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WisdomTree Efficient Core

An old idea to herald a new era of smart investing

WisdomTree®

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Executive summary

Asset allocation is ultimately about balancing returns with risks. While it is relatively easy to reduce risk in a portfolio, it's a bit harder to do so without diminishing its return potential. In his Modern Portfolio Theory, H. Markowitz introduced two tools to do so:

+ Diversification

+ Leverage

This paper demonstrates how to use both tools to create very efficient portfolios.

Chapter One aims to extend C. Asness's 1996 idea to leverage the typical 60/40 US portfolio as a way to beat equities over the long term while lowering volatility and max drawdown. To do so, we extended Asness's research in time and to other geographies, allowing us to demonstrate that his proposed levered portfolio:

+ Performed even better in the past 30 years (out of sample) than it did in the paper.

+ Worked not just with US assets but also in Europe, Japan, emerging markets and global developed markets.

Building on this early success, Chapter Two proposes a real-world solution to construct this levered portfolio. Called the US Efficient Core Strategy, it consists of investing in the equity physically (aiming for 90% exposure) and then using the remaining cash (10%) as margin for a 60% fixed income exposure built using government bond futures contracts. Having developed a backtested series for this strategy across multiple regions, Chapter Two highlights very important results:

+ The US Efficient Core Strategy delivered higher returns, lower volatility and higher Sharpe ratios than US equities over long historical periods.

+ Results are similar not just in the US but across geographies.

+ Using bootstrapping techniques, we showed that in 95.2% of 10-year trajectories, the Sharpe ratio of the US Efficient Core Strategy is improved versus equities and in 99.2%, the max drawdown is reduced.

Finally, Chapter Three focuses on the different ways that this Efficient Core Strategy can be used in a portfolio to aim to improve efficiency: first as a replacement for equity strategy and second as a capital efficiency tool to increase diversification in multi-asset portfolios. Through multiple analyses, we demonstrate that:

+ Efficient Core could be an excellent replacement for delta one, market cap-weighted exchange-traded funds (ETFs) or index funds, as it delivers, on average, better returns, lower volatility and, therefore, a better Sharpe ratio.

+ Efficient Core is also an excellent replacement for active equity strategies, as it compares positively with active mutual funds in Morningstar Peer groups, delivering top third or top quartile performance with reduced volatility.

+ Efficient Core can help build extremely efficient portfolios by creating space for diversifiers and boosting diversification in portfolios. Using Efficient Core, it is possible to create a 60/40 portfolio exposure with only 67% of the cash. This leaves 33% of the capital to be invested in diversifiers, such as commodities, gold, hedge funds, managed futures or digital assets.

By returning to basics, the Efficient Core concept aims to provide another powerful tool for all investors to push the boundaries of what is possible and improve their portfolio. By combining the two main tools from the Modern Portfolio Theory, diversification and leverage, it is possible to unlock even more efficient portfolios.

Introduction

The renowned American entrepreneur and investor Peter Lynch once wisely stated, 'The key to making money in stocks is not to get scared out of them'. While fundamentally true, balancing the pursuit of higher returns and prudent risk management remains a constant challenge for investors.

In this pursuit of balance, an innovative concept has come to the fore after decades of sitting in the background: 'stacking assets' or 'portfolio scaling'. This idea, grounded in H. Markowitz's Nobel Prize-winning work, seeks to harness the power of both diversification and leverage to optimise capital efficiency and aim to achieve superior risk-adjusted returns.

In a financial landscape characterised by ever-evolving market dynamics and increasingly complex investment instruments, understanding the concept of portfolio scaling and its implications for capital efficiency has never been more critical. This research paper embarks on a journey to explore the intricacies of stacking investments, uncover its historical foundations and evaluate its potential as a means to enhance capital efficiency and improve diversification in modern investment portfolios.

"The key to making money in stocks is not to get scared out of them."

1.

Solving the portfolio paradox: Combining upside capture and downside risk mitigation

In this section

A. The asset allocation rockstar: The 60/40 portfolio

The 60/40 portfolio emerged as a response to the need for a balanced approach to portfolio construction that could provide both capital appreciation and risk mitigation. The concept of the 60/40 portfolio is relatively simple: it consists of a 60% allocation to equities and a 40% allocation to fixed income assets, typically government bonds.

