

The Intra-day Momentum Method was designed to give a low-to-mid frequency intra-day trader confidence in making better trading decisions. This scientific approach for determining daily direction is scalable and can be used in conjunction with any tool or technical analysis that a trader currently implements to arrive at his trading decisions.

The Intra-Day Momentum Method

A Quantitative Source for Short-Term and Intra-Day
Traders

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The Intra-Day Momentum Method – Todd Hudson

Introduction

The Intra-day Momentum Method is a mathematical model that has been designed to help determine the best way to trade a particular stock / ETF, whether it be trend-following or reversion to the mean, in connection with a low-to-mid frequency intra-day trade. In order to determine which method had worked best over time, I created an algorithm that would find a measurement in price from the Open where the Close of the day had historically been above this level for Longs or below this level for Shorts approximately 50% of the time, for many stocks. While this is by no means perfect, it certainly gives a trader a method for selecting stocks and entry points that have a reasonable chance for success. The Method was developed to adapt to market changes rather quickly as it takes into account price-action, patterns, and volume. The most important factor that one must take into consideration is that not all stocks / markets have the same tendencies. By designing a more scientific approach to trading, a methodology based on 'measured moves', gives a trader or researcher, the ability to identify historical tendencies across many markets. The Intra-Day Momentum Method gives the trader confidence in his trade decisions by using statistical analysis of price patterns and can be used as a guide to help a trader with Trade Entry, Trade Exit, and Risk Management.

Summary

The Intra-day Momentum Method was designed to give a low-to-mid frequency intra-day trader confidence in making better trading decisions. This scientific approach for determining daily direction is scalable and can be used in conjunction with any tool or technical analysis that a trader currently implements to arrive at his trading decisions. The method also helps a trader outline risk parameters for a trade, at the time of trade entry. The Intra-Day Momentum Method was designed to help traders identify trade-able market tendencies using Price, Pattern, Time, and in the coming months will include a designation to identify Speed (Rate of Change). The scientific approach can also assist a trader better understanding how to trade a stock when implementing a larger time frame trend analysis, fade or trade the directional move.

Daily Range

In order to determine what stocks to trade on a daily basis, the overall daily range is the starting point for evaluating which stocks to trade. My original observation stated that when analyzing stocks / markets that do not move a reasonable distance in price (less than 1.00 from Low to High), I have found these methods are not of much help in determining daily direction. After reviewing 3 years of data over approximately 450 stocks from the S & P 500, I have determined that this observation was inaccurate. My most recent findings have been that the daily range, simply does not play a big factor in the percentage of time that the stock closes above / below the Intra-Day Momentum Levels. The historical probability of a Close above or below the calculated Momentum Levels do not have a tendency to diminish when dealing with stocks with a low price range intra-day.

Daily Direction for the Intra-Day Trader

Once a Momentum Level has been reached, either Long or Short, the 'low-to-mid' frequency trader would also benefit from looking for trade opportunities on the side of the Momentum Method Indication for Daily Direction. After Daily Direction has been determined, historically, the Close of the Day has been on the side of the Open of the Daily Direction Indication of that day, approximately 75-80% of the time, for many stocks / ETFs. This gives the trader, many opportunities to look for entries using many different techniques for trade entry. In further research included in the paper as well as developing research, we discuss the advantages of

implementing a trend-following filter on a larger time frame as well as using a filter to determine the 'Speed of a Move' to increase the probabilities of success from these levels.

Long Level Up



Figure 1

TJX crossed above the ML1 @ 66.56 shortly after 10:30 am on June 3, 2015 . Historically, the Close of the day has been above the Long Level Up in TJX 50% of the time. The Close of the day historically has been above the Open 80% of the time, once the Long Level Up had been reached. Historically, many stocks display the same tendency, which is to Close above the Momentum Level Long approximately 50% of the time, once the level has been reached. The Close has historically been above the Open 75-80% of the time, once the Levels have been reached, in many stocks.

