Rho Trend Barometer

Connecting the trading environment to CTA returns

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Overview

Strange things happened to Alice after she fell down the rabbit hole in Lewis Carrolls's "Alice in Wonderland". When she drank a potion that had a sort of mixed flavor of cherry-tart, custard, pine-apple, roast turkey, toffee, and hot buttered toast (read diversified portfolio) she shrank to a mere 10 inches in height. But she had forgotten to take the key to open the door to the garden, and wanted to return to her former height so she could get to the key. So she ate a very small cake with currants, but grew so rapidly that she became nine feet tall (past performance is not necessarily indicative of future results). Literature is full of instances where performance is evaluated without reference to the "market" environment (Julius Caesar: "Et tu, Brute?").

We describe how to quantify the trend strength at the portfolio level, and show this single number is quite sufficient to describe Commodity Trading Advisor (CTA) performance. We can extend this approach to describe both monthly absolute return as well as rolling risk-adjusted performance. Thus, we have developed a powerful approach to connect the external trading environment and resultant manager performance. Since no manager quite controls, nor can precisely predict, the future trading environment, our technique enables investors to build calibration charts to approximate potential future performance under varying market conditions, and hence empowers them to make better allocation decisions.

Stable environments

Virtually all sports, (and it seems, trading models), are predicated on the stability of the playing surface, conditions or environment. The recent Formula One (F1) Grand Prix at Monza, Italy provided a wonderful example of how a change in the environment can disrupt performance. F1 cars are optimized for a dry track, and therefore rain can drastically increase lap times. For example, at Monza, lap times were 23 seconds slower in very wet conditions, an eternity in a sport that measures lap times to four decimal places. Did you ever notice how golf scores balloon over par when the winds kick up?

Just as cars are optimized for each track in F1, financial trading models are optimized on past data,



Table 1 Summary of Simple Linear Regression data (CTA Benchmark vs. %T)									
BENCHMARK	R-SQUARED	CORRELATION	%T BREAKEVEN VALUE						
Barclay TOP50 CTA Index	0.56	0.75	42.2						
Barclay NewEdge Trend Sub-Index	0.52	0.72	42.6						
IASG Trend Following Strategy Index	0.60	0.78	40.5						

to varying degrees, and any disruption in the market environment can lead to sudden losses. Just ask investors at Goldman Sachs Alpha, Amaranth, Long Term Capital Management or the typical hedge fund in 2008. Anyone can tell you if it is raining or not, but characterizing the trading environment is much harder. Commodity Trading Advisors (CTAs) find enumerating the environment even more difficult, because they trade many different markets, with ever shifting volatility, liquidity, correlation and sensitivity to market events.

Naturally, this makes investors more reluctant to invest with systematic CTAs, because they "cannot understand" how the machinery works, better known as "Black-Box Disease". So, discretionary traders are glamorized, even when they start anew after spectacular draw-downs. It is evident that a systematic approach to describing the trading environment would benefit investor and manager alike.

The bulk of funds invested with CTAs are traded using some type of trend-following strategy, which tries to put on positions in the direction of dominant price movement over the time period chosen for analysis. Hence, we start by describing the trading conditions (i.e., trend strength) market by market, subdividing the trend strength into five ranges: strong up, medium up, neutral, medium down and strong down. The trend strength data on individual markets are then aggregated at the portfolio level to compute a single number to describe trend strength across the portfolio. We have deliberately chosen relatively broad "ranges" for defining when a trend is strong up or strong down to allow for the daily fluctuations in prices. Lastly, our method of determining trend strength is arbitrary, since there is no natural definition for what constitutes a strong or weak trend.

Describing trend environment in portfolio

Even though the exact formulation of the Rho Trend Barometer is arbitrary and proprietary, it uses daily data, and ranks the trend strength of a market on a scale from +100 to -100 (see Fig.1), which can be divided into five areas of trend strength: strong up, medium up, neutral, medium down or strong down. On the last day of the month, we merely calculate the percent of markets in the portfolio that are trending, i.e., are not in a neutral trend condition. For example, if 22 markets in a portfolio of 44 markets are trending, then the percent of markets trending, %T, is 50%. We find there is a strong connection between the performance of well-diversified, trend-following CTAs and %T. Fig.1 shows a snapshot of a 44-market portfolio with markets grouped into sectors, and each market's trend strength classified into one of the five ranges described above.

