

Trend Following: How?

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Trend Basics

Trends are a persistent feature of liquid markets. This is the core principle underpinning trend following strategies. Why do markets trend? There are many reasons including human nature, behavioural biases and structural feedback loops in markets. Systematic trend following *isn’t* about building models to explicitly understand and predict the impact of these factors on markets. What it *is* about is identifying and capturing the trends that appear as a result of these factors, in order to generate absolute returns.

Persistent isn’t the same as consistent. Trend following recognises markets tend to move up and down at different times, not always together and not always in the same order. Trends can appear in any market, at any time, which is why trend followers typically trade as many diversifying markets as possible. In order to maximise the chance of profiting from trends when they do arise, trend following strategies have the following key features:

Trend Following: Key Features

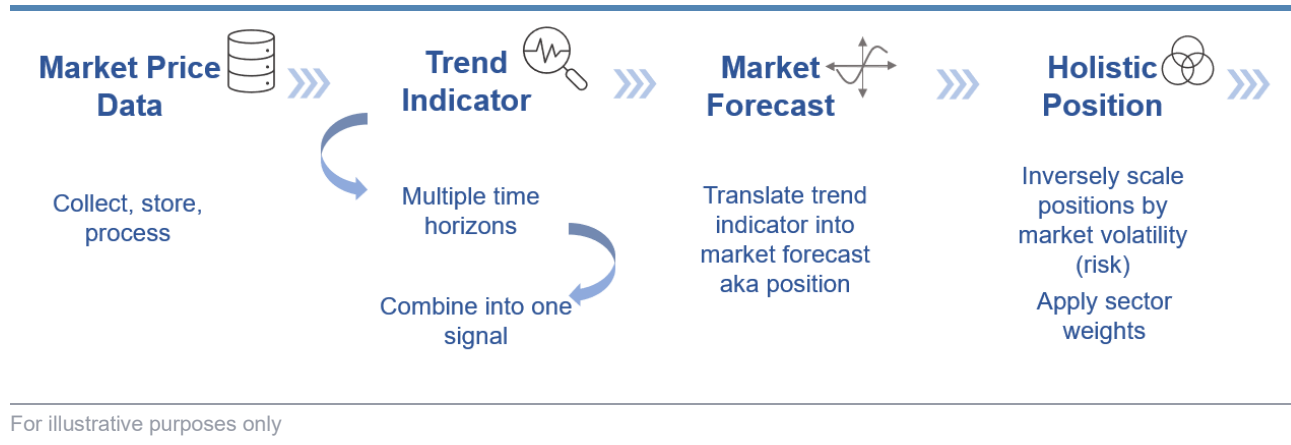
Directionally Unbiased	Can profit equally from upward and downward trends	Taking long and short positions	No inherent long-bias
Diverse Liquid Investment Universe	Highly liquid futures and other OTC contracts	Spanning stock indices, government bonds, interest rates, currencies and commodities	
Multiple Time Horizons	Capture trends over multiple timeframes	Long-term (years) Medium-term (months) Short-term (days)	‘Medium term’ is most prevalent, i.e. 3+ months

- The result is diversification achieved on several levels: asset class, markets traded and time-horizon



Step by Step: Trend Following

Trend following is reactive, not predictive. The system isn't trying to predict the beginning or the end of a trend, but rather to identify whether a trend exists, the direction of that trend and when to enter and exit the trend. But how?



1. Input: Market Price Data

In its simplest form, a trend following strategy's core input is historical market price data - and lots of it. Recall the investment universe is diverse, consisting of many markets (in some cases 100+). An adequate system is therefore needed to capture the price data, store it and then process it for all the markets traded.



To build a coherent portfolio that trades many markets across different asset classes, markets need to be made somewhat comparable. For example, the market price of the S&P 500 is measured in index points and for Crude oil, dollars per barrel. These different price levels across markets are arbitrary for a trend following system so market prices can be converted into returns.

But returns across different markets will still differ in their magnitude and variability. To take care of this, some trend following strategies will scale these market returns by their own volatility to create risk adjusted returns.

Now we have all markets on a level playing field.

