23/2014 | (750) | 2 | (790) | 740 | -790 | -790 | 15 | 1.75 | 3.5 | 830 | 1500 | 1086.7 |
| 09/17/14 | To | 09/23/14 | 9/24/2014 | 300 | 2 | 260 | 1000 | -150 | -150 | 20 | 1.25 | 1.25 | 830 | 1500 | 1099.1 |
| 09/18/14 | To | 09/24/14 | 9/25/2014 | (30) | 4 | (110) | 890 | -610 | -610 | 15 | 0.5 | 0.25 | 830 | 1500 | 1081.5 |
| 09/19/14 | To | 09/25/14 | 9/26/2014 | 620 | 2 | 580 | 1470 | 0 | 0 | 20 | 4.25 | 0.5 | 830 | 1500 | 1089 |
| 09/22/14 | To | 09/26/14 | 9/29/2014 | 1110 | 1 | 1090 | 2560 | 0 | 0 | 25 | 1.5 | 4.5 | 830 | 1500 | 1087.1 |
| 09/23/14 | To | 09/29/14 | 9/30/2014 | 980 | 1 | 960 | 3520 | 0 | 0 | 25 | 5 | 0.75 | 830 | 1500 | 1071.5 |
| 09/24/14 | To | 09/30/14 | 10/1/2014 | 1330 | 1 | 1310 | 4830 | 0 | 0 | 25 | 5 | 3.5 | 830 | 1500 | 1057 |

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|------------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 09/25/14 | To | 10/01/14 | 10/2/2014 | (1070) | 2 | (1110) | 3720 | -920 | -1070 | 25 | 4.25 | 5 | 830 | 1500 | 1066.2 |
| 09/26/14 | To | 10/02/14 | 10/3/2014 | 150 | 1 | 130 | 3850 | 0 | 0 | 20 | 2.25 | 4.5 | 830 | 1500 | 1073.2 |
| 09/29/14 | To | 10/03/14 | 10/6/2014 | (230) | 2 | (270) | 3580 | -720 | -720 | 15 | 4 | 3.5 | 830 | 1500 | 1064 |
| 09/30/14 | To | 10/06/14 | 10/7/2014 | 890 | 1 | 870 | 4450 | 0 | 0 | 15 | 4.75 | 3 | 830 | 1500 | 1047.6 |
| 10/01/14 | To | 10/07/14 | 10/8/2014 | (1170) | 2 | (1210) | 3240 | -1680 | -1680 | 20 | 3.5 | 4.75 | 830 | 1500 | 1067.5 |
| 10/02/14 | To | 10/08/14 | 10/9/2014 | (320) | 2 | (360) | 2880 | -1430 | -1430 | 25 | 1.5 | 0.25 | 830 | 1500 | 1040.8 |
| 10/03/14 | To | 10/09/14 | 10/10/2014 | 800 | 1 | 780 | 3660 | 0 | 0 | 20 | 5 | 0.25 | 830 | 1500 | 1023.8 |
| 10/06/14 | To | 10/10/14 | 10/13/2014 | 350 | 3 | 290 | 3950 | -260 | -260 | 10 | 3.5 | 4 | 830 | 1500 | 1019.2 |
| 10/07/14 | To | 10/13/14 | 10/14/2014 | 180 | 3 | 120 | 4070 | -310 | -310 | 10 | 3.5 | 3.25 | 830 | 1500 | 1035 |
| 10/08/14 | To | 10/14/14 | 10/15/2014 | 190 | 4 | 110 | 4180 | -1510 | -1940 | 10 | 1.5 | 0.25 | 830 | 1500 | 1039.2 |
| 10/09/14 | To | 10/15/14 | 10/16/2014 | 2420 | 1 | 2400 | 6580 | 0 | 0 | 15 | 5 | 3.5 | 830 | 1500 | 1057.7 |
| 10/10/14 | To | 10/16/14 | 10/17/2014 | (900) | 2 | (940) | 5640 | -1180 | -1180 | 15 | 4 | 4 | 830 | 1500 | 1053.6 |
| 10/13/14 | To | 10/17/14 | 10/20/2014 | (1120) | 1 | (1140) | 4500 | -1120 | -1120 | 25 | 3.25 | 0.75 | 830 | 1500 | 1067.2 |
| 10/14/14 | To | 10/20/14 | 10/21/2014 | 1190 | 1 | 1170 | 5670 | 0 | 0 | 25 | 1.75 | 5 | 830 | 1500 | 1085.3 |
| 10/15/14 | To | 10/21/14 | 10/22/2014 | 20 | 2 | (20) | 5650 | -850 | -850 | 25 | 1.75 | 5 | 830 | 1500 | 1070.1 |
| 10/16/14 | To | 10/22/14 | 10/23/2014 | (600) | 2 | (640) | 5010 | -730 | -730 | 25 | 2.5 | 3.25 | 830 | 1500 | 1089.4 |
| 10/17/14 | To | 10/23/14 | 10/24/2014 | (220) | 1 | (240) | 4770 | -220 | -220 | 25 | 2.5 | 0.25 | 830 | 1500 | 1090.3 |
| 10/20/14 | To | 10/24/14 | 10/27/2014 | (270) | 2 | (310) | 4460 | -440 | -440 | 15 | 1 | 0.75 | 830 | 1500 | 1091.1 |
| 10/21/14 | To | 10/27/14 | 10/28/2014 | 2530 | 1 | 2510 | 6970 | 0 | 0 | 25 | 0.5 | 1.25 | 830 | 1500 | 1122.6 |
| 10/22/14 | To | 10/28/14 | 10/29/2014 | (340) | 1 | (360) | 6610 | -340 | -340 | 15 | 2.5 | 1 | 830 | 1500 | 1116.6 |
| 10/23/14 | To | 10/29/14 | 10/30/2014 | 530 | 1 | 510 | 7120 | 0 | 0 | 15 | 0.75 | 4.5 | 830 | 1500 | 1128.7 |
| 10/24/14 | To | 10/30/14 | 10/31/2014 | 210 | 1 | 190 | 7310 | 0 | 0 | 15 | 2.5 | 4.75 | 830 | 1500 | 1145.9 |
| 10/27/14 | To | 10/31/14 | 11/3/2014 | 710 | 2 | 670 | 7980 | 0 | 0 | 15 | 2.5 | 4.75 | 830 | 1500 | 1141.2 |
| 10/28/14 | To | 11/03/14 | 11/4/2014 | 490 | 1 | 470 | 8450 | 0 | 0 | 20 | 0.5 | 2.75 | 830 | 1500 | 1137.2 |
| 10/29/14 | To | 11/04/14 | 11/5/2014 | (540) | 1 | (560) | 7890 | -540 | -540 | 20 | 0.25 | 4 | 830 | 1500 | 1140.6 |
| 10/30/14 | To | 11/05/14 | 11/6/2014 | | | | 7890 | | | 25 | 0.75 | 5 | 830 | 1500 | 1146.3 |
| 10/31/14 | To | 11/06/14 | 11/7/2014 | (150) | 2 | (190) | 7700 | -490 | -490 | 15 | 1.5 | 4.75 | 830 | 1500 | 1145 |
| 11/03/14 | To | 11/07/14 | 11/10/2014 | (1830) | 3 | (1890) | 5810 | -780 | -1830 | 25 | 1.5 | 0.25 | 830 | 1500 | 1152.1 |
| 11/04/14 | To | 11/10/14 | 11/11/2014 | (510) | 3 | (570) | 5240 | -250 | -510 | 25 | 2.25 | 0.25 | 830 | 1500 | 1153.8 |
| 11/05/14 | To | 11/11/14 | 11/12/2014 | 1040 | 1 | 1020 | 6260 | 0 | 0 | 15 | 1.25 | 1.25 | 830 | 1500 | 1160.6 |
| 11/06/14 | To | 11/12/14 | 11/13/2014 | 100 | 4 | 20 | 6280 | -460 | -460 | 10 | 1 | 1 | 830 | 1500 | 1148.1 |
| 11/07/14 | To | 11/13/14 | 11/14/2014 | (680) | 2 | (720) | 5560 | -380 | -680 | 10 | 0.25 | 4 | 830 | 1500 | 1147.8 |
