Applying The EPFFT To A NASDAQ High Flyer

Many stocks on the Nasdaq market trade with such volatility, that there is little to distinguish them from index futures contracts in the way and manner in which they trade. Many of these Nasdaq high flyers are very liquid, trading with volumes in the 10million+ shares per day range. Congress is considering allowing futures exchanges to trade futures on individual stocks. Thus, it becomes essential to examine these volatile Nasdaq stocks using the technical analysis techniques that we use on futures contracts..

Current public acceptance and use of the Internet has created many discount online brokerage firms that can execute NYSE and Nasdaq stock orders fast and cheaply on the internet. A few real time data vendors have partnerships with internet online brokers. The user can open an account with the online broker and execute trades from the real time data vendors window's interface with just a click of a button. The order size, buy/sell/short and type of order can be preset so that the user need only click on one button to be filled within seconds. Other online brokers allow internet browser interfaces so that the user can sign on to the broker's web site, execute his order, and receive confirmation within seconds. Many Online brokers have real time portfolio tracking following the P&L of the user's day trading positions in real time. An internet site that evaluates many of today's online brokers can be found at http://www.sonic.net/donaldj/brokers.html

In the July, 2000 Futures Magazine article entitled "Day-trading a quieter S&P 500", we showed how to use the technique called the End Point Fast Fourier Transform (EPFFT) to develop a trading system that traded the S&P500 futures contract. Here we will show how to use the EPFFT system on 5 minute bars of the Nasdaq stock JDS Uniphase (JDSU). JDSU is one the Nasdaq's most volatile high flyers trading between 10 to 30 million shares a day and typically having a bid/ask spread of a $1/16^{th}$ of a point ($0.0625). JDS Uniphase is a technology company that designs, develops, manufactures and distributes a range of products for the fiberoptic communications market, deployed by systems manufacturers worldwide to develop optical networks.

The EPFFT System

The mechanics for the construction of the EPFFT curve have been discussed in the reference mentioned above. Let us call the curve generated by the EPFFT, **EPCurve**

Although the EPCurve generated by the EPFFT 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. As shown in the previous article for the EPFFT system, we will use a simple curve following technique. Here are the system entry rules (all exits are on the close).

Buy Rule:

- If **EPCurve** has moved up by more than the point amount of *pntup* from the lowest low recorded in **EPCurve** while short, then buy 1000 shares of JDSU at the market.

Sell Rule:

- If **EPCurve** has moved down by more than the point amount *pntdn* from the highest high recorded in **EPCurve** while long, then short 1000 shares of JDSU at the market.

Walk Forward Optimization Procedure

Walk forward optimization will be used here as a result of the changing nature of stocks trading on the Nasdaq. The intraday price dynamics of the NASDAQ stocks are constantly changing due to news surprises from the company, security analysts that follow the stock, economic events and trader sentiment. Also the time of year, seasons, holidays, vacation time, etc. changes the nature of intraday markets. As such, parameters determined by optimizations on intraday data performed 3 months ago may no longer be representative of today's intraday price dynamics nor give good trading results.

The walk forward procedure will be applied as follows: A test period of one month of trading days of JDSU 5 minute bar data, April 19th, 2000 through May 19th, 2000, is chosen and system parameter values are found through optimization on this intraday data segment. The parameter values found are then applied to the out-of-sample 5 minute intraday bar data following the test segment which in this case is the trading day week of May 22nd, 2000 to May 26th, 2000.

Why a one month of intraday data test segment? There is no correct ratio of test data needed to produce good one week intraday out-of-sample results. By experimenting with different window lengths, the four to one ratio seemed to work well. In walk forward testing, enough data is needed to model most of the price dynamics that will be encountered in the out-of-sample segment, but not so much data that when the price dynamics start to change they are swamped by the weight of distant past data price dynamics that no longer are valid. An important unspoken point in walk forward testing is that if you can not get good results in the out-of-sample segments, then the price dynamics cannot be modeled with the system . This means that real time performance will be random using the model. Traders observe this type of random performance (that is it looks great on paper but falls apart in real time) when trying systems based on curve fitting or anecdotal "proof" (looking at 3 or 4 successful cases only) without any out-of-sample testing .