As detailed in the book *Stocks for the Long Run, Sixth Edition* (Siegel and Schwartz, 2023), the origin of this recommendation is generally attributed to Bengen (1994). By using simulations of actual historical stock and bond returns from 1926, Bengen counselled that an optimal asset allocation would be between 50% and 75% in equities based on the client's 'comfort zone'. Many advisers settled on 60% in stocks, and the 60/40 stock-bond allocation became a common benchmark. It was a considerably more aggressive approach than the 'Age in Bonds' rule, which prevailed in the 1950s and 1960s and stipulated (without much theoretical or empirical basis) that the percentage of the portfolio that was to be allocated to bonds should equal the age of the investor.

This strategy gained popularity over time as stock performance gained superiority over the last few decades and as it leveraged the teachings of Modern Portfolio Theory (MPT) introduced by Harry Markowitz. The 60/40 portfolio also weathered the dot-com bubble bursting in the early 2000s and the global financial crisis in 2008, solidifying its role in portfolios. As illustrated in Figure 1, in 2000, 2001 and 2008, the returns of US equities were negative. In all those years, bond markets posted strong positive returns. For an investor in a 60/40 portfolio, the fixed income performance helped compensate for the loss in equities.

Figure 1: US equities and US high investment-grade bonds' performance in crisis

	US equities	US high investment-grade bonds
2000	-9.1%	12.9%
2001	-11.9%	10.6%
2008	-37.0%	8.8%

Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. Data from December 1925 to September 2023. Monthly data in USD. US equities are proxied by the data series Ibbotson SBBI US Large Stock TR USD. US high investment-grade bonds are proxied by the Ibbotson SBBI US LT Corp TR USD series until February 2022. After that, the Bloomberg U.S. Long Credit Aa Total Return Index is used. **Historical performance is not an indication of future performance and any investments may go down in value.**

This complementary behaviour of equities and fixed income results from the low long-term correlation between those assets. While their correlation can fluctuate over time, their correlation is very low to negative over the medium to long term. In Figure 2, we list the long-term equity/bond correlation for many geographies around the world. For example, the correlation between US equities and US Treasuries is only 8.3%. In Europe, the correlation between equities and euro government bonds is even lower at -7.1% or -8.8%, depending on the equity index used. In Japan, the correlation drops to -26.1%.

8.3%

The correlation between US equities and US Treasury.

Figure 2: Equity vs. fixed income correlation for many geographies around the world

	US Treasury	EUR Treasury	JPY Treasury
MSCI World	5.7%		
MSCI EM	-9.7%		
S&P 500	8.3%		
Eurostoxx 50		-7.1%	
DAX		-8.8%	
Nikkei			-26.1%
MSCI Asia Pac ex Japan	-5.5%		

Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. As of 30 September 2023. Monthly data in the relevant currency (USD, EUR or JPY) is used. Global and US analyses started on 31 January 1973. Eurozone and German analyses started in December 1986. Emerging markets and Asia Pac ex-Japan analyses started in December 1987. Japan analysis started in July 2000. Global developed equities = MSCI World TR, Emerging markets equities = MSCI EM TR, US equities = S&P 500 TR, Eurozone equities = EuroSTOXX 50 TR, German equities = DAX, Japan equities = Nikkei 225 TR, Asia Pacific ex Japan equities = MSCI AC Asia Pac ex Japan TR. US Treasury = Bloomberg US Treasury TR, EUR Treasury = ICE BofA German Government TR, JPY Treasury = Bloomberg Asian-Pacific Japan Treasury TR. **Historical performance is not an indication of future performance and any investments may go down in value.**

This low or negative correlation is key to the advantages of the 60/40 portfolio. It explains why when equities are down, the likelihood is that government bonds are up or at least less down, creating a cushion for the investor. Of course, the correlation is not stable and varies significantly over time. Historically, there have been many instances where the negative correlation remained negative in the most important periods—for example, when the stock market went down, leading to fixed income cushioning the loss. However, 2022 was not such a year. In 2022, the correlation turned negative at the worst moment, leading to losses in both stocks and fixed income. We will discuss 2022 in more detail later in the paper, but this resulted from a combination of factors: negative real yields, inflation concerns and aggressive hiking by central banks.