| 11/10/14 | To | 11/14/14 | 11/17/2014 | (30) | 2 | (70) | 5490 | -430 | -430 | 15 | 0.25 | 3 | 830 | 1500 | 1139.2 |
| 11/11/14 | To | 11/17/14 | 11/18/2014 | (400) | 1 | (420) | 5070 | -400 | -400 | 15 | 0.75 | 1.75 | 830 | 1500 | 1142.6 |
| 11/12/14 | To | 11/18/14 | 11/19/2014 | (270) | 4 | (350) | 4720 | -250 | -340 | 20 | 1.25 | 1.25 | 830 | 1500 | 1132.3 |
| 11/13/14 | To | 11/19/14 | 11/20/2014 | (230) | 2 | (270) | 4450 | -890 | -890 | 25 | 2.5 | 1 | 830 | 1500 | 1144.3 |
| 11/14/14 | To | 11/20/14 | 11/21/2014 | 260 | 2 | 220 | 4670 | -350 | -350 | 20 | 4.5 | 0.75 | 830 | 1500 | 1145.5 |
| 11/17/14 | To | 11/21/14 | 11/24/2014 | 220 | 1 | 200 | 4870 | 0 | 0 | 20 | 4.5 | 4 | 830 | 1500 | 1160.4 |
| 11/18/14 | To | 11/24/14 | 11/25/2014 | (570) | 3 | (630) | 4240 | -680 | -810 | 10 | 0.25 | 2.75 | 830 | 1500 | 1160.6 |
| 11/19/14 | To | 11/25/14 | 11/26/2014 | 550 | 1 | 530 | 4770 | 0 | 0 | 10 | 0.25 | 3 | 830 | 1500 | 1165.6 |
| 11/24/14 | To | 11/28/14 | 12/1/2014 | 260 | 2 | 220 | 4990 | -590 | -590 | 20 | 0.25 | 4.75 | 830 | 1500 | 1127.8 |
| 11/25/14 | To | 12/01/14 | 12/2/2014 | 720 | 2 | 680 | 5670 | -70 | -70 | 25 | 0.5 | 4.75 | 830 | 1500 | 1142.6 |
| 11/26/14 | To | 12/02/14 | 12/3/2014 | 1320 | 1 | 1300 | 6970 | 0 | 0 | 10 | 3.75 | 2.75 | 830 | 1500 | 1153.8 |
| 11/27/14 | To | 12/03/14 | 12/4/2014 | (520) | 3 | (580) | 6390 | -270 | -520 | 25 | 1.5 | 0.25 | 830 | 1500 | 1148.9 |
| 11/28/14 | To | 12/04/14 | 12/5/2014 | (180) | 3 | (240) | 6150 | -120 | -180 | 25 | 5 | 0.25 | 830 | 1500 | 1157.2 |
| 12/01/14 | To | 12/05/14 | 12/8/2014 | 90 | 2 | 50 | 6200 | -550 | -550 | 20 | 1 | 2 | 830 | 1500 | 1141.1 |
| 12/02/14 | To | 12/08/14 | 12/9/2014 | 840 | 2 | 800 | 7000 | -1250 | -1250 | 20 | 0.25 | 4.75 | 830 | 1500 | 1159.8 |
| 12/03/14 | To | 12/09/14 | 12/10/2014 | 710 | 2 | 670 | 7670 | -660 | -660 | 25 | 3.25 | 4.25 | 830 | 1500 | 1136.6 |
| 12/04/14 | To | 12/10/14 | 12/11/2014 | (750) | 3 | (810) | 6860 | -1120 | -1670 | 25 | 4.25 | 0.25 | 830 | 1500 | 1137.3 |
| 12/05/14 | To | 12/11/14 | 12/12/2014 | (1230) | 3 | (1290) | 5570 | -820 | -1330 | 25 | 2 | 1.75 | 830 | 1500 | 1121.5 |
| 12/08/14 | To | 12/12/14 | 12/15/2014 | 1930 | 1 | 1910 | 7480 | 0 | 0 | 10 | 3.75 | 1.25 | 830 | 1500 | 1116.9 |
| 12/09/14 | To | 12/15/14 | 12/16/2014 | (240) | 3 | (300) | 7180 | -950 | -1140 | 10 | 0.5 | 2.25 | 830 | 1500 | 1110.6 |

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|------------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 12/10/14 | To | 12/16/14 | 12/17/2014 | (90) | 2 | (130) | 7050 | -1660 | -1660 | 15 | 4.75 | 0.75 | 830 | 1500 | 1150.3 |
| 12/11/14 | To | 12/17/14 | 12/18/2014 | 680 | 1 | 660 | 7710 | 0 | 0 | 15 | 4.25 | 1.75 | 830 | 1500 | 1168 |
| 12/12/14 | To | 12/18/14 | 12/19/2014 | 610 | 1 | 590 | 8300 | 0 | 0 | 10 | 4.75 | 1.5 | 830 | 1500 | 1172.5 |
| 12/15/14 | To | 12/19/14 | 12/22/2014 | (750) | 1 | (770) | 7530 | -750 | -750 | 10 | 4.5 | 1 | 830 | 1500 | 1177.9 |
| 12/16/14 | To | 12/22/14 | 12/23/2014 | (40) | 3 | (100) | 7430 | -140 | -200 | 25 | 1.5 | 2.25 | 830 | 1500 | 1180.8 |
| 12/19/14 | To | 12/25/14 | 12/26/2014 | 180 | 3 | 120 | 7550 | -370 | -370 | 10 | 1.5 | 3.5 | 830 | 1500 | 1192.5 |
| 12/22/14 | To | 12/26/14 | 12/29/2014 | (70) | 1 | (90) | 7460 | -70 | -70 | 10 | 2.25 | 1.75 | 830 | 1500 | 1196.2 |
| 12/23/14 | To | 12/29/14 | 12/30/2014 | 20 | 2 | (20) | 7440 | -340 | -340 | 20 | 1 | 5 | 830 | 1500 | 1189.6 |
| 12/24/14 | To | 12/30/14 | 12/31/2014 | 290 | 3 | 230 | 7670 | -420 | -510 | 10 | 0.25 | 4.25 | 830 | 1500 | 1179.9 |
| 12/26/14 | To | 01/01/15 | 1/2/2015 | 1540 | 2 | 1500 | 9170 | 0 | 0 | 20 | 0.25 | 4.5 | 830 | 1500 | 1171.4 |
| 12/29/14 | To | 01/02/15 | 1/5/2015 | 160 | 3 | 100 | 9270 | -260 | -260 | 10 | 0.75 | 0.75 | 830 | 1500 | 1158.3 |
| 12/30/14 | To | 01/05/15 | 1/6/2015 | 820 | 2 | 780 | 10050 | -230 | -230 | 10 | 2.5 | 5 | 830 | 1500 | 1136.1 |
| 12/31/14 | To | 01/06/15 | 1/7/2015 | 630 | 1 | 610 | 10660 | 0 | 0 | 10 | 2.5 | 4.75 | 830 | 1500 | 1150.8 |
| 01/01/15 | To | 01/07/15 | 1/8/2015 | 970 | 1 | 950 | 11610 | 0 | 0 | 10 | 2 | 2.75 | 830 | 1500 | 1170.8 |
| 01/02/15 | To | 01/08/15 | 1/9/2015 | (490) | 2 | (530) | 11080 | -690 | -690 | 10 | 2 | 3.25 | 830 | 1500 | 1159.7 |
| 01/05/15 | To | 01/09/15 | 1/12/2015 | 690 | 2 | 650 | 11730 | 0 | 0 | 15 | 2.25 | 1.25 | 830 | 1500 | 1156.5 |
| 01/06/15 | To | 01/12/15 | 1/13/2015 | (860) | 3 | (920) | 10810 | -1110 | -1290 | 25 | 5 | 4.25 | 830 | 1500 | 1157 |
| 01/07/15 | To | 01/13/15 | 1/14/2015 | (540) | 1 | (560) | 10250 | -540 | -540 | 25 | 5 | 2.75 | 830 | 1500 | 1153.2 |