For example, the first market, AA or LME Aluminum, has a trend strength of 0, an oddity. However, at that moment, another metal, HG or High-Grade Copper was found to have a trend strength of 30, which put it just outside the neutral zone. Stock indexes were neutral to down, and bonds and interest rates were rallying. A total of 19 of 44 or 43.2% of the markets are not in neutral mode, showing medium to strong trends. This value calculated on the last day of the month is designated %T, or the Rho Trend Barometer.

As Fig.1 shows, by design, if every one of the markets was trending, then %T would be 100% (44/44), or conversely, if all markets were in the rather wide neutral zone, then %T would be 0 percent (0/44). We know that for trend-following strategies to be successful, the trends must last for many weeks or months. Hence, we can postulate that high values of %T should be correlated with strong performance by trend-followers and vice versa. Note that we use a rather small portfolio of 44 markets for the calculation, but there is no limit on the number of markets that may be included in the %T calculations. However, due to correlation between markets, we make the argument that our 44-market portfolio is a good stand-in for larger portfolios.

In short, the Rho Trend Barometer (%T) is the percentage of markets in a portfolio with medium to strong trends on the last trading day of the month. As is obvious from the previous discussion, we can calculate a daily value of the Trend Barometer should we so desire. We choose the month-end date merely to facilitate analysis with easily available monthly performance data and to simplify data collection. We show a long-term view of the Rho Trend Barometer, %T, starting December, 2003 in Fig.2. At quick glance, one can observe that most of the time (~70%), the %T values range between 30 and 60, and values above 60 or below 30 are relatively infrequent.

Connecting %T to absolute monthly return

We performed a one-factor simple linear regression between the monthly %T values and monthly returns for the Barclay Top50 CTA Index, the Barclay NewEdge Trend Sub-Index and the IASG Trend Following Strategy Index, as three examples of CTA industry benchmarks. Table 1 show a summary of the regression analysis for the time period shown in Fig.2 above (93 months of data). All three simple linear regressions were statistically significant.

We wish to emphasize that even though we use only one variable, and even though the composition benchmarks have changed over time, and reflect the performance of many different strategies and portfolio weights, this simple model has good explanatory power.



Unlike back-fitted hedge fund replication strategies, we are computing the %T with real-time data, with precisely the same rules applied over a long period of time, making the power of the connection between the trend strength and benchmark returns even more remarkable.

A direct implication of the simple linear regression model is that we can calculate the break-even value as the %T value at which the linear regression predicts zero monthly return. The values for all three benchmark indexes are approximately similar and suggest that CTAs as a group will report zero return (break-even) when %T values are between 40%-45% (see Fig.3). Naturally, the returns are strong when trends are strong (high %T), and returns are negative when trends are weak (low %T). Let us now look at the year-by-year break-down of %T values from 2004 through August, 2011 to get a quick feel for the numbers.

Table 2 shows that 2009, the only year shown with negative benchmark returns, was a particularly difficult year for trend-followers, since it is the only year with extremely weak trends (%T < 25%) for a full four months, and an unbearable nine months below breakeven trend strength (%T <45%). The year 2008 was unusual because it had four months with %T > 60%, i.e., with very strong trends, and a full eight months above break-even trend strength. The CTA industry had good returns in 2004 and 2010 because there were no months with extremely weak trends (%T < 25%), and at least 2 months with very strong trends (%T < 25%).

Table 2 Frequency distribution by year of %T values, shows a clear connection between return	h
and %T distribution	

	YEAR	%T < = 25	25 < %T < = 45	45 < %T < = 60	%T > 60%	BTOP50 RETURN (%)	IASG TREND-FOLLOWING STRATEGY INDEX RETRUN (%)		
	2004	0	5	5	2	0.86%	7.90%		
	2005	1	2	7	2	2.41%	7.91%		
	2006	1	4	6	1	5.61%	9.88%		
	2007	2	3	7	0	7.57%	16.54%		
	2008	1	3	4	4	13.58%	40.55%		
	2009	4	5	2	1	-4.77%	-4.16%		
	2010	0	6	4	2	6.38%	16.50%		
	2011	0	6	2	0	-1.42%	1.53%		
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Fig. 3 We show the direct connection between trading environment (as described by %T) and expected monthly return for the three CTA industry benchmarks selected for analysis (from the one-factor simple linear regression models). First, we note that the returns for the indexes vary due to differences in volatility i.e., leverage used by the managers in the index. Second, despite the differences in leverage, the break-even %T values are quite similar, in the 40-45% range. Third, note that, on average, trading conditions are very difficult for trend-followers with %T < 25%, with expected losses exceeding one standard deviation of monthly return. Of course, actual returns will vary, though naturally, returns are strong when trends are strong (high %T), and weak when aggregate trends are few (low %T).



