



Predictions of High and Low Prices as Technical
Indicators of Stock Price Movement

Information and Price Dynamics

“Technical Indicators”

- *Trend indicators (lagging) analyze whether a market is moving up, down, or sideways over time.*
- *Mean reversion indicators (lagging) measure how far a price swing will stretch before a counter impulse triggers a retracement.*
- *Relative strength indicators (leading) measure oscillations in buying and selling pressure.*
- *Momentum indicators (leading) evaluate the speed of price change over time.*
- *Volume indicators (leading or lagging) tally up trades and quantify whether bulls or bear are in control.*

<https://www.investopedia.com/terms/t/technical-analysis-of-stocks-and-trends.asp>

The Bottom Line – Technical Indicators support evaluation of trading opportunities. If a metric provides signals that lead to profitable trades, that metric probably can be considered to be some form of technical indicator

BEATING THE MARKET - 2

The Table shows annual returns for Trading Strategy TSR5 before and after capital gains taxes, based on simulating trades of the popular exchange traded fund SPY over a 14 year period March 2007 to November 2019. Trading Strategy TSR5 is based on signals from the predicted price range, calculated as the difference between predicted High and Low prices for various periods.

Annual returns for a Buy and Hold trading strategy are also listed in the Table.

Annual Returns

	TSR5 BEFORE TAX	TSR5 AFTER TAX*	BUY AND HOLD
2007	17%	12%	4%
2008	-10%	-10%	-38%
2009	72%	55%	23%
2010	8%	6%	13%
2011	9%	6%	0%
2012	18%	12%	13%
2013	16%	11%	30%
2014	5%	4%	11%
2015	28%	20%	-1%
2016	20%	14%	10%
2017	-5%	-5%	19%
2018	2%	2%	-6%
2019	9%	8%	24%
Overall Gain	4.93	3.27	2.20

**Capital losses from 2008 and 2017 are carried forward, reducing capital gains taxes in subsequent years.*

BEATING THE MARKET - 2

Combining gains from long and short trades, overall gains from reinvesting funds from trades into the next trade cumulate to a factor of 4.93. When 30 percent capital gains are deducted from profitable trades at the end of each tax year, the overall gain drops to 3.27, still significantly greater than the raw gain from a buy and hold strategy of 2.2.