| 01/08/15 | To | 01/14/15 | 1/15/2015 | 2130 | 1 | 2110 | 12360 | 0 | 0 | 20 | 3 | 3 | 830 | 1500 | 1130.6 |
| 01/09/15 | To | 01/15/15 | 1/16/2015 | 1190 | 2 | 1150 | 13510 | -400 | -400 | 10 | 2.75 | 2.75 | 830 | 1500 | 1151 |
| 01/13/15 | To | 01/19/15 | 1/20/2015 | (710) | 6 | (830) | 12680 | -940 | -1150 | 10 | 3.25 | 0.25 | 830 | 1500 | 1145.8 |
| 01/14/15 | To | 01/20/15 | 1/21/2015 | (380) | 2 | (420) | 12260 | -340 | -380 | 25 | 0.75 | 4.5 | 830 | 1500 | 1141.7 |
| 01/15/15 | To | 01/21/15 | 1/22/2015 | 2150 | 1 | 2130 | 14390 | 0 | 0 | 20 | 0.75 | 1 | 830 | 1500 | 1167.9 |
| 01/16/15 | To | 01/22/15 | 1/23/2015 | (230) | 1 | (250) | 14140 | -230 | -230 | 10 | 1 | 2.5 | 830 | 1500 | 1163.6 |
| 01/19/15 | To | 01/23/15 | 1/26/2015 | 70 | 2 | 30 | 14170 | -750 | -750 | 15 | 1.25 | 2.5 | 830 | 1500 | 1178.5 |
| 01/20/15 | To | 01/26/15 | 1/27/2015 | (900) | 3 | (960) | 13210 | -1180 | -1240 | 15 | 1.5 | 0.5 | 830 | 1500 | 1174.6 |
| 01/21/15 | To | 01/27/15 | 1/28/2015 | 1050 | 1 | 1030 | 14240 | 0 | 0 | 20 | 3 | 5 | 830 | 1500 | 1148.8 |
| 01/22/15 | To | 01/28/15 | 1/29/2015 | 1990 | 2 | 1950 | 16190 | 0 | 0 | 10 | 0.25 | 4.25 | 830 | 1500 | 1169 |
| 01/23/15 | To | 01/29/15 | 1/30/2015 | (2260) | 3 | (2320) | 13870 | -1260 | -2260 | 10 | 0.25 | 4.25 | 830 | 1500 | 1140.4 |
| 01/26/15 | To | 01/30/15 | 2/2/2015 | 1490 | 2 | 1450 | 15320 | 0 | 0 | 25 | 4.25 | 3.25 | 830 | 1500 | 1153.1 |
| 01/27/15 | To | 02/02/15 | 2/3/2015 | (300) | 3 | (360) | 14960 | -480 | -830 | 15 | 4.75 | 3.5 | 830 | 1500 | 1173.7 |
| 01/28/15 | To | 02/03/15 | 2/4/2015 | 150 | 2 | 110 | 15070 | 0 | 0 | 25 | 2.75 | 0.25 | 830 | 1500 | 1165.8 |
| 01/29/15 | To | 02/04/15 | 2/5/2015 | 1060 | 1 | 1040 | 16110 | 0 | 0 | 15 | 1.25 | 5 | 830 | 1500 | 1182.6 |
| 01/30/15 | To | 02/05/15 | 2/6/2015 | (1070) | 3 | (1130) | 14980 | -700 | -1320 | 15 | 1.25 | 0.5 | 830 | 1500 | 1182.3 |
| 02/02/15 | To | 02/06/15 | 2/9/2015 | 680 | 1 | 660 | 15640 | 0 | 0 | 10 | 1.75 | 0.5 | 830 | 1500 | 1173.4 |
| 02/03/15 | To | 02/09/15 | 2/10/2015 | 690 | 2 | 650 | 16290 | 0 | 0 | 15 | 1.75 | 4.25 | 830 | 1500 | 1178.7 |
| 02/04/15 | To | 02/10/15 | 2/11/2015 | (10) | 1 | (30) | 16260 | -10 | -10 | 10 | 0.25 | 5 | 830 | 1500 | 1179.5 |
| 02/05/15 | To | 02/11/15 | 2/12/2015 | 360 | 1 | 340 | 16600 | 0 | 0 | 10 | 2 | 3.5 | 830 | 1500 | 1192 |
| 02/06/15 | To | 02/12/15 | 2/13/2015 | 400 | 1 | 380 | 16980 | 0 | 0 | 10 | 2.5 | 3.25 | 830 | 1500 | 1200.2 |
| 02/10/15 | To | 02/16/15 | 2/17/2015 | 380 | 1 | 360 | 17340 | 0 | 0 | 10 | 2.75 | 2.5 | 830 | 1500 | 1202 |
| 02/11/15 | To | 02/17/15 | 2/18/2015 | (530) | 1 | (550) | 16790 | -530 | -530 | 20 | 1.75 | 2 | 830 | 1500 | 1204.2 |
| 02/12/15 | To | 02/18/15 | 2/19/2015 | 370 | 1 | 350 | 17140 | 0 | 0 | 15 | 0.5 | 2.75 | 830 | 1500 | 1206.3 |
| 02/13/15 | To | 02/19/15 | 2/20/2015 | (910) | 1 | (930) | 16210 | -910 | -910 | 15 | 4.75 | 2 | 830 | 1500 | 1206.9 |
| 02/16/15 | To | 02/20/15 | 2/23/2015 | 520 | 1 | 500 | 16710 | 0 | 0 | 25 | 1.25 | 3.5 | 830 | 1500 | 1209.6 |
| 02/17/15 | To | 02/23/15 | 2/24/2015 | (210) | 1 | (230) | 16480 | -210 | -210 | 25 | 3.75 | 4.5 | 830 | 1500 | 1211.6 |
| 02/18/15 | To | 02/24/15 | 2/25/2015 | | | | 16480 | | | 15 | 4.75 | 5 | 830 | 1500 | 1211.6 |
| 02/19/15 | To | 02/25/15 | 2/26/2015 | | | | 16480 | | | 15 | 4.75 | 5 | 830 | 1500 | 1216.9 |
| 02/20/15 | To | 02/26/15 | 2/27/2015 | (480) | 1 | (500) | 15980 | -480 | -480 | 10 | 1.5 | 3.25 | 830 | 1500 | 1210.8 |
| 02/23/15 | To | 02/27/15 | 3/2/2015 | 410 | 1 | 390 | 16370 | 0 | 0 | 10 | 1.5 | 4.75 | 830 | 1500 | 1218.6 |
| 02/24/15 | To | 03/02/15 | 3/3/2015 | (140) | 3 | (200) | 16170 | -340 | -340 | 25 | 1.5 | 3.25 | 830 | 1500 | 1211.8 |
| 02/25/15 | To | 03/03/15 | 3/4/2015 | (310) | 2 | (350) | 15820 | -270 | -310 | 15 | 1.75 | 4.5 | 830 | 1500 | 1208.2 |
| 02/26/15 | To | 03/04/15 | 3/5/2015 | 560 | 1 | 540 | 16360 | 0 | 0 | 20 | 0.25 | 4 | 830 | 1500 | 1211.9 |

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|-----------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 02/27/15 | To | 03/05/15 | 3/6/2015 | (580) | 2 | (620) | 15740 | -860 | -860 | 25 | 0.75 | 4.5 | 830 | 1500 | 1197.8 |
| 03/02/15 | To | 03/06/15 | 3/9/2015 | 140 | 1 | 120 | 15860 | 0 | 0 | 20 | 0.25 | 4.5 | 830 | 1500 | 1201.8 |
| 03/03/15 | To | 03/09/15 | 3/10/2015 | (980) | 3 | (1040) | 14820 | -540 | -980 | 20 | 0.25 | 4.75 | 830 | 1500 | 1186.5 |
| 03/04/15 | To | 03/10/15 | 3/11/2015 | 450 | 2 | 410 | 15230 | -200 | -200 | 25 | 2.75 | 5 | 830 | 1500 | 1194.5 |
| 03/05/15 | To | 03/11/15 | 3/12/2015 | 940 | 1 | 920 | 16150 | 0 | 0 | 20 | 2.25 | 0.25 | 830 | 1500 | 1215.1 |