Short Level Down



Figure 2

This is an example of a Short Level Down being reached in MU. Historically, the Close of the day has been below the Short Level Down approximately 50% of the time in MU, once the Short Level Down had been

reached. Historically, the Close of the day has been below the Open 82% of the time in MU, once the Short Level Down had been reached.

Historical Probability of Reversal

Upon finding Levels that allow me to ascertain that the historical probability of a stock closing in the direction of these levels was approximately 50%, my goal was to reduce the probability of a reversal. A reversal is defined as a day when both the Long Level Up and the Short Level Down are reached in the same trading session. This is also what I like to refer as a 'Volatile Day', as it does not display a 'Directional Move'. After arriving at my initial findings, I had developed an algorithm that had found levels that would allow for a stock to create a reversal to the other side of the Open, by approximately the same distance in price roughly 30% of the time. In order to create a more robust method, I began to adjust for specific price patterns, which allowed me to improve on the results to some degree. Making further modifications to the algorithm allowed me to find Levels that historically generated a reversal approximately 25% of the time, for many stocks / ETFs. I am actively searching for new ways to better improve the method and feel that I will be able to effectively generate reversal probabilities less than 20% of the time, for many stocks / ETFs.

The Intra-day Reversal

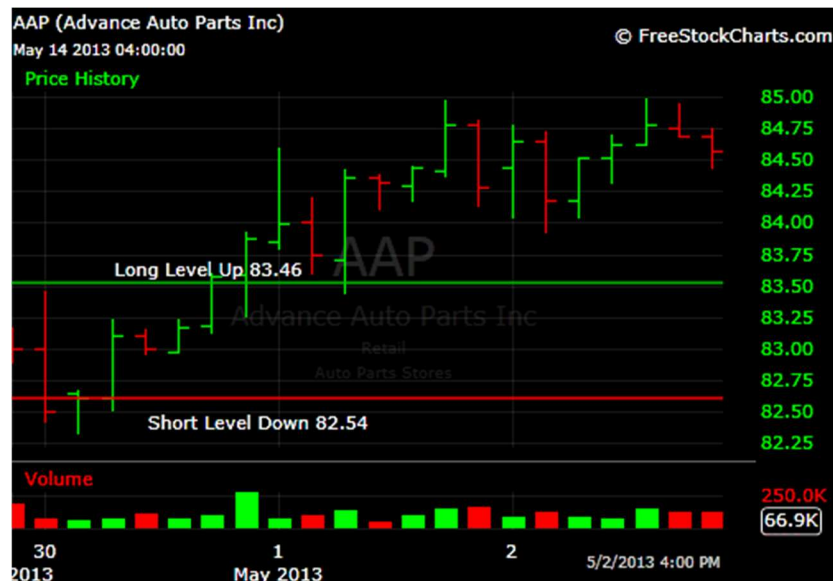


Figure 3

The Momentum Method was designed in an attempt to avoid this scenario, as much as possible. On 4/30/2013, AAP reached the Short Level Down and then rallied to cross above the Long Level Up. Historically, this has happened 23% of the time, in AAP. The Intra-day Reversal has occurred approximately 25-30% of the time, in many stocks.

Intra-Day Reversal and the Close of the Day

Over the past 3 years and 3 months, of the stocks have met an Intra-Day Reversal (High \geq ML1 and Low \leq MS1) 47% of these stocks have closed between ML1 and MS1.

29%	Close \geq ML1	Close at or Above ML1
47%	ML1 > Close > MS1	Close between ML1 - MS1
24%	Close \leq MS1	Close at or Below MS1

Table 1

While looking at this analysis of the Intra-Day Reversal, our goal is to be able to identify what patterns often lead to intra-day reversals. If we can identify such patterns, this would likely increase our probability of success from these levels. Identifying possible 'Reversal Patterns' before they occur could also lead to increased profits and decreased risk.

