PGIM

DECODING RECESSIONS WITH NLP:

Harnessing Sentiment Analysis in Asset Allocation

October 2025

INTRODUCTION

Economic recessions — the most acute phase of the business cycle — are a persistent and critical concern and recurring focus of researchers and investors given their profound impact on risk asset performance.

The National Bureau of Economic Research (NBER) defines recessions as broad and significant economic downturns. However, the delayed, retrospective methodology for identifying recessions limits its immediate efficacy for timely investment decisions. Traditional recession analyses that rely on backward-looking economic data (like changes in unemployment, leading economic indicators, and the Sahm rule), market signals (like the yield curve), and econometric models often fail to capture real-time sentiment shifts that can materially influence asset prices.

To address these limitations, our team has developed a US Recession Sentiment Index using Natural Language Processing (NLP) to quantify recession sentiment from news articles and provide a real-time, forward-looking measure of public economic sentiment. Unlike "hard" data that captures realized economic activity, sentiment-based data (termed "soft") quantifies views and attitudes about the economy in real time.

We believe sentiment plays a significant role in shaping the economy and influencing asset prices. When recession fears dominate, individuals prioritize income and job security, often delaying or canceling big-ticket purchases like cars or homes. They're also more likely to sell risky assets. Conversely, when recession fears subside, consumers are more open to discretionary spending, such as vacations or other non-essential items. This behavior highlights the importance of recession sentiment as a predictive lens for future economic decisions.

By capturing a broader range of economic participants' views, it complements traditional economic data and market-based indicators. Additionally, NLP-based methods offer a distinct edge over traditional, data-based economic metrics, as they provide real-time updates with no release lag. Academic research further validates the predictive power of NLP in forecasting macroeconomic variables and short-term interest rate moves, highlighting its potential as a valuable tool for economic analysis.[1]

Our prior analysis identified a notable relationship between the next-day returns of the S&P 500 Index and prior-day changes in US Recession Sentiment Momentum (RSM). Specifically, S&P 500 daily returns skewed heavily toward large losses when RSM deteriorated, underscoring its potential to anticipate asset price moves. Key questions emerging from these findings include whether RSM can enhance investment performance and/or mitigate downside risk within asset allocation frameworks.

This paper explores RSM's practical applications, beginning with standalone equity strategies and progressing to tactical asset allocation overlays for a traditional 60/40 portfolio without using leverage or shorting. Our findings reveal that shifts in RSM—measured by changes in recession sentiment—offer a valuable signal for predicting asset price movements and enhancing risk management strategies. Through this analysis, we explore how RSM's applications in equity strategies, tactical overlays, and diversified portfolios can be integrated to enhance risk-adjusted returns and strengthen portfolio resilience.

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1 Example studies include: 1. van Binsbergen, J. H., Bryzgalova, S., Mukhopadhyay, M., & Sharma, V. (2024). (Almost) 200 years of news-based economic sentiment (No. w32026). *National Bureau of Economic Research.* 2. Audrino, F., & Offner, E. A. (2024). The impact of macroeconomic news sentiment on interest rates. *International Review of Financial Analysis*, 94, 103293.

# Recession Sentiment Index: Data and Construction
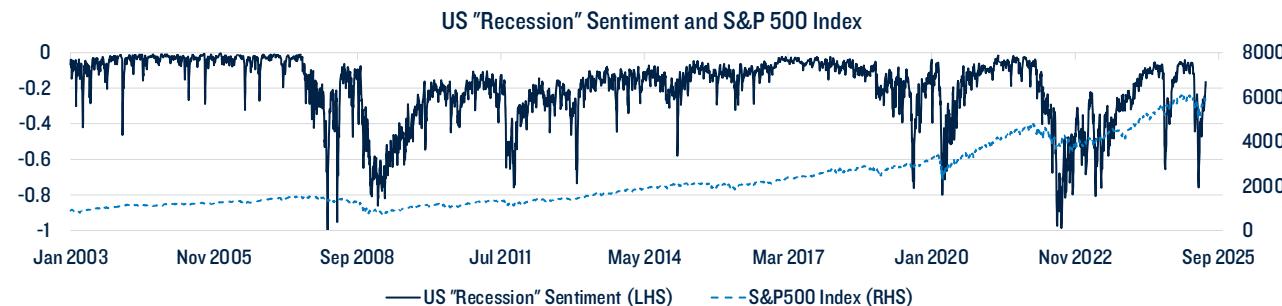
Our NLP analysis utilizes daily news articles sourced from Bloomberg Professional Service, drawing from an extensive collection of publications, including Bloomberg News, The New York Times and other newspapers, and web scrapes. The model processes thousands of articles covering diverse topics in multiple languages, and identifies fewer than a thousand English-language articles closely related to the US economy. From this subset, it extracts, quantifies, and summarizes the negative sentiment related to a potential US recession.