2. Trend Identification

The process for turning the information gathered from each market's price into an actual trend indicator can range in complexity but will be performed through some form of statistical technique. For example, the simplest to understand are moving average crossovers, which come in many different varieties but generally speaking:



- ▶ Moving averages are a statistical process for reducing a time series into a single value (i.e. an average). This helps smooth out some of the 'noise' in the time series
- ▶ Recalculated frequently (hence 'moving'), over a period called the 'look-back window'
- ▶ All observations of data in the look-back window are assigned a weighting to represent their level of importance in the dataset
- ▶ They are a 'lagging' indicator', i.e. backward looking not forward looking

For simplicity, we will show a theoretical example of a dual simple moving average (SMA) cross-over model for a trend following system on a single market's price history. Each SMA uses a fixed look-back window (one is short-term, one is longer-term), which is

Trend Following: How?



calculated by weighting each observation in the window equally, i.e. recent price data is given the same importance as more historic data. The model has a long signal when the quicker moving (short-term) average is above the slower moving (long-term) average and vice versa.



Trend Indicator: Dual Simple Moving Average Crossover

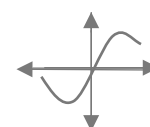
For illustrative purposes only

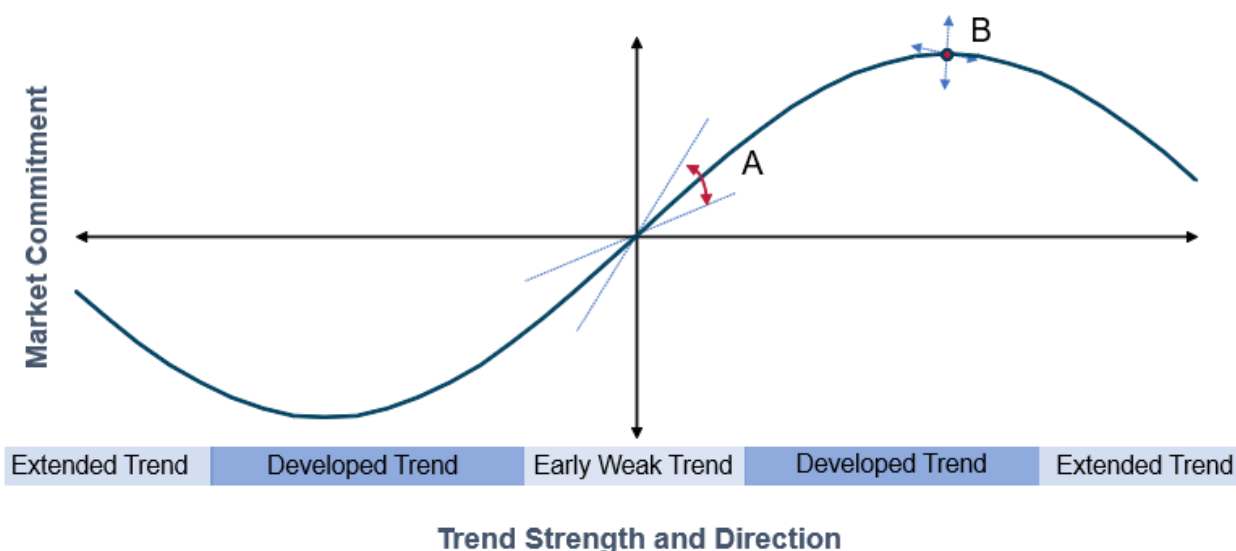
The figure above highlights the difference between the 'noise' typically present in a market price time series versus the smoothing effect of a moving average. By using a *dual* moving average, further smoothing is provided, producing a more stable trend indicator but at the cost of a slight delay in responding to turning points. This is representative of one of the biggest challenges facing trend following, [the trade-off between the system's responsiveness and position stability](#).

Once the system has formed its trend indicator for each market, some strategies will repeat this process across multiple time horizons to capture price trends over different timescales. Recall we mentioned earlier that most trend followers have the characteristic of 'medium-term' trend identification. The strategy can be designed to combine multiple different trend identification time horizons (let's call them trend speeds) into one continuous trend indicator per market, that results in a 'medium-term' trend capture strategy overall. Faster trend speeds incur more trading and transaction costs than slower speeds, hence the method for combining trend speeds should be optimised to balance long-term performance and short-term reactivity.

3. Market Forecast: Map Indicator to Desired Position

After the system has identified whether a trend is present in the market or not, the mechanism to translate each market's trend indicator into a market forecast (aka the desired position) is carried out via the market forecast function. This is where the system can form a view on the actual *strength* of the trend as it develops and factor that into the market forecast.