The diversification effect between two assets with low correlation results in the volatility of the portfolio being reduced. The lower the correlation, the more the volatility is reduced. Take a simple example where equities have a volatility of 15%, and bonds have a volatility of 10%; without the diversification effect, the volatility of the 60/40 portfolio would be 13%. Assuming a correlation of 0% between the two assets, the volatility drops to 9.85%, a reduction of 3.15%.

Figure 3 exhibits this volatility reduction historically for different regions around the world. When mixing equities and bonds with a 60/40 split, we observe that this volatility reduction (versus a 60/40 portfolio that would not benefit from the low correlation) amounts to -1% in Japan and up to -1.5% in the US.

Figure 3: Average volatility reduction in a 60/40 portfolio across rolling 12-month periods

	US Treasury	EUR Treasury	JPY Treasury
MSCI World	-1.5%		
MSCI EM	-1.8%		
S&P 500	-1.5%		
Eurostoxx 50		-1.4%	
DAX		-1.5%	
Nikkei			-1.0%
MSCI Asia Pac ex Japan	-1.7%		

Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. As of 30 September 2023. Monthly data in the relevant currency (USD, EUR or JPY) is used. Global and US analyses started on 31 January 1973. Eurozone and German analyses started in December 1986. Emerging markets and Asia Pac ex-Japan analyses started in December 1987. Japan analysis started in July 2000. Global developed equities = MSCI World TR, Emerging markets equities = MSCI EM TR, US equities = S&P 500 TR, Eurozone equities = EuroSTOXX 50 TR, German equities = DAX, Japan equities = Nikkei 225 TR, Asia Pacific ex Japan equities = MSCI AC Asia Pac ex Japan TR. US Treasury = Bloomberg US Treasury TR, EUR Treasury = ICE BofA German Government TR, JPY Treasury = Bloomberg Asian-Pacific Japan Treasury TR. **Historical performance is not an indication of future performance and any investments may go down in value.**

The volatility reduction fluctuates over time depending on the volatility of the two assets and their correlation. However, it remains consistently negative. In the US, for example, the reduction oscillates between -0.5% and -5%, with an average of -1.5%.

3.15%

The volatility reduction when mixing a 15% volatility asset and a 10% volatility asset with zero correlation.

Figure 4: Rolling 12-month volatility reduction in a 60/40 portfolio in different geographies
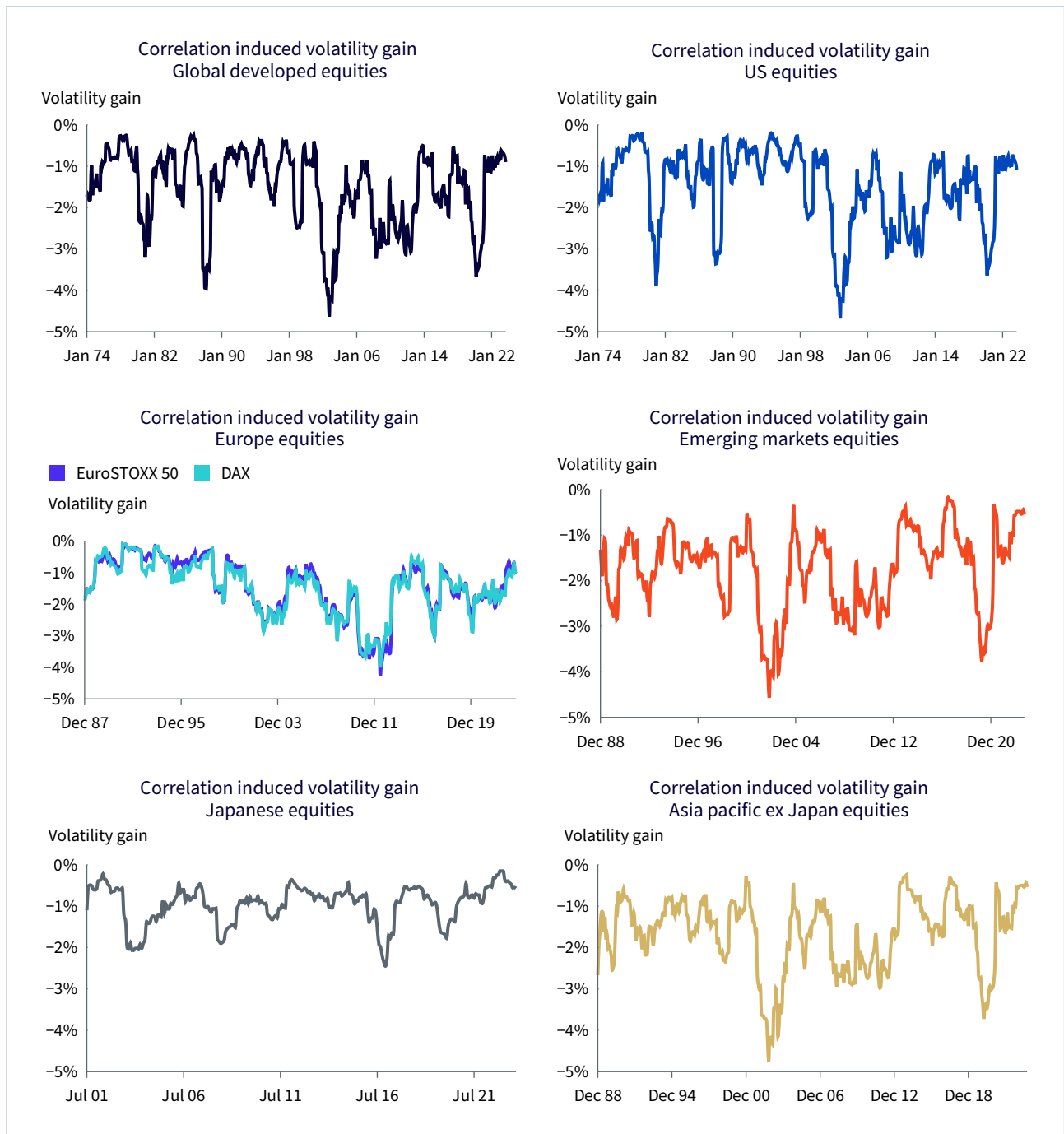

Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. As of 30 September 2023. Monthly data in the relevant currency (USD, EUR or JPY) is used. Global and US analyses started on 31 January 1973. Eurozone and German analyses started in December 1986. Emerging markets and Asia Pac ex-Japan analyses started in December 1987. Japan analysis started in July 2000. Global developed equities = MSCI World TR, Emerging markets equities = MSCI EM TR, US equities = S&P 500 TR, Eurozone equities = EuroSTOXX 50 TR, German equities = DAX, Japan equities = Nikkei 225 TR, Asia Pacific ex Japan equities = MSCI AC Asia Pac ex Japan TR. US Treasury = Bloomberg US Treasury TR, EUR Treasury = ICE BofA German Government TR, JPY Treasury = Bloomberg Asian-Pacific Japan Treasury TR. **Historical performance is not an indication of future performance and any investments may go down in value.**

Concept 1: What is the max drawdown?

It is the maximum observed loss from a peak to a trough of an asset or portfolio, before a new peak is attained. The Maximum drawdown is an indicator of downside risk.

Concept 2: What is the Sharpe ratio?

It is the difference between the annualised return of an asset minus the return of the risk-free rate divided by the asset's volatility.

Of course, the volatility is not the only metric investors care about. The Sharpe ratio and max drawdown are also important statistics. Figure 5 exhibits the long-term statistics of 60/40 portfolios around the world. We observe the same behaviour across every region:

+ The volatility and max drawdown of the 60/40 portfolios are lower than those of the equities alone.

+ The Sharpe ratios of the 60/40 portfolios are better than those of equities.

+ The returns of the 60/40 portfolios are reduced compared to the equity portfolios.

22%

On average the max drawdown of the 60/40 Portfolio is improved by 22% versus the max drawdown of equities alone.