If we remove the Intra-Day Reversals from our calculations in determining if the levels are significant, we get increased probabilities of success from the levels themselves, as should be expected. If we remove the Intra-Day Reversals from the calculation to determine if the ML1 is significant, we find that 55% of stocks that met the ML1 that were not Intra-Day Reversals closed at that level or higher. Doing the same to the MS1 calculation, we find that 54% of the stocks that met the MS1 and were not Intra-Day Reversals closed at that level or lower. If we filter for a trend on a longer-term timeframe, it would likely increase these probabilities more, as is demonstrated in the section on trend-following (**Increasing the Odds with Trend-Following**).

False Moves come From Fast Moves

If the Momentum Level is reached in rapid time, it is possible that this is a move that is not sustainable. Fast moves often come off the Open and can reverse rather quickly. These moves are often generated by news or some other event that many believe to be relevant, but in fact may not be. By fast move, in this instance, I am referring to the time from the Open to when the price is met. If this price is reached too fast, it is often to the benefit of the trader to take a reversal of the trade. I have been developing ways to identify and quantify the "Intra-Day Fast Move" as well. The "Intra-Day Fast Move" would be any price movement where a specific and predetermined price range is reached within a specified period of time (calculated in minutes). These moves may also indicate potential reversals or patterns of resistance or unsustainable momentum. Two examples of 'Fast Moves' are featured later in this paper.

Entry Techniques

A trader can use the Intra-day Momentum Method in combination with any entry technique that he / she currently implements. The Method can be used as a guide to help a trader better understand intra-day price patterns and to help identify high probability, low risk trade entries for the low-to-mid frequency intra-day trader.

Risk Management

One of the advantages of developing a methodology based on 'measured moves', is that it allows a trader to attempt to control risk at trade entry. Once the Momentum Method has indicated the Daily Direction for the day, a trader knows that historically, the Close of the day has been above or below the Open approximately 75-80% of the time. This allows the trader to calculate with some degree of certainty, his / her risk exposure at the time of entering a trade.

Position Size

Risk management when utilizing the Intra-Day Momentum Method Model starts with knowing when the trade is taken and at what point the trade would be exited, in the event the market went against the trader and trader had to implement a Stop-Loss.

$$\text{Position Size} = \frac{\$ \text{ Amount at Risk}}{\text{Original Entry - Stop Out}}$$

Table 2

Combining Probability of Success with Risk Management

In order to successfully speculate to anticipate an increase in returns while also reducing risk it is imperative that a trader consider the probability of success from a specified level with the amount of capital he is willing to risk on each individual trade. It would greatly benefit the trader to apply less capital to a trade that has a lower probability of success than he would to a trade that has a higher probability of success. The Intra-Day Momentum Method was designed to enable the trader to apply this sort of Risk Management.

The Study

In order to demonstrate the Intra-Day Momentum Method on a large number of stocks I chose to do this on approximately 460 stocks in the SP 500 on a day-to-day basis. The Intra-Day Momentum Method is NOT a 'trading system'. It is a 'Guide' to help traders establish with reasonable certainty, daily direction. This study is conducted on an on-going basis, to demonstrate the approach based on Price-action, Patterns and Volume patterns. The study will soon include a category based on 'Speed'. This study will attempt to determine overbought / oversold conditions based on how fast a stock / market reaches a level. The initial study based on 'Speed' will be conducted from the 'Open'. The study based on 'Speed' in the coming months will include a study based on Intra-Day 'Speed'. Fast moves are easily identified off the 'Open', but are a little more difficult to identify intra-day.

The 'SPEED'

Is the *SPEED* or 'Rate of Change' of a market important? Do 'Fast Moves come from False Moves'? In an attempt to answer these questions, we must first define what 'Fast' is. 'Fast' is a measurement in price that occurs over a short period of 'Time'. These are both relative because depending on one's time frame for a trade, the speed will be different. Speed may hold the key to answering questions such as should you 'Trade' or 'Fade' this move? Should you trade the breakout or wait for a pullback? Does the 'Speed' indicate a deeper pullback or reversal is likely?

