BOUNDARIES: HOW FAR IS TOO FAR?

The validation of thresholds in MAP institutional PBO and PBD signals

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INTRODUCTION TO OUR DAILY PROCESS

We begin our daily analysis of 4000+ US equities by defining a universe of stocks that we deem to be tradable by institutions. Among other criteria, we filter stocks for liquidity, market capitalization, average volume, and whether options are available. This universe is defined daily and yields an average of 1400 US equities. The stocks that pass the filters collectively function as an index of institutionally tradable stocks that we refer to as the **MAP 1400.**

At this point, 120+ individual historical data points are pulled for each equity. A truncated list of example data points is in the table below.
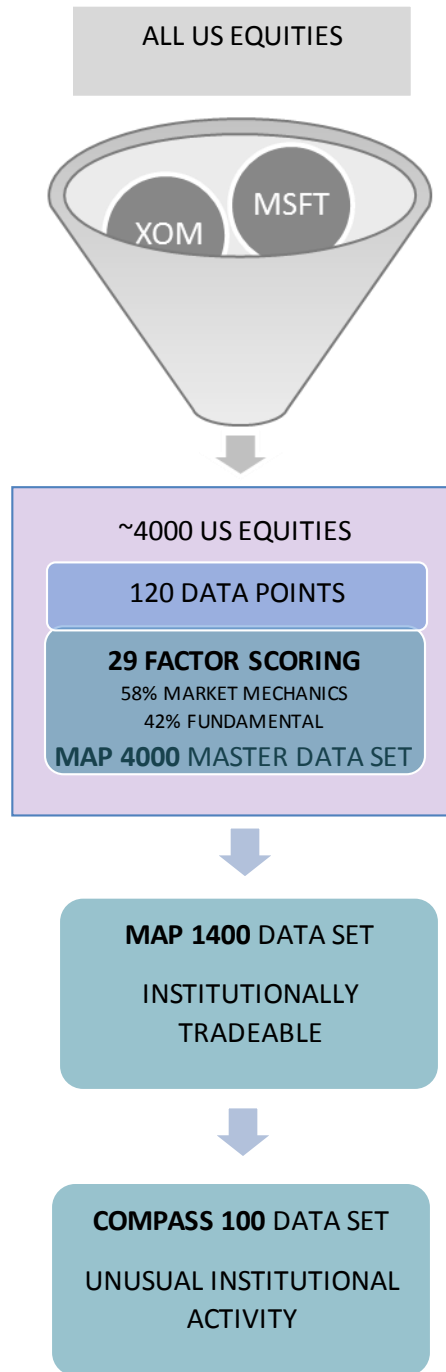
STOCK DATA EXAMPLES:

TECHNICAL	FUNDAMENTAL
Price highs and lows within a specified time period	Revenue and Earnings Growth - Single and Multi Year
52 week highs and lows	Analyst Revisions
Average Daily Volume within a specified time period	P/E ratio
Historical Volatility for a specified time period	Debt Levels
Several Moving Averages	Cash Flow
Relative Performance to Sector	Enterprise Value

We then employ a factor scoring method on the MAP 1400 utilizing 29 factors, each with various combinations of subsets of the 120 data points. Each factor component is part of an aggregate score. Aggregate scores approaching 100 are more bullish; approaching 0 are more bearish. The scores are further divided into technical and fundamental components. The technical score is our factor scoring methodology dealing with market mechanics: trading volumes, buying/selling pressure, price ranges, and volatility - to name a few factors. The fundamental score is our factor scoring methodology dealing with the fundamental health of a company: revenues, earnings, debt, and revisions to name a few. The composite Compass Score is roughly 58% market mechanics (technical) and 42% fundamentals.