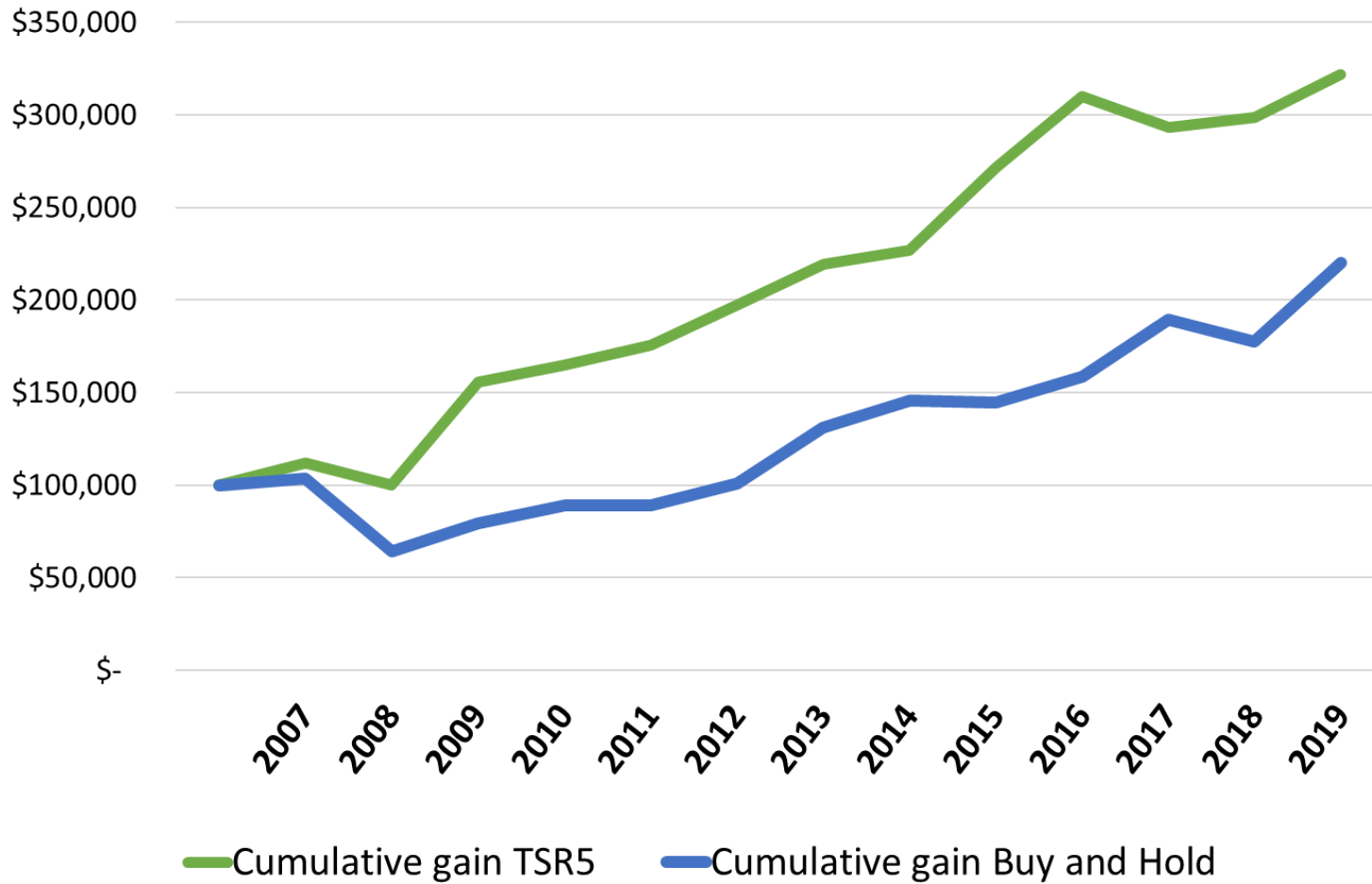
Expressed as Compound Annual Growth Rates (CAGR), Before Tax TSR5 logs a 13.3 percent CAGR, which drops to 9.72 percent after 30 percent capital gains taxes are deducted each tax year. These TS5R CAGR's compare with 6.4 percent for Buy and Hold which is boosted to around 8 percent with reinvestment of SPY dividends.

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Cumulative Gain From \$100,000 Invested March 1, 2007



Growth of
\$100,000
Seed Capital
with TSR5
and Buy and
Hold

A Trading Simulation With Trading Signals from Predicted Price Ranges – Basic Algorithm