| 03/06/15 | To | 03/12/15 | 3/13/2015 | (110) | 3 | (170) | 15980 | -110 | -110 | 20 | 2.25 | 0.25 | 830 | 1500 | 1210.3 |
| 03/09/15 | To | 03/13/15 | 3/16/2015 | 210 | 1 | 190 | 16170 | 0 | 0 | 25 | 1.25 | 2.25 | 830 | 1500 | 1216.6 |
| 03/10/15 | To | 03/16/15 | 3/17/2015 | 600 | 1 | 580 | 16750 | 0 | 0 | 20 | 5 | 5 | 830 | 1500 | 1221.1 |
| 03/11/15 | To | 03/17/15 | 3/18/2015 | (310) | 3 | (370) | 16380 | -870 | -870 | 20 | 0.5 | 1.25 | 830 | 1500 | 1232.8 |
| 03/12/15 | To | 03/18/15 | 3/19/2015 | (240) | 2 | (280) | 16100 | -340 | -340 | 10 | 2 | 2.5 | 830 | 1500 | 1235.1 |
| 03/13/15 | To | 03/19/15 | 3/20/2015 | 60 | 3 | 0 | 16100 | -110 | -110 | 10 | 1.75 | 1 | 830 | 1500 | 1244.6 |
| 03/16/15 | To | 03/20/15 | 3/23/2015 | 420 | 2 | 380 | 16480 | 0 | 0 | 15 | 0.5 | 2.75 | 830 | 1500 | 1244.1 |
| 03/17/15 | To | 03/23/15 | 3/24/2015 | (70) | 1 | (90) | 16390 | -70 | -70 | 25 | 2 | 2.25 | 830 | 1500 | 1245.3 |
| 03/18/15 | To | 03/24/15 | 3/25/2015 | 2970 | 1 | 2950 | 19340 | 0 | 0 | 15 | 0.5 | 1 | 830 | 1500 | 1215.2 |
| 03/19/15 | To | 03/25/15 | 3/26/2015 | (1270) | 2 | (1310) | 18030 | -720 | -1270 | 20 | 0.25 | 2.5 | 830 | 1500 | 1211.2 |
| 03/20/15 | To | 03/26/15 | 3/27/2015 | 510 | 1 | 490 | 18520 | 0 | 0 | 15 | 0.5 | 3 | 830 | 1500 | 1218.8 |
| 03/23/15 | To | 03/27/15 | 3/30/2015 | 750 | 1 | 730 | 19250 | 0 | 0 | 15 | 0.5 | 3 | 830 | 1500 | 1235.7 |
| 03/24/15 | To | 03/30/15 | 3/31/2015 | (410) | 2 | (450) | 18800 | -260 | -410 | 20 | 0.25 | 0.25 | 830 | 1500 | 1233 |
| 03/25/15 | To | 03/31/15 | 4/1/2015 | 260 | 1 | 240 | 19040 | 0 | 0 | 10 | 0.5 | 3 | 830 | 1500 | 1233.4 |
| 03/26/15 | To | 04/01/15 | 4/2/2015 | (320) | 1 | (340) | 18700 | -320 | -320 | 15 | 3 | 3.5 | 830 | 1500 | 1236.4 |
| 03/30/15 | To | 04/03/15 | 4/6/2015 | 1090 | 1 | 1070 | 19770 | 0 | 0 | 10 | 3.5 | 2 | 830 | 1500 | 1241.6 |
| 03/31/15 | To | 04/06/15 | 4/7/2015 | (720) | 3 | (780) | 18990 | -750 | -1060 | 25 | 0.25 | 1.25 | 830 | 1500 | 1232.2 |
| 04/01/15 | To | 04/07/15 | 4/8/2015 | (640) | 2 | (680) | 18310 | -710 | -710 | 25 | 0.25 | 4 | 830 | 1500 | 1244.4 |
| 04/02/15 | To | 04/08/15 | 4/9/2015 | 620 | 1 | 600 | 18910 | 0 | 0 | 25 | 5 | 3.25 | 830 | 1500 | 1240.8 |
| 04/03/15 | To | 04/09/15 | 4/10/2015 | 70 | 1 | 50 | 18960 | 0 | 0 | 15 | 3 | 3.5 | 830 | 1500 | 1246.3 |
| 04/06/15 | To | 04/10/15 | 4/13/2015 | (140) | 1 | (160) | 18800 | -140 | -140 | 15 | 2.75 | 3.25 | 830 | 1500 | 1246.4 |
| 04/07/15 | To | 04/13/15 | 4/14/2015 | 0 | 3 | (60) | 18740 | -160 | -230 | 25 | 1.25 | 0.75 | 830 | 1500 | 1246.8 |
| 04/08/15 | To | 04/14/15 | 4/15/2015 | 540 | 1 | 520 | 19260 | 0 | 0 | 10 | 0.25 | 2.5 | 830 | 1500 | 1255.5 |
| 04/09/15 | To | 04/15/15 | 4/16/2015 | 230 | 2 | 190 | 19450 | 0 | 0 | 25 | 3 | 3 | 830 | 1500 | 1254.6 |
| 04/10/15 | To | 04/16/15 | 4/17/2015 | 870 | 1 | 850 | 20300 | 0 | 0 | 20 | 4.75 | 1.5 | 830 | 1500 | 1233.4 |
| 04/13/15 | To | 04/17/15 | 4/20/2015 | (1010) | 2 | (1050) | 19250 | -810 | -1010 | 25 | 5 | 4.5 | 830 | 1500 | 1245.6 |
| 04/14/15 | To | 04/20/15 | 4/21/2015 | (570) | 1 | (590) | 18660 | -570 | -570 | 25 | 3.75 | 2.5 | 830 | 1500 | 1244.4 |
| 04/15/15 | To | 04/21/15 | 4/22/2015 | (1580) | 3 | (1640) | 17020 | -900 | -1690 | 25 | 2.25 | 2.5 | 830 | 1500 | 1247.2 |
| 04/16/15 | To | 04/22/15 | 4/23/2015 | 160 | 1 | 140 | 17160 | 0 | 0 | 10 | 4.5 | 4.25 | 830 | 1500 | 1251.9 |
| 04/17/15 | To | 04/23/15 | 4/24/2015 | (390) | 1 | (410) | 16750 | -390 | -390 | 10 | 4.5 | 3 | 830 | 1500 | 1248.3 |
| 04/20/15 | To | 04/24/15 | 4/27/2015 | (1920) | 3 | (1980) | 14770 | -1810 | -1920 | 20 | 1 | 4 | 830 | 1500 | 1235.8 |
| 04/21/15 | To | 04/27/15 | 4/28/2015 | (310) | 2 | (350) | 14420 | -390 | -390 | 20 | 4.5 | 4.75 | 830 | 1500 | 1243.6 |
| 04/22/15 | To | 04/28/15 | 4/29/2015 | 1090 | 3 | 1030 | 15450 | -180 | -180 | 15 | 0.5 | 0.5 | 830 | 1500 | 1224.7 |
| 04/23/15 | To | 04/29/15 | 4/30/2015 | 470 | 3 | 410 | 15860 | -810 | -810 | 20 | 1.25 | 1.25 | 830 | 1500 | 1200.5 |
| 04/24/15 | To | 04/30/15 | 5/1/2015 | (490) | 3 | (550) | 15310 | -590 | -910 | 20 | 1.25 | 2 | 830 | 1500 | 1208.3 |
| 04/27/15 | To | 05/01/15 | 5/4/2015 | 340 | 2 | 300 | 15610 | 0 | 0 | 20 | 1.25 | 1.75 | 830 | 1500 | 1212.4 |
| 04/28/15 | To | 05/04/15 | 5/5/2015 | 1590 | 1 | 1570 | 17180 | 0 | 0 | 25 | 0.75 | 1.5 | 830 | 1500 | 1198.3 |
| 04/29/15 | To | 05/05/15 | 5/6/2015 | 1380 | 2 | 1340 | 18520 | 0 | 0 | 20 | 4 | 4.75 | 830 | 1500 | 1202.1 |
| 04/30/15 | To | 05/06/15 | 5/7/2015 | 630 | 1 | 610 | 19130 | 0 | 0 | 20 | 4.5 | 4.75 | 830 | 1500 | 1207.9 |
| 05/01/15 | To | 05/07/15 | 5/8/2015 | 240 | 2 | 200 | 19330 | -50 | -50 | 10 | 1.25 | 0.5 | 830 | 1500 | 1213.3 |
