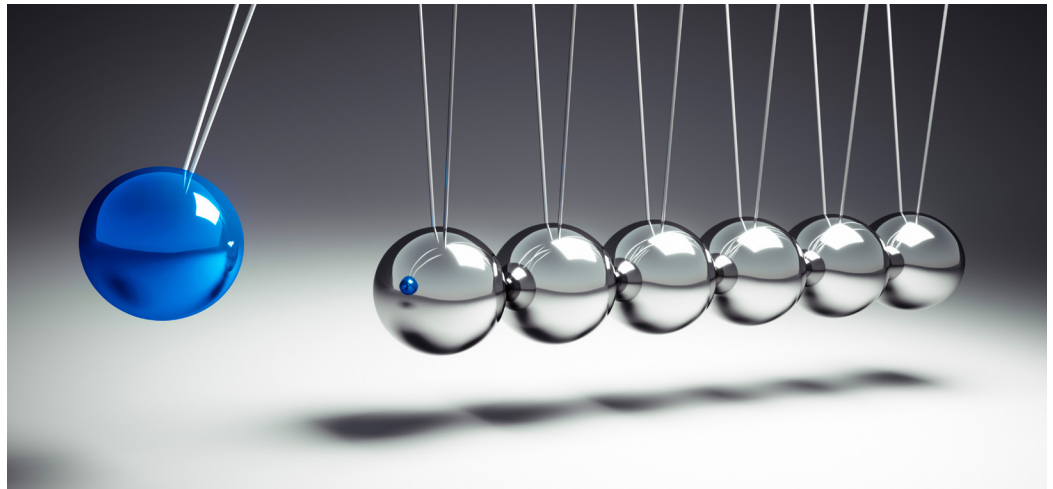


Befriending the Trend: **A Trend-Following Strategy for Portfolio Diversification**

Jeffrey Sherman, CFA and Eric Dhall | October 2022



Every body continues in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it.

– Isaac Newton

An object in motion, Isaac Newton postulated, continues in motion unless acted on by another force. That law of classical physics has its analog in the realm of financial markets. Crowd psychology and pricing dynamics create observable momentum in returns, prices tending to continue in one direction until a catalyst shifts sentiment. This phenomenon has been observed over centuries and across assets, cultures, and time zones.ⁱ The utilization of this tendency by practitioners is called trend following, or momentum trading, an investment strategy made famous by Richard Dennis and the turtle traders.ⁱⁱ Historically, trend-following strategies were accessible by private investors only in illiquid opaque formats such as hedge funds via commodity trading advisors (CTAs), but now they exist in widely accessible, liquid investment vehicles.

We will explore the performance, benefits and limitations of actual trend-following indexes and the academic case for a positive momentum risk premium that the algorithms driving these indexes seek to capture. Then we will present the DoubleLine Multi-Asset Trend Strategy, which we believe offers a superior trend-exposure solution.

Why Invest in the Trend?

Investing in a portfolio of diverse assets is a core tenet of financial risk management and modern portfolio theory.ⁱⁱⁱ An optimal portfolio should offer the most attractive return for the risk taken. A cornerstone of this concept is composing a portfolio that blends uncorrelated sources of positive expected return to reach an investor's risk target.^{iv} Trend-following strategies take both long and short positions within individual asset classes. Therefore, it is worth exploring the potential diversification benefits of allocating to these strategies.



Befriending the Trend: A Trend-Following Strategy for Portfolio Diversification

Trend-following strategies historically have generated a positive momentum risk premium¹ as demonstrated by publicly available indexes. (Figure 1a) Of these, the most widely referenced trend-following index is the SG Trend Index. As a group, these indexes exhibit homogeneity in terms of return per unit of risk but have different volatility profiles. (Figure 1b) Taking the SG Trend Index, we can see that it has exhibited relatively low correlation to traditional markets, providing investors the potential to increase the breadth of their risk exposures. (Figure 2) By adding a trend-following strategy to a portfolio, investors can increase their diversification while also receiving the opportunity for a positive return. This allocation potentially increases the capital efficiency of the portfolio, raising the expected return per unit of risk taken. This benefit justifies using trend strategies as part of a rational asset allocation framework.