Figure 5: Historical statistics for a 60/40 portfolio across different geographies

	Equities	Bonds	60/40 Portfolio
Global developed equities			
Annualised returns	7.7%	6.3%	7.4%
Volatility	15.1%	5.2%	9.4%
Sharpe ratio	0.22	0.36	0.33
Max drawdown	-53.6%	-17.8%	-32.7%
US equities			
Annualised returns	10.5%	6.3%	9.1%
Volatility	15.5%	5.2%	9.7%
Sharpe ratio	0.39	0.36	0.49
Max drawdown	-50.9%	-17.8%	-30.5%
European equities			
Annualised returns	6.5%	4.3%	6.1%
Volatility	18.2%	4.1%	10.9%
Sharpe ratio	0.19	0.29	0.28
Max drawdown	-60.5%	-21.7%	-36.0%
German equities			
Annualised returns	6.7%	4.3%	6.3%
Volatility	20.7%	4.1%	12.4%
Sharpe ratio	0.17	0.29	0.26
Max drawdown	-68.3%	-21.7%	-43.0%
Japanese equities			
Annualised returns	4.8%	1.3%	3.8%
Volatility	18.5%	2.1%	10.9%
Sharpe ratio	0.26	0.58	0.28
Max drawdown	-57.2%	-9.0%	-37.2%
Asia Pacific ex Japan equities			
Annualised returns	7.4%	5.0%	7.0%
Volatility	20.3%	4.6%	12.2%
Sharpe ratio	0.15	0.13	0.22
Max drawdown	-61.4%	-17.8%	-39.1%
Emerging markets equities			

Figure 5 (continued): Historical statistics for a 60/40 portfolio across different geographies

	Equities	Bonds	60/40 Portfolio
Annualised returns	8.7%	5.0%	7.9%
Volatility	22.1%	4.6%	13.2%
Sharpe ratio	0.19	0.13	0.27
Max drawdown	-61.4%	-17.8%	-38.9%

Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. As of 30 September 2023. Monthly data in the relevant currency (USD, EUR or JPY) is used. Global and US analyses started on 31 January 1973. Eurozone and German analyses started in December 1986. Emerging markets and Asia Pac ex-Japan analyses started in December 1987. Japan analysis started in July 2000. Global developed equities = MSCI World TR, Emerging markets equities = MSCI EM TR, US equities = S&P 500 TR, Eurozone equities = EuroSTOXX 50 TR, German equities = DAX, Japan equities = Nikkei 225 TR, Asia Pacific ex Japan equities = MSCI AC Asia Pac ex Japan TR. US Treasury = Bloomberg US Treasury TR, EUR Treasury = ICE BofA German Government TR, JPY Treasury = Bloomberg Asian-Pacific Japan Treasury TR. **Historical performance is not an indication of future performance and any investments may go down in value.**

By combining equity and fixed income into a single portfolio, investors can meaningfully boost the risk efficiency of the allocation, lowering the volatility and the drawdowns as well as improving the Sharpe ratio. However, those advantages tend to come at the cost of lower returns.

B. The portfolio paradox

When mixing equities and fixed income, investors are seeking capital appreciation provided by the former and risk mitigation provided by the latter. The inherent trade-off between risk and return created the foundation for the portfolio management industry. It prompted the timeless question: 'How can I grow my investments during bull markets while seeking to mitigate risk during bear markets?'

Historically, an allocation to one asset came at the expense of the other's benefits. Investors intent on growing their portfolios may be comfortable adopting more equity exposure to participate further in market rallies. But risk-averse investors dread losing investment value during a market correction and steer toward the perceived safety and income generation historically provided by fixed income. Thus, the portfolio paradox was born: equities' upside and bonds' downside risk mitigation seem fundamentally incompatible.

This incompatibility can be observed directly in portfolio mathematics. The simple formula in equation (1) drives the portfolio's return. The only way to improve on the return of the first asset (usually equities) is to add an asset with an even better return, which is very difficult since

equities are widely considered as one of the assets with the highest risk premium.

Equation (1)

$$Portfolio\ Return = w_1 R_1 + w_2 R_2$$

Where

w_1 and w_2 are the weights of the two assets in the portfolio, with

$w_1 + w_2 = 100\%$. In our case, w_1 is 60%, and w_2 is 40%.

R_1 and R_2 are the respective returns of both assets.

The portfolio's volatility is driven by the slightly more complicated formula in equation (2). Here, we note that the volatility can be decreased if the volatility of asset 2 is lower than that of asset 1 or if the correlation is below 1.