Finding The System Parameters Using Walk Forward Optimization

There are two system parameters to find *pntup, and pntdn*. The best parameters will be defined as those values that give the best Net Profits with the maximum winning bars, minimum losing bars, minimum drawdown, minimum largest losing trades. In addition, the results should be stable, that is slight changes in the parameters from their optimum values should not lead to big gaps in performance. Also in choosing the "best" parameters, only those parameters sets whose maximum consecutive losses were 4 or less were considered. Optimization is defined as the search for the parameter values that give the best results as defined above. It should be noted that in this stage of system development, the only thing indicated by the optimum values that are selected in the test portion is that the data has been *curve fitted* as best it can with this system.

Without further testing on out-of-sample data there is no way to tell if the system will work in the future.

As been pointed out in previous articles even a random time series defined over a fixed number of bars can be curve fitted rather easily. The performance results and the statistical measurements that validate this performance of the curve fit will look excellent giving the false illusion of future profitability. However, the truth is that these excellent performance and associated statistics on the test section in no way validate how the system will perform on data it has not been optimized on. Only out-of-sample testing, that is testing on data the parameters were not derived on, can determine if the parameters found in the test section have captured the price dynamics. For instance in the End Point FFT process the mathematics of the error minimization forces the generated curve to fit the past data like a glove. It's almost impossible not to get an excellent fit with excellent statistical results. Unfortunately, this excellent fit in no way implies that the system will perform equally well on out-of-sample data, it just tells us we have a very good curve fit.

Results

Figure 1 presents a table of the test window optimum parameters for the JDSU 5min data series.

Start Date	End Date	Pntup	Pntdn
4/19/2000	5/19/2000	1.75	2.25

Figure 1 Optimum Parameter Values For Test Data Segment

Figures 2 presents the performance summary of the test segment using the optimum parameters shown in Figure 1.

Figure 3 presents the performance summary of the out-of-sample data segment from 05/22/2000 to 05/26/2000. This performance represents what would have happened in *real time* if one used the parameters found in the test section. Slippage, and commissions are not included.

Figure 4 presents a trade by trade summary from 5/22/2000 to 5/26/2000. Note only the out of sample trades are presented here for the in sample trades were generated by the curve fit.

Figures 5A through 5B present the 5 minute bar charts of the JDSU with the EPFFT Curve and all the buy and sell signals from the trade by trade summary of Figure 4 indicated on the charts.

Discussion of System Performance

As can be seen from the test sample Performance summary in Figure 2 and the out-of-sample performance summary of Figure 3, the out-of-sample performance was better than the test sample performance. This better performance in the out-of-sample section was mainly due the $10,563 daily gain on 5/24/2000. The out-of-sample performance statistics do indicate that one month of 5 minute bar test data was enough to capture the intraday price dynamics of JDS Uniphase for one week into the future.

Observing the out-of-sample trade by trade summary of Figure 4, we can see that the system did equally well on longs and shorts. This is a good sign showing that neither longs nor shorts were favored in the current JDSU bull market. The average trade (win & loss) was $607 in the test section and $1397 in the out-of-sample section(taking out the big $10,563 gain on May 24). Since the average number of bars in winners and losers were similar in the test and out-of-sample sections, the larger average trade profit was due to larger price trend magnitudes in the out-of-sample section. What is interesting about the out-of-sample performance is that the out-of-sample section used the parameters derived in the less trendy test section but performed outstandingly in the big down and up trends of May 22 to May 26. This indicates stability in the parameter selection. In addition, the average losing trades and the largest losing trades were similar in both the test and out-of-sample sections indicating that the bigger gains in the out-of-sample section did not also produce bigger losses.

One test and out-of-sample trial does not prove we have found nirvana. In order to use this system in real time trading, at least ten to twenty more test and out-of-sample windows from the past would have to be examined to gain confidence that the results above were not due to pure chance.

