Automated Trading using Delta Points

by Slawomir Bobrowski

The method presented below has been based on two of several principles upon which Welles Wilder supported his Delta Phenomenon model. These two principles are: The Middle Term Delta (MTD) is based on a market cycle which is repeating itself each Lunar Year; equity price characteristics allow to identify the Turning Point One location within the Lunar Cycle – thus helping to verify the existence of the market inversions.

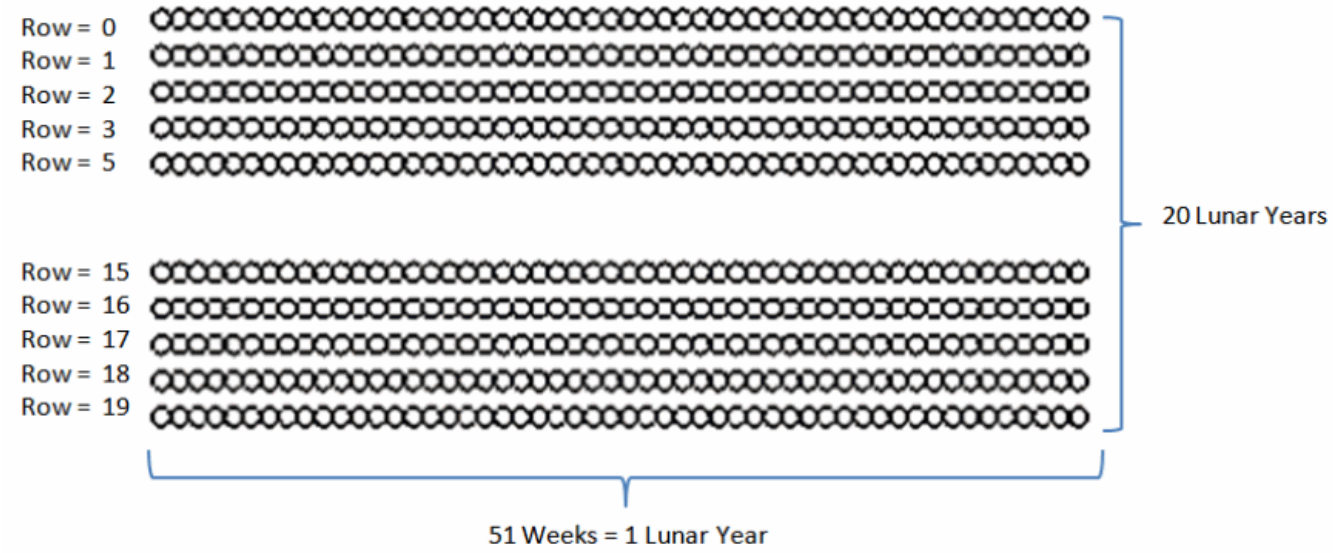
My approach to Delta points trading differs from Welles Wilder's methodology in that it is fully algorithmic and driven by *Computer Program*, which is using trades *YIELDS* as the main criteria for the Turning Points location. The presented program simulates trading of MTD setups.
This is NOT a back-testing process. It is a simulation of the trading process where the computer makes a decision ahead of the trading day and the respective market Turning Point. More on the simulation and algorithmic placing orders one will find in part titled "ABOUT ANALYTICAL TOOLS & METHODS", provided below.

The subject simulation covers trading of *SPDR S&P 500 (SPY)* from 2007-09-24 thru 2010-06-25, which represents three Lunar Years; as well as covers the market collapse of 2008-2009 when most investors lost at least 30% of their holdings value.
Let's see what would be their situation had they used our new algorithmic approach.

STEPS LEADING TO COLLECTING AND PROCESSING NECESSARY DATA

Finding Turning Point P1

We are starting with a matrix of downloaded daily data, for ease of processing converted to weekly data. As a result we have a [20 x 51] data matrix representing 20 Lunar Years, where each Lunar Year consists of 51.3 weeks, rounded to 51 weeks.



P1 represents in the Matrix the week(s) of the largest price spread.
P1 is unique for its greatest price variation and possible price inversion. However the price inversion does not happen in stock components of DJ and SP500 indexes. SPY used in this modeling is a scaled replication of SP500.

For each single week we have a = max. weekly price, b = min. weekly price, and ((a + b) / 2.0) which we use to normalize the avg weekly price for each component of the weekly column shown in the Array below.