Speed may also provide answers to questions such as:

- If x% of stocks in this list (SP 500) have met the levels ML 1 / ML 2 / ML 3 by a certain 'Time' during the trading day, what % of the time historically has this indicated that a high for the day is near or that a market turn is likely?
- If x% of stocks in this list (SP 500) have met the levels MS 1 / MS 2 / MS 3 by a certain 'Time' during the trading day, what % of the time historically has this indicated a low for the day is near or that a market turn is likely?

On 6-3-15, 70 stocks in a list of 460 from the SP 500 met the MS 1 Level down within the first 5 minutes of trading. The price measurement for the distance from the Open to MS 1 down is significant for a time period lasting a few hours. At any time during the day, a stock or market travels this distance in price within 15 minutes, the move should be deemed suspicious. Is it true that the quicker a level is reached, the more likely a reversal is to occur?

SPY – Fast Move



Figure 4

The importance of speed in the markets is simply due to the fact that it's quite possible that the emotions of 'Fear' and 'Greed' are played out in these fast price moves. The 'Fast' nature of markets indicates a need or desire by market participants to get 'in' or 'out' of a position no matter what the cost.

The idea is that fast moving markets are not sustainable for long periods of time. Market turns often occur after a significant move in price that has occurred over a short period of time. Nothing is perfect, the objective is to make observations and find ways to prove / disprove that the tendencies are in fact real. This ongoing study should provide insight into whether or not 'fast moves' give trade-able clues.

Profit Targets?

Speed may also help identify possible locations / time for profit targets. If an individual stock meets a level by a specific time, would this be a good time / price to exit a position? If this is the case, it is likely that it would allow a trader to re-enter on a pullback at other levels.

Price Patterns

A thirst for knowledge: Are there price patterns that exist that significantly identify opportunities for 'Trading' a Fast Move? Using this research, we will attempt to identify opportunities where there is an advantage to taking a FAST move.

Patterns of statistical significance can be found when implementing a methodology or model based on 'Measured Moves'. Of the types of 'Patterns', we will be looking for in our search include those that present themselves on daily charts as well as intra-day charts. Daily Price Patterns of interest include when a stock

closes Above or Below an extended Level for consecutive days. For instance, we will ask what percentage of the time, has a particular stock or instrument closed below MS3 for two (2) consecutive days.

Intra-Day Price Patterns (Example)

Intra-Day Price Patterns can include Fast Moves, Extended Levels, and many different variations of these and their combinations. The following is an example of an 'Extended Level Fast Move' that occurred on Thursday 9-6-2018.

Extended Level 'Fast Move'



Figure 5

On Thursday 9-6-2018, SPY crossed below the MS3 by 11:00 am. Our goal using the Model / Methodology is to design patterns such as this that demonstrate that if this occurs, the Low of the day would be 'Close in Price'. This would indicate that it is not likely that the SPY would go much lower during the day that the MS3 level. This would be a possible turning point and if a trader had a 'Short' position, he would like to look to take profits at this level. If the trader were looking to establish a Long Position, this would be a price area where he would be looking to establish that position.

Historical Results

The following image displays the results of the approach from 4-1-15 to 5-31-18. These results were derived from implementing the Intra-Day Momentum Method Levels on a group of stocks from the S & P 500. The goal was to consistently apply the mathematical model, every single day on the same stocks for a long period of time to determine if the levels are in fact historically significant. The goal was also to catalog, track, and report findings on these levels over time.

The Intra-Day Momentum Method as applied to approximately 460 / 500 stocks in the SP 500

One date which is included in the following results had less stocks being monitored 10-16-17. This was due to inaccurate configuration and was resolved the following day.