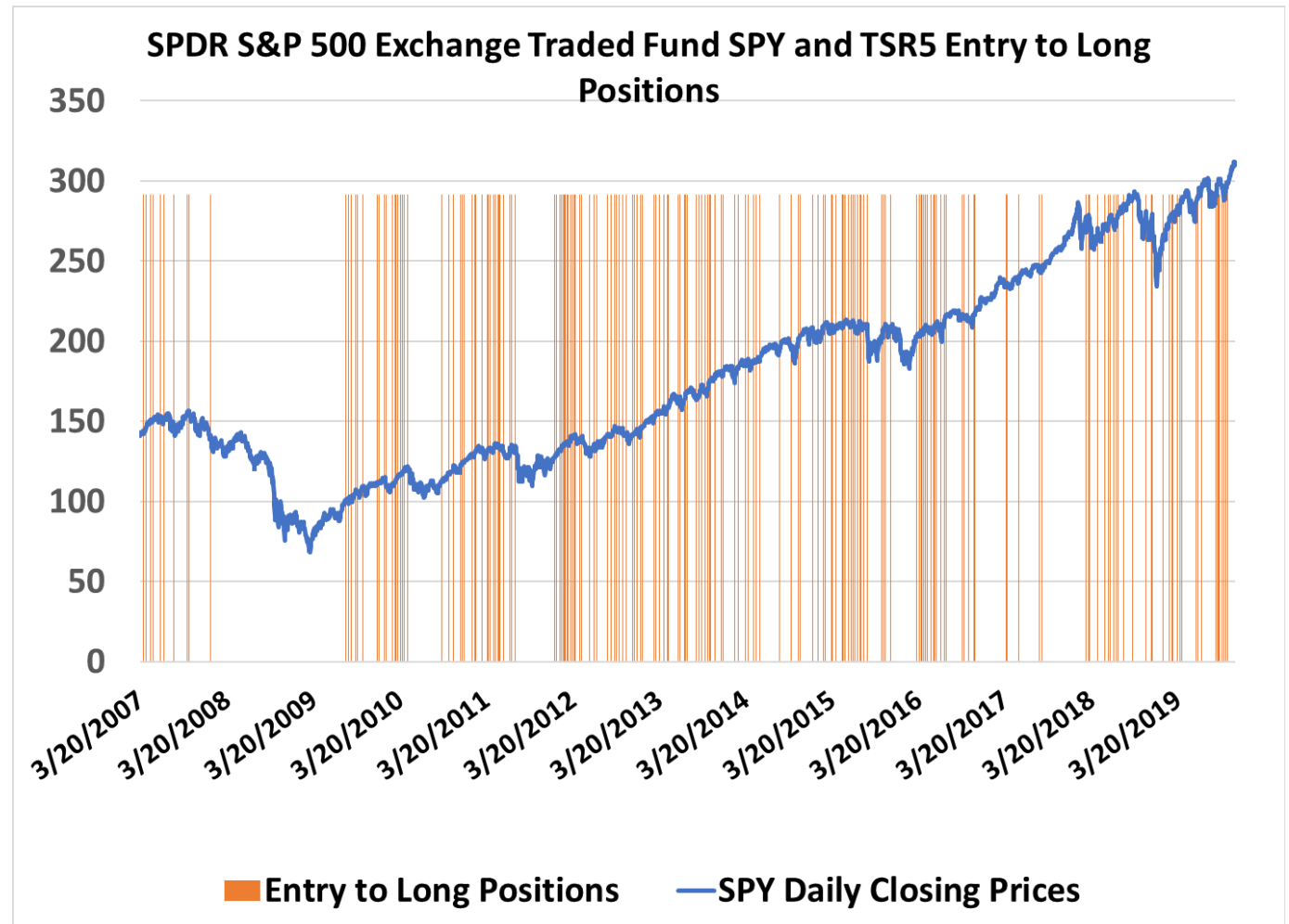
Trading strategy TSR5 has rules for entry into a trade, holding, and exit from long and short positions. Entry to a long trade occurs, when RANGE5* is above a threshold value. Positions are held while RANGE5* is higher than the threshold value. When RANGE5* drops below the threshold value, a long position is closed out. Trades are executed at closing prices on the days when these triggers occur. Short trades are initiated at the exit of long trades, and long trades are entered at the exit of short trades, so an investor is fully invested with TSR5. The Study Period is a 14-year period from 2007 through late 2019, with daily prices from a popular exchange traded fund which tracks the S&P 500 – called SPY.

TSR5 procedure.