| 05/04/15 | To | 05/08/15 | 5/11/2015 | 380 | 1 | 360 | 19690 | 0 | 0 | 10 | 5 | 0.25 | 830 | 1500 | 1215.5 |
| 05/05/15 | To | 05/11/15 | 5/12/2015 | (1270) | 2 | (1310) | 18380 | -1020 | -1270 | 15 | 3.25 | 1.75 | 830 | 1500 | 1215.3 |
| 05/06/15 | To | 05/12/15 | 5/13/2015 | (180) | 1 | (200) | 18180 | -180 | -180 | 20 | 1.75 | 1.5 | 830 | 1500 | 1213 |
| 05/07/15 | To | 05/13/15 | 5/14/2015 | (890) | 1 | (910) | 17270 | -890 | -890 | 25 | 4.75 | 1.5 | 830 | 1500 | 1226.5 |
| 05/08/15 | To | 05/14/15 | 5/15/2015 | 30 | 1 | 10 | 17280 | 0 | 0 | 10 | 4.25 | 0.25 | 830 | 1500 | 1225.3 |
| 05/11/15 | To | 05/15/15 | 5/18/2015 | (650) | 2 | (690) | 16590 | -1160 | -1160 | 25 | 3.75 | 0.25 | 830 | 1500 | 1239.7 |
| 05/12/15 | To | 05/18/15 | 5/19/2015 | (170) | 3 | (230) | 16360 | -70 | -170 | 10 | 1.25 | 0.5 | 830 | 1500 | 1238.9 |

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|-----------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 05/13/15 | To | 05/19/15 | 5/20/2015 | (280) | 1 | (300) | 16060 | -280 | -280 | 20 | 2.75 | 1 | 830 | 1500 | 1240.3 |
| 05/14/15 | To | 05/20/15 | 5/21/2015 | (100) | 1 | (120) | 15940 | -100 | -100 | 10 | 4.75 | 4.75 | 830 | 1500 | 1237.6 |
| 05/15/15 | To | 05/21/15 | 5/22/2015 | 330 | 1 | 310 | 16250 | 0 | 0 | 25 | 0.25 | 0.5 | 830 | 1500 | 1233.7 |
| 05/19/15 | To | 05/25/15 | 5/26/2015 | 380 | 2 | 340 | 16590 | 0 | 0 | 15 | 0.75 | 4.75 | 830 | 1500 | 1222.8 |
| 05/20/15 | To | 05/26/15 | 5/27/2015 | 1810 | 1 | 1790 | 18380 | 0 | 0 | 15 | 1 | 4.75 | 830 | 1500 | 1237 |
| 05/21/15 | To | 05/27/15 | 5/28/2015 | 130 | 1 | 110 | 18490 | 0 | 0 | 10 | 5 | 4.25 | 830 | 1500 | 1237 |
| 05/22/15 | To | 05/28/15 | 5/29/2015 | (200) | 3 | (260) | 18230 | -380 | -410 | 20 | 1.5 | 1 | 830 | 1500 | 1228.4 |
| 05/25/15 | To | 05/29/15 | 6/1/2015 | (300) | 1 | (320) | 17910 | -300 | -300 | 20 | 0.5 | 4.75 | 830 | 1500 | 1232.5 |
| 05/26/15 | To | 06/01/15 | 6/2/2015 | 660 | 1 | 640 | 18550 | 0 | 0 | 25 | 0.25 | 3.25 | 830 | 1500 | 1234.5 |
| 05/27/15 | To | 06/02/15 | 6/3/2015 | 1270 | 1 | 1250 | 19800 | 0 | 0 | 15 | 0.5 | 3.75 | 830 | 1500 | 1248.4 |
| 05/28/15 | To | 06/03/15 | 6/4/2015 | 700 | 1 | 680 | 20480 | 0 | 0 | 25 | 2 | 0.75 | 830 | 1500 | 1236.2 |
| 05/29/15 | To | 06/04/15 | 6/5/2015 | 130 | 2 | 90 | 20570 | -730 | -730 | 20 | 1.75 | 0.25 | 830 | 1500 | 1244.5 |
| 06/01/15 | To | 06/05/15 | 6/8/2015 | 360 | 1 | 340 | 20910 | 0 | 0 | 15 | 4.75 | 3 | 830 | 1500 | 1236.4 |
| 06/02/15 | To | 06/08/15 | 6/9/2015 | 90 | 2 | 50 | 20960 | -60 | -60 | 15 | 4.25 | 4.75 | 830 | 1500 | 1235 |
| 06/03/15 | To | 06/09/15 | 6/10/2015 | 140 | 2 | 100 | 21060 | -380 | -380 | 15 | 4.5 | 3 | 830 | 1500 | 1250.8 |
| 06/04/15 | To | 06/10/15 | 6/11/2015 | 50 | 3 | (10) | 21050 | -150 | -170 | 15 | 1.25 | 3 | 830 | 1500 | 1251.9 |
| 06/05/15 | To | 06/11/15 | 6/12/2015 | 20 | 1 | 0 | 21050 | 0 | 0 | 20 | 0.5 | 3.75 | 830 | 1500 | 1249.5 |
| 06/08/15 | To | 06/12/15 | 6/15/2015 | (1300) | 3 | (1360) | 19690 | -1280 | -1300 | 15 | 1.25 | 0.25 | 830 | 1500 | 1244.2 |
| 06/09/15 | To | 06/15/15 | 6/16/2015 | 750 | 1 | 730 | 20420 | 0 | 0 | 25 | 2.5 | 3.25 | 830 | 1500 | 1254.9 |
| 06/10/15 | To | 06/16/15 | 6/17/2015 | (720) | 1 | (740) | 19680 | -720 | -720 | 20 | 3 | 4.75 | 830 | 1500 | 1251.4 |
| 06/11/15 | To | 06/17/15 | 6/18/2015 | 1010 | 1 | 990 | 20670 | 0 | 0 | 20 | 5 | 5 | 830 | 1500 | 1269.8 |
| 06/12/15 | To | 06/18/15 | 6/19/2015 | (80) | 1 | (100) | 20570 | -80 | -80 | 25 | 0.25 | 5 | 830 | 1500 | 1266.5 |
| 06/15/15 | To | 06/19/15 | 6/22/2015 | 100 | 1 | 80 | 20650 | 0 | 0 | 10 | 0.75 | 3.25 | 830 | 1500 | 1276.7 |
| 06/16/15 | To | 06/22/15 | 6/23/2015 | (110) | 2 | (150) | 20500 | -160 | -160 | 10 | 1 | 1.25 | 830 | 1500 | 1280.7 |
| 06/17/15 | To | 06/23/15 | 6/24/2015 | 950 | 1 | 930 | 21430 | 0 | 0 | 15 | 1.5 | 0.75 | 830 | 1500 | 1269.5 |
| 06/18/15 | To | 06/24/15 | 6/25/2015 | (340) | 1 | (360) | 21070 | -340 | -340 | 15 | 0.5 | 2.5 | 830 | 1500 | 1269.4 |
| 06/19/15 | To | 06/25/15 | 6/26/2015 | 470 | 1 | 450 | 21520 | 0 | 0 | 20 | 0.75 | 1.75 | 830 | 1500 | 1268.8 |
| 06/22/15 | To | 06/26/15 | 6/29/2015 | 850 | 2 | 810 | 22330 | -850 | -850 | 25 | 0.25 | 3.25 | 830 | 1500 | 1234.7 |
| 06/23/15 | To | 06/29/15 | 6/30/2015 | 160 | 2 | 120 | 22450 | -20 | -20 | 20 | 0.5 | 3 | 830 | 1500 | 1239.6 |
| 06/24/15 | To | 06/30/15 | 7/1/2015 | (610) | 1 | (630) | 21820 | -610 | -610 | 15 | 1 | 2.75 | 830 | 1500 | 1240.7 |
| 06/25/15 | To | 07/01/15 | 7/2/2015 | 750 | 1 | 730 | 22550 | 0 | 0 | 25 | 4.25 | 0.5 | 830 | 1500 | 1234 |
| 06/29/15 | To | 07/03/15 | 7/6/2015 | 810 | 1 | 790 | 23340 | 0 | 0 | 25 | 1 | 3.75 | 830 | 1500 | 1235.3 |