INTRODUCING THE PBO (POTENTIAL BREAKOUT) AND PBD (POTENTIAL BREAKDOWN)

An additional technical tag is applied searching for potentially unusual institutional activity. We identify this activity by studying violations of relationships between price, volume and volatility. When a stock violates the upper thresholds on our filter it receives a PBO or Potential Breakout (bullish signal) designation indicating the potential for unusual institutional accumulation. When a stock violates the lower thresholds on our filter it receives a PBD or Potential Breakdown (bearish signal) designation indicating the potential for unusual institutional distribution. Each day finds roughly 100 stocks resulting in PBO/PBDs. We refer to this daily pool as the **COMPASS 100.**

The MAP Equity Filtering and PBO/PBD Process

ALL US EQUITIES

XOM   MSFT

~4000 US EQUITIES

120 DATA POINTS

29 FACTOR SCORING
58% MARKET MECHANICS
42% FUNDAMENTAL
MAP 4000 MASTER DATA SET

MAP 1400 DATA SET

INSTITUTIONALLY
TRADEABLE

COMPASS 100 DATA SET

UNUSUAL INSTITUTIONAL
ACTIVITY

SUMMARY

We attempted to validate if current thresholds of the MAP-IT ratio (a ratio constructed from daily PBO and PBD signals) lead to strong indicators of overbought and oversold markets. If these indicators are valid predictive alerts, then we pose the question "what did the S&P 500 return for one week through eight weeks after the appearance of an indicator?" We also attempted the same validation process on the Russell 2000 Index and sector instruments in the S&P 500 via associated sector ratios.

With these notions in mind, this paper explores in detail the returns of the S&P500 Index, the Russell 2000 Index, and sector instruments for the last 4+ years after our parametric ratios violate certain thresholds. Three studies were conducted and detailed below. The first explores if the current MAP-IT ratio thresholds are strong, reliable, forward indicators of overbought and oversold markets as it pertains to the S&P 500 index. The second study explores if the thresholds applied to the Russell 2000 index are also strong, reliable forward indicators of overbought and oversold markets. The third study explores if S&P 500 sectors follow the same pattern as the broad markets given certain thresholds on moving average PBO and PBD sector ratios. **(PBO= Potential Breakout – Buy Signal, PBD= Potential Breakdown – Sell Signal).**

STUDY ONE:

This study posed the questions:

- *Are MAP-IT ratio thresholds strong indicators of overbought and oversold markets for the S&P 500?*

- *After MAP-IT ratios violate the thresholds, would the future S&P 500 returns (one week through eight weeks) deviate from their historical average returns?*

HYPOTHESIS

The MAP-IT ratio is defined as the 25-day moving average of PBO/(PBO+PBD) derived from an average daily universe of 1400 institutionally tradeable stocks. When the reading of the MAP-IT ratio passes the overbought thresholds, it indicates that there are an extreme number of stocks being accumulated relative to those being sold. Such an overbought action would not be expected to continue at this rate for long, as one would expect the exuberance to revert. Thus, reducing market risk at indications of extreme accumulation would be advantageous. When the reading of the MAP-IT ratio passes the oversold threshold, it indicates that there are an extreme number of stocks being sold relative to those being bought. This oversold action should not be expected to continue at the same rate for long, as one would expect the selling intensity to be met with buyers. Thus, adding market risk at indications of extreme distribution would be advantageous.

RESULT

We calculated the return of S&P 500 Index after each observance of passing through these thresholds for each investment period and compared them with the historical mean return for each investment period. **The returns produced once the oversold threshold was triggered highly deviated from the historical mean return of S&P 500 and the returns produced once the overbought threshold was triggered differed greatly from the historical mean return.**

STUDY TWO

This study posed the questions:

- *Are MAP-IT ratio thresholds strong indicators of overbought and oversold markets for the Russell 2000?*

- *After MAP-IT ratios pass the thresholds, would the future Russell 2000 returns (one week through eight weeks) deviate from their historical average returns?*

HYPOTHESIS

The MAP-IT ratio is defined as the 25-day moving average of PBO/ (PBO+PBD) derived from an average universe of 1400 institutionally tradeable stocks which could also be a good indicator for Russell 2000. When the reading of the MAP-IT ratio passes the overbought thresholds, it indicates that there are an extreme number of stocks being accumulated relative to those being sold. This overbought action should not be expected to continue at this rate for long as one would expect the exuberance to revert. Thus, reducing market risk at indications of extreme accumulation would be advantageous. When the reading of the MAP-IT ratio passes the oversold threshold, it indicates that there are an extreme number of stocks being distributed relative to those being bought. This oversold action should not be expected to continue at this rate for long as one would expect the selling intensity to be met with buyers. Thus, adding market risk at indications of extreme distribution would be advantageous.