Trend Following: Generic Single Market Forecast Construction

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The relationship between the trend indicator and the market forecast tends not to be linear, as can be seen from the generic market forecast function for a single market above. Market commitment increases with trend strength but only up to a certain point. Once a market's trend is considered 'over extended' (in either direction – recall there is no long or short bias), the signal reduces, reflecting lower conviction that the trend will continue. More sophisticated trend following strategies trading markets across multiple asset classes and measuring trends over multiple timeframes, may use subtly different forecast functions for the different asset classes and trend speeds. For example, for the faster/slower trend speeds, the forecast function might be flatter/steeper around zero (section A) to avoid overreaction/underreaction to newly developed trends. Equally, the point at which a trend is considered to be strongest before it becomes overextended, might differ for different asset classes (section B).

Now we have a trend indicator mapped to a market forecast for each market. This tells us what the system's view is of the desired position it would like to take in the market, based on (1) whether it considers a trend to exist, (2) which direction that trend is in and (3) how strong that trend is.



4. Holistic Position: Volatility Scaling and Sector Weights

The main driver of a trend follower's position in each market is the trend indicator and market forecast described in sections two and three above, however there are two other key ingredients required to refine the trend signal for each market: volatility and risk allocations.



Volatility Scaling:	Risk budgeting:
A trend following strategy can inversely scale its desired position in a market by that market's volatility. If a market is displaying heightened volatility relative to its history, the system would actually deploy a smaller position than its original signal would want to (and vice versa), in order to be responsive to that market's current conditions. This volatility scaling is carried out at the market level and helps with the risk management for that particular market, but also helps with the general risk management of the entire portfolio.	Approaches on how to allocate the portfolio's risk to each of the markets will vary, but the emphasis here would normally be on maximising diversification. Some trend followers might simply assign equal allocations across all markets. Others will go further and factor in the correlations between markets, adjusting the initially equal market allocations to ensure each sector (bonds, stock indices etc) overall contributes equally to risk in the long run. Whilst trend followers trade highly liquid instruments, not all markets are equal. So a further refinement to the risk budgeting process can include an assessment of each market's liquidity profile.



To this point, we've discussed how the trend signals are formed on a market-by-market basis, independent of the other positions in the portfolio. In order to construct a coherent portfolio, the overall risk-taking of the portfolio needs to take into account *all* the various positions. In practice, portfolio level risk management can be carried out at various stages within the investment process but for simplicity we will discuss it next, as a final part of the portfolio construction process.

5. Portfolio Level Risk Targeting

Trend followers usually adopt a systematic approach to risk management. This is built into the strategy rather than applied as an afterthought. The system will generate risk forecasts for all the different markets in the portfolio and estimate the correlation between different assets, combining these estimates and the trend signals to construct the portfolio.



Trend following strategies generally target a specific level of risk and will maximise the expected return subject to taking this degree of risk. Some trend followers will allow the risk level to vary within a target range, and where necessary, position sizes across the portfolio are adjusted to ensure the risk level remains within its target range. The target range is chosen to achieve the required level of volatility for the strategy over the long-term.

One of the nice features of trend following is the diverse and broad spectrum of markets traded. Markets displaying strong trending behaviour will naturally have larger positions. The portfolio's approach to risk management should allow this to happen while also



ensuring the portfolio isn't too concentrated in any one market or sector at any time. This can be taken care of by applying risk constraints to avoid over-concentration and to ensure that correlation risk is also controlled.

Liquidity risk also needs to be carefully controlled. Limits can help here. Examples include limits on maximum position sizes as a percentage of open interest and limits on the magnitude of trading in a particular market as a proportion of average daily volume.

All of the above guidelines can be coded in the systematic framework of the strategy and operate automatically. By dynamically controlling portfolio risk, the strategy has the ability to ensure the level of risk being taken by each component of the model is appropriate at all times.

6. Execution

The final stage in the investment process is to ensure an efficient translation of the strategy's desired exposures into actual market positions, i.e. execution.

Large and established trend followers can trade well over 100 markets, on multiple exchanges across the world and operate around the clock. Their systems are continuously re-calculating the desired position for all the markets they trade in response to new market data throughout the day. The key is to be able to execute all orders anonymously and invisibly so that costs and market impact are minimised.

This can be achieved in a variety of ways. Each market's desired trades can be systematically split up and spread out into a schedule so they can be executed in line with expected market liquidity patterns throughout the day. The electronic algorithms used to execute the trades are typically built in-house and / or implemented via a third party. Either way, a sophisticated execution algorithm will be customised and calibrated specifically to the markets traded to take into account the different microstructures of each market. This helps the system to trade in more passive fashion, and for the order flow to blend into the usual order patterns of each market.