Historical Return of Broad Trend-Following Indexes

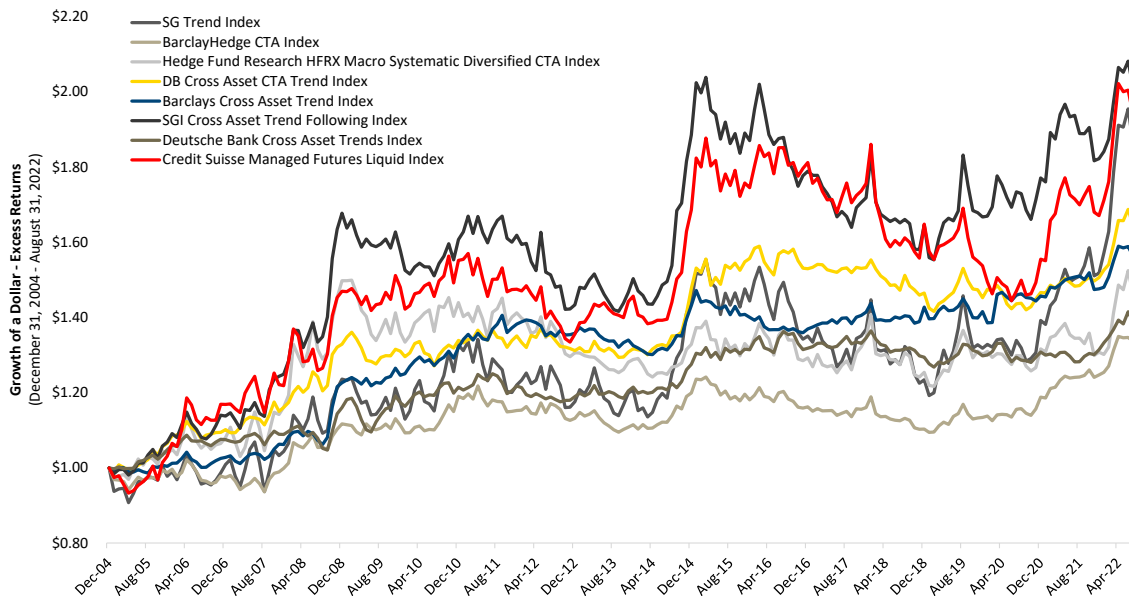


Figure 1a
Source: DoubleLine

Return and Risk Statistics of Broad Trend-Following Indexes

| December 31, 2004 – August 31, 2022 Excess Returns | Credit Suisse Managed Futures Liquid Index | SG Trend Index | BarclayHedge CTA Index | Hedge Fund Research HFRX Macro Systematic Diversified CTA Index | DB Cross Asset CTA Trend Index | Barclays Cross Asset Trend Index | SGI Cross Asset Trend Following Index | Deutsche Bank Cross Asset Trends Index |
|--|--|----------------|------------------------|---|--------------------------------|----------------------------------|---------------------------------------|--|
| Annualized Arithmetic Return | 4.48% | 4.40% | 1.78% | 2.73% | 3.12% | 2.64% | 4.51% | 2.11% |
| Annualized Geometric Return | 4.08% | 3.82% | 1.67% | 2.35% | 3.02% | 2.57% | 4.13% | 2.04% |
| Annualized Standard Deviation | 9.78% | 11.38% | 5.02% | 9.06% | 5.26% | 4.55% | 9.64% | 4.22% |
| Annualized Sharpe Ratio | 0.46 | 0.39 | 0.35 | 0.30 | 0.59 | 0.58 | 0.47 | 0.50 |

Figure 1b
Source: DoubleLine

¹ A risk premium is the investment return that an asset is expected to deliver in excess of the risk-free rate of return. The risk premium of an asset represents a form of compensation to investors for assuming the extra risk by investing in that asset in lieu of investing in a risk-free asset.



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The Power of Diversification

“The only free lunch in investing” – Harry Markowitz, 1952

As we discussed, introducing an asset that exhibits low correlation to an existing portfolio boosts portfolio diversification. Take for example a traditional U.S. equity portfolio that is exposed to systemic market risk and consequently is vulnerable to drawdown during periods of high volatility. A traditional risk mitigant to this investor’s equity portfolio is to add an allocation to a lower-volatility asset class such as high-grade fixed income. This pairing of asset classes, commonly implemented in so-called 60-40 equity-bond allocations, offers the opportunity to mitigate losses and lower volatility. Nonetheless, this approach can fail to deliver effective risk offsets under certain scenarios, notably in a risk-off scenario with contagion or when equities and bonds both have low expected returns due to overvaluation. Another approach is to integrate alternative assets, such as commodities, into the portfolio. Commodities have a low correlation to equities and bonds and can protect in an inflationary environment. (Figure 2) However, being long only in nature, an allocation to a mix of commodities has a bias toward growing market environments and can suffer in a risk-off scenario. So, what if we diversify beyond the limited opportunity set of long-only equities, bonds and commodities to trend-following strategies? The resulting potential benefit is price agnosticism: indifference to the direction of price movement.

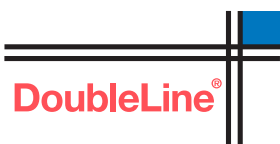
Correlation of SG Trend Index to Global Markets

| December 31, 1999 – August 31, 2022 | SG Trend Index | S&P 500 | Russell 2000 | EAFE | ACWI | Emerging Markets Equity | U.S. REIT | US Aggregate | High Yield | Emerging Markets Fixed Income | Global Aggregate | Commodities |
|-------------------------------------|----------------|--------------|--------------|--------------|--------------|-------------------------|-------------|--------------|--------------|-------------------------------|------------------|-------------|
| SG Trend Index | 1.00 | -0.10 | -0.08 | -0.03 | -0.06 | -0.02 | 0.01 | 0.12 | -0.13 | -0.04 | 0.16 | 0.17 |
| S&P 500 | | 1.00 | 0.84 | 0.87 | 0.96 | 0.75 | 0.64 | 0.04 | 0.69 | 0.55 | 0.24 | 0.38 |
| Russell 2000 | | | 1.00 | 0.79 | 0.85 | 0.72 | 0.65 | -0.01 | 0.68 | 0.53 | 0.17 | 0.37 |
| EAFE | | | | 1.00 | 0.96 | 0.85 | 0.61 | 0.10 | 0.72 | 0.63 | 0.40 | 0.50 |
| ACWI | | | | | 1.00 | 0.86 | 0.64 | 0.07 | 0.74 | 0.63 | 0.34 | 0.48 |
| Emerging Markets Equity | | | | | | 1.00 | 0.52 | 0.09 | 0.71 | 0.65 | 0.36 | 0.52 |
| U.S. REIT | | | | | | | 1.00 | 0.23 | 0.64 | 0.55 | 0.35 | 0.28 |
| US Aggregate | | | | | | | | 1.00 | 0.28 | 0.56 | 0.75 | -0.03 |
| High Yield | | | | | | | | | 1.00 | 0.76 | 0.38 | 0.43 |
| Emerging Markets Fixed Income | | | | | | | | | | 1.00 | 0.59 | 0.35 |
| Global Aggregate | | | | | | | | | | | 1.00 | 0.29 |
| Commodities | | | | | | | | | | | | 1.00 |

Figure 2
Source: DoubleLine

With this observation in mind, we construct illustrative examples utilizing three key global markets: U.S. equities, the 10-year U.S. Treasury and global commodity prices (ex-agriculture and livestock). (Figures 3-5) Our starting point for this analysis is bear markets. For each asset class above, we look at the five (or six) worst shocks as defined by negative yearly calendar returns. We compare calendar-year returns for each negative shock across four different portfolios: the underlying asset class, a diversified long-only portfolio, a simple trend-following strategy in each market and a diversified portfolio utilizing a simple trend-following strategy on each of the three components (Diversified Portfolio using Trend-Following or DPTF). The DPTF portfolio is the same for Figures 3-5.