The normalized weekly price spread equals $c_i = \sum_{j=0}^{N} (a_j - b_j)/((a_j + b_j) / 2.0)) / N$

where i – the week column position in the Matrix; j – the year (row) position in the Matrix;
N = 19 for the total number of years (20).

SPY Normalized Price Variations computed for 51 Weekly Columns:

```
[ 0.03400854  0.03676268  0.03785253  0.03341877  0.03315363  0.04830342
  0.04755808  0.03965713  0.04208705  0.03516907  0.03856017  0.04238526
  0.03319129  0.03650737  0.03412302  0.03555842  0.03223687  0.03264165
  0.03632454  0.03863678  0.03559051  0.04587849  0.03615176  0.03810851
  0.03574769  0.03152534  0.03306042  0.03835825  0.03211145  0.02922374
  0.03035036  0.03396729  0.02856998  0.02738424  0.02905149  0.03058907
  0.04260209  0.03802056  0.03601632  0.03005112  0.03275804  0.03064615
  0.03260573  0.0363098   0.03808659  0.04170586  0.04354985  0.03615538
  0.03544314  0.03532967  0.0397172 ]
```

P1 spread = 0.04830342
P1 index = 5

The computing sequence of Turning Points

The optimum number of Turning Points for the SPY MTD model is 12. This number brings the highest Yield for the simulated transactions.

For 12 Turning Points there is the following computing sequence:

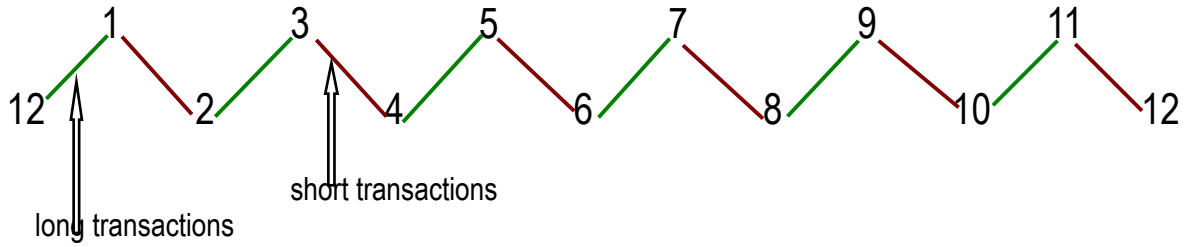


Fig. 1

Next step consists of using the Monte Carlo Method for random selection of 5 Odd and 6 Even Turning Points, except P1 which already has a fixed position (week number 5 for SPY).

The best Yield from all random transaction runs results in selecting the Numerical Key – a simple coding indicating the week assigned to each of the Turning Points:

SPY NumericalKey = [2 5 8 9 12 15 17 26 33 38 39 43]

P12 P2 P4 P6 P8 P10

P1 P3 P5 P7 P9 P11

The time needed to create NumericalKey may take several hours.
The above provided NumericalKey took over 3 hours to process it using 2 GHz laptop, and having run 50,000 random simulations.
However, having the NumericalKey already selected, updating the latest data pull will take only a couple of seconds.

TEST RESULTS FOR SPY

Before we get to the trade simulation results documented on Excel Spreadsheet there is a bit of helping explanation on how to read the spreadsheet shown in Figure2, and again in Figure 3.

	A	B	C	D	E	F	G	H	I	J
1	MediumTermDelta Transaction Records									
2							SPY			
3										
4	Date1	Date2	Long($)	Short($)	Profit($)	Loss($)	SharePrice($) WeeklyClose	Balance($)	Trans'Date	Turn'Point
5										
6										
7	2007-09-24	2007-09-28	0.00	152.58	0.0	0.0	152.58	152.58	2007-09-28	12
8	2007-10-15	2007-10-19	149.67	0.00	2.91	0.0	149.67	155.49	2007-10-19	1
9	2007-11-05	2007-11-09	0.00	145.14	0.0	0.0	145.14	155.49	2007-11-09	2
10	2007-11-12	2007-11-16	145.79	0.00	0.0	-0.69	145.79	154.79	2007-11-16	3

Figure 2: The above presented Transaction Records are explained below.

Row 7: The starting investment capital ("Balance($)"), [H7]=$152.58= ("SharePrice($)"), [G7] = $152.58.
The capital is invested by taking a short position in 1 share of SPY, [D7] = [G7].