RESULT

We calculated the return of the Russell 2000 after each observance of passing through these thresholds for each investment period and compared them with the historical mean return for the same investment period. **The returns produced once the oversold threshold was triggered highly deviated from the historical mean return of the Russell 2000 and the returns produced once the overbought threshold was triggered differed greatly from the historical mean return.**

STUDY THREE

This study posed the questions:

- *Do sectors in the S&P 500 follow the same patterns if we set thresholds for 25 day moving averages of sector PBO and PBD ratios?*

- *After the moving average of sector PBO and PBD ratios pass certain thresholds, would the sector index future returns (one week through eight weeks) deviate from their historical average returns?*

HYPOTHESIS

When the reading of the moving average of PBO ratio passes the overbought thresholds, it indicates that there are an extreme number of stocks being accumulated relative to those being sold. This overbought action should not be expected to continue at this rate for long, as one would expect the exuberance to revert. Thus, reducing sector risk at indications of extreme accumulation would be advantageous. When a reading of the sector ratio passes the oversold threshold, it indicates that there are an extreme number of stocks being sold relative to those being bought. This oversold action should not be expected to continue at this rate for long, as one would expect the selling intensity to be met with opportunistic buyers. Thus, adding sector risk at indications of extreme distribution would be advantageous.

RESULT

We calculated the return after each observance of passing thresholds for each investment period and compared them with the historical mean return for each investment. We then repeated the process for each sector. We observed that all sectors could be grouped into two classes: one with similar patterns of the broad market with high deviation, and the other with low deviation relative to its historical mean return. However, the returns in the latter class are still quite different from historical mean in terms of value. **Additionally, the oversold threshold tends to conclusively show high deviation from the historical mean in nearly all instances.**

DETAIL

STUDY ONE: MAP-IT RATIO AS A LEADING MARKET INDICATOR ON THE S&P 500

The MAP-IT Ratio is a ratio defined as the ratio of PBOs to the total number of PBOs and PBDs.

Map-IT Ratio= the moving average of (# of PBO)/(# of PBO+# of PBD)×100%

The ratio reflects the weight of the daily number of PBOs. If the rate increases, it indicates that institutional accumulation is increasing relative to distribution and vice versa. By taking the 25-day moving average of a MAP-IT Ratio, we are able to detect the trend of institutional movement as follows: if the moving average continues to increase, the market bullishness increases and vice versa.

We wished to study if the current overbought threshold of 80% and oversold threshold of 25% can indicate a future overbought and oversold market, respectively. Our approach to define historical context was to consider the first point whenever the ratio crosses the threshold and calculate the forward 1-8 week return.

The process for this scenario was to first identify the data points that satisfied the conditions. We then calculated the 1-8 week S&P 500 Index return going forward. We then averaged the S&P 500 returns from the calculated data set and compared these averaged returns to historical returns under each horizon (where we calculated returns using all data available). We found that historical returns did not follow a normal distribution which made it difficult to compute meaningful statistics.

Consequently, before calculating the statistics, we transformed historical returns into a normal distribution. Then we were able to see how far the threshold returns deviated from the historical return by computing the standard deviation from the historical return. The table below summarizes the results:

Entering Point

Thresholds 80%/25%	Overbought (10 times)	deviation	SPX	Oversold (3 times)	deviation
1 week return	0.16%	-0.04	0.23%	0.12%	-0.07
2 weeks return	0.39%	-0.03	0.46%	3.96%	1.69
3 weeks return	-0.44%	-0.41	0.69%	4.93%	1.70
4 weeks return	0.40%	-0.17	0.92%	6.68%	2.11
5 weeks return	-0.22%	-0.40	1.14%	7.55%	2.17
6 weeks return	0.36%	-0.28	1.36%	8.83%	2.50
7 weeks return	-0.04%	-0.43	1.57%	8.05%	2.04
8 weeks return	0.78%	-0.26	1.79%	8.41%	2.04

In all but one case, oversold returns were over 1.69 standard deviation from historical mean returns. Even though overbought returns were not greater than one standard deviation from the mean, they were however, much lower than the mean in most of the cases. **From the calculations above, if the MAP-IT Ratio moves above the overbought threshold, it pays to reduce market risk and if the MAP-IT Ratio crosses below the oversold threshold, it pays to increase market risk. A strong trading strategy would be to buy the S&P 500 when the MAP-IT Ratio is below the oversold threshold.**

STUDY TWO: MAP-IT RATIO AS A LEADING MARKET INDICATOR FOR THE RUSSELL 2000

We used the same overbought threshold of 80% and oversold threshold of 25% as indicators of overbought and oversold markets, respectively. The approach was the same as considering the initial point at which the ratio crosses the threshold and then calculating the market returns.