Portfolio One (Asset Class): In order to make comparisons easier, we rescale each market to a trailing volatility of 8%. For example, in the case of the U.S. equity market, if the trailing 12-month standard deviation of the U.S. equity index was 16%, the allocation would be half U.S. equities and half cash to reflect a targeted volatility of 8%. This rescaling is done on a daily basis.



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Portfolio Two (Diversified Long-Only Portfolio): Based on a mean variance framework, this portfolio comprises the three aforementioned asset classes: U.S. equities proxied by the BNP Paribas US Equity Futures Index (Bloomberg ticker BNPIFUS), the U.S. 10-year Treasury proxied by the BNP Paribas USD 10-Year Futures Index (BNPIFU10) and a basket of global commodities proxied by the Bloomberg Commodity ex-Agriculture and Livestock Capped Index (BBUXALC). On a daily basis, the portfolio weights are calculated by applying the mean-variance-optimization methodology utilizing a 12-month lookback window (that seeks to give maximum return per unit of risk while keeping the one-year portfolio volatility below the target volatility of 8%).

Portfolio Three (Trend-Following Asset Class): The third step is to construct a simple trend-following strategy for each asset class. For example, our U.S. equities example scaled to a trailing volatility of 8%. However, unlike the long-only equity proxy, the trend-following exposure is either long or short based on a momentum signal from the U.S. equity market while still targeting an 8% volatility point. Thus, it will have the same dollar amount in both the equity position and the cash position as the equity proxy, but the equity position will either be long or short based on the current market price relative to the average price level over the preceding 12 months. Like the other portfolios, this process is done on a daily basis.

Portfolio Four (Diversified Portfolio using Trend-Following or DPTF): Similar to the diversified long-only portfolio, the DPTF portfolio uses the BNPIFUS, BNPIFU10 and BBUXALC indexes. On a daily basis, the weights are determined using the mean variance framework, scaled to an annualized volatility of 8% using a 12-month lookback window. However, the allocation on each will be long or short according to the trend signal of the corresponding index. The determination of the long or short exposure to each index uses a similar approach to the equity portfolio: If the current index price is at or above the 12-month average, the exposure will be long; and if the current index price is below the 12-month average, the exposure will be short.

Figure 3 displays the four portfolios performance during the six worst annual downturns of the U.S. stock market since 1960. The diversified mean-variance portfolio did a respectable job outperforming the equity-only allocation during the first oil shock in 1973, as oil prices rose, and in the 2002 corporate crisis, as bonds provided a safe haven. Unfortunately, in four of six crises, the diversified mean-variance portfolio failed to end the year in the black. That said, outside the 1981 Volcker rate-tightening shock, the diversified mean-variance portfolio still outperformed the equity-only allocation. Fortunately, trend-following strategies can turn such crises into opportunities. This approach works best in the large, protracted crises, as was the case after the first (1973) and second (1974) oil shocks, in the 2002 corporate-crisis recession that followed the bursting of the dot.com bubble and in the wake of the 2008 credit crisis.

Returns Conditional to the Six Worst Shocks to U.S. Stocks

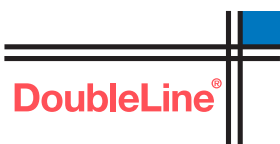
Market volatilities rescaled to 8% annualized volatility target

| Crisis | Years | Without Trend | | With Trend | |
|--------------------|-------|---------------|---------------------------------|---------------------------|------|
| | | U.S. Equities | Diversified Long Only Portfolio | U.S. Equities Trend Alone | DPTF |
| 1974 oil shock | 1974 | -14% | -12% | 15% | 22% |
| 1973 oil shock | 1973 | -13% | 2% | -6% | 23% |
| Subprime crisis | 2008 | -12% | -8% | 8% | 14% |
| Volcker tightening | 1981 | -11% | -17% | 4% | 18% |
| 1977 Bear Market | 1977 | -11% | -6% | -7% | -10% |
| Corporate crisis | 2002 | -10% | 14% | -1% | 8% |

Figure 3

Source: BNP Paribas

U.S. Equities and U.S. Equities Trend Alone: BNPIFUS Index. Diversified Long-Only Portfolio and DPTF: BNPIFUS Index, BNPIFU10 Index, BBUXALC Index.



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Figure 4 examines the worst bond markets as measured by the 10-year Treasury. Our study's diversified mean-variance portfolio only led to appreciable nonzero returns in the 1973 and 1979 oil shocks when commodities had tremendous returns. In the four other bond bear markets, the diversified mean-variance portfolio failed to earn a positive return. Trend following, however, afforded investors an opportunity to take advantage of the protracted trends and enhance portfolio returns (columns 3 and 4 of Figure 4).