| 06/30/15 | To | 07/06/15 | 7/7/2015 | 520 | 3 | 460 | 23800 | -1120 | -1120 | 10 | 1.25 | 4 | 830 | 1500 | 1234.1 |
| 07/01/15 | To | 07/07/15 | 7/8/2015 | (200) | 2 | (240) | 23560 | -660 | -660 | 25 | 4.75 | 2.5 | 830 | 1500 | 1215.4 |
| 07/02/15 | To | 07/08/15 | 7/9/2015 | (390) | 2 | (430) | 23130 | -720 | -720 | 25 | 4.75 | 4 | 830 | 1500 | 1217.3 |
| 07/03/15 | To | 07/09/15 | 7/10/2015 | 260 | 1 | 240 | 23370 | 0 | 0 | 25 | 1.75 | 4.5 | 830 | 1500 | 1233.5 |
| 07/06/15 | To | 07/10/15 | 7/13/2015 | 480 | 1 | 460 | 23830 | 0 | 0 | 25 | 1.25 | 4.5 | 830 | 1500 | 1251.2 |
| 07/07/15 | To | 07/13/15 | 7/14/2015 | 790 | 1 | 770 | 24600 | 0 | 0 | 25 | 4 | 3 | 830 | 1500 | 1257.9 |
| 07/08/15 | To | 07/14/15 | 7/15/2015 | 860 | 1 | 840 | 25440 | 0 | 0 | 20 | 5 | 0.5 | 830 | 1500 | 1252.7 |
| 07/09/15 | To | 07/15/15 | 7/16/2015 | (220) | 1 | (240) | 25200 | -220 | -220 | 15 | 5 | 1.25 | 830 | 1500 | 1259.5 |
| 07/10/15 | To | 07/16/15 | 7/17/2015 | 10 | 1 | (10) | 25190 | 0 | 0 | 25 | 2 | 3.25 | 830 | 1500 | 1252.2 |
| 07/13/15 | To | 07/17/15 | 7/20/2015 | 470 | 1 | 450 | 25640 | 0 | 0 | 25 | 2.25 | 3.25 | 830 | 1500 | 1247.3 |
| 07/14/15 | To | 07/20/15 | 7/21/2015 | 680 | 1 | 660 | 26300 | 0 | 0 | 25 | 2 | 4 | 830 | 1500 | 1240.8 |
| 07/15/15 | To | 07/21/15 | 7/22/2015 | (950) | 3 | (1010) | 25290 | -600 | -950 | 25 | 0.75 | 0.5 | 830 | 1500 | 1245.3 |
| 07/16/15 | To | 07/22/15 | 7/23/2015 | 1620 | 1 | 1600 | 26890 | 0 | 0 | 25 | 3.25 | 0.25 | 830 | 1500 | 1231.4 |
| 07/17/15 | To | 07/23/15 | 7/24/2015 | 1590 | 1 | 1570 | 28460 | 0 | 0 | 20 | 3.5 | 4.5 | 830 | 1500 | 1212.7 |
| 07/20/15 | To | 07/24/15 | 7/27/2015 | 480 | 2 | 440 | 28900 | 0 | 0 | 15 | 2 | 4.5 | 830 | 1500 | 1201.2 |
| 07/21/15 | To | 07/27/15 | 7/28/2015 | 1030 | 1 | 1010 | 29910 | 0 | 0 | 15 | 1.75 | 5 | 830 | 1500 | 1209.5 |
| 07/22/15 | To | 07/28/15 | 7/29/2015 | 510 | 1 | 490 | 30400 | 0 | 0 | 25 | 4.75 | 0.25 | 830 | 1500 | 1213.6 |
| 07/23/15 | To | 07/29/15 | 7/30/2015 | (1290) | 3 | (1350) | 29050 | -1070 | -1340 | 10 | 3 | 0.5 | 830 | 1500 | 1219 |
| 07/24/15 | To | 07/30/15 | 7/31/2015 | 980 | 2 | 940 | 29990 | 0 | 0 | 10 | 4.75 | 1 | 830 | 1500 | 1224.4 |
| 07/27/15 | To | 07/31/15 | 8/3/2015 | 410 | 1 | 390 | 30380 | 0 | 0 | 10 | 4.75 | 1.5 | 830 | 1500 | 1218.6 |

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|------------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 07/28/15 | To | 08/03/15 | 8/4/2015 | (1210) | 2 | (1250) | 29130 | -790 | -1210 | 25 | 0.5 | 4.25 | 830 | 1500 | 1212.9 |
| 07/29/15 | To | 08/04/15 | 8/5/2015 | (1000) | 3 | (1060) | 28070 | -920 | -1020 | 10 | 1 | 5 | 830 | 1500 | 1218.6 |
| 07/30/15 | To | 08/05/15 | 8/6/2015 | 1830 | 2 | 1790 | 29860 | 0 | 0 | 25 | 3.25 | 2 | 830 | 1500 | 1201.1 |
| 07/31/15 | To | 08/06/15 | 8/7/2015 | 680 | 3 | 620 | 30480 | 0 | 0 | 10 | 0.25 | 1.5 | 830 | 1500 | 1193.2 |
| 08/03/15 | To | 08/07/15 | 8/10/2015 | 450 | 1 | 430 | 30910 | 0 | 0 | 10 | 0.5 | 1.5 | 830 | 1500 | 1207.4 |
| 08/04/15 | To | 08/10/15 | 8/11/2015 | (520) | 5 | (620) | 30290 | -660 | -1110 | 10 | 0.5 | 0.5 | 830 | 1500 | 1197.2 |
| 08/05/15 | To | 08/11/15 | 8/12/2015 | (590) | 3 | (650) | 29640 | -820 | -820 | 10 | 2.5 | 0.25 | 830 | 1500 | 1195.4 |
| 08/06/15 | To | 08/12/15 | 8/13/2015 | (620) | 1 | (640) | 29000 | -620 | -620 | 25 | 4.5 | 3.5 | 830 | 1500 | 1190.9 |
| 08/07/15 | To | 08/13/15 | 8/14/2015 | (130) | 2 | (170) | 28830 | -500 | -500 | 25 | 1.25 | 0.5 | 830 | 1500 | 1199.3 |
| 08/10/15 | To | 08/14/15 | 8/17/2015 | 1890 | 1 | 1870 | 30700 | 0 | 0 | 25 | 1.25 | 3 | 830 | 1500 | 1211.9 |
| 08/11/15 | To | 08/17/15 | 8/18/2015 | 680 | 2 | 640 | 31340 | 0 | 0 | 10 | 3.5 | 0.75 | 830 | 1500 | 1201 |
| 08/12/15 | To | 08/18/15 | 8/19/2015 | 350 | 3 | 290 | 31630 | -150 | -150 | 15 | 2.25 | 0.75 | 830 | 1500 | 1186.9 |
| 08/13/15 | To | 08/19/15 | 8/20/2015 | 1490 | 2 | 1450 | 33390 | -170 | -170 | 25 | 1.5 | 3 | 830 | 1500 | 1155.9 |
| 08/14/15 | To | 08/20/15 | 8/21/2015 | (1230) | 2 | (1270) | 31810 | -620 | -1230 | 10 | 0.25 | 4.75 | 830 | 1500 | 1145.1 |
| 08/17/15 | To | 08/21/15 | 8/24/2015 | (5050) | 4 | (5130) | 26680 | -2650 | -5050 | 10 | 0.75 | 3 | 830 | 1500 | 1088.6 |
| 08/18/15 | To | 08/24/15 | 8/25/2015 | 4790 | 3 | 4730 | 31410 | 0 | 0 | 25 | 5 | 0.25 | 830 | 1500 | 1098.6 |
| 08/19/15 | To | 08/25/15 | 8/26/2015 | 4240 | 2 | 4200 | 35610 | 0 | 0 | 25 | 3.25 | 4.25 | 830 | 1500 | 1118.8 |
| 08/20/15 | To | 08/26/15 | 8/27/2015 | (410) | 2 | (450) | 35160 | -840 | -840 | 15 | 1.5 | 1 | 830 | 1500 | 1142.7 |
| 08/21/15 | To | 08/27/15 | 8/28/2015 | 810 | 2 | 770 | 35930 | -140 | -140 | 15 | 1.5 | 1 | 830 | 1500 | 1153.2 |
