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# Trend Aggregation

Tuttle Tactical Management

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## The Problem

At any point in time, markets are in one of three states: bull market, bear market, or correction. Optimal portfolio construction means having some part of one's portfolio that will generally do well in each environment, **while making sure that the other parts of the portfolio aren't losing money.**

Traditional asset allocation addresses the bull market part of the equation and tries to address bear markets and corrections by blending bonds into a portfolio of stocks. During a bull market, stocks will go up, whereas during a correction or a bear market, bonds will go up. However, the problem is that during a bear market or a correction, bonds won't go up nearly enough to offset the losses in stocks, and during a bull market bonds will be a drag on stocks.

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## The Problem (cont.)

The financial crisis of 2008 and the corrections that the market has had since have born that out, leading to the popularity of tactical asset allocation (TAA). TAA can shift an entire portfolio between bearish and bullish, seemingly providing a holy grail for investors. During a bull market, a portfolio may be in stocks, whereas during a bear market or a correction, the portfolio could move to cash, Treasuries, or inverse products. Unfortunately, the promise has not lived up to expectations as TAA strategies generally use one methodology to make asset allocation decisions, and no methodology is correct 100% of the time, leading to large drawdowns when the model is bullish during a bear market or correction and bearish during a bull market. Furthermore, tactical methodologies frequently cycle out of favor, especially when markets are choppy, which they have been over the past few years.

## Defining Trend Aggregation

**Trend Aggregation** involves combining multiple methodologies that are not only uncorrelated with each other, but are also able to address each possible market condition. Trend Aggregation shares elements with Tactical Asset Allocation (TAA) while also attempting to improve upon some common tactical management issues, such as performing well in choppy market conditions and not being reliant on one methodology.

Additionally, instead of trying to shift an entire portfolio from bull to bear mode, and back again, based on one imperfect model, Trend Aggregation divides the portfolio into sleeves, wherein each sleeve is designed to do well in one or more market states without losing money in the other states. Money in each sleeve is subsequently managed tactically in the attempt to accomplish this goal.

## Market Dynamics

People trade in markets. People are also influenced by their emotions. The main emotions that can impact the market are fear and greed, which can, in turn, cause two main market dynamics:

1. *Trend Following*: Trend following takes advantage of the fact that objects in motion tend to stay in motion. If stocks are strong, they tend to stay strong for a period of time. Conversely, if stocks are weak, they tend to stay weak for a period of time. Trend following models can take advantage of this by buying into strength and selling into weakness. These types of models will generally do well in straight up or straight down markets. For example, during straight up markets, investors may buy stocks and hold them, riding the market up. During straight down markets, these investors may

## Market Dynamics (cont.)

move to cash and stay there as the market continues to slide. However, these models generally do not do well during choppy markets. During a choppy market, stocks appear to be strong, only to weaken. A trend following methodology can get a lot of false buy and sell signals, causing losses.

2. *Counter Trend*: Counter trend models take advantage of the fact that markets tend to overshoot to the upside and downside before eventually snapping back to equilibrium. If the market is rallying, it typically goes a bit too far and profit-takers start to sell, pushing the market back down a bit. Conversely, if the market is dropping, it tends to drop a bit too far before buyers move in to pick up bargains. Counter trend models can take advantage of this behavior by buying into weakness and selling into strength. On the surface, this may seem to cancel out what a trend following model is doing, but counter trend models tend to operate on a shorter time frame than a trend following model does. In effect, the intermediate term trend on a stock might be up, keeping a trend following model invested, while a counter trend model would involve buying into the shorter term dips and selling into the shorter term rallies along the overall trend. Counter trend models can run into trouble during straight down markets as they buy weakness that leads to more weakness. They can also have trouble during straight up markets as they will often sell too soon. However, these models can generally work well in choppy markets as they are designed to take advantage of the false signals that plague a trend following model.

Markets are generally either in a trend following mode or in a counter trend mode. The problem many TAA strategies have is that they are designed for trend following markets. In a counter trend market, these strategies can collapse by buying and selling at the wrong times. Trend Aggregation can combine trend following and counter trend strategies so that a portion of a portfolio is calibrated for whatever mode the market is in.