Returns Conditional to the Five Worst Shocks to 10-Year U.S. Treasuries

Market volatilities rescaled to 8% annualized volatility target

| Crisis | Years | Without Trend | | With Trend | |
|----------------------|-------|---------------|---------------------------------|---------------------|------|
| | | 10Y UST | Diversified Long Only Portfolio | 10Y UST Trend Alone | DPTF |
| Volcker tightening | 1980 | -16% | 0% | 3% | 11% |
| 1974 oil shock | 1974 | -15% | -12% | 24% | 22% |
| 1979 oil shock | 1979 | -15% | 9% | 13% | 26% |
| Inflation + Ukraine* | 2022 | -14% | -15% | 8% | 1% |
| 1973 oil shock | 1973 | -14% | 2% | 8% | 23% |

Figure 4

Source: BNP Paribas

10Y UST and 10Y UST Trend Alone: BNPIFU10 Index. Diversified Long-Only Portfolio and DPTF: BNPIFUS Index, BNPIFU10 Index, BBUXALC Index

*Partial Year 12/31/2021-10/10/2022

Figure 5 records the study portfolios' performance in the five worst shocks to the global commodity markets (ex-agriculture and livestock). In each of the five commodity shocks, the traditional diversified risk-parity portfolio failed to score a positive annual return. Because these crises were protracted, trend following was able to pick up on the declining prices and accrue positive return in a protracted market decline.

Returns Conditional to the Five Worst Shocks to Global Commodities (ex-agriculture and livestock)

Market volatilities rescaled to 8% annualized volatility target

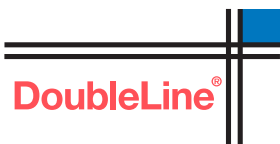
| Crisis | Years | Without Trend | | With Trend | |
|---------------------------|-------|---------------|---------------------------------|-------------------------|------|
| | | Commodities | Diversified Long Only Portfolio | Commodities Trend Alone | DPTF |
| Volcker tightening | 1981 | -20% | -17% | 23% | 18% |
| Russian crisis | 1998 | -17% | -1% | 19% | 26% |
| Global Commodity Downturn | 1984 | -14% | -6% | 3% | 6% |
| China crash | 2015 | -14% | -8% | 15% | 9% |
| OPEC oil surplus | 2014 | -12% | 10% | 14% | 16% |

Figure 5

Source: BNP Paribas

Commodities and Commodities Trend Alone: BBUXALC Index. Diversified Long-Only portfolio and DPTF: BNPIFUS Index, BNPIFU10 Index, BBUXALC Index.

Overall, the examples above show how utilizing trend allows investors to potentially transform protracted market moves into diversification opportunities.



Befriending the Trend: A Trend-Following Strategy for Portfolio Diversification

Why Does the Trend Factor Exist?

Financial assets including stocks, bonds, currencies and commodity futures exhibit momentum in their returns as attested in published peer-reviewed literature.^{v,vi,vii} Eugene Fama, Nobel laureate and father of modern finance, has been quoted as saying that “momentum is a big embarrassment for market efficiency.”^{viii} Fama has written that he “hopes (momentum) goes away” because it flies in the face of the Efficient Market Hypothesis.^{ix} If efficient market theorists find the notions of momentum and trend following so vexing, their intellectual discomfiture begs the question, Why does the trend factor exist? Several rational hypotheses have emerged to explain the trend factor. One explanation holds that trend following picks up on the behavioral bias of underreaction: In a delayed reaction, investors respond gradually to new information. Another is naïve extrapolation of the previous results: Investors use backward-looking returns, both positive and negative, to assess forward-looking attractiveness. If an asset returns 20% in a year, a naïve extrapolator will expect 20% the following year.^x Potential supply-and-demand imbalances also might create a need for the momentum risk premia. In order to execute their risk-management strategies, hedgers need a counterparty to buy high-priced assets and sell low-priced assets, creating a demand for trend investors in order to balance the bids and offers in the market. In theory, this mechanism contributes to the momentum risk premium that an investor can collect by enduring the volatility and associated drawdowns. In our view, all these theories offer credible answers, or partial answers, to the momentum puzzle – but the “why” of the conundrum remains unproven.

Homogeneity: Are All Trend-Following Strategies the Same?

Historically, investors interested in trend strategies had to utilize a CTA or private vehicle like a hedge fund. These vehicles lack transparency, have high fees and impose liquidity gates. With the advent of liquid alternatives, trend-following strategies are available in comingled, daily liquidity vehicles, providing a possible solution to this conundrum. Unfortunately, discovering an appropriate trend-following strategy can be overwhelming for an investor. It is often impossible for investors to access cutting-edge investment strategies easily.^{xi} Most broad trend indexes offer similar exposures because they employ similar construction methodologies by which the assets in the strongest trend, up or down, receive the largest dollar-value exposure. (Figures 2 and 6) While this approach offers exposure to momentum risk premia, it falls into the pitfall of ignoring the cross-correlation of the trend portfolio itself. This can lead to larger correlated bets than assumed by investors, setting up portfolios for outsized volatility and diminished risk-adjusted returns. We at DoubleLine think there is a sensible solution to this problem, offering the potential for greater risk-adjusted returns.

Correlation Is Strong Among Broad Trend Indexes

| December 31, 2004 – August 31, 2022 | Credit Suisse Managed Futures Liquid Index | SG Trend Index | BarclayHedge CTA Index | Hedge Fund Research HFRX Macro Systematic Diversified CTA Index | DB Cross Asset CTA Index | Barclays Cross Asset Trend Index | SGI Cross Asset Trend Following Index | Deutsche Bank Cross Asset Trends Index |
|---|--|----------------|------------------------|---|--------------------------|----------------------------------|---------------------------------------|--|
| Credit Suisse Managed Futures Liquid Index | 1.00 | 0.83 | 0.82 | 0.81 | 0.73 | 0.72 | 0.86 | 0.66 |
| SG Trend Index | | 1.00 | 0.90 | 0.88 | 0.74 | 0.68 | 0.80 | 0.69 |
| BarclayHedge CTA Index | | | 1.00 | 0.85 | 0.63 | 0.67 | 0.82 | 0.59 |
| Hedge Fund Research HFRX Macro Systematic Diversified CTA Index | | | | 1.00 | 0.70 | 0.65 | 0.76 | 0.66 |
| DB Cross Asset CTA Trend Index | | | | | 1.00 | 0.60 | 0.69 | 0.79 |
| Barclays Cross Asset Trend Index | | | | | | 1.00 | 0.75 | 0.59 |
| SGI Cross Asset Trend Following Index | | | | | | | 1.00 | 0.61 |
| Deutsche Bank Cross Asset Trends Index | | | | | | | | 1.00 |