The process for this scenario was to first identify the data points that satisfied the conditions, then calculate the 1-8 week Russell 2000 return going forward. We then averaged the Russell 2000 returns from the calculated data set and compared these averaged returns to historical returns under each horizon (where we calculate returns using all data available). We found that historical returns did not follow a normal distribution which made it difficult to compute meaningful statistics.

Consequently, before calculating the statistics, we transformed historical returns into a normal distribution. Then we were able to see how far the threshold returns deviated from the historical return by computing the standard deviation from the historical return. The table below summarizes the results:

Entering Point

Thresholds 80%/25%	Overbought (10 times)	deviation	RUT	Oversold (3 times)	deviation
1 week return	-0.22%	-0.21	0.27%	-1.90%	-0.93
2 weeks return	-0.04%	-0.18	0.54%	3.13%	0.82
3 weeks return	-0.96%	-0.46	0.80%	4.12%	0.87
4 weeks return	-0.37%	-0.33	1.06%	5.92%	1.14
5 weeks return	-1.08%	-0.49	1.31%	5.58%	0.92
6 weeks return	-0.46%	-0.39	1.55%	7.40%	1.22
7 weeks return	-1.05%	-0.51	1.78%	5.84%	0.80
8 weeks return	-0.22%	-0.39	2.02%	7.27%	1.01

In the above table, we observe overbought returns which varied greatly from the historical mean. Oversold returns (excluding one-week return) were positive and around 1 standard deviation away from the historical mean return. Even though overbought returns were not greater than one standard deviation from the mean, they were negative in all periods. **From the calculations above, if the MAP-IT Ratio moves above the overbought threshold, it pays to reduce market risk and if the MAP-IT Ratio crosses below the oversold threshold, it pays to increase market risk. A strong trading strategy would be to buy the Russell 2000 when the MAP-IT Ratio is below the oversold threshold and short the Russell 2000 when the MAP-IT Ratio crosses above the overbought threshold.**

STUDY THREE: MAP-IT SECTOR RATIOS AS MARKET INDICATORS

Similar to the approach in Study One, we wished to validate if the moving averages of the PBO ratio and PBD ratio could be good indicators of overbought and oversold sector markets. If the moving average of the PBO ratio increases past our threshold, it implies that institutional accumulation is nearing an unsustainable exuberance level and thus a reversion could be near. If the moving average of the PBD ratio increases past our threshold, it implies that institutional distribution is nearing an unsustainable selling point and should be met with buyers.

The approach only considered the first point whenever the moving average of PBO or PBD ratio passed the threshold. We then calculated the forward one week to eight week ETF (corresponding to studying sector) return starting from these data points. We used the average ETF return from one to eight weeks for each sector studied. We then compared the average returns to historical returns under each horizon (where we calculate returns using all data available). We found that historical returns do not follow a normal distribution which made it difficult to compute meaningful statistics.

Consequently, before calculating the statistics, we transformed historical returns into a normal distribution and were then able to see how far away the desired return was from the historical return by computing how many standard deviations it is from the historical return.

According to deviations from historical mean return, all studied sectors are divided into two groups, the first being high deviation and the other being low deviation. For each sector we only list the result of an entering point.