Research indicates that individuals react more strongly to negative news than to positive information, a phenomenon explained through psychological and informational frameworks.[2] Our NLP-based sentiment analysis incorporates this bias, measuring the negative tone of recession-related news coverage.

The sentiment score, by design, ranges from -1 to 0, with more negative values reflecting deteriorating sentiment, and therefore, heightened recession concerns. The sentiment index demonstrates sharp, clustered declines during significant economic events, reflecting the infrequent but severe nature of recessions.

As illustrated in Figure 1, the NLP-based recession sentiment index (rescaled to [-1, 0]) shows abrupt declines both before and during the 2008 Global Financial Crisis (GFC), as well as during the Federal Reserve's (Fed) post-pandemic interest rate hikes aimed at curbing inflation overshoots. These patterns reinforce the index's role as a timely and forward-looking tool for gauging public sentiment during critical economic periods.

Figure 1: PGIM NLP-Based US Recession Sentiment Index

US "Recession" Sentiment and S&P 500 Index

— US "Recession" Sentiment (LHS)   - - - S&P500 Index (RHS)
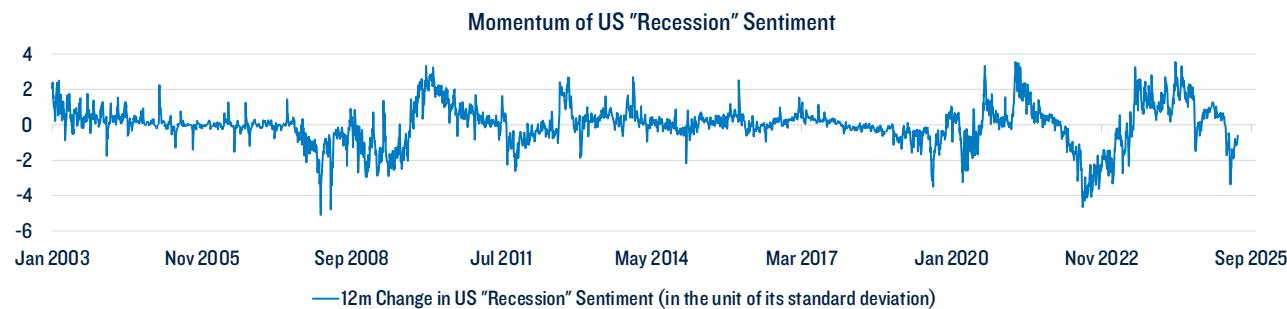
Source: PGIM, Bloomberg Professional Services, as of May 31, 2025.

To illustrate, we construct a momentum factor from the recession sentiment by calculating its 12-month change. Figure 2 shows that this Recession Sentiment Momentum (RSM) factor typically hovers around zero, but occasionally experiences a large, sudden drop, a characteristic inherent to recession sentiment.

> Recession Sentiment Momentum (t) = Recession Sentiment (t) − Recession Sentiment (t-12)

Figure 2: 12-Month Change in US Recession Sentiment Index

Momentum of US "Recession" Sentiment

— 12m Change in US "Recession" Sentiment (in the unit of its standard deviation)

Source: PGIM, as of May 31, 2025.

2 Example research includes: 1. Tutino, A. (2018). Consumers Respond More to Negative News than Positive Info. Economic Letter, 13 (7). Federal Reserve Bank of Dallas. 2. Unkelbach, C., Alves, H. & Koch, A. (2020). Valence asymmetries: Explaining the differential processing of positive and negative information. Advances in Experimental Social Psychology, 62, 115-187. 3. Hibbert, A., Kang, Q., Kumar, A. & Mishra, S. (2024). Negativity bias, social media, and analyst behavior. Working paper.

Applications in Equity and Bond Markets

US Equity Market

The following analysis introduces two rudimentary yet intuitive strategies for incorporating RSM into equity market allocations. Given the central role of US equities in many portfolios, both strategies are applied to the S&P 500 Index.

The first strategy is designed to enhance diversification and provide downside protection during periods when the equity market is under pressure. It responds dynamically to changes in recession sentiment (RSM) adjusting when RSM crosses the 10th and 90th percentile thresholds. As shown in Table 1, this strategy exhibits a negative correlation with the equity market. Table 2 illustrates how this strategy achieves positive gains during significant S&P 500 downturns. Given these characteristics, the strategy is named Strategy D, reflecting its focus on diversification.