Figure 6
Source: DoubleLine



Befriending the Trend: A Trend-Following Strategy for Portfolio Diversification

A Better Mousetrap: The BNP Paribas Multi-Asset Trend Index

The DoubleLine Cross Asset team worked with BNP Paribas to create a custom trend index with 58 underlying market components that we think has the potential to generate superior risk-adjusted returns. (*Figures 7 and 8*) A key element of the BNPP Multi-Asset Trend Index (the “Index”) is the use of strict risk controls to allocate capital in a diversified manner incorporating the correlation structure between components. This avoids the pitfall of going all in on any one sector or investment, a recipe for high volatility. The Index has three performance pillars underlying its design philosophy.

- Trend recognition is based on continuation of prices, either up or down, and the Index is agnostic to price direction in the 58 underlying markets. As an example, looking back to summer 2008, just before the Lehman Brothers crisis, the Index became short on equities and increased long exposure to government bonds.
- A volatility-targeting risk-management mechanism captures the performance of each component. The Index leverages positions in periods of low volatility (gradual phase), which enables it to pick up large moves when they materialize (sudden phase), and deleverages as realized volatility increases to maintain ex ante targeted volatility. This helps capture the momentum risk premia gains, while reducing volatility. Some recent examples: short duration exposure on two-year Treasury notes surrounding minutes releases from the Federal Reserve in January 2022 and long positions on commodities (oil, gas and gold) surrounding the Russian invasion of Ukraine.² (*Figure 9*)
- Cross-sectional mean-variance risk-control mechanism: The Index calculates the expected return of each component based on its trend, then utilizes a mean-variance optimization framework to distribute the portfolio exposures in a well-diversified, risk-balanced manner. This is a source of outperformance in the long run because it enables the Index to benefit from diverging trends between assets irrespective of average market moves. An illustrative example is the strong contributions of both equity and bond returns in 2019 (respectively, +9% and +14%), a time when the Fed was particularly dovish following the stressed markets the previous year. This was possible thanks to the diversification effect enabling high exposure on both asset classes (69% average weight for equities and 156% for bonds) while keeping cross-sectional risk under control.

The above performance pillars drive the BNPP Multi Asset Trend Index and can help increase the capital efficiency of a portfolio when the Index is included in an investor’s universe of assets. (*Figure 10*)

² Another example on commodities, capturing a down-trend signal, occurred around the beginning of the COVID-19 lockdown crisis. The allocation within the Index became progressively more negative, starting at the end of January 2020, to efficiently capture the emerging negative price trends in March 2020 (as a result of the COVID-19 pandemic lock-downs and financial panic) and then to start deleveraging by end of spring, realizing the captured returns.



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BNPP Multi-Asset Trend Index Components

Eligibility Criteria

- Widely recognized markets across five major asset classes
- Operational effectiveness: utilize futures for leveraging and shorting
- Large markets with significant daily liquidity
- Cost efficiency (as measured by the cost to execute a trade on an Index component)



- 13** **Commodities**
Brent Crude Oil | WTI Crude Oil | Gas Oil | Heating Oil | Unleaded Gas | Natural Gas | Aluminum | Copper | Lead | Nickel | Zinc | Gold | Silver
- 4** **Credit**
EUR 5Y IG | EUR 5Y HY | US 5Y IG | US 5Y HY
- 19** **Equities**
Russell 2000 | S&P 500 | TSX 60 | AEX | CAC 40 | DAX | Eurostoxx 50 | FTSE MIB | FTSE 100 | SMI | OMX | ASX SPI 200 | HSCEI | HSI | KOSPI | MSCI Taiwan | Nikkei | TOPIX | MSCI EM
- 7** **Forex**
AUD | CAD | CHF | EUR | GBP | JPY | NZD
- 15** **Rates**
AUD 3Y | AUD 10Y | BTP 10Y | CAD 10Y | DBR 2Y | DBR 5Y | DBR 10Y | DBR 30Y | JGB 10Y | OAT 10Y | UKT - Long | UST 2Y | UST 5Y | UST 10Y | UST 30Y