HIGH DEVIATION GROUP

INDUSTRIALS

Thresholds 12%/12%	Overbought (1 times)	std deviation from mean	XLI	Oversold (3 times)	std deviation from mean
1 week return	2.63%	1.22	0.26%	2.27%	1.02
2 weeks return	0.98%	0.17	0.52%	4.46%	1.42
3 weeks return	1.03%	0.08	0.77%	7.05%	1.85
4 weeks return	0.05%	-0.26	1.01%	7.24%	1.60
5 weeks return	1.17%	-0.02	1.26%	7.22%	1.41
6 weeks return	1.30%	-0.05	1.51%	10.73%	2.10
7 weeks return	1.09%	-0.15	1.76%	10.24%	1.86
8 weeks return	2.45%	0.09	2.01%	11.34%	1.97

REAL ESTATE

Thresholds 12%/9%	Overbought (3 times)	std deviation from mean	IYR	Oversold (7 times)	std deviation from mean
1 week return	-0.36%	-0.21	0.09%	1.21%	0.57
2 weeks return	-0.63%	-0.28	0.17%	2.53%	0.87
3 weeks return	-1.85%	-0.59	0.26%	1.76%	0.44
4 weeks return	-2.43%	-0.67	0.34%	3.19%	0.74
5 weeks return	-3.83%	-0.92	0.42%	5.01%	1.08
6 weeks return	-4.20%	-0.94	0.51%	6.49%	1.31
7 weeks return	-3.58%	-0.81	0.60%	5.90%	1.06
8 weeks return	-2.85%	-0.67	0.66%	5.72%	0.96

CONSUMER DISCRETIONARY

Threshold 6%/9%	Overbought (9 times)	std deviation from mean	XLY	Oversold (3 times)	std deviation from mean
1 week return	0.02%	-0.13	0.28%	3.49%	1.83
2 weeks return	-0.25%	-0.30	0.55%	4.67%	1.61
3 weeks return	-0.56%	-0.44	0.83%	3.39%	0.82
4 weeks return	-0.88%	-0.55	1.10%	3.31%	0.64
5 weeks return	0.57%	-0.20	1.36%	4.48%	0.82
6 weeks return	0.96%	-0.16	1.64%	7.53%	1.53
7 weeks return	0.15%	-0.40	1.90%	8.85%	1.79
8 weeks return	0.93%	-0.28	2.16%	9.01%	1.77

MATERIALS

Threshold 8%/9%	Overbought (3 times)	std deviation from mean	XLB	Oversold (5 times)	std deviation from mean
1 week return	0.95%	0.34	0.16%	0.73%	0.25
2 weeks return	-0.44%	-0.24	0.33%	3.87%	1.14
3 weeks return	-0.33%	-0.22	0.52%	4.80%	1.16
4 weeks return	0.11%	-0.13	0.68%	3.65%	0.70
5 weeks return	1.63%	0.16	0.85%	3.98%	0.66
6 weeks return	0.71%	-0.06	1.01%	6.41%	1.09
7 weeks return	3.70%	0.46	1.18%	6.00%	0.90
8 weeks return	0.55%	-0.14	1.35%	7.44%	1.09

HEALTH CARE

Thresholds 7%/10%	Overbought (8 times)	std deviation from mean	XLV	Oversold (3 times)	std deviation from mean
1 week return	-0.11%	-0.20	0.29%	3.89%	2.01
2 weeks return	-0.46%	-0.38	0.56%	4.69%	1.64
3 weeks return	-0.51%	-0.42	0.83%	3.16%	0.78
4 weeks return	0.67%	-0.12	1.09%	3.79%	0.83
5 weeks return	-0.17%	-0.40	1.36%	4.32%	0.85
6 weeks return	0.23%	-0.35	1.64%	4.46%	0.76
7 weeks return	0.15%	-0.41	1.93%	3.84%	0.47
8 weeks return	0.94%	-0.28	2.22%	4.31%	0.49

INFORMATION TECHNOLOGY

Thresholds 7%/8%	Overbought (15 times)	std deviation from mean	XLK	Oversold (5 times)	std deviation from mean
1 week return	-0.64%	-0.46	0.27%	0.83%	0.30
2 weeks return	-0.72%	-0.48	0.55%	1.81%	0.50
3 weeks return	-0.98%	-0.59	0.83%	3.61%	0.93
4 weeks return	-0.03%	-0.33	1.11%	0.91%	-0.06
5 weeks return	-0.57%	-0.51	1.41%	2.36%	0.25
6 weeks return	-0.53%	-0.54	1.70%	3.97%	0.58
7 weeks return	0.31%	-0.40	1.99%	5.27%	0.81
8 weeks return	0.86%	-0.33	2.29%	5.26%	0.72