## In Depth: Trend Aggregation vs. Traditional Tactical Asset Allocation

Traditional tactical management styles generally excel in a straight up or straight down market, but they tend to struggle to perform well in choppy markets. Conversely, Trend Aggregation uses a multi-dimensional strategy that combines methodologies that have different, uncorrelated return streams, such as intermediate-term momentum methodologies and short-term countertrend methodologies. The goal of trend aggregation is to have well-defined strategies for all market climates.

As a result, Trend Aggregation methodologies can have a better chance to protect against large losses during market downturns, while still positioning investors for gains when the market is trending upward. Through trend aggregation, one analyzes trends and countertrends, positioning investments according to confirmed information from the markets.

The Trend Aggregation approach includes a strategy not only for markets with a clearly defined trend, but also for choppy, directionless markets. Despite regular rebalancing, traditional asset allocation strategies tend to ride a bull market up, ride the bear market down, and move with the choppy market, hoping for a positive result. In a traditional tactical approach, investors generally participate in a portion of bull market returns and avoid large losses of a bear market. However, choppy markets present a problem as there is no defined trend for the tactical investor to follow. Additionally, while some tactical methodologies may protect investors from significant losses, generally no one methodology works in all markets. This is why trend aggregation uses multiple methodologies.

For example, if a tactical strategy relies solely on a momentum methodology, it can perform well in some markets and experience unnecessary losses in other types of markets. This is because a momentum methodology relies on whatever asset class happens to be strong, remaining strong for a long-enough period to profit. But a momentum methodology tends to struggle during choppy market environments, as market leadership will often vary with no discernible trend to latch onto.

When using a Trend Aggregation approach, each type of market is handled differently. In bull markets, investors can be mostly or completely in stocks. In bear markets, investors are generally out of stocks, but have the ability to participate in bear market rallies through countertrend methodologies. Additionally, with the use of specific methodologies, investors can participate in the overreactions of choppy markets.

## Applied Trend Aggregation: Sample Sleeves

To illustrate how trend aggregation could be applied to a portfolio, consider the following sample sleeves:

### Sleeve 1

Sleeve 1 would be designed with the goal to make money in a bull market and not lose money in a bear market. This sleeve would be comprised of a mix of stocks and ETFs and a mix of trend following and counter trend following models all using different time frames. This sleeve should be fairly equally weighted between counter trend and trend following models. Theoretically, during straight up markets, the trend following methodologies would excel. During choppy markets, the counter trend methodologies would excel.

The stock universe would be picked using a **quantamental approach** that utilizes **factor investing**.

### ***Quantamentals***

Picking individual stocks to use in a portfolio is no easy exercise; there is a reason that active managers typically cannot outperform their benchmarks. *Quantamentals* is the next generation of stock picking. Instead of trying to decide whether a fundamental approach or a quantitative approach is better, it combines the two. It then stacks as many “edges” as it can on top of each other. For example, low price to sales and high return on equity are two fundamental factors that have beaten the market over time. A Quantamental approach might find stocks that have these two characteristics, instead of relying on one and then applying something quantitative, such as momentum, to find the stocks in the list that have the strongest momentum.

### ***Factor Investing***

Traditional asset allocation has typically revolved around studies showing that over 90% of portfolio returns come from asset allocation, not stock selection. These studies have since been refined as certain factors have been identified that are more important for portfolio returns than asset classes. Some of these factors have significant research backing the idea that they have beaten the market handily over time. These include value stocks, low volatility stocks, momentum stocks, “quality” stocks, small cap stocks, among others. These factors also tend to be somewhat uncorrelated with each other and their returns tend to be cyclical in nature. A quantamental approach to stock selection would stack a number of these factors. ETFs that track different factors can also be used.

### **Considerations during Bull Markets**

Given how frequently markets are in a bull phase, the bulk of a portfolio could theoretically be allocated to models that are designed to make money during up markets. However, unlike a buy and hold approach, this part of the portfolio could be designed to have some sort of safety mechanism to avoid losses in bear markets and major corrections. Note that this part doesn’t need to make money during downturns since the other parts of the portfolio will do that; it just needs to avoid losses. Often, one of the most effective ways to make money in a bull market is through stocks and/or equity ETFs. Ideally, one would use a combination of the two. Individual equities can offer the potential to add alpha to the portfolio, but they can diverge from the market. ETFs won’t add any alpha, but they will usually track whatever market they are designed to track

## Sleeve 2

Sleeve 2 would be designed with the goal to make money in a correction and to also make money in a bull or a bear market.