Figure 7
Source: BNP Paribas

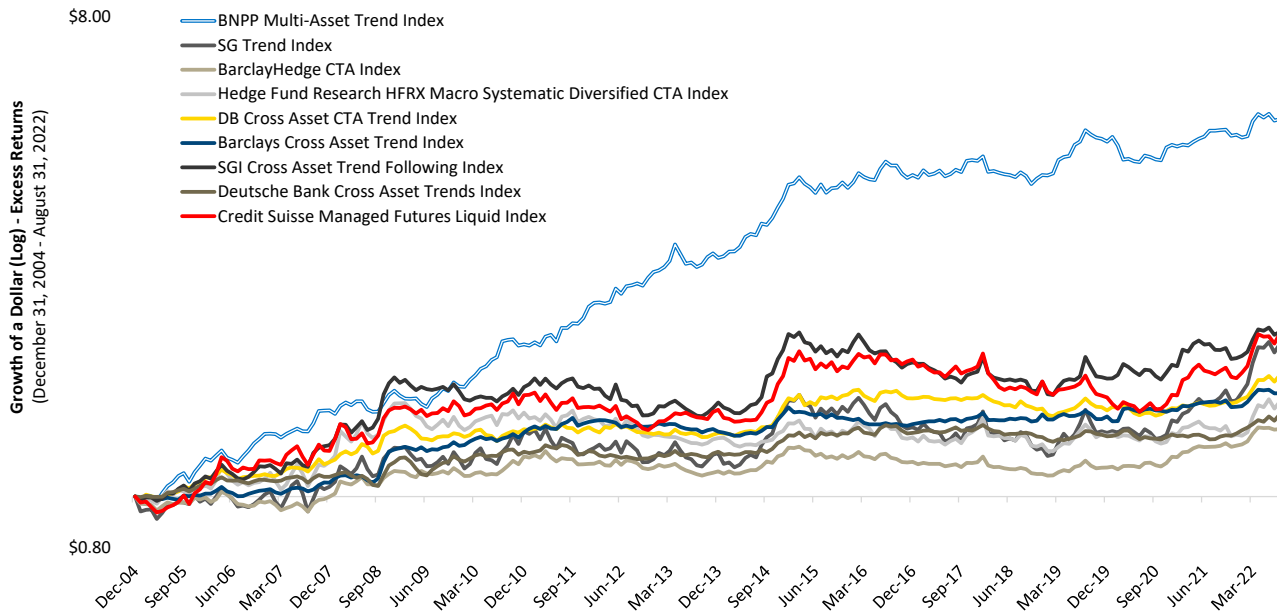


Figure 8
Source: DoubleLine



Befriending the Trend: A Trend-Following Strategy for Portfolio Diversification

Volatility-Targeting Risk Mechanism on Commodity Weights of the BNPITRND Index

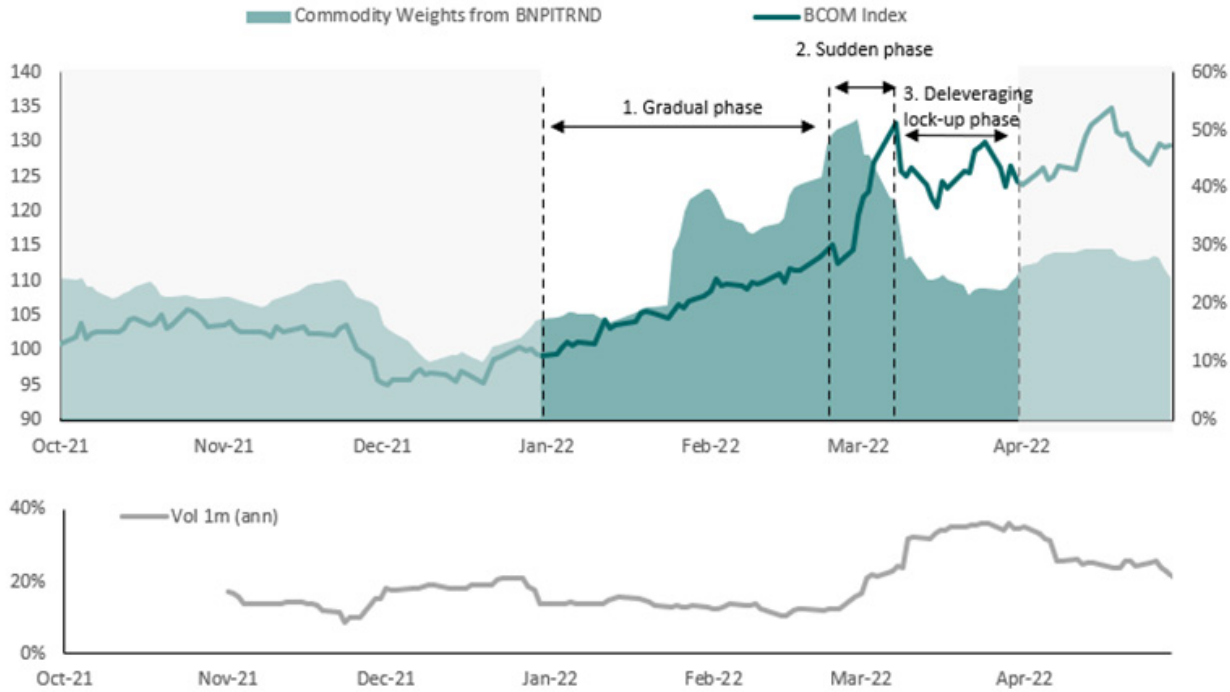


Figure 9
Source: BNP Paribas

Capital Efficiency of Including BNPP MAT Index in a Portfolio

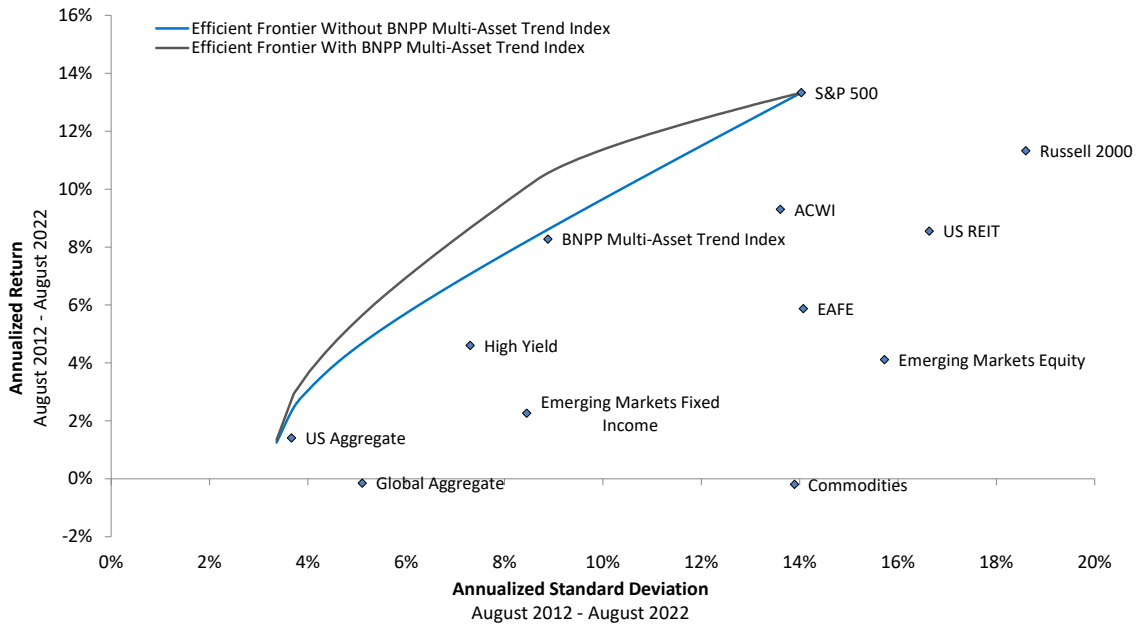


Figure 10
Source: DoubleLine



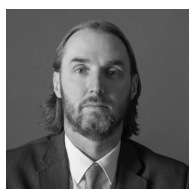
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Why the DoubleLine Multi-Asset Trend Strategy?

The DoubleLine Multi-Asset Trend Strategy is a turnkey solution offering what DoubleLine thinks is a superior trend exposure along with enhanced collateral management at a competitive price. By simultaneously providing exposure to the BNP Paribas Multi-Asset Trend Index (accessed through a swap contract) and a portfolio of fixed income securities with low interest-rate risk, investors obtain trend exposure and an incremental income stream in their portfolio. This double-value proposition utilizes DoubleLine's expertise in managing fixed income portfolios as well as its experience in managing derivative-based collateral overlay strategies for nearly a decade. The strategy provides investors a convenient, publicly available solution that they can use to complement their existing asset allocation framework.

For more information on the DoubleLine Multi-Asset Trend Strategy, please e-mail ProductSpecialists@DoubleLine.com ■

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As DoubleLine's Deputy Chief Investment Officer, Jeffrey Sherman oversees and administers DoubleLine's Investment Management sub-committee coordinating and implementing policies and processes across the investment teams. He also serves as lead portfolio manager for multi-sector and derivative-based strategies. Mr. Sherman is a member of DoubleLine's Executive Management and Fixed Income Asset Allocation Committees. He can be heard regularly on his podcast "The Sherman Show" (Twitter @ShermanShowPod, ShermanShow@Doubleline.com) where he interviews distinguished guests, giving listeners insight into DoubleLine's current views. In 2018, Money Management Executive named Jeffrey Sherman as one of "10 Fund Managers to Watch" in its yearly special report. Prior to joining DoubleLine in 2009, Mr. Sherman was a Senior Vice President at TCW where he worked as a portfolio manager and quantitative analyst focused on fixed income and real-asset portfolios. He was a statistics and mathematics instructor at both the University of the Pacific and Florida State University. Mr. Sherman taught Quantitative Methods for Level I candidates in the CFA LA/USC Review Program for many years. He holds a B.S. in Applied Mathematics from the University of the Pacific and an M.S. in Financial Engineering from the Claremont Graduate University. Mr. Sherman is a CFA® charterholder.