| 08/24/15 | To | 08/28/15 | 8/31/2015 | 600 | 2 | 560 | 36490 | 0 | 0 | 15 | 1.75 | 1 | 830 | 1500 | 1146.7 |
| 08/25/15 | To | 08/31/15 | 9/1/2015 | 1450 | 1 | 1430 | 37920 | 0 | 0 | 15 | 4.5 | 1.25 | 830 | 1500 | 1119.4 |
| 08/26/15 | To | 09/01/15 | 9/2/2015 | 1320 | 2 | 1280 | 39200 | 0 | 0 | 10 | 1.25 | 3.75 | 830 | 1500 | 1135 |
| 08/27/15 | To | 09/02/15 | 9/3/2015 | 270 | 2 | 230 | 39430 | -150 | -150 | 10 | 1.5 | 3.5 | 830 | 1500 | 1132.5 |
| 08/28/15 | To | 09/03/15 | 9/4/2015 | (130) | 1 | (150) | 39280 | -130 | -130 | 10 | 3.5 | 4 | 830 | 1500 | 1125.4 |
| 09/01/15 | To | 09/07/15 | 9/8/2015 | 970 | 2 | 930 | 40210 | 0 | 0 | 20 | 4.25 | 1.25 | 830 | 1500 | 1148.5 |
| 09/02/15 | To | 09/08/15 | 9/9/2015 | (1990) | 2 | (2030) | 38180 | -1990 | -1990 | 15 | 1.25 | 3 | 830 | 1500 | 1136.9 |
| 09/03/15 | To | 09/09/15 | 9/10/2015 | (1420) | 2 | (1460) | 36720 | -1030 | -1420 | 25 | 2 | 4.25 | 830 | 1500 | 1139.9 |
| 09/04/15 | To | 09/10/15 | 9/11/2015 | 110 | 2 | 70 | 36790 | -570 | -570 | 25 | 2.75 | 4.25 | 830 | 1500 | 1149.4 |
| 09/07/15 | To | 09/11/15 | 9/14/2015 | 460 | 2 | 420 | 37210 | 0 | 0 | 15 | 1.5 | 0.5 | 830 | 1500 | 1142.1 |
| 09/08/15 | To | 09/14/15 | 9/15/2015 | 500 | 2 | 460 | 37670 | -270 | -270 | 25 | 3.5 | 1.75 | 830 | 1500 | 1156.2 |
| 09/09/15 | To | 09/15/15 | 9/16/2015 | 660 | 1 | 640 | 38310 | 0 | 0 | 10 | 4.75 | 2.25 | 830 | 1500 | 1166.3 |
| 09/10/15 | To | 09/16/15 | 9/17/2015 | 1370 | 2 | 1330 | 39640 | 0 | 0 | 10 | 1.25 | 1 | 830 | 1500 | 1166.8 |
| 09/11/15 | To | 09/17/15 | 9/18/2015 | 530 | 1 | 510 | 40150 | 0 | 0 | 25 | 0.5 | 1 | 830 | 1500 | 1157.2 |
| 09/14/15 | To | 09/18/15 | 9/21/2015 | (2070) | 3 | (2130) | 38020 | -1510 | -2070 | 25 | 2.75 | 1 | 830 | 1500 | 1154.8 |
| 09/15/15 | To | 09/21/15 | 9/22/2015 | 410 | 1 | 390 | 38410 | 0 | 0 | 25 | 0.75 | 1.25 | 830 | 1500 | 1134.2 |
| 09/16/15 | To | 09/22/15 | 9/23/2015 | (830) | 2 | (870) | 37540 | -650 | -830 | 25 | 1.5 | 4 | 830 | 1500 | 1129.1 |
| 09/17/15 | To | 09/23/15 | 9/24/2015 | 1310 | 2 | 1270 | 38810 | 0 | 0 | 15 | 3.75 | 3 | 830 | 1500 | 1126.7 |
| 09/18/15 | To | 09/24/15 | 9/25/2015 | (1970) | 2 | (2010) | 36800 | -2010 | -2010 | 20 | 3.75 | 4.75 | 830 | 1500 | 1110.1 |
| 09/21/15 | To | 09/25/15 | 9/28/2015 | 2430 | 1 | 2410 | 39210 | 0 | 0 | 25 | 4.5 | 3.75 | 830 | 1500 | 1080.4 |
| 09/22/15 | To | 09/28/15 | 9/29/2015 | (660) | 1 | (680) | 38530 | -660 | -660 | 20 | 0.25 | 3 | 830 | 1500 | 1073.5 |
| 09/23/15 | To | 09/29/15 | 9/30/2015 | 1040 | 2 | 1000 | 39530 | 0 | 0 | 25 | 4 | 0.75 | 830 | 1500 | 1091 |
| 09/24/15 | To | 09/30/15 | 10/1/2015 | (2040) | 3 | (2100) | 37430 | -1860 | -2690 | 10 | 2.75 | 3 | 830 | 1500 | 1090.2 |
| 09/25/15 | To | 10/01/15 | 10/2/2015 | 20 | 3 | (40) | 37390 | -1490 | -1950 | 10 | 5 | 3 | 830 | 1500 | 1107.3 |
| 09/28/15 | To | 10/02/15 | 10/5/2015 | 1580 | 1 | 1560 | 38950 | 0 | 0 | 20 | 4.5 | 2 | 830 | 1500 | 1130.9 |
| 09/29/15 | To | 10/05/15 | 10/6/2015 | (1330) | 2 | (1370) | 37580 | -1010 | -1330 | 20 | 4.75 | 2 | 830 | 1500 | 1123.4 |
| 09/30/15 | To | 10/06/15 | 10/7/2015 | 890 | 1 | 870 | 38450 | 0 | 0 | 10 | 1.5 | 4.75 | 830 | 1500 | 1145 |
| 10/01/15 | To | 10/07/15 | 10/8/2015 | 1310 | 1 | 1290 | 39740 | 0 | 0 | 20 | 4.75 | 4 | 830 | 1500 | 1154.8 |
| 10/02/15 | To | 10/08/15 | 10/9/2015 | (50) | 1 | (70) | 39670 | -50 | -50 | 25 | 5 | 4.25 | 830 | 1500 | 1156.6 |
| 10/05/15 | To | 10/09/15 | 10/12/2015 | 40 | 1 | 20 | 39690 | 0 | 0 | 20 | 2.75 | 0.5 | 830 | 1500 | 1156.4 |
| 10/06/15 | To | 10/12/15 | 10/13/2015 | 1280 | 1 | 1260 | 40950 | 0 | 0 | 20 | 1.75 | 0.5 | 830 | 1500 | 1138 |
| 10/07/15 | To | 10/13/15 | 10/14/2015 | 1160 | 1 | 1140 | 42090 | 0 | 0 | 15 | 1.5 | 4.5 | 830 | 1500 | 1125.8 |
| 10/08/15 | To | 10/14/15 | 10/15/2015 | 2100 | 1 | 2080 | 44170 | 0 | 0 | 20 | 0.25 | 4.5 | 830 | 1500 | 1157.4 |

| In-Sample Trading Dates | | | OOS Date | osnp | ont | NOnp\$20 | NetEq | ollt | odd | Thres | pntup | pntdn | xopn | xt | TF Close |
|-------------------------|----|----------|------------|--------|-----|----------|-------|-------|-------|-------|-------|-------|------|------|----------|
| 10/09/15 | To | 10/15/15 | 10/16/2015 | (100) | 1 | (120) | 44050 | -100 | -100 | 20 | 3.75 | 4.5 | 830 | 1500 | 1151.8 |
| 10/12/15 | To | 10/16/15 | 10/19/2015 | 380 | 1 | 360 | 44410 | 0 | 0 | 20 | 4.25 | 4.5 | 830 | 1500 | 1156 |
| 10/13/15 | To | 10/19/15 | 10/20/2015 | (1190) | 3 | (1250) | 43160 | -600 | -1190 | 20 | 0.5 | 0.75 | 830 | 1500 | 1152.3 |
| 10/14/15 | To | 10/20/15 | 10/21/2015 | (870) | 2 | (910) | 42250 | -1450 | -1450 | 15 | 1 | 3.75 | 830 | 1500 | 1135.6 |