Fig. 4 We compare the distribution of %T values when the Barclay Top 50 CTA index (BTop50) is in draw-down, to the distribution when the BTop50 is at new equity highs. New highs are associated with strong trends, and draw-downs with weak trends. (We have included the months leading up to new recovery highs in the drawdown distribution, so there are a few months with values of %T > 50 in that distribution.) The time period is from December 2003 through August 2011.

Once again, it is fair to say that there is the expected link between trend strength in the portfolio (as measured by %T), and monthly return, with strong trends generating strong returns and vice versa. It is noteworthy that we can demonstrate this numerically, instead of presenting this observation as an article of faith.

We continue our analysis of %T and the equity curve by studying the histogram of %T values when the Barclay Top50 CTA index (BTop50) in a drawdown, compared to the histogram of %T when the BTop50 index is making new highs (see Fig.4). It is reasonable to expect that when the BTop50 index is in a drawdown, the histogram will be skewed "to the left", i.e., towards lower values of %T, since we know that weak trends are associated with values of %T < 25%, and break-even being a bit beyond 40%.

Conversely, when the BTop50 is at new equity highs, we would expect the histogram to be "skewed to the right", i.e., towards higher values of %T. And this is precisely what the data show, confirming that there is indeed a connection between the trend environment and draw-downs or new equity highs in the equity curve.

We clarify the connection between the trend environment and recovery to new highs by first adjusting the %T values, i.e., subtracting the breakeven value of 42% from %T. Thus, negative adjusted %T values should correspond to weak trends in order to facilitate comparison to draw-downs. Then, we superimpose the values of the adjusted %T upon the under-water curve of the BTop50 index, in which new highs are 0% and draw-downs are excursions below zero (see Fig.5). Looking to negative values of the light-blue line shows periods of draw-down, and these periods correspond to negative values of adjusted %T as we should expect. Thus Fig.5 shows convincingly why "past performance is not necessarily indicative of future results", because the trend environment in the portfolio changes over time, with favourable periods followed by unfavourable periods and so on, with no clear ways to precisely forecast the depth and duration of drawdowns or run-ups. Now we are showing the %T values for a relatively well-diversified portfolio. A portfolio concentrated on a handful of sectors may perform much better or much worse than a well-diversified portfolio due to the %T changes i.e. trend strength changes in that portfolio.

Connecting risk-adjusted performance

We next connect the risk-adjusted performance of a CTA industry benchmark (BTop50 index) to the Rho Trend Barometer (%T). Since the risk-adjusted performance is measured over a period of many months, we have to use the same time interval for calculations for both the index and %T. For convenience, we use a rolling 12-month interval, and calculate risk-adjusted performance for the benchmark as the average monthly return divided by the standard deviation of monthly returns. This ratio, which we call Return Efficiency, normalizes returns by their volatility, thus allowing us to compare one manager to another.

We compare the 12-month rolling Return Efficiency for the BTop50 to the 12-month simple moving average of the adjusted Rho Trend Barometer, %T -42%, because the volatility of the trend is not relevant in our analysis, and because we want both positive and negative values for both series being compared. Fig.6 shows that there is a close connection between the rolling Return Efficiency of the BTop50 index and the 12-month average of the adjusted Rho Trend Barometer.

We next zoom in to the time period November, 2008 through October, 2010, the most recent period with significant stress in the markets. The risk-adjusted performance of the BTop50 index fell steadily over this period, turning negative, before bouncing back. We should expect this period to show very few trends, and %T confirms this finding, with 11/15 months below the break-even value of 42%, as many as four months with %T below 25% showing extreme stress, and three other months with %T between 25% and 30%, showing there were few if any trends (see Fig.7).

Fig.7 shows the level of stress in a well diversified portfolio, which implies there may be specialized or focused portfolios which may perform better than a diversified portfolio in such times of extreme stress. It is well known that equity markets rallied strongly during the final three quarters of 2009. Hence, a portfolio over-weighted towards equity market futures, metals and short rates would have performed better than a well diversified portfolio during this period. Thus the %T can be used to construct responsive portfolios over time.

Using %T to explain performance

We can also explain the absolute and risk-adjusted performance of individual trend-following managers using %T and rolling averages of adjusted %T. Of course, portfolio weights and strategy mix can vary significantly between a particular manager and the %T, leading to loss of explanatory power. However, it is clear that %T does capture the trend strength in the portfolio.