The second strategy takes a more balanced approach, aiming to capture equity market upside while mitigating downside risk. This strategy adopts a short position on the S&P 500 Index when RSM moves deeper into negative territory, using a 5th percentile threshold compared to the 10th percentile threshold used in Strategy D, above.[3] With a near zero correlation to the S&P 500, as shown in Table 1, this strategy, which we term Strategy T, delivers higher returns and a superior Sharpe ratio, positioning it as an effective tactical investment tool.

> Strategy D(iversified): Go long S&P 500 Index if RSM rises above the 90th percentile of its trailing 10-year history; go short S&P 500 Index if RSM drops below the 10th percentile of its trailing 10-year history; retain the prior S&P 500 position if RSM remains within the 10th and 90th percentile range.

> Strategy T(actical): Go long S&P 500 Index if RSM rises above the 95th percentile of its trailing 10-year history; go short S&P 500 Index if RSM drops below the 5th percentile of its trailing 10-year history; retain the prior S&P 500 position if RSM remains within the 5th and 95th percentile range.

Following academic research practice to evaluate these strategies, we conducted backtests with monthly rebalancing, incorporating reasonable transaction costs to simulate real-world conditions.[4] The backtest performance outcomes are presented in terms of excess returns over Treasury bills, factoring in the opportunity cost of investing in cash.[5]

Table 1: Performance Metrics of RSM-Based US Equity Market Strategies

	A S&P 500 INDEX	B STRATEGY D ON S&P 500 INDEX	C STRATEGY T ON S&P 500 INDEX
Annual Geometric Return (%)	5.86	2.89	9.13
Annual Average Return (%)	6.89	3.96	9.79
Annual Volatility (%)	15.31	14.94	14.40
Sharpe Ratio	0.45	0.27	0.69
% Periods Up	62.30	53.11	57.70
Skew	-0.48	0.13	0.13
Max Drawdown (%)	-56.02	-64.23	-39.33
Correlation (SPXT)	1	-0.14	0.04
Correlation (US_AGG)	0.12	-0.13	-0.14
Average Turnover (%)	N/A	106.23	59.02

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025.
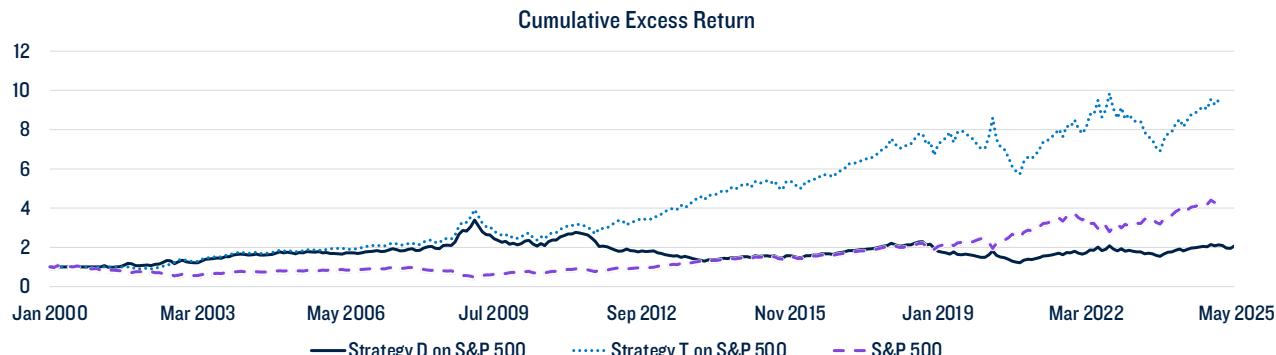
3 For demonstration purpose and to avoid data mining, we present the results based on two intuitive pairs of percentile thresholds: (5th, 95th) and (10th, 90th). While other thresholds were tested, the core findings of the strategies outlined in this article largely remain consistent. Additionally, strategies using shallower thresholds (e.g. a 25th percentile compared to a 5th percentile, as the higher threshold increases the likelihood of triggering a short S&P 500 position) generally exhibit negative correlation to the equity market.

4 The round-trip transaction costs in backtests are assumed to be 20 bps for the S&P 500 Index, 6 bps for its E-mini futures, 20 bps for US Aggregate Bond Index, 6 bps for US 10-year Treasury Note futures, 6 bps for the Bloomberg Commodity Index, 20 bps for US REITs, 1 bp for Treasury bills.