Eric Dhall
Quantitative Analyst, Macro Asset Allocation

Eric Dhall joined DoubleLine in 2013. He is a Quantitative Analyst on the Macro-Asset Allocation team where he works with portfolio management performing analysis and trading for derivatives-based and multi-asset strategies. Mr. Dhall's research and analysis has contributed to the team's development of DoubleLine's smart-beta suite of strategies. Prior to DoubleLine, he worked at Capital Group performing quantitative analysis in fixed income. Prior to Capital Group, Mr. Dhall was an instructor in finance at the UCLA Anderson School of Management and a research instructor at the UCLA Samueli School of Engineering. Previous to that, he worked in International Finance at Gulf Machinery company. Mr. Dhall holds a BS in Physics with a secondary emphasis in Business from the University of California, Berkeley and an MS in Financial Engineering from the UCLA Anderson School of Management.



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Definitions

Basis Points (BPS) – Basis points (or basis point (bp)) refer to a common unit of Arithmetic Return – Return based on arithmetic mean, which is a sum of values of a data set divided by a number of values.

BarclayHedge CTA Index – This index, which is equal weighted and rebalanced at the beginning of each year, is an industry benchmark of representative performance of commodity trading advisors. There were 416 programs included in the calculation of the Barclay CTA Index for 2021.

Barclays Cross Asset Trend Index – This index reflects the returns of a systematic trend-following strategy applied to a wide range of underlying instruments across multiple asset classes. The strategy uses the same signal mechanism for all instruments and is designed to generate return profiles similar to commodity trading advisor (CTA) funds.

Bloomberg Commodity (BCOM) Index – This index (formerly the Dow Jones-UBS Commodity Index) is calculated on an excess return basis and reflects the price movements of commodity futures. It rebalances annually, weighted two-thirds by trading volume and one-third by world production, and weight caps are applied at the commodity, sector and group levels for diversification. The roll period typically occurs from the sixth to 10th business day based on the roll schedule.

Bloomberg Commodity ex-Agriculture and Livestock Capped Index – Derived from the Bloomberg Commodity Index (BCOM), excluding the commodities that make up the Bloomberg Agriculture and Bloomberg Livestock indexes. This index is calculated on an excess return basis and reflects the price movements of commodity futures. The roll period typically occurs from the sixth to 10th business day based on the roll schedule.