| 10/15/15 | To | 10/21/15 | 10/22/2015 | (950) | 4 | (1030) | 41220 | -580 | -1080 | 15 | 0.25 | 4 | 830 | 1500 | 1150.1 |
| 10/16/15 | To | 10/22/15 | 10/23/2015 | (690) | 1 | (710) | 40510 | -690 | -690 | 25 | 4.75 | 1.5 | 830 | 1500 | 1156.5 |
| 10/19/15 | To | 10/23/15 | 10/26/2015 | (130) | 2 | (170) | 40340 | -450 | -450 | 10 | 2.5 | 0.75 | 830 | 1500 | 1150 |
| 10/20/15 | To | 10/26/15 | 10/27/2015 | 780 | 1 | 760 | 41100 | 0 | 0 | 10 | 2.5 | 0.75 | 830 | 1500 | 1137 |
| 10/21/15 | To | 10/27/15 | 10/28/2015 | 2300 | 4 | 2220 | 43320 | -240 | -240 | 10 | 3 | 0.75 | 830 | 1500 | 1170.8 |
| 10/22/15 | To | 10/28/15 | 10/29/2015 | 870 | 2 | 830 | 44150 | 0 | 0 | 10 | 1 | 1.5 | 830 | 1500 | 1156 |
| 10/23/15 | To | 10/29/15 | 10/30/2015 | 70 | 1 | 50 | 44200 | 0 | 0 | 10 | 2.5 | 5 | 830 | 1500 | 1153.4 |
| 10/26/15 | To | 10/30/15 | 11/2/2015 | 1080 | 2 | 1040 | 45240 | -470 | -470 | 25 | 2.75 | 2.5 | 830 | 1500 | 1175.5 |
| 10/27/15 | To | 11/02/15 | 11/3/2015 | 830 | 1 | 810 | 46050 | 0 | 0 | 15 | 1 | 3.75 | 830 | 1500 | 1183 |
| 10/28/15 | To | 11/03/15 | 11/4/2015 | 410 | 1 | 390 | 46440 | 0 | 0 | 25 | 0.75 | 0.5 | 830 | 1500 | 1181.1 |
| 10/29/15 | To | 11/04/15 | 11/5/2015 | 70 | 2 | 30 | 46470 | 0 | 0 | 10 | 4 | 1.5 | 830 | 1500 | 1182.3 |
| 10/30/15 | To | 11/05/15 | 11/6/2015 | 1170 | 1 | 1150 | 47620 | 0 | 0 | 10 | 0.25 | 4.75 | 830 | 1500 | 1193.9 |
| 11/02/15 | To | 11/06/15 | 11/9/2015 | 90 | 2 | 50 | 47670 | -420 | -420 | 10 | 3.75 | 2.5 | 830 | 1500 | 1175.5 |
| 11/03/15 | To | 11/09/15 | 11/10/2015 | (440) | 1 | (460) | 47210 | -440 | -440 | 10 | 3.5 | 2.25 | 830 | 1500 | 1182.1 |
| 11/04/15 | To | 11/10/15 | 11/11/2015 | 1100 | 1 | 1080 | 48290 | 0 | 0 | 10 | 3.75 | 3.5 | 830 | 1500 | 1169.8 |
| 11/05/15 | To | 11/11/15 | 11/12/2015 | (1800) | 2 | (1840) | 46450 | -1410 | -1800 | 10 | 2.5 | 4.75 | 830 | 1500 | 1148.2 |
| 11/06/15 | To | 11/12/15 | 11/13/2015 | (700) | 2 | (740) | 45710 | -500 | -700 | 10 | 1 | 4.75 | 830 | 1500 | 1138.1 |
| 11/09/15 | To | 11/13/15 | 11/16/2015 | 20 | 2 | (20) | 45690 | -500 | -500 | 15 | 4.25 | 1.25 | 830 | 1500 | 1147.8 |
| 11/10/15 | To | 11/16/15 | 11/17/2015 | (330) | 1 | (350) | 45340 | -330 | -330 | 10 | 4 | 4 | 830 | 1500 | 1146.1 |
| 11/11/15 | To | 11/17/15 | 11/18/2015 | 720 | 2 | 680 | 46020 | -510 | -510 | 10 | 4.75 | 0.25 | 830 | 1500 | 1165.5 |
| 11/12/15 | To | 11/18/15 | 11/19/2015 | 10 | 1 | (10) | 46010 | 0 | 0 | 25 | 4.5 | 0.25 | 830 | 1500 | 1158.8 |
| 11/13/15 | To | 11/19/15 | 11/20/2015 | (590) | 3 | (650) | 45360 | -600 | -760 | 25 | 4.5 | 0.25 | 830 | 1500 | 1168 |
| 11/16/15 | To | 11/20/15 | 11/23/2015 | (740) | 3 | (800) | 44560 | -940 | -1060 | 15 | 2.25 | 1.25 | 830 | 1500 | 1174.4 |
| 11/17/15 | To | 11/23/15 | 11/24/2015 | (1520) | 2 | (1560) | 43000 | -1420 | -1520 | 25 | 4 | 2 | 830 | 1500 | 1182 |
| 11/18/15 | To | 11/24/15 | 11/25/2015 | 800 | 1 | 780 | 43780 | 0 | 0 | 25 | 4.5 | 4.5 | 830 | 1500 | 1192 |
| 11/23/15 | To | 11/27/15 | 11/30/2015 | 410 | 1 | 390 | 44170 | 0 | 0 | 25 | 5 | 3 | 830 | 1500 | 1191 |
| 11/24/15 | To | 11/30/15 | 12/1/2015 | 360 | 1 | 340 | 44510 | 0 | 0 | 10 | 0.25 | 4.75 | 830 | 1500 | 1199.2 |
| 11/25/15 | To | 12/01/15 | 12/2/2015 | 970 | 1 | 950 | 45460 | 0 | 0 | 15 | 1.75 | 4.75 | 830 | 1500 | 1188.8 |
| 11/26/15 | To | 12/02/15 | 12/3/2015 | 2700 | 1 | 2680 | 48140 | 0 | 0 | 25 | 1 | 2.25 | 830 | 1500 | 1165.4 |
| 11/27/15 | To | 12/03/15 | 12/4/2015 | 420 | 2 | 380 | 48520 | -350 | -350 | 10 | 0.25 | 1.5 | 830 | 1500 | 1178.6 |
| 11/30/15 | To | 12/04/15 | 12/7/2015 | 1070 | 1 | 1050 | 49570 | 0 | 0 | 10 | 2.5 | 0.5 | 830 | 1500 | 1160.9 |
| 12/01/15 | To | 12/07/15 | 12/8/2015 | (1720) | 2 | (1760) | 47810 | -1230 | -1720 | 10 | 3.75 | 3.75 | 830 | 1500 | 1151.5 |
| 12/02/15 | To | 12/08/15 | 12/9/2015 | (50) | 2 | (90) | 47720 | -810 | -810 | 15 | 4 | 4.25 | 830 | 1500 | 1137.5 |
| 12/03/15 | To | 12/09/15 | 12/10/2015 | (1020) | 2 | (1060) | 46660 | -900 | -1020 | 20 | 4.75 | 3.5 | 830 | 1500 | 1142.3 |
| 12/04/15 | To | 12/10/15 | 12/11/2015 | 950 | 1 | 930 | 47590 | 0 | 0 | 25 | 0.25 | 2 | 830 | 1500 | 1117.7 |
| 12/07/15 | To | 12/11/15 | 12/14/2015 | 950 | 1 | 930 | 48520 | 0 | 0 | 15 | 4.25 | 0.75 | 830 | 1500 | 1107.6 |
| 12/08/15 | To | 12/14/15 | 12/15/2015 | 740 | 1 | 720 | 49240 | 0 | 0 | 15 | 0.75 | 1.75 | 830 | 1500 | 1128.7 |
| 12/09/15 | To | 12/15/15 | 12/16/2015 | 1080 | 1 | 1060 | 50300 | 0 | 0 | 15 | 1.75 | 2 | 830 | 1500 | 1144.7 |
| 12/10/15 | To | 12/16/15 | 12/17/2015 | (1270) | 2 | (1310) | 48990 | -1450 | -1450 | 15 | 1.5 | 3.75 | 830 | 1500 | 1125.7 |
| 12/11/15 | To | 12/17/15 | 12/18/2015 | 1230 | 1 | 1210 | 50200 | 0 | 0 | 20 | 5 | 0.75 | 830 | 1500 | 1113.8 |