During the following study, if the ML1 or MS1 were reached in a given day, the stats were calculated as follows:

THE INTRA-DAY MOMENTUM METHOD

4-1-15 TO 8-31-2018

SP 500		
Current Stats 4-1-15 to 8-31-2018		
*Fed Meetings / Announcement Dates will be included in separate stats (Some dates may be included) here)		
63687	Close >= ML 1	49 %
97006	Close >= Open	75 %
129901	Total ML 1	
129797	Total MS 1	
93976	Close <= Open	72 %
60618	Close <= MS1	47 %
32551	ML 1 Reversals	25 %
32551	MS 1 Reversals	25 %
	Total Reversals	14 %
These numbers are calculated EOD		
Reversals are only counted if they close above ML1 or below MS1		
*Reversals are not counted in Close Above / Below OPEN		
*Therefore, the Close Above / Below OPEN % are less than actual		

Figure 6

In the image above, the 'Reversals' calculation is based on the fact that the ML 1 and MS 1 levels were met in the same trading day. Reversals are not counted unless they close above ML 1 or below MS 1, they are not counted in the Close Above Open / Close Below Open Calculations. Therefore, these calculations are lower than actual.

Upon further examination, it has been determined that if the ML1 and MS1 were exceeded by .01, the probabilities of success from the respective levels increased. The remainder of this paper assumes that the Levels were 'met', not exceeded.

Increasing the Odds with Trend Following

The Intra-Day Momentum Method was designed to help determine daily intra-day direction. Over the past 3 years and 3 months, I have kept a record of a list of stocks from the S & P 500 (approximately 450) that have met the levels and where they closed, in relation to the levels. This information can be found on my website at QATSystems.com/SP500, under Historical Results. This is a very brief introduction to 'Increasing the Odds' of entering a trade with the help of defining a trend on a longer-term time frame, in this case, the daily chart.

Defining a Trend

By applying a mathematical equation to define a trend, we find that there is an increased opportunity to get the results that you want, as a trader. The results illustrated below are examples for two different time periods where the **SPY** was determined to be in an uptrend and a downtrend. Each individual stock's trend was not a factor, in the results.

The Intra-Day Momentum Method Review

ML1 - a level above the Open that has been determined to be historically significant in that if this level has been reached, historically, a stock will have closed above this level 47-50% of the time.

MS1 - a level below the Open that has been determined to be historically significant in that if the level has been reached, historically, a stock will have closed below this level 47-50% of the time.

Reversal - a single day or trading session where both the ML1 and MS1 have both been reached. This is considered a 'Volatile Day'.

Tight Range Stocks – any stock or market that does not move a reasonable distance from Low-to-High on an intra-day basis. Any stock that has a range of less than 1.00 from Low-to-High would be considered a stock in a Tight Range. These stocks would not tend to have a close above or below the directional levels 47-50% of the time. Tight Range Stocks also is the list of stocks that did not meet either the ML1 or the MS1 Levels during the trading session.

Extended Levels

In further developing research, these levels have been extended in each direction for more probability studies and the ability to define patterns based on Price, Time, Volume, and Speed. This research will lead to clues as to when markets have become overbought / oversold as determined by a level being reached by a specific time of day (an example of this was demonstrated earlier in this paper in the section **Intra-Day Price Patterns Example**). My research has shown that if a market / stock reaches an extended level by a certain time of day, it's likely that the High / Low for the day is in place or near. Further research will help identify possible turning points after significant price moves over a specified period of time.

A few things you should consider about this research:

- The directional trend of each individual stock was not a factor in compiling this research.
- In volatile markets (often large gap openings), there will be a higher percentage of stocks meeting Intra-Day Reversals.

SPY Graph – Trending Up



Figure 7

The SPY is clearly in an uptrend during the time period studied 02-16-2016 to 03-22-2016.