Row 8: The share price dropped from [G7] = $152.58 to [G8] = $149.67, which results in ("Profit($)", [E8] = $2.91.
Closing the short position in SPY increases the trading capital [E8] + [H7] = [H8] =$155.49.
The next trade is a long position taken in SPY, [C8], at a price of [G8]; the whole available balance [H8] is invested.

Row 9: The SPY price dropped from [G8] to [G9] = $145.14 which results in the price differential of [G8] – [G9] = - $4.53.
The ("Loss($)") equals [F9] = ([G8] – [G9]) * ([H8] / [G8]) = - $4.70, and the new capital balance [H9] = $150.78 (inaccurate by 1¢ by machine error).
The shorting of SPY [D9] at the share price [G9] is "Blocked" as a result of the decision made by the Blocking Function – which kicked in after the preceding Friday (2007-11-02) EODD was made available for the Program analysis.

Row 10: As a result of "Blocking" at the preceding Turning Point Week (P2), there is neither profit nor loss, [E10] = [F10] = $0.0. The trader now longs SPY at the share price [G10] = [C10] = $145.79, investing the whole available capital balance of [H10].

All transactions performed by the algorithmic simulation on SPY for the period from 2007-09-24 thru 2010-06-25 are shown in Figure 3.

MediumTermDelta Transaction Record

SPY

Date1	Date2	Long	Short	Profit	Loss	SharePrice	Balance($)	Trans'Date WeeklyClose	Turn'Point	Notes
2007-09-24	2007-09-28	0.0	152.58	0.0	0.0	152.58	152.58	2007-09-28	12	
2007-10-15	2007-10-19	149.67	0.0	2.91	0.0	149.67	155.49	2007-10-19	1	
2007-11-05	2007-11-09	0.0	145.14	0.0	-4.70	145.14	150.78	2007-11-09	2	Blocked
2007-11-12	2007-11-16	145.79	0.0	0.0	0.0	145.79	150.78	2007-11-16	3	
2007-12-03	2007-12-07	0.0	150.91	5.29	0.0	150.91	156.07	2007-12-07	4	
2007-12-24	2007-12-28	147.3	0.0	3.73	0.0	147.3	159.81	2007-12-28	5	Blocked
2008-01-07	2008-01-11	0	140.15	0.0	0.0	140.15	159.81	2008-01-11	6	
2008-03-10	2008-03-14	129.61	0.0	12.01	0.0	129.61	171.83	2008-03-14	7	
2008-04-28	2008-05-02	0.0	141.51	15.77	0.0	141.51	187.60	2008-05-02	8	
2008-06-02	2008-06-06	136.29	0.0	6.92	0.0	136.29	194.52	2008-06-06	9	
2008-06-09	2008-06-13	0.0	136.15	0.0	-0.19	136.15	194.32	2008-06-13	10	
2008-07-07	2008-07-11	123.84	0.0	17.57	0.0	123.84	211.89	2008-07-11	11	
2008-09-15	2008-09-19	0.0	124.12	0.47	0.0	124.12	212.37	2008-09-19	12	
2008-10-06	2008-10-10	88.5	0.0	60.94	0.0	88.5	273.32	2008-10-10	1	
2008-10-27	2008-10-31	0.0	96.83	25.72	0.0	96.83	299.05	2008-10-31	2	
2008-11-03	2008-11-07	93.86	0.0	9.17	0.0	93.86	308.22	2008-11-07	3	Blocked
2008-11-24	2008-11-28	0	90.09	0.0	0.0	90.09	308.22	2008-11-28	4	
2008-12-15	2008-12-19	88.19	0.0	6.50	0.0	88.19	314.72	2008-12-19	5	
2008-12-29	2009-01-02	0.0	92.96	17.02	0.0	92.96	331.74	2009-01-02	6	
2009-03-02	2009-03-06	68.92	0.0	85.79	0.0	68.92	417.54	2009-03-06	7	
2009-04-20	2009-04-24	0.0	86.66	107.47	0.0	86.66	525.01	2009-04-24	8	Blocked
2009-05-25	2009-05-29	92.53	0.0	0.0	0.0	92.53	525.01	2009-05-29	9	
2009-06-01	2009-06-05	0.0	94.55	11.46	0.0	94.55	536.47	2009-06-05	10	
2009-06-29	2009-07-03	89.81	0.0	26.89	0.0	89.81	563.37	2009-07-03	11	
2009-09-07	2009-09-11	0.0	104.77	93.84	0.0	104.77	657.21	2009-09-11	12	
2009-09-28	2009-10-02	102.49	0.0	14.30	0.0	102.49	671.51	2009-10-02	1	
2009-10-19	2009-10-23	0.0	108.08	36.62	0.0	108.08	708.14	2009-10-23	2	Blocked
2009-10-26	2009-10-30	103.56	0	0.0	0.0	103.56	708.14	2009-10-30	3	
2009-11-16	2009-11-20	0.0	109.43	40.13	0.0	109.43	748.28	2009-11-20	4	Blocked
2009-12-07	2009-12-11	111.11	0.0	0.0	0.0	111.11	748.28	2009-12-11	5	
2009-12-21	2009-12-25	0.0	112.48	9.22	0.0	112.48	757.50	2009-12-25	6	
2010-02-22	2010-02-26	110.74	0.0	11.71	0.0	110.74	769.22	2010-02-26	7	
2010-04-12	2010-04-16	0.0	119.36	59.87	0.0	119.36	829.10	2010-04-16	8	Blocked
2010-05-17	2010-05-21	109.11	0	0.0	0.0	109.11	829.10	2010-05-21	9	
2010-05-24	2010-05-28	0.0	109.37	1.97	0.0	109.37	831.08	2010-05-28	10	
2010-06-21	2010-06-25	107.87	0.0	11.39	0.0	107.87	842.47	2010-06-25	11	