Equation (2)

$$Portfolio\ Volatility = \sqrt{(w_1^2\ \sigma_1^2 + w_2^2\ \sigma_2^2 + 2\rho w_1\ w_2\ \sigma_1\ \sigma_2)}$$

Where

σ_1 and σ_2 are the respective volatilities of both assets.
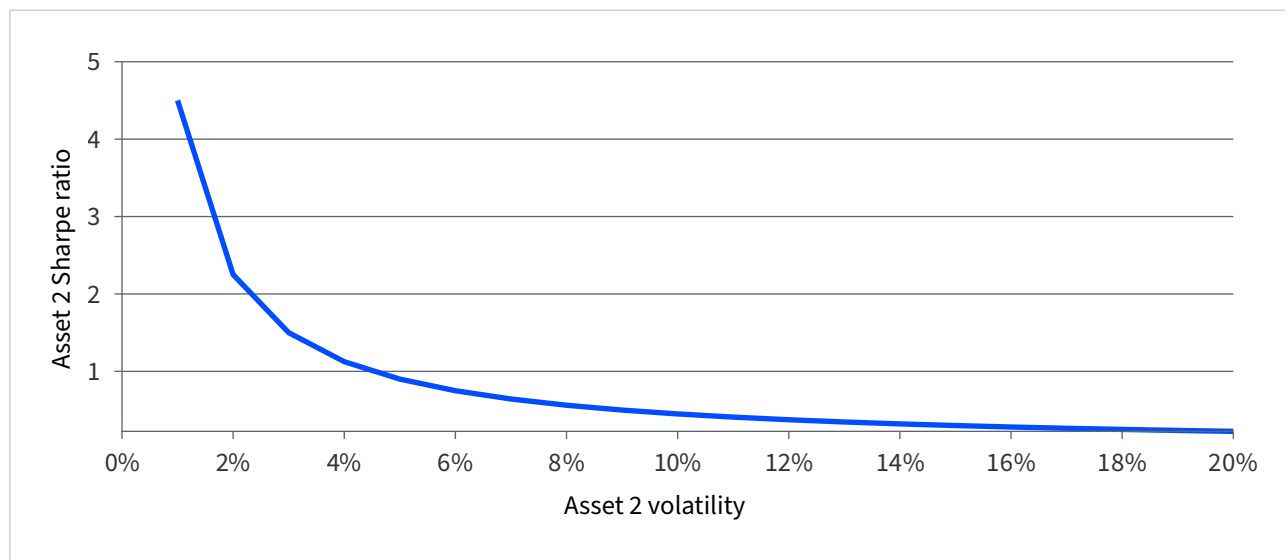
ρ is the correlation between the two assets.

So, to improve the return, volatility and Sharpe ratio of the first asset (usually equities) in a portfolio with a second asset, this second asset needs to have the same or better returns than equities, lower volatility and low correlation. This is quite a tall order.

There are a few candidates like broad commodities that could tick all the boxes, but they would have volatilities very close to equities, leading to small gains in volatility and drawdown. Of course, as in 2022, when inflationary concerns are high, commodities offer unique hedging characteristics.

The portfolio paradox was born: equities' upside and bonds' downside risk mitigation seem fundamentally incompatible.

As the volatility of asset 2 decreases, though, the likelihood of finding a suitable candidate diminishes very quickly since the required Sharpe ratio increases exponentially, as illustrated in Figure 6.

Figure 6: Minimum Sharpe ratio of asset 2 to ensure that the return of the 60/40 portfolio (between assets 1 and 2) is at least equal to asset 1

Source: WisdomTree. Assumptions: Asset 1 volatility is 15%, and the Sharpe ratio is 0.3. Cash return is 2%. The correlation between the two assets is 0.

Investors seem to face an insurmountable paradox when aiming to diversify the risk of their equity exposure: every asset addition that reduces the risk also reduces the return.

C. Cliff Asness's thought experiment: The leveraged 60/40

As with any problem, the solutions usually require out-of-the-box thinking. In our case, it requires us to start thinking about leverage. Cliff Asness, co-founder of AQR Capital, provided such a solution in December 1996 when serving as Goldman Sachs Asset Management's director of quantitative research with his paper 'Why Not 100% Equities: A Diversified Portfolio Provides More Expected Return per Unit of Risk' (Asness, Winter 1996, Volume 22 No 2). In his paper, his primary goal is to challenge the widely held belief that an all-equity portfolio is the optimal choice for maximising long-term returns. Asness argues that investors can potentially achieve