References:

Meyers, Dennis , "Digging through the noise in the S&P 500", *Futures Magazine*, June, 2000
Meyers, Dennis , "Day-trading a quieter S&P 500", *Futures Magazine*, July, 2000

Info on Dennis Meyers

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Figure 2 Test Window Performance Summary for JDSU EPFFT System 4/19/2000 - 5/19/2000

EPFFT System JDSU-5 min [Trade Size = 1000 Shares] 04/19/2000 - 05/19/2000

Performance Summary: All Trades

Total net profit	$ 21871.	Open position P/L	$ 0.000
Gross profit	$ 40435.	Gross loss	$-18564.
Total # of trades	36	Percent profitable	58%
Number winning trades	21	Number losing trades	15
Largest winning trade	$ 5250.	Largest losing trade	$ -2312.
Average winning trade	$ 1925.	Average losing trade	$ -1238.
Ratio avg win/avg loss	1.556	Avg trade(win & loss)	$ 607.52
Max consec. winners	7	Max consec. losers	3
Avg # bars in winners	35	Avg # bars in losers	23
Max intraday drawdown	$ -5688.		
Profit factor	2.178	Max # contracts held	1

Figure 3 Out-Of-Sample Performance Summary for JDSU EPFFT System 5/22/2000 – 5/26/2000

EPFFT System JDSU5-5 min [Trade Size = 1000 Shares] 05/22/2000 - 05/26/2000

Performance Summary: All Trades

Total net profit	$ 24532.	Open position P/L	$ 0.000
Gross profit	$ 28938.	Gross loss	$ -4406.
Total # of trades	12	Percent profitable	67%
Number winning trades	8	Number losing trades	4
Largest winning trade	$ 7750.	Largest losing trade	$ -1781.
Average winning trade	$ 3617.	Average losing trade	$ -1101.
Ratio avg win/avg loss	3.284	Avg trade(win & loss)	$ 2044.33
Max consec. winners	3	Max consec. losers	2
Avg # bars in winners	34	Avg # bars in losers	27
Max intraday drawdown	$ -2969.		
Profit factor	6.568	Max # contracts held	1

FIGURE 4 Out-Of-Sample Trade By Trade Summary
JDSU 5min EPFFT System Trade Size = 1000 Shares May 22, 2000 – May 26, 2000

Entry Date	Entry Time		Entry Price	Exit Date	Exit Time	Exit Price	Bars In Trd	Trade $P&L	Trade %P&L	Trade Max $Pft	Time	Trade Max $DD	Time
5/22/00	940	Sell	82.750	5/22/00	1450	80.969	62	$1,781	2.15%	$5,875	1105	$0	940
5/22/00	1450	Buy	80.969	5/22/00	1600	85.313	14	$4,344	5.37%	$4,344	1600	($1,719)	1500
5/23/00	940	Buy	84.656	5/23/00	1240	82.875	36	($1,781)	-2.10%	$1,125	945	($2,718)	1025
5/23/00	1240	Sell	82.875	5/23/00	1600	79.125	40	$3,750	4.52%	$3,750	1600	($875)	1400
5/24/00	940	Sell	78.563	5/24/00	1350	75.750	50	$2,813	3.58%	$4,563	1320	($937)	1040
5/24/00	1350	Buy	75.750	5/24/00	1600	83.500	26	$7,750	10.23%	$7,750	1600	($625)	1400
5/25/00	940	Buy	84.625	5/25/00	1305	83.875	41	($750)	-0.89%	$1,125	950	($1,875)	1150
5/25/00	1305	Sell	83.875	5/25/00	1600	79.000	35	$4,875	5.81%	$5,687	1550	($1,125)	1325
5/26/00	940	Sell	79.750	5/26/00	1055	80.750	15	($1,000)	-1.25%	$2,625	1010	($1,750)	945
5/26/00	1055	Buy	80.750	5/26/00	1220	79.875	17	($875)	-1.08%	$125	1150	($1,125)	1115
5/26/00	1220	Sell	79.875	5/26/00	1435	78.375	27	$1,500	1.88%	$1,875	1415	($438)	1220
5/26/00	1435	Buy	78.375	5/26/00	1600	80.500	17	$2,125	2.71%	$2,438	1555	($125)	1435