Figure 3: Final Results of the MTD Transactions Simulation.

The conclusion that can be drawn from the results presented in Figure 3 is very simple:
A trader who had used our algorithmic program for trading SPY during the three critical years would have made a profit of 452.15%, while someone else who had stayed vested long during the same time in SPY would have suffered a loss of 29.3%.

Figures 4, 5, and 6 are to show on Price Charts the high accuracy of Turning Points found by the searching algorithm using the Monte Carlo Method, and applying YIELD as the search criteria.

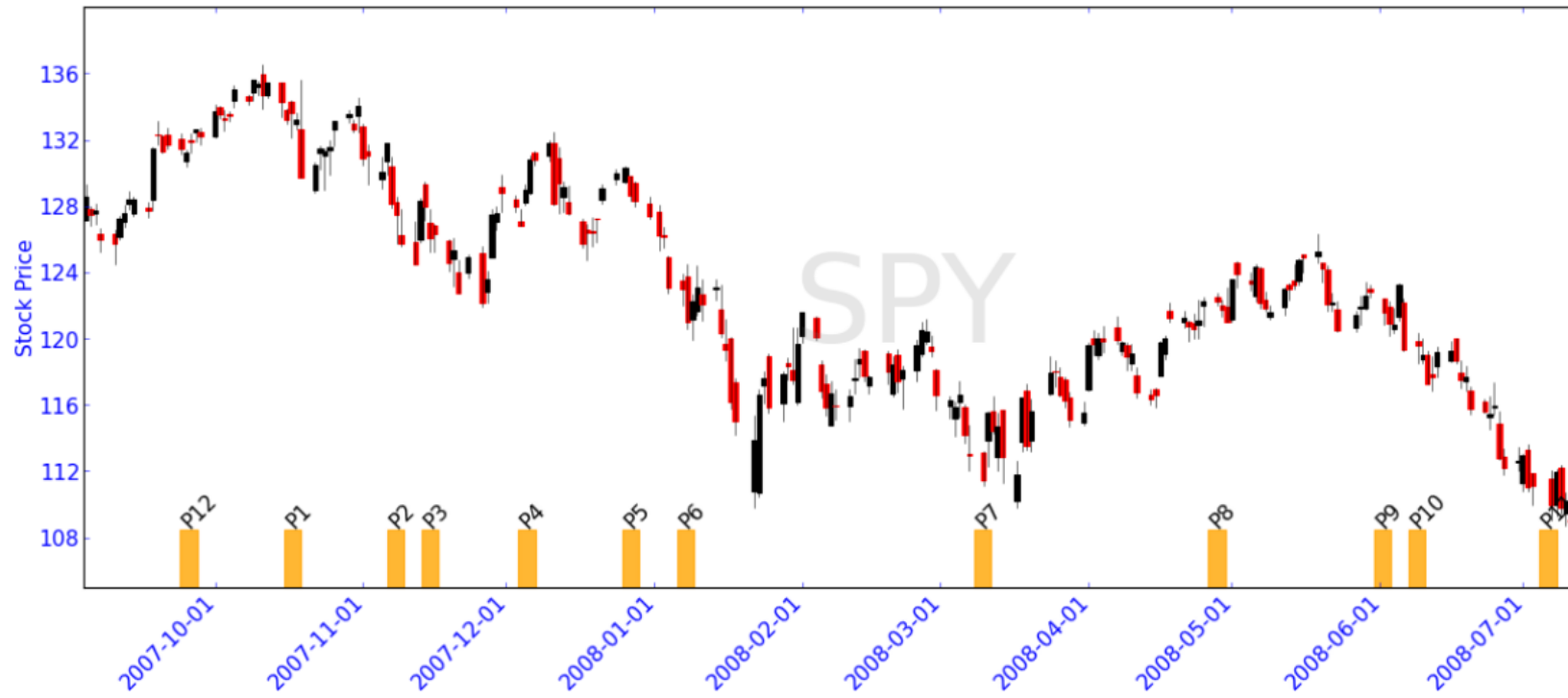


Figure 4: Daily Chart showing Lunar Year 2007-09-24_2008-07-11

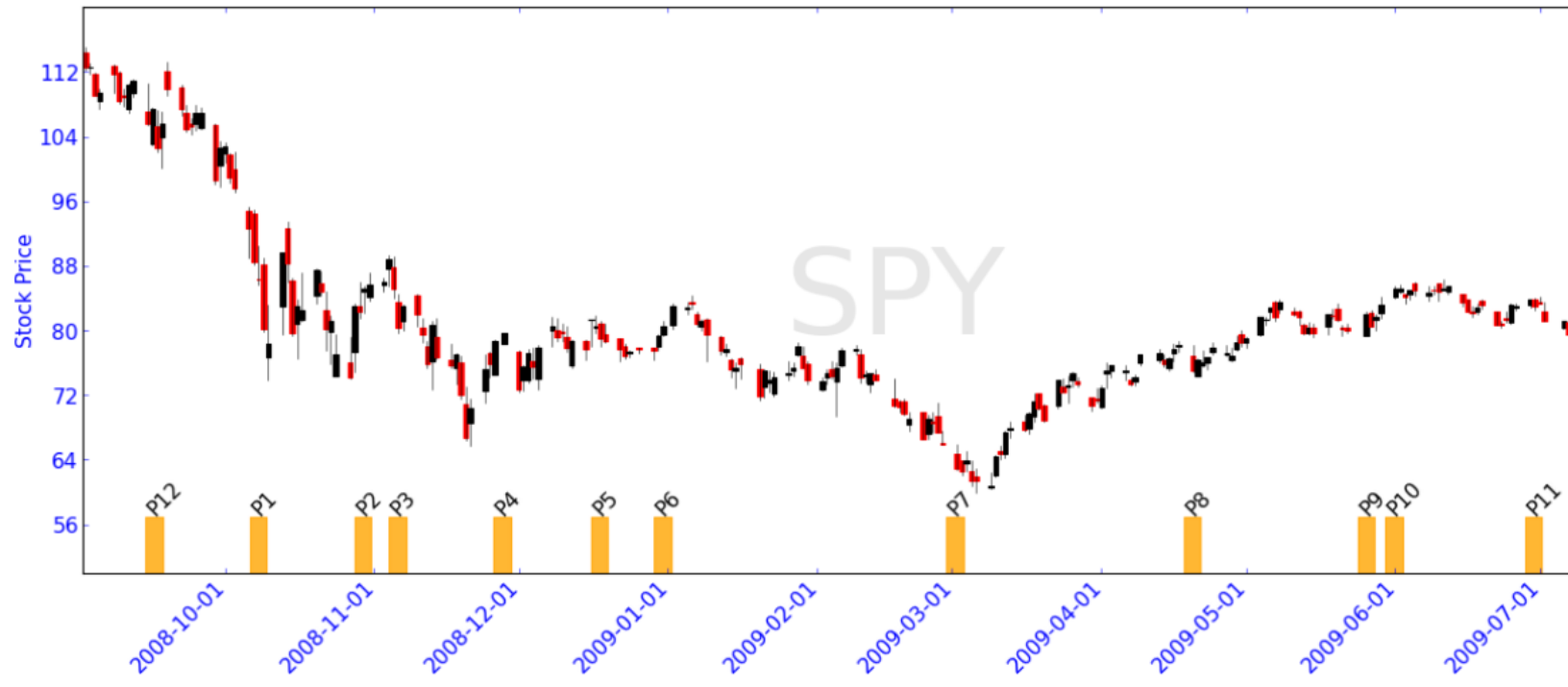


Figure 5: Daily Chart showing Lunar Year 2008-09-15_2009-07-03