### Considerations during Corrections

Corrections are short and sharp declines in the market that can be as large as 20%. They often come with little, or no, warning. The correction part of a portfolio is designed to make money during these times, but because they happen so quickly, these models need to have constant exposure. This presents a problem as instruments and strategies that would typically make money in a correction, such as short selling, puts, and volatility, will lose money during a bull market. It does not make sense to have something in one's portfolio that will lose money most of the time, only to make money every once in a while when the market corrects. One potential solution is Treasury Bonds. Unlike puts, short selling, and volatility, Treasuries are often positioned to make money during a bull market, so one can have constant exposure without it being a drag on a portfolio and have certainty that no matter how quick a correction comes this part of the portfolio can react accordingly. However, for this sleeve, it's not as simple as buying and holding Treasuries, since they can be as volatile or more volatile than stocks at times. Tactical methodologies still need to be used to move up and down the yield curve based on what is going on in the Treasury markets.

## Sleeve 3

Sleeve 3 would be designed with the goal to make money in a bear market and not lose money in a bull market. Generally, it could also make money in a longer-term correction. This sample sleeve would consist of trend following and counter trend following models for bear market instruments or strategies like short selling, volatility, or put buying. These models would also use different time frames.

### Considerations during Bear Markets

Bear markets are large, sustained declines of more than 20%, and often more than 50%. They last longer than corrections and usually come with some warning. The bear market part of a portfolio could consist of securities and strategies such as short selling, put buying, and/or volatility. These would be the slowest moving of the tactical models as they would only need to trigger during a disaster.

## Underwater Correlation

Traditional asset allocation generally uses correlation to decide which assets to allocate to. This ignores a few key points about correlation:

1. Investors want their portfolio to be correlated on the upside, meaning they want everything to be able to go up at the same time.
2. US Stocks, international stocks, small stocks, large stocks, etc. are all going to be highly correlated as the return streams rely on stock markets going up.
3. What investors really want is a scenario in which when one part of their portfolio is going down, another part is going up.

*Underwater correlation* measures what happens to one part of a portfolio when another part is going down. Trend Aggregation focuses solely on underwater correlation, both from a methodology standpoint and from a day-by-day standpoint.

From a methodology standpoint, a counter trend strategy will tend to not be correlated with a trend following strategy on an underwater basis. A trend following strategy may do great in a straight up or down market but may struggle in a choppy market. A counter trend strategy can still make money in a straight up or down market but tends to do really well in a choppy market. Combining the two helps to ensure that no matter what mode the market is in, there is a strategy designed for it.

Trend Aggregation also looks at underwater correlation on a day-by-day basis. This is because markets move quicker than they ever have before, and a major trend change can happen in an instant, much too quickly for any tactical methodology to respond. Trend Aggregation is always going to have a part of the portfolio that is designed with the goal to do well during times of market stress.

The resulting portfolio, then, attempts to make money in any market environment with two levels, with a lack of underwater correlation within the different sleeves and then by sleeve. The result is extremely small drawdowns and a resulting high **MAR Ratio**.

MAR Ratio is the average annual return of one's portfolio divided by maximum drawdown. Maximum drawdown is a measure of the maximum peak to trough loss over a period of time. For example, if you have been invested in the S&P 500 since October 2007, you would have made money, but you would have experienced a drawdown of approximately 60% during the 2008 bear market. Maximum drawdown is an extremely important measure. While conventional wisdom may try to convince you to be a long-term investor during bear markets, it is extremely difficult to stay fully invested when your portfolio gets cut in half. Sharpe Ratio is the traditional way to measure risk adjusted return. Instead of maximum drawdown, it uses volatility.

Since investors are much more emotionally tied to drawdowns, this is a much better measure in calculating risk adjusted returns. MAR Ratio also takes **time dilation** into account.

### ***Time Dilation***

Time dilation refers to the idea that investors and portfolio managers tend to believe whatever is going on in the market or with their portfolios will persist for a long period of time. However, drawdowns that could appear to be minor blips on a long-term backtest could turn into major problems for investors and could cause the portfolio manager to dump a winning strategy.