Intra-Day Momentum Method – Market Trending Up

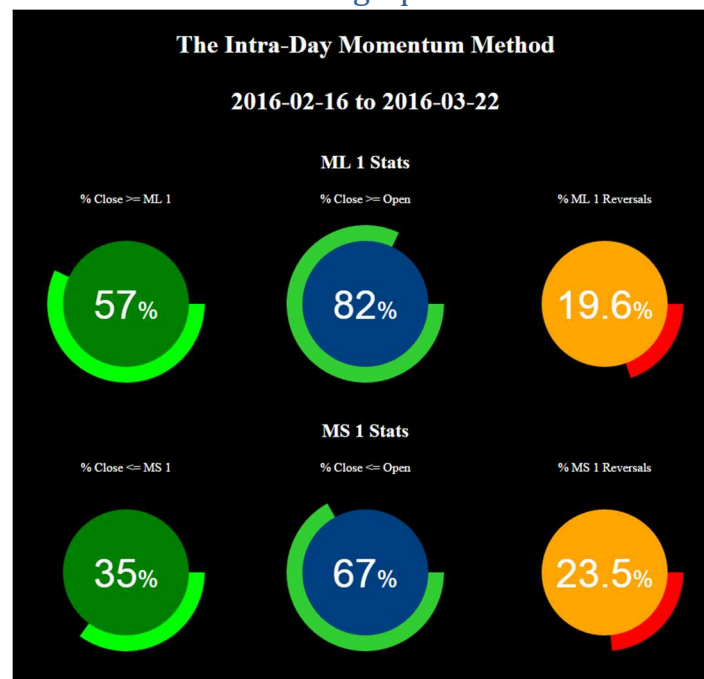


Figure 8

A Market Trending Up

After reviewing trends, we are able to determine that it is possible to get the following results in a market that is in an uptrend:

1. More Stocks Closing >= the ML1 Directional Level
2. More Stocks Closing >= the Open
3. Fewer Intra-Day Reversals when compared to MS1

While there were certainly stocks in the group that were trending up as well as down, the results while looking at the SPY itself is rather interesting. If we define an uptrend in the SPY, we get a higher percentage of stocks closing at or above ML1, more Closes above the Open, and fewer Intra-Day Reversals, on the long side.

SPY Graph – Trending Down



Figure 9

SPY Trending Down

The time period studied here was a fairly volatile time as the SPY gapped open 8 days out of the time period studied. My research also shows that the size of the gap is likely to indicate how volatile the market may be in a given day. Intra-day volatility can be measured by the number of stocks that become an 'Intra-Day Reversal.'

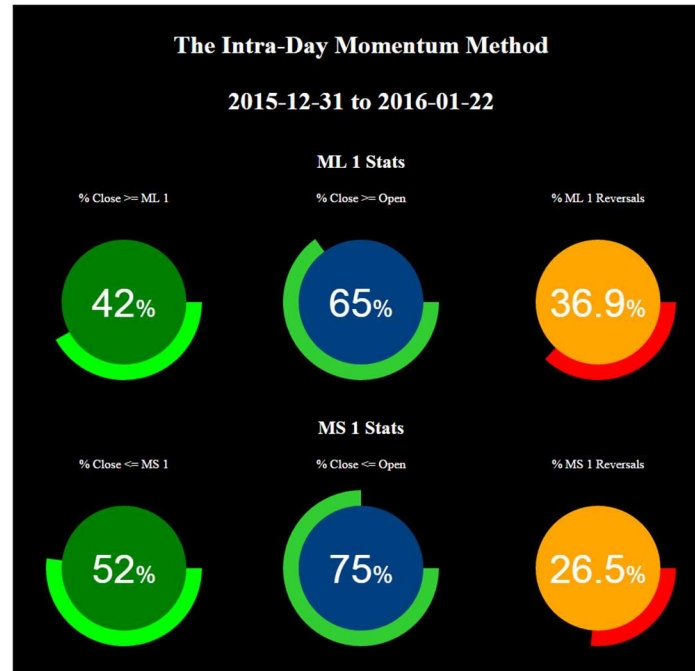


Figure 10

A Down-Trending Market

It is possible to get the following results in a market that is in a downtrend:

1. More Stocks Closing \leq the MS1 Directional Level
2. More Stocks Closing \leq the Open
3. Fewer Intra-Day Reversals when compared to ML1

When we define a downtrend in the SPY, we get a higher percentage of stocks closing at or below MS1, more Closes below the Open, and fewer Intra-Day Reversals when compared to the number of stocks meeting the ML1 level.