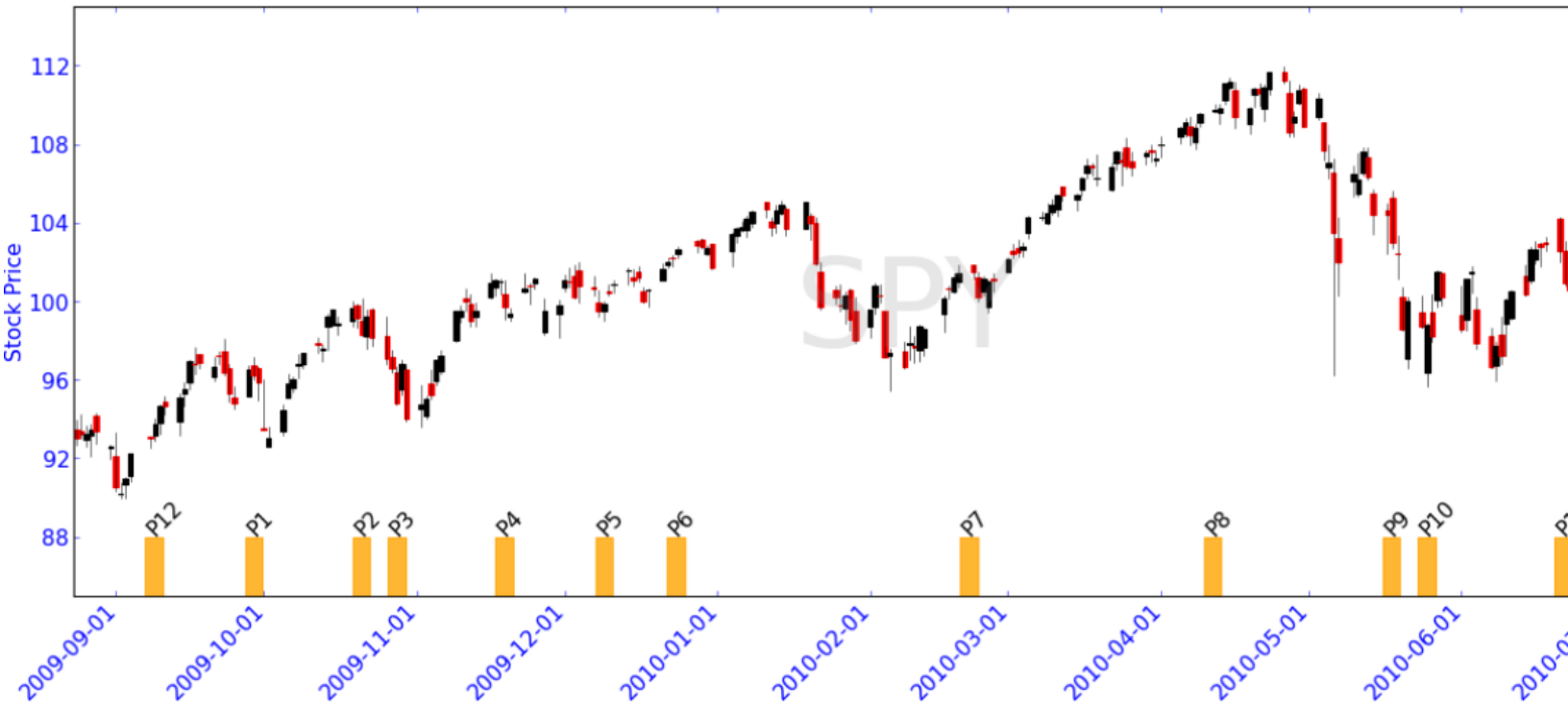


Figure 6: Daily Chart showing Lunar Year 2009-09-07_2010-06-25

ABOUT ANALYTICAL TOOLS & METHODS

Computer Program: Python 2.7 is the programming language used in the creation of this simulation and trading project. All Python releases are Open Source (see http://www.opensource.org/ for the Open Source Definition).