We measured the correlation of many leading managers, using data we believe is reliable, against the %T values (see Fig.8), showing that we can extend the use of %T to individual managers. We then examine the relationship between returns and different ranges of "buckets" of %T values (see





Fig. 6 The rolling 12-month Return Efficiency of the Barclay Top-50 Index is closely related to the rolling 12-month simple moving average of the adjusted Rho Trend Barometer (%T-42%). The strength of relationship has varied over time, perhaps as the composition of the index has changed, but has been particularly close since November 2008. The correlation to other industry benchmarks, such as the Barclay NewEdge Trend Sub-Index and the IASG Trend Strategy Index is essentially similar to what is shown here, i.e., risk-adjusted performance is also determined by variation in trend strength in the portfolio. Fig.9). Once again, most managers show a linear relationship, with weak returns for low values of %T, and strong positive returns for high values of %T.

Lastly, we show the risk-adjusted performance of the Rho Altius Program against the adjusted %T, to illustrate the risk-adjusted performance of individual managers can also be related to a rolling average of adjusted %T (see Fig.10). Hence, it is essential that investors consider portfolio weights in evaluating risk-adjusted performance, because a narrowly focused set of portfolio weights may provide superior performance in one time period, whereas a diversified set of portfolio weights excels in another.

Applying %T, the Rho Trend Barometer

The Rho Trend Barometer solves the crucial problem for investors of quantifying the trend environment at the portfolio level with a single number. The enormous convenience and usefulness of such a number should not be underestimated. Hence, it can be used to evaluate the performance of trendfollowing managers in the context of trend strength in broadly diversified portfolios. If a portfolio is focused or concentrated, the methodology can easily be applied to this narrow portfolio. For example, a "new" manager with a relatively short track record, who happens to start trading just before the environment becomes harsh, can be evaluated without unfairly tagging performance as "poor", favouring managers with much longer track records, even though those managers themselves had weak performance during the harsh trend environment.

The linear changes in average return in different %T range buckets (as shown in Fig.3 and Fig.9) can be used to set expectations of future return, because there is a direct connection between %T and expected return. Naturally, actual return will vary based on portfolio weights and strategy design. However, these figures can be used as "control charts", to set objective expectations of future performance under different market conditions, and check for style drift. Hence these calibration charts are helpful to answer "what, if?" questions for industry benchmarks or individual managers.

There is great interest in hedge fund strategy replication by applying simple linear regression to estimate effective strategy portfolio weights from the actual returns of a large number of hedge funds. This replication approach has at least two significant limitations. One, due to lags in the reporting of live performance data in real-time, there are significant delays in actually adjusting the replication portfolio to reflect the changes in other portfolios. Two, the replication portfolio reflects the strategy weights averaged over a large number of hedge funds, and thus will respond very slowly to relative changes in strategy weights. This approach will work



Fig. 7 The extremely difficult trending conditions in a diversified portfolio from November, 2008 through February, 2010 are captured well by this figure, which shows the risk-adjusted performance fell steadily, and turned negative before recovering a bit. This figure helps support the view that risk-adjusted performance closely follows the trend strength at the portfolio level over time.





Fig. 9 Calibration of returns showing performance of randomly chosen CTAs versus Rho Trend Barometer "buckets". Note the strong linear relationship between %T values in a particular range and average return in that return. There is scatter in the data, so that we can only estimate average expected return in for any given range of %T values. It is not an accident that low values of %T correspond to negative return on average, and vice versa.



wonderfully when there are long-lasting trends, but will be too slow to respond when markets are moving rapidly. Hence, if there are rapid changes in the market weights, or rapid changes in market direction, such a replication portfolio will, by design, be slow to respond, assuring that the replication portfolio will be caught flat-footed at key turning points.

The Rho Trend Barometer is a trend-replication strategy, which can be recomputed rapidly, in realtime, without regard to the portfolio weights across the industry, and hence a %T-based trend strength replication strategy is likely to reposition quickly at key turning points in the markets, while at the same time, holding on to positions in strong trends. Hence, a %T-based trend strength replication approach could have significant practical advantages over a linear-regression-driven strategy weights replication approach.

"A %T-based trend replication approach could have significant practical advantages"

The %T and smoothed adjusted %T allow us to evaluate the absolute and the risk-adjusted performance, by providing a bridge between market environment and actual returns. We have shown that the trend strength influences both areas of performance, and hence manager evaluation can focus on how well they can recognize onset of trends, future trend strength, and performance at key turning points. Portfolio weights also play a critical role in influencing the effective trend strength in the portfolio, and hence investors should adjust performance for portfolio composition when evaluating manager performance. So, rather than letting our imaginations run away with rabbits down deep holes, we can keep expectations firmly anchored to the difficulty of the trading environment when evaluating manager performance. THFJ

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