Solution

The goal as an intra-day trader is to reduce intra-day drawdowns and trade in the direction of the longer-term trend. In order to do this, we have identified levels to help us with possible entry points / levels with both a directional trade as well as a reversion to the mean / contra-trend trade, that is in the direction of the longer-term trend.

Does Trend Following Give a Trader an Edge?

The goal with the Intra-Day Momentum Method is to determine probabilities of mathematical patterns. Using the IDMM, the following illustrates the probability of the stocks closing at or above the respective levels. When the Intra-Day Reversals are removed it demonstrates that there is a higher probability of a close in the direction of the levels by approximately 7% in relation to the ML1 and MS1 levels.

Close in Relation to the Intra-Day Momentum Levels

				49%	48%
				ML3	ML3 NR
		48%	50%		
		ML2	ML2 NR		
49%	56%				
ML1	ML1 NR				

OPEN

MS1	MS1 NR				
47%	54%				
		MS2	MS2 NR		
		49%	49%		
				MS3	MS3 NR
				48%	52%

Dates missing 10-17-17 and 9-4-2019

In the following graph we demonstrate what % of the time the stocks closed at or above the levels when the market high exceeded the ML1 or MS1 by at least .01. This simply applies a filter that eliminates stocks where the ML1 was not the high of the day and MS1 was not the low of the day. This demonstrates that if the high of the day is greater than ML1, the probability of a close above ML1 goes from 49% to 50%. If the low of the day is below MS1, the probability of a close below MS1 goes from 47% to 48%.