## **How Trend Aggregation Strategies are Formed**

Trend Aggregation portfolios consist of multiple models. The process of forming Trend Aggregation models starts with a premise. This premise should be based on market psychology, which typically doesn't change, vs. basing it on current market dynamics, which can change.

The premise behind trend following, for example, is that due to investor psychology, assets that are rising should continue to rise for a time, and assets that are falling should continue to fall for a time. Similarly, the premise behind counter trend following is that assets that are rising or falling tend to overshoot before snapping back to an equilibrium. These premises are then tested using **walk-forward testing**. Models are then combined into a portfolio that considers **time dilation, actual diversification, and forward-looking due diligence**.

### ***Walk-Forward Testing***

Trend Aggregation strategies are formed with the use of walk-forward testing, which is the most rigorous form of backtesting. This helps to avoid curve fitting and determines how robust a strategy could be going forward. Many managers do not employ the use of walk-forward testing, since it is extremely complex, time consuming, and often exposes dangers in their current strategies. However, when used, walk-forward testing may help to filter out personal biases held by managers. Walk-forward testing allows one to accurately test a strategy without using clients' money. If the strategy is robust throughout this process, there is a better chance it will continue to be robust when it is traded live with actual money. Walk-forward testing involves splitting a backtest among in-sample and out-of-sample data. A strategy is optimized on in-sample data and then tested on out-of-sample data.

### ***Utilizing Actual Diversification as opposed to Perceived Diversification***

Traditional asset management diversifies portfolios through different asset classes, which can be referred to as *perceived diversification*, since there are occasionally times when most, if not all, asset classes move downward simultaneously. To help guard against this, trend aggregation combines non-correlated methodologies, timeframes, and return streams. This is referred to as *actual diversification*.

### ***Time Frame Variation***

The answer to the question, “What is the market doing?” depends on what time frame one is looking at. Over the intermediate term, the market could be up, but for the week it could be down. Many TAA methodologies take one time frame to analyze markets. Using one time frame, however, subjects a strategy to rebalance date risk (i.e., the risk that the day you choose to rebalance a portfolio is the worst possible date). Conversely, trend aggregation uses multiple time frames, with lookbacks ranging from 30 minutes to 4 months.

### ***Forward-Looking Due Diligence***

Trend aggregation methodologies are also developed using forward-looking due diligence. The forward-looking due diligence process consists of evaluating the methodologies of models and strategies to gauge how they will likely perform in the future. Although past performance is also reviewed, it does not provide an indication of future performance and is therefore not used as a method for assessing future abilities of a particular strategy. Rather, forward-looking due diligence focuses on how well that strategy is likely to perform on an ongoing basis. Forward-looking due diligence asks the following questions:

1. Why or why not are returns likely to persist into the future?
2. What can go wrong?
3. How will the model adapt when market dynamics change?

— **Due Diligence of Individual Strategies:** This process starts with standard measurement systems, such as track record, correlation, and volatility. Then it looks at every strategy against four filters:

1. *Return Attribution.* From a reverse-engineering standpoint, where have any recent returns come from?
2. *Attribution Persistency.* How likely will the current performance persist going forward, and, if likely, why?
3. *Tail Risk Analysis.* What factors may contribute to potential loss?
4. *Portfolio Flexibility.* What changes in strategy, if any, should be made?

— **Due Diligence of Aggregated Strategies:** When determining whether any changes are to be made to portfolios, additional questions are asked pertaining to the aggregation of strategies:

1. *Performance vs. Expectations.* How did portfolios of combined strategies, for example, perform against expectations?
2. *Portfolio Optimization.* What changes in allocation percentages, if any, are required to improve portfolios?
3. *Scenario Analysis.* What are possible market scenarios going forward on an immediate basis? How would current portfolios perform in those markets?
4. *Failure Mode and Effect Analysis.* How does what is going on in one model impact the others and the overall portfolio?

## Summary

Trend Aggregation uses a variety of different methodologies to help build a portfolio that attempts to do well in all market trends. Trend Aggregation can be used to help position a portfolio to profit during market uptrends, avoid large losses during sustained market downturns, and retain the ability to perform well in choppy markets.