Monte Carlo Method: Monte Carlo method has been applied in this project for the repeated random sampling of MTD Turning Points and data filtering to arrive at acceptable numerical results. In the presented case study such acceptability was achieved after 50,000 simulation runs.

Market Data Feed: The reader can copy and paste the following URL into his/her browser address bar:

http://ichart.yahoo.com/table.csv?s=SPY&a=24&b=9&c=2007&d=06&e=25&f=2010&g=d&ignore=.csv

The result of the above data pull for SPY will be loaded into Excel spreadsheet.

Matlab (Matrix Laboratory) provides numerical computational environment including easy handling of market data downloads.

Python interfaces with Matlab thus facilitating free data pull from stock exchanges.

Several years ago both Google and Yahoo blocked access to free downloading of main Indexes data such as DJ-30 and S&P 500.

"Balance", or the available Capital: In Figure 2 the logic of trades and the related cash flow are presented - to help understand Transaction Records and the step-by-step simulation shown in Figure 3.
From our equivalent 1-share simulation we record a profit of ($842.47 / $152.58 – 1.0) x 100% = 452.15%, after having bought back (closed the short position) the ending batch of $842.47 / $107.87 = 7.81 equivalent shares.

Let's say we started with a 1,000-share (SPY) block.
For the initial number of 1,000 (SPY) shares, valued at $152,580.00, the above translates into a final capital of $842,000 made by closing the 7,810-share short position held in SPY.

"Blocked" by trade Blocking Function: The trade Blocking Function acts based on information collected and analyzed during the trading week immediately preceding the first day of a Turning Point week and continuing into the Turning Point week.
The Blocking Function performs analysis of two Simple Moving Averages SMA). Checks for the presence of crossover and/or the trends mutual relations of the SMAs. If the coming trade is Blocked then the Trader stays out of market and remains in cash till the next Turning Point week arrives.
In the trading simulation of SPY the 3-year trade results were as follows:

Stock Initial Price = $152.58, Balance0 = $152.58
Final Price = $107.40 Balance1 = $795.40
Balance2 = $842.47

where:

Balance1 - achieved with the Blocking Function **"off";**
Balance2 - achieved with the Blocking Function **"on"**.

Why SPDR S&P 500 (SPY)? Quoting from Wikipedia - "**SPDR** funds (pronounced like "spider") [,,,] are a family of exchange-traded funds (ETFs) traded in the United States, Europe, and Asia-Pacific and managed by State Street Global Advisors (SSgA). Informally, they are also known as **Spyders** or **Spiders**. SPDR is a trademark of Standard and Poor's Financial Services LLC, [...] a subsidiary of McGraw Hill Financial." (see http://en.wikipedia.org/wiki/SPDR for more information).
SPY is a good proxy for the S&P 500 Index when we cannot download S&P 500 anymore free of charge.

What was simplified: The settlement time has been omitted in the calculations. Usually such time is defined as T+3 which means that trader's cash generated by trade is available for investing 3 days after the trade. Here an assumption is made that the trader either has access to margin (something that I strongly advise against), or has cash available to immediately reinvest, thus continuing the algorithmic process.

Another simplification here is in the absence of commission. Schwab is charging one way $9.00 in commission and trading fee per 1,000 shares. In the subject simulation we are testing the algorithm effectiveness by investing in a single share and then compounding by returning profit/loss into the trading capital. In the real world of trading an initial block of (SPY) shares the reporting spreadsheet should be expanded by the information on fluctuating numbers of shares. As a result, the algorithmic process, as viewed through the printout, would be less transparent. However, starting from one share then tracking the capital compounding provides us with full information about any initial number of shares traded instead.

SUGGESTED READING

Wilder, J. Welles [1990]. "Predicting Market Order With The Delta Phenomenon." *Technical Analysis of STOCKS & COMMODITIES*, Volume 8: April.

____[1991]. *The Delta Phenomenon, Or The Hidden Order In All Markets*, Trend Research.