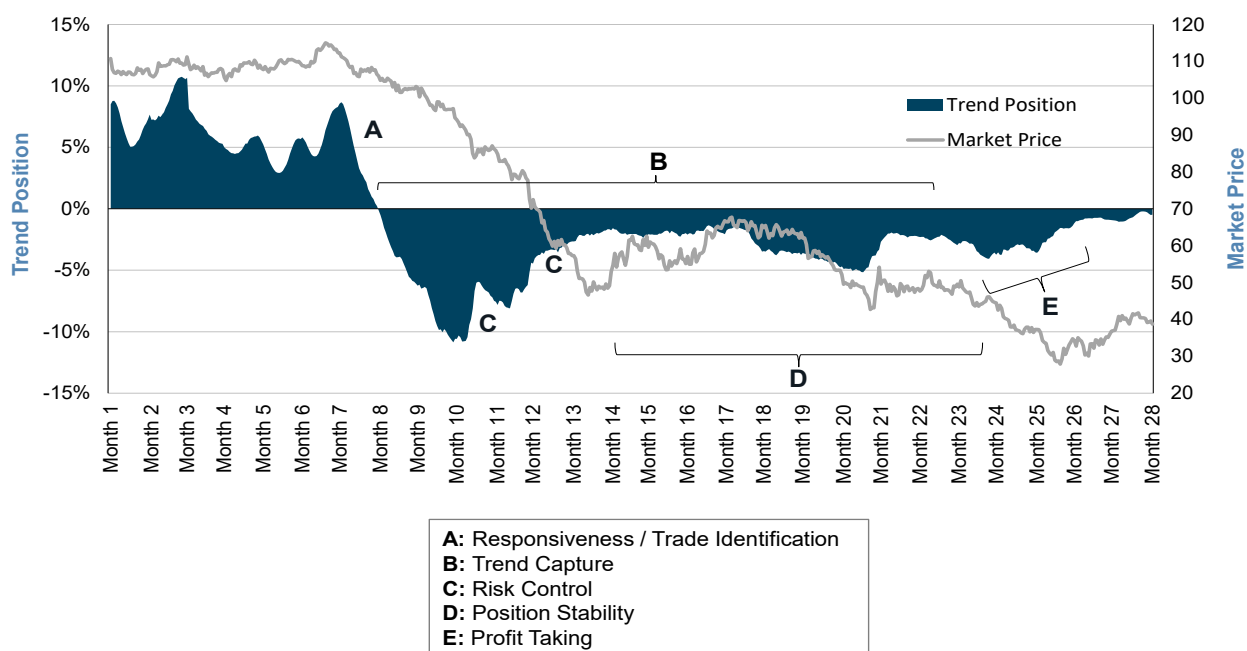


Read on for a 'typical' medium term trend following trade explained.



A 'Typical' Medium Term Trend Following Trade

Now that we've described the key stages of the investment process for trend following, we can show how a 'typical' trend following trade can play out and how some of the features described above work in practice. The chart below plots the price of the market in grey and the trend following strategy's position held in blue.



Illustrative Trend Following Position in Changing Market Conditions

For illustrative purposes only

- ▶ **Region A:** Since trend following is backward looking, there is always a lag from when the price begins to trend and when the system identifies this new trend. The existing long position starts to reduce in reaction to the new downward price trend.
- ▶ **Region B:** As the downward price trend extends and the system's conviction in this trend increases, it exits the long position, and a short position is established which grows gradually. Recall there will be a limit to how large a position can become, which is driven by risk controls designed to avoid overconcentration. During this trend capture phase, positions are continuously sized in order to ensure that they account for changes in market volatility in order to control position-level risk.
- ▶ **Region C:** These regions show the system reducing its position, mainly due to the increase in volatility as the system's volatility scaling kicks in.



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- ▶ **Region D:** Shows a period of relative position stability. Timeframe selection and system design are important in ensuring that the system doesn't over-react to periods that lack trending opportunities and incur significant transaction costs as it responds to 'noise'.
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- ▶ **Region E:** As the trend continues to extend, the position starts to gradually reduce, locking in profits. By the time the price begins to reverse to an upward trend, the position is much smaller and the majority of gains have been retained.
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In Summary

We've highlighted the general principles of a modern-day systematic trend following strategy. In practice, trend followers come in all different shapes and sizes. Approaches to market universe selection, techniques for trend identification, portfolio construction, risk management and execution can differ significantly, and are all really important to trend following.

Regardless of these intricacies, the strategy requires a coherent framework as well as robust technological and operational infrastructures in order to be implemented effectively and efficiently. We believe the consistency of a trend follower's profitability is highly dependent on heavy investment in ongoing research and development, to improve and evolve the trading models used.

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