5 Treasury bills with maturity of 1-3 months.

Over the sample period from January 2000 to May 2025, both Strategy D and T delivered positive annual returns (2.89% and 9.13%, respectively). Additionally, both strategies exhibit positive skewness in contrast to the negative skewness of the 500 Index (0.13, 0.13, -0.48, respectively). While Strategy D has a lower annual return, it achieves a negative correlation -0.14 with the S&P 500. Strategy T, on the other hand, significantly outperforms the S&P 500 with an annual geometric return of 9.13%. Over the full sample period, Strategy T's compounding effect generates substantially higher cumulative wealth, as shown in Figure 3.

Figure 3: Cumulative Returns of Strategy D and T on S&P 500 Index

Cumulative Excess Return

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025.

Strategy T also achieves a higher Sharpe ratio (0.69 vs. 0.45), lower volatility (14.40% vs. 15.31%), and a much smaller maximum drawdown (39% vs. 56%) compared to the S&P 500 Index. Furthermore, Strategy T exhibits a very low correlation with the equity market (0.04) and a negative correlated (-0.14) with the US Aggregate Bond Index (US_AGG). We believe both strategies can offer diversification benefits for asset owners investing in equities and traditional 60/40 portfolios, tailored to varying risk appetites. The next section explores these diversification opportunities in detail. To better understand how these strategies perform across different market conditions, we evaluate their behavior during various equity market environments. Building on the diversification potential outlined earlier, we categorize S&P 500 monthly returns into distinct intervals and summarize the average returns of the equity market index and the two strategies during these periods.

For example, in Table 2 below, column 1 depicts months when the S&P 500 Index declined by more than 7%. During these sharp downturns, the S&P 500 averaged a 9.15% loss, while Strategy D and T recorded average gains of 4.25 and 4.91%, respectively.

Table 2: Recession Sentiment Momentum-Based Strategy Performance in Various Equity Market Environments

	INTERVAL OF S&P 500 INDEX MONTHLY EXCESS RETURNS										
	1	2	3	4	5	6	7	8	9	10	
	< -7%	(-7%, -5%]	(-5%, -3%]	(-3%, -1%]	(-1%, 0%]	(0%, 1%]	(1%, 3%]	(3%, 5%]	(5%, 7%]	> 7%	
% of Time	6.9%	4.9%	5.6%	14.8%	5.3%	11.8%	22.7%	14.1%	7.6%	6.3%	
Average Monthly Excess Returns											
	In Corresponding S&P 500 Return Intervals										Over Full Spectrum of S&P 500 Environment
S&P 500	-9.15%	-5.97%	-3.84%	-1.91%	-0.40%	0.51%	1.93%	3.77%	5.83%	8.76%	0.58%
Strategy D on S&P 500	4.25%	0.37%	-2.37%	-0.81%	0.17%	0.26%	0.83%	0.60%	1.04%	-1.90%	0.33%
(t-stat of diff. vs S&P 500)	6.67	3.99	2.06	4.12	3.54	-2.87	-5.38	-5.40	-4.06	-5.18	
Strategy T on S&P 500	4.91%	-2.20%	-2.74%	-1.25%	-0.01%	0.42%	1.33%	2.51%	2.53%	0.47%	0.82%
(t-stat of diff. vs S&P 500)	7.23	2.87	1.72	3.21	2.34	-1.95	-3.55	-2.82	-3.04	-4.10	

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025.

As shown in Table 2, both Strategy D and Strategy T outperform the S&P 500 Index during market downturns (columns 1-5) as seen by their average monthly returns and accompanying t-statistics. However, both strategies tend to underperform when the equity market rises (columns 6-10).

Strategy D is particularly effective during periods of negative returns for the S&P 500. The strategy's average monthly returns improve progressively from columns 3 to 1 as the S&P 500's losses deepen. The strategy remains roughly flat when the S&P 500 experiences minimal movement (monthly returns between -1% and 1%, columns 5 and 6), reports modest gains when the S&P 500 rises (monthly returns between 1% and 7%, columns 7-9), but records modest losses during periods of significant market gains (monthly returns exceeding 7%, column 10). These characteristics reflect Strategy D's negative correlation to the S&P 500 and its countercyclical tendencies, driven by the recession sentiment index's focus on negative news signals. Although its long-term returns are modest, Strategy D can be used as a potential hedging tool to reduce risk for equity portfolios.

Strategy T, in contrast, performs quite differently. While it delivers positive returns, on average, during market upswings (columns 6-10), it posts negative returns when the S&P 500 declines moderately (columns 2-4, but still outperforms the S&P 500 during these periods). However, when the equity market declines become severe (column 1), Strategy T delivers sizeable gains by opportunistically shorting the S&P 500. This dynamic approach underpins Strategy T's much stronger long-term performance compared to the S&P 500, as previously highlighted.