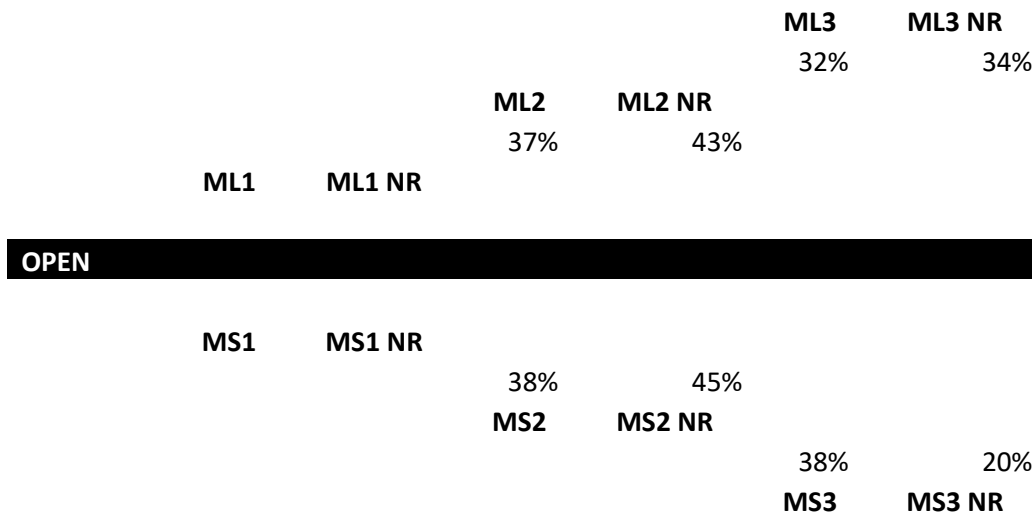
50%
ML1

OPEN

MS1
48%

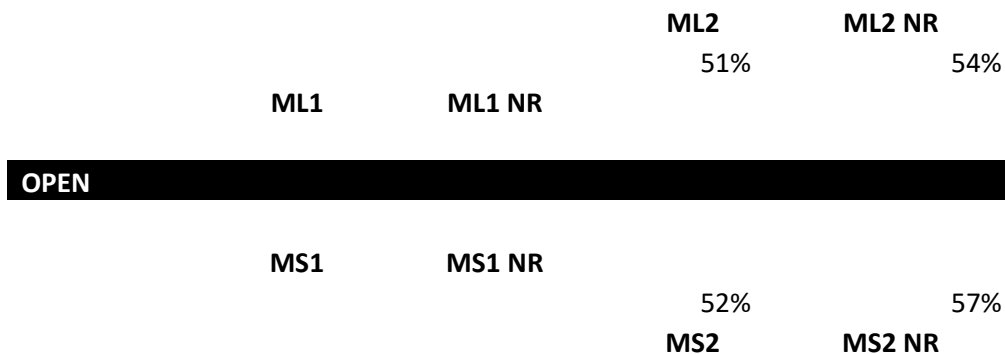
To determine if trend following would give a trader an edge, we look to the extended levels for determining the probabilities of these levels being met. As you can see, the first level must be reached and the probability of a stock reaching the second level is 37% from ML1 to ML2 and 38% from MS1 to MS2. If we remove the intra-day reversals, we find that the probability of reaching the next level is increased by 6% on the upside and 7% on the downside.

Probability of Levels Going to the Next Level



In our last graph, we want to look at the probability of an extended level being reached if the market exceeds the first level by 33% of the distance from the Open to ML1 / Open to MS1. As you can see, the probability of ML2 being reached increases from 37% to 51% if the stock has exceeded the ML1 by 33% of the distance from ML1 – Open. The graph also demonstrates that the probability of an MS2 being reached increases from 38% to 52% if the stocks exceeds MS1 by 33% of the distance from Open – MS1. In both instances, the filtering out of the Intra-Day Reversals increases the probabilities 3% on the upside and 5% on the downside.

Probability of Levels Going to the Next Level if the market moves above ML1 / below MS1 by 33% of the distance from the Open to ML1 / MS1



Trend Following Summary

These are two examples of short-term time periods that demonstrate using a trend following approach is helpful in increasing the odds of implementing the Intra-Day Momentum Method for the intra-day trader. These examples suggest that the Intra-Day Momentum Method is adaptable with both trend-following approaches as well as reversion to the mean approaches, for intra-day trading.

Using the Intra-Day Momentum Method we have demonstrated that trend-following would likely give the trader an edge and the probability of extended levels being reached is increased as a stock moves in the direction of the extended level.

Historical Results

To view the historical daily results of the Intra-Day Momentum Method

(<http://www.qatsystems.com/SP500/>). Due to the nature of the research, the updates on this page will be on a weekly basis.

Upcoming studies will also include:

1. Intra-Day Momentum Method applied to Sector based ETFs
2. Intra-Day Momentum Method applied to Market based ETFs
3. Intra-Day Momentum Method for stocks that meet Proprietary Patterns (Based on this Model)
4. 'Time of Day' and 'Speed' (Velocity) Based Turning Points
5. Heat Map for S & P 500
6. Heat Map for Dow 30
7. Current Market Conditions

Summary

The Intra-day Momentum Method was designed to give a low-to-mid frequency intra-day trader confidence in making better trading decisions. This scientific approach for determining daily direction is scalable and can be used in conjunction with any tool or technical analysis that a trader currently implements to arrive at his trading decisions. The method also helps a trader outline risk parameters for a trade, at the time of trade entry. The Intra-Day Momentum Method was designed to help traders identify trade-able market tendencies using Price, Pattern, Time, and in the coming months will include a designation to identify Speed (Rate of Change). The scientific approach can also assist a trader better understanding how to trade a stock when implementing a larger time frame trend analysis, fade or trade the directional move.

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