FIGURE 5a JDSU 5min Bar Chart
JDSU 5min EPFFT System May 22, 2000 – May 26, 2000

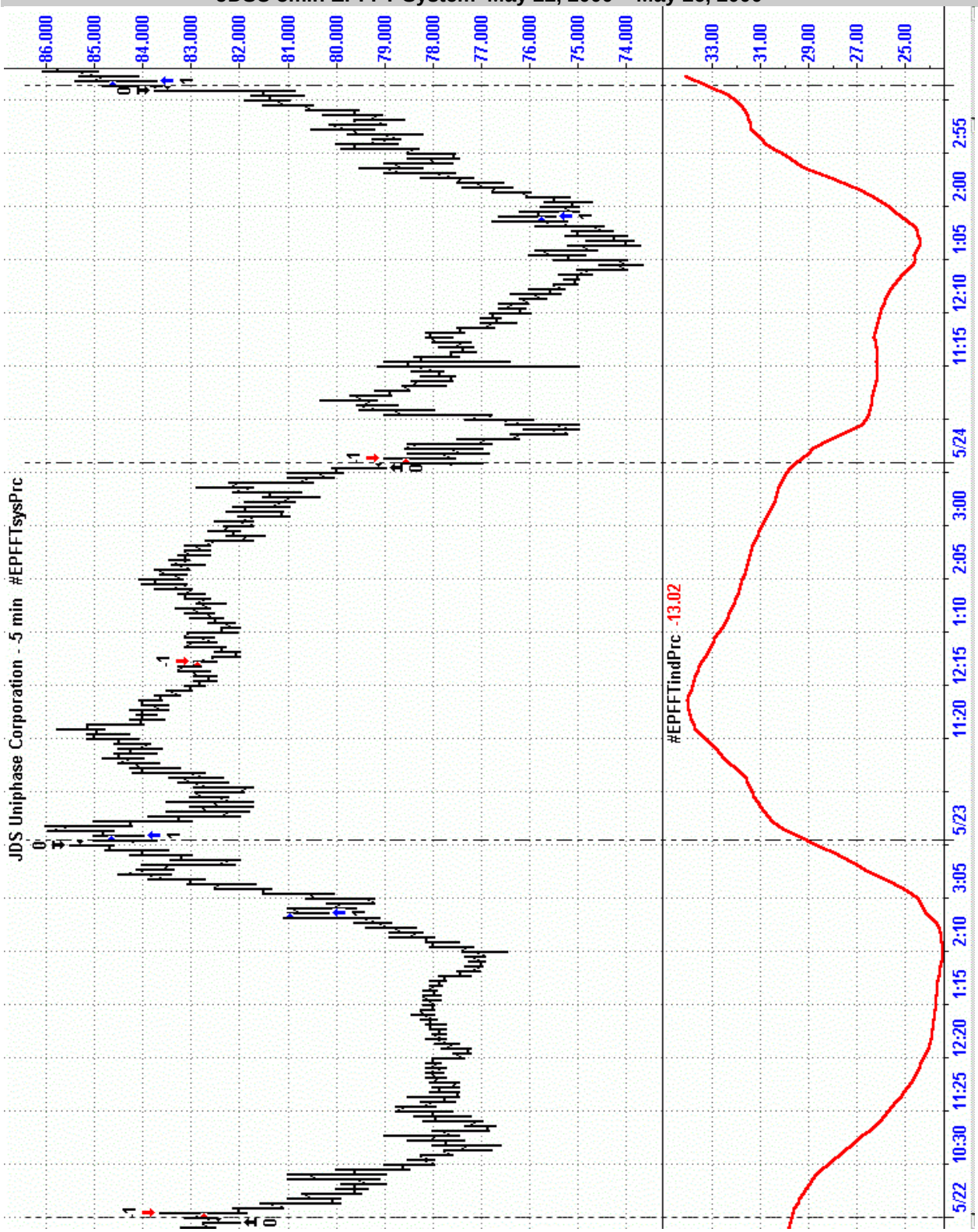

FIGURE 5b JDSU 5min Bar Chart
JDSU 5min EPFFT System May 22, 2000 – May 26, 2000