ENERGY

Thresholds 11%/16%	Overbought (6 times)	std deviation from mean	XLE	Oversold (4 times)	std deviation from mean
1 week return	-0.68%	-0.24	0.02%	1.37%	0.47
2 weeks return	-1.37%	-0.36	0.02%	2.03%	0.53
3 weeks return	-1.30%	-0.29	0.03%	-0.04%	-0.02
4 weeks return	-1.00%	-0.20	0.02%	1.44%	0.28
5 weeks return	-1.38%	-0.24	0.02%	-0.66%	-0.12
6 weeks return	-2.67%	-0.42	0.01%	2.05%	0.33
7 weeks return	-2.66%	-0.39	0.00%	3.68%	0.58
8 weeks return	-2.15%	-0.29	-0.01%	2.50%	0.36

UTILITIES

Threshold 12%/11%	Overbought (5 times)	std deviation from mean	XLU	Oversold (4 times)	std deviation from mean
1 week return	-0.31%	-0.24	0.16%	2.95%	1.53
2 weeks return	-1.09%	-0.50	0.32%	1.73%	0.54
3 weeks return	-0.64%	-0.34	0.47%	1.98%	0.48
4 weeks return	0.03%	-0.16	0.62%	3.01%	0.67
5 weeks return	0.88%	0.03	0.77%	2.24%	0.37
6 weeks return	1.64%	0.16	0.93%	2.70%	0.41
7 weeks return	2.95%	0.40	1.09%	3.63%	0.55
8 weeks return	2.35%	0.23	1.23%	1.38%	0.03

FINANCIALS

Threshold 15%/10%	Overbought (2 times)	std deviation from mean	XLF	Oversold (3 times)	std deviation from mean
1 week return	2.33%	0.95	0.27%	-0.30%	-0.26
2 weeks return	4.45%	1.30	0.53%	0.81%	0.09
3 weeks return	4.14%	0.91	0.81%	1.54%	0.20
4 weeks return	3.80%	0.65	1.08%	-0.08%	-0.28
5 weeks return	3.18%	0.39	1.35%	1.83%	0.10
6 weeks return	3.01%	0.27	1.63%	2.46%	0.16
7 weeks return	3.68%	0.32	1.92%	3.13%	0.22
8 weeks return	2.58%	0.07	2.20%	4.65%	0.42

CONCLUSION

In this paper, we propose our overbought and oversold thresholds for the S&P 500, Russell 2000 and each major sector. We tested to see if overbought and oversold thresholds are strong indicators of forward returns. To address these questions, we tested an approach to validate both thresholds. We compared the post-threshold returns in each scenario with the average market & sector returns over the last 4+ years. The following summarizes the results:

- *We tested the MAP-IT Ratio thresholds to measure the forward S&P 500 returns post an overbought (80%) and oversold (25%) threshold being triggered.* **The returns post the oversold threshold are over 1.69 standard deviation away from the historical mean in most cases. We recommend adding S&P 500 Index risk if the MAP-IT Ratio crosses below the oversold threshold.**

- *We tested the MAP-IT Ratio thresholds to measure the forward Russell 2000 returns post an overbought (80%) and oversold (25%) threshold being triggered.* **The returns post an oversold threshold being triggered are above 1 standard deviation away from the historical mean in many cases and the returns post an overbought trigger are lower than historical mean and on average negative in one – eight week returns. We recommend adding Russell 2000 risk if the MAP-IT Ratio crosses below the oversold threshold and reducing risk or selling short the Russell 2000 if the ratio crosses above the overbought threshold.**

- *We tested the moving average of PBO and PBD ratios separately to measure each sector's forward return post an overbought and oversold threshold being triggered. According to the deviation statistics, we separated each sector's returns into two classes.* **The high deviation group includes: Industrials, Real Estate, Consumer Discretionary and Materials. These four sectors follow a similar pattern to S&P 500 & the Russell 2000, where we recommend adding sector risk via the ETF if the oversold ratio threshold is triggered and reducing risk post the overbought threshold being triggered. The low deviation group contains Health Care, Information Technology, Energy, Utilities and Financials. These five sectors do not show a high deviation in forward returns, however the returns post an overbought and oversold trigger still differ from historical mean return in value. When it comes to oversold thresholds, these sectors show a similar pattern to the S&P 500 Index and Russell 2000 Index, and we recommend adding risk post an oversold trigger.**