Overlay on 60/40 Portfolios

We next extend Strategies D and T to the equity-bond allocation framework. Specifically, we evaluate a dollar-neutral tactical asset allocation between the S&P 500 and the US_AGG. For simplicity, the modified versions are still referred to as Strategy D and T. These strategies are applied as tactical asset allocation overlays on a traditional 60/40 portfolio and designed as follows:

Strategy D_EB_Overlay (equity and bond): Overweight 10% S&P 500 and underweight 10% US_AGG when RSM rises above the 90th percentile of its trailing 10-year history; underweight 10% S&P 500 and overweight 10% US_AGG when RSM drops below the 10th percentile of its trailing 10-year history; positions remain unchanged when RSM lies within the 10th and 90th percentile range.

Strategy T_EB_Overlay (equity and bond): Overweight 10% S&P 500 and underweight 10% US_AGG when RSM rises above the 95th percentile of its trailing 10-year history; underweight 10% S&P 500 and overweight 10% US-Agg when RSM drops below the 5th percentile of its trailing 10-year history; positions remain unchanged when RSM lies within the 5th and 95th percentile range.

The 10% overweight/underweight is selected purely for demonstration purpose; these values can be adjusted to achieve a target tracking error relative to the underlying 60/40 portfolio. Importantly, maintaining equal magnitudes of the overweight and underweight positions ensures dollar neutrality in this asset allocation exercise.

Table 3: Summary of Equity-Bond Tactical Allocation Overlays and the Combined Portfolio

	A	B	C
	60/40 PORTFOLIO	60/40 WITH STRATEGY D_EB_OVERLAY	60/40 WITH STRATEGY T_EB_OVERLAY
Number of Observation	305	305	305
Annual Geometric Return (%)	4.63	5.04	5.56
Annual Average Return (%)	4.99	5.37	5.89
Annual Volatility (%)	9.55	9.48	9.71
Tracking Error (%)	N/A	1.49	1.43
Sharpe Ratio	0.52	0.57	0.61
% Periods Up	62.30	62.95	61.97
Skew	-0.50	-0.39	-0.32
Max Drawdown (%)	-34.20	-29.79	-29.79
Beta to SPXT	0.61	0.60	0.62
Beta to US_AGG	0.69	0.64	0.62
Beta to 60/40	1.00	0.98	1.01

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025

Table 4: Correlation of Overlay Strategies with 60/40 Portfolio

PAYOFF CORRELATION	60/40 PORTFOLIO	STRATEGY D_EB_OVERLAY	STRATEGY T_EB_OVERLAY
60/40 Portfolio	1.00	-0.15	0.04

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025.

As Table 4 demonstrates, Strategy D as a standalone strategy records a negative correlation of -0.15 to the 60/40 portfolio; as an overlay Strategy D reduces the 60/40 portfolio's volatility from 9.55% to 9.48%, offering a diversification premium as defined by Booth and Fama.[6] Furthermore, it can serve as an overlay to enhance the risk efficiency of a 60/40 portfolio as outlined by Cavaglia et al. in the total portfolio management framework.[7]
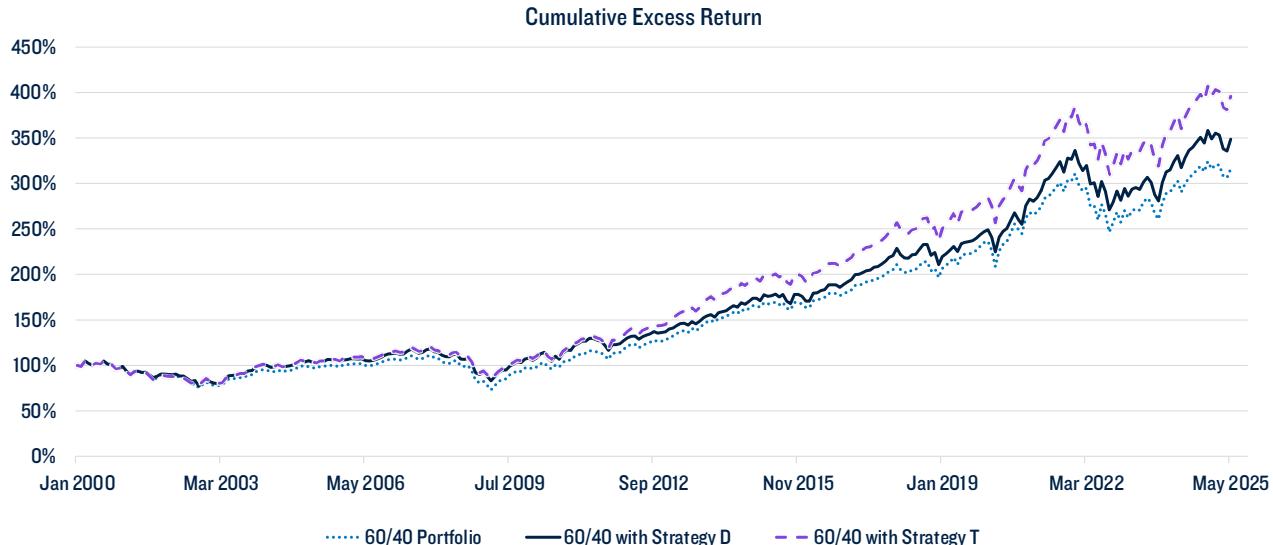
To capitalize on the reduced risk while maintaining a fixed risk budget equal to the volatility of 60/40 portfolio, an investor could combine Strategy D with a leveraged 60/40 portfolio. This approach retains the same risk level as an unlevered 60/40 portfolio but delivers higher returns. Alternatively, the risk budget could be utilized by adding investment strategies with better payoff profiles than the 60/40 portfolio.

Strategy T (Table 3, column D) as an overlay has a correlation close to zero (0.04) with the 60/40 portfolio. It behaves more like an alpha enhancement component, elevating the 60/40 portfolio's annual geometric return from 4.63% to 5.56%. With more than 20 years of compounding, this overlay makes a meaningful contribution to cumulative returns (or terminal wealth), increasing returns by about 80% compared to the baseline, as shown in Figure 4.

6 Booth, D. G., & Fama, E. F. (1992). Diversification returns and asset contributions. *Financial Analysts Journal*.
7 Cavaglia, S., Fan, J. H., & Wang, Z. (2022). Portable Beta and Total Portfolio Management. *Financial Analysts Journal*.
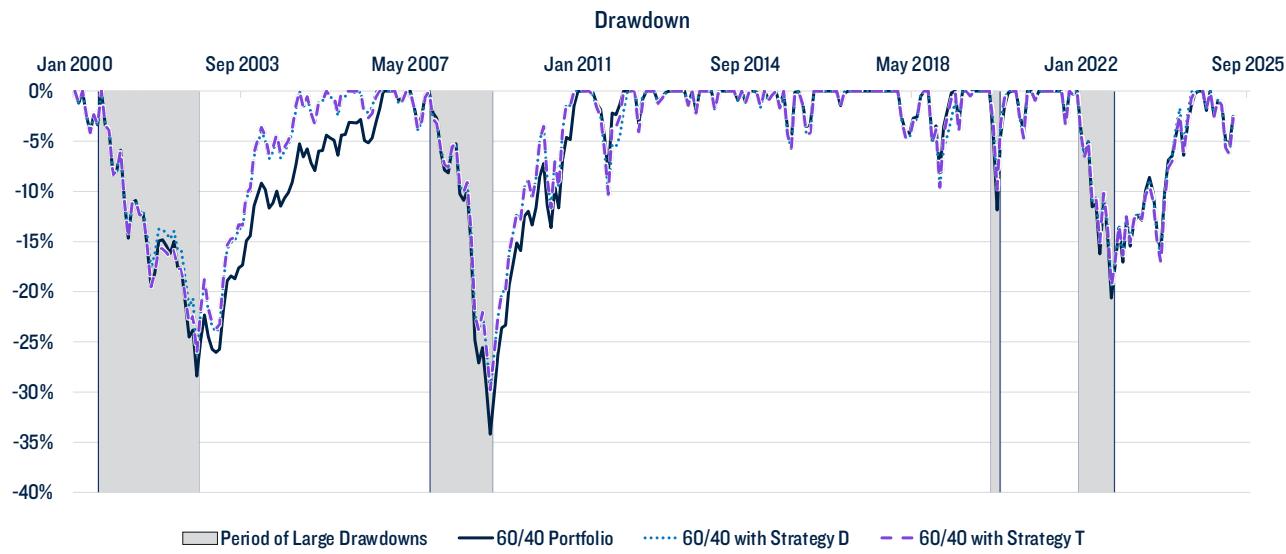
Figure 4: Cumulative Return of Strategies D and T as Overlays to a 60/40 Portfolio

Cumulative Excess Return

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025.

Additionally, the Strategy T overlay increases the portfolio's Sharpe ratio from 0.52 to 0.61, while reducing the maximum drawdown from 34.20% to 29.79%. This improvement is accompanied by a modest increase in volatility, from 9.55% to 9.71%. In terms of downside risk, the Strategy T overlay reduces the drawdown of a 60/40 portfolio across critical market events, including the dot-com crash, the 2008 GFC, the onset of the COVID-19 pandemic, and the most recent inflation spike, as shown in Figure 5.

Figure 5: Drawdown Time Series of Strategies D and T as Overlays to 60/40 Portfolio

Drawdown

Source: PGIM, Bloomberg Professional Services. Data from Jan 31, 2000 – May 31, 2025.

In summary, RSM-based asset allocation Strategies D and T have proven effective at enhancing performance of a traditional 60/40 equity-bond portfolio, demonstrating their potential as valuable tools for portfolio enhancement.

Incorporating Real Assets

Real assets, such as commodities and REITs, are not typically considered core holdings for many investors, unlike equities and bonds. However, both academic researchers and industry practice highlight the diversification benefits these assets can bring to traditional stock-bond portfolios.[8] Commodities, in particular, often perform well during higher inflation regimes, as their prices tend to rise with inflation. This has led some investors to view them as effective inflations hedges.

For over three decades, US inflation remained subdued. But in the post-COVID period (2021-2023), surging inflation caught central bankers and investors off guard. The traditional 60/40 portfolio experienced a significant drawdown in 2022 when both equities and bonds suffered simultaneously. To explore alternatives, we consider an inflation-aware portfolio with a 60% equity, 30% bond, and 10% real assets allocation.[9] The real assets exposure is divided equally, with 5% allocated to the Bloomberg Commodity (BCom) Index and 5% to FTSE NAREIT All Equity REITs (FNER) Index.[10]

This 60/30/10 portfolio delivers modestly higher risk and return than the 60/40 portfolio, with a 0.25% higher annual geometric return for the full sample period (Table 5). Notably, as shown in Table 6, during 2021-2023, the 60/30/10 portfolio outperformed the 60/40 portfolio by an average of 1.41%, with particularly strong results in 2021-22 when US inflation climbed dramatically. The inclusion of real assets proved effective in providing an inflation hedge, performing as anticipated.

Table 5: 60/40 Portfolio Compared to 60/30/10 Portfolio

	60/40 PORTFOLIO	60/30/10 PORTFOLIO
Number of Observation	305	305
Annual Geometric Return (%)	4.63	4.88
Annual Average Return (%)	4.99	5.33
Annual Volatility (%)	9.55	10.49
Sharpe Ratio	0.52	0.51
% Periods Up	62.30	61.97
Skew	-0.50	-0.61
Max Drawdown (%)	-34.20	-39.23
Beta to SPXT	0.61	0.67
Beta to US_AGG	0.69	0.67
Beta to 60/40	1.00	1.09

Source: PGIM. Data from Jan 31, 2000 – May 31, 2025.

Table 6: Return Enhancement Relative to 60/40 Portfolio

	RETURN IN EXCESS OF 60/40 PORTFOLIO		
YEAR	60/30/10 PORTFOLIO	60/40 WITH STRATEGY D_EBR	60/40 WITH STRATEGY T_EBR
2021	3.71	3.29	3.29
2022	0.54	1.10	1.10
2023	-0.01	-0.66	-1.50
Average	1.41	1.24	0.96

Source: PGIM. Data from Jan 31, 2000 – May 31, 2025.

8 Example publications include: 1. Gibb, J. (2024). The Power of a commodities allocation: A little goes a long way. Bloomberg Professional Services. 2. Blanchett, D. & Stempien, J. (2024). Commodities for the long run? Enterprising Investor. CFA Institute.
9 The 10% real assets allocation is split evenly between commodities (5%) and US REITs (5%).
10 Bloomberg Commodity Index consists of liquid commodity futures traded in the US and UK. For more information, please refer to the index methodology.

Extending Strategies D and T to Real Assets

Strategies D and T can be adapted to incorporate real assets through a streamlined allocation approach. To avoid over-engineering, we propose reallocating a small portion (3%) of the overlays to commodities (1.5%) and US REITs (1.5%), while reducing the S&P 500 allocation from 10% to 7% to maintain dollar neutrality within the overlay framework. This adjustment results in the following revised overlays:

Strategy D_EBR (Equity, Bond, and Real Assets): Overweight 7% S&P 500 Index / 1.5% BCom Index / 1.5% FNER Index, while underweight 10% US_AGG when RSM exceeds the 90th percentile of its trailing 10-year history. If RSM falls below the 10th percentile, the portfolio flips to underweight 7% S&P 500 Index / 1.5% BCom Index / 1.5% FNER Index and overweight 10% US_AGG. Positions remain unchanged if RSM remains within the 10th and 90th percentile range.

Strategy T_EBR (Equity, Bond, and Real Assets): Overweight 7% S&P 500 Index / 1.5% BCom Index / 1.5% FNER Index, while underweight 10% US_AGG when RSM exceeds the 95th percentile of its trailing 10-year history. If RSM falls below the 5th percentile, the portfolio flips to underweight 7% S&P 500 Index / 1.5% BCom Index / 1.5% FNER Index and overweight 10% US_AGG. Positions remain unchanged if RSM remains within the 5th and 95th percentile range.

Compared to the inflation-aware 60/30/10 portfolio, these overlays further enhance portfolio performance, consistent with findings of our previous analysis (Table 7). Specifically, Strategy D_EBR reduces the volatility of the underlying portfolio from 10.49% to 10.35%, while providing a modest annual return increase of 0.45%. Meanwhile, Strategy T_EBR delivers a significant annual geometric return increase of 5.74% compared to the 4.88% gain of the 60/30/10 portfolio. Both strategies improve the combined portfolio's Sharpe Ratios and reduce drawdowns.[11]

Table 7: Overlaying Strategies D and T onto the 60/30/10 Portfolio

	A	B	C
	60/30/10 PORTFOLIO	60/30/10 WITH STRATEGY D_EBR	60/30/10 WITH STRATEGY T_EBR
Number of Observation	305	305	305
Annual Geometric Return (%)	4.88	5.33	5.74
Annual Average Return (%)	5.33	5.74	6.16
Annual Volatility (%)	10.49	10.35	10.58
Tracking Error (%)	N/A	1.38	1.33
Sharpe Ratio	0.51	0.55	0.58
% Periods Up	61.97	62.62	61.97
Skew	-0.61	-0.48	-0.41
Max Drawdown (%)	-39.23	-35.15	-35.15
Beta to SPXT	0.67	0.66	0.68
Beta to US_AGG	0.67	0.63	0.62
Beta to 60/40	1.09	1.07	1.09
Beta to 60/30/10	1.00	0.98	1.00

Source: PGIM. Data from Jan 31, 2000 – May 31, 2025.

11 When applying the overlays of Strategies D_EBR and T_EBR to the 60/40 equity-bond portfolio, we observe performance improvements similar to those in the 60/30/10 portfolio. The return enhancement for the 2021-2023 period are detailed in Table 6.

During the higher-inflation period from 2021-2023, the overlays from Strategies D and T raised the 60/30/10 portfolio's average annual return by 1.28% and 1.00%, respectively (see Table 8). The RSM-driven strategies consistently enhanced portfolio performance in this atypical market environment.

Table 8: Return Enhancement Relative to 60/30/10 Portfolio with Strategies D and T

YEAR	RETURN IN EXCESS OF 60/30/10 PORTFOLIO	
	60/30/10 WITH STRATEGY D_EBR	60/30/10 WITH STRATEGY T_EBR
2021	3.38	3.38
2022	1.11	1.11
2023	-0.65	-1.49
Average	1.28	1.00

Source: PGIM. Data from Jan 31, 2000 – May 31, 2025.

Conclusion

Our NLP-based news sentiment indicator offers investors a valuable complement to traditional economic data and market-based indicators by providing a timely, alternative perspective on the state of the business cycle and the health of the underlying economy. This tool's unique insights into the economy and business cycle enable investors to anticipate significant asset price movements greater precision. Through our analysis of stylized investment strategies, we highlight how leveraging NLP-based recession sentiment momentum—whether as standalone strategies or tactical asset allocation overlays—can deliver compelling returns and meaningful diversification benefits to traditional portfolios, both over the full sample and even amid challenging market environments like the recent inflationary periods. We believe NLP-based recession sentiment can be a powerful addition to an investor's toolkit.[12]

As NLP and AI tools continue to evolve, their integration into investment strategies will likely unlock new opportunities for real-time, data-driven decision-making. However, while advances in machine learning are rapidly expanding the potential for deeper insights from news data, caution remains essential. Investors and researchers must thoroughly vet and validate the robustness and interpretability of such models before implementation. We believe NLP-based sentiment analysis stands as a powerful addition to the modern investor's toolkit, offering a competitive edge in navigating an increasingly complex financial landscape.

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12 We also examine using futures to implement Strategies D and T in this report, enabling investors to separate the overlays from their existing equity/bond allocations and operate in a leverage-efficient way. The backtest results align closely with those presented here.

NOTICE LANGUAGE

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About PGIM

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