- *Develop predictions of 5 trading day high and low prices*
- *Calculate the predicted 5-trading-day range (RANGE5*) as the difference of the predicted 5 day high and low predictions*
- *If RANGE5* > threshold value X then buy SPY at the closing price of the trading day*
- *If a long position is held on at the beginning of a trading day, continue to hold the position, as long as RANGE5* > threshold X*
- *If a long position is held on the previous trading day, exit the position at the daily closing price if RANGE5* is less than or equal to threshold x*
- *Enter complementary short positions when a long position is not held at the same price points*

Entry into Long Positions and Stock Prices

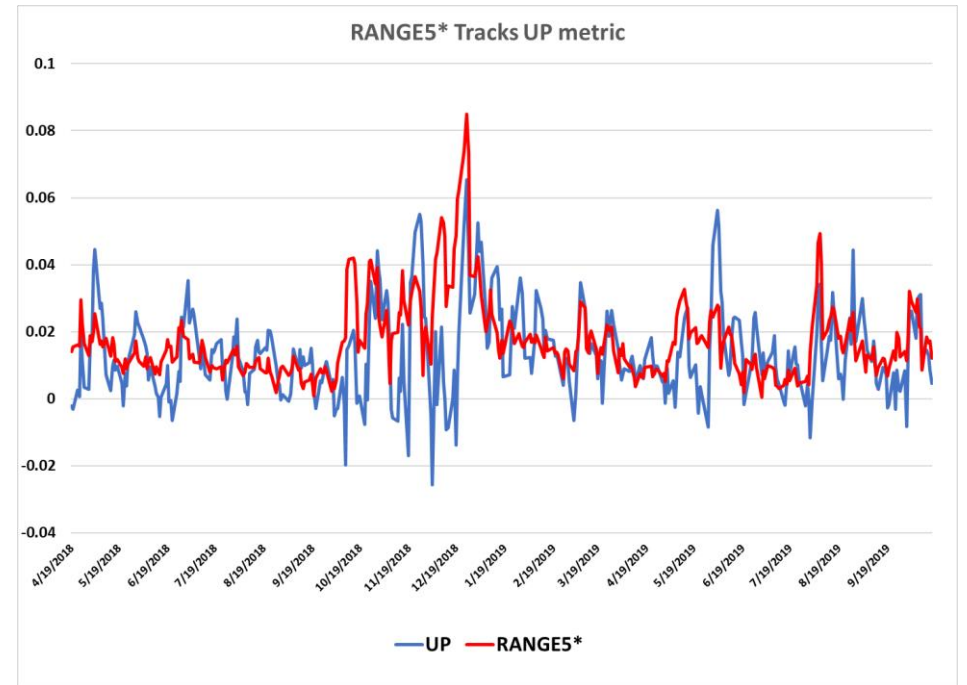
- Altogether, Trading Strategy TSR5 results in 198 long and 196 short trades. 74.7 percent of the long trades are profitable, while 51.5 percent of short trades are profitable.



The Predicted Range Closely Tracks Metrics of Forward Price Movement

The predicted range RANGE5* tracks the UP metric which shows how the high, five trading days forward, compares with the current closing price. Accordingly, UP is a metric of potential profits from taking short term long positions.

RANGE5* is the difference between the predicted 5 day high and low price.



High/Low price forecasts

Methods of predicting H/L stock prices are a focus of research in finance.¹ This research often is motivated by the concept that high and low prices are cointegrated time series, and maximum likelihood (ML) methods, accordingly, may be used to develop predictions. There is evidence, however, ML performs poorly in real time forecasting. The method is computationally intensive and not guaranteed to converge. Information and Price Dynamics price prediction algorithms focus on computationally efficient and robust methods for predicting high/low prices.

Note that the accuracy of the 5-trading-day high and low price predictions is a factor in the profitability of TSR5

¹ See, for example, Jozef Barunik and Sylvie Dvorakove, An Empirical model of fractionally cointegrated daily high and low stock market prices, *Economic Modeling* 45 (2015) 193-206; Angela W.W. He and Alan T.K. Wan, Predicting daily high and lows of exchange rates: a cointegration analysis, *Journal of Applied Statistics*, 36 (2009) 1191-1204.

For more information

Contact

Send an email to

research@priceinfodynamicsinc.com

Or call

303-444-6356 and leave a message for

C. V. Jones, CEO

Boulder, Colorado 80301