Bloomberg Global Aggregate Bond Index – This index is a flagship measure of global investment grade debt from 24 local currency markets. This multicurrency benchmark includes treasury, government-related, corporate and securitized fixed-rate bonds from both developed and emerging market issuers.

Bloomberg US Aggregate Bond Index – This index (the “Agg”) represents securities that are SEC registered, taxable and dollar denominated. It covers the U.S. investment grade, fixed-rate bond market, with components for government and corporate securities, mortgage pass-through securities and asset-backed securities. These major sectors are subdivided into more specific indexes that are calculated and reported on a regular basis.

BNP Paribas Multi-Asset Trend Index – This index has been designed to seek investment exposure to trends in price movements of a broad universe of assets across different markets, including domestic, foreign and emerging markets equities; sovereign bonds and other debt securities; interest rates; currencies; and commodities (e.g., energy and metals). The index was selected, in significant part, because it reflects trend-following strategies using a broadly diversified set of investments.

BNP Paribas US Equity Futures Index – This index aims to provide continuous exposure to the E-mini S&P 500 Index Futures Contract, with the nearest expiration month for which the last trading day has not occurred. The BNP Paribas US Equity Futures Index level is intended to reflect the performance of the first near futures contract.

BNP Paribas USD 10Y Futures Index – This index aims to provide continuous exposure to the 10-Year T-Note Futures Contract. The BNP Paribas USD 10Y Futures Index level is intended to reflect the performance of the first near futures contract based on a daily volume-weighted average price, subject to certain trade filters.

Credit Suisse Managed Futures Liquid Index – This index measures is designed to provide exposure to both up and down price trends in four broad asset classes: equities, fixed income, commodities and currencies.

DB Cross Asset CTA Trend Index – This index comprises 16 subindexes that are each intended to reflect the weighted, foreign exchange (FX)-hedged excess return of a number of indexes covering the following asset classes: equities, interest rates, commodities and FX.

Deutsche Bank Cross Asset Trends Index – This index, which is rebalanced monthly, comprises four subindexes that are intended to reflect the weighted, foreign exchange (FX)-hedged excess return performance of a number of indexes that track one of the following asset classes: equities, interest rates, commodities and FX.

Geometric Return – The average of a set of products, the calculation of which is commonly used to determine the performance results of an investment or portfolio. Technically defined as the Nth root product of N numbers.

Hedge Fund Research HFRX Macro Systematic Diversified CTA Index – This index, published by Hedge Fund Research Inc., track hedge funds that use a systematic diversified strategy. The index is periodically rebalanced to reflect the current universe of hedge funds that rely on such strategies.

ICE BofA U.S. High Yield (HY) Index – This index tracks the performance of U.S. dollar-denominated, below-investment-grade corporate debt, currently in a coupon paying period, that is publicly issued in the U.S. domestic market. Qualifying securities must have a below-investment-grade rating (based on an average of Moody's, S&P and Fitch foreign currency, long-term sovereign debt ratings). They must also have one year remaining to maturity and a minimum outstanding amount of \$100 million.

J.P. Morgan Emerging Markets Bond Index (EMBI) – This index tracks emerging markets (EM) bonds and comprises sovereign debt and EM corporate bonds.

Morgan Stanley Capital International All Country World Index (MSCI ACWI) – This market capitalization-weighted index is designed to provide a broad measure of stock performance throughout the world. It comprises stocks from 23 developed countries and 27 emerging markets.



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Morgan Stanley Capital International Emerging Markets Index (MSCI EMI)

– This index captures large- and mid-cap representation across 26 emerging markets countries. With 1,385 constituents, the index covers approximately 85% of the free-float-adjusted market capitalization in each country.

Morgan Stanley Capital International (MSCI) Europe, Australasia and Far East (EAFE) Index

– This index is designed to represent the performance of mid- and large-cap securities across 21 developed markets, including countries in Europe, Australasia and the Far East, excluding the U.S. and Canada. The index is available for a number of regions, market segments/sizes and covers approximately 85% of the free float-adjusted market capitalization in each of the 21 countries.

Morgan Stanley Capital International (MSCI) U.S. REIT Index – This free-float-adjusted, market capitalization-weighted index comprises of equity real estate investment trusts (REITs). The index is based on the MSCI USA Investable Market Index (IMI), which captures the large-, mid- and small-cap segments of the U.S. market.

Russell 2000 Index – This market capitalization-weighted index comprises 2,000 small-cap U.S. companies and is considered a bellwether index for small-cap investing.

S&P 500 Index – This unmanaged capitalization-weighted index of the stocks of the 500 largest publicly traded U.S. companies is designed to measure performance of the broad domestic economy through changes in the aggregate market value of the 500 stocks, which represent all major industries.

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SG Trend Index – This index, which is equal weighted and reconstituted annually, calculates the net daily rate of return for a pool of trend-following-based hedge fund managers.

S&P Cross Asset Trend Following Index – This index uses a systematic, rules-based trend-following strategy to provide dynamic exposure to a broad basket of fixed income, equity, foreign exchange and commodity indexes in different global regions.

Sharpe Ratio – Used to help investors understand the return of an investment compared to its risk. The ratio is the average return earned in excess of the risk-free rate per unit of volatility or total risk. Volatility is a measure of the price fluctuations of an asset or portfolio. Subtracting the risk-free rate from the mean return allows an investor to better isolate the profits associated with risk-taking activities. The risk-free rate of return is the return on an investment with zero risk, meaning it’s the return investors could expect for taking no risk. The yield for a U.S. Treasury bond, for example, could be used as the risk-free rate.

Standard Deviation – Measure of the variation or dispersion of a set of data from its mean or expected/budgeted value. A low standard deviation indicates that the data points tend to be very close to the mean, whereas a high standard deviation indicates that the data is spread out over a large range of values. A measure of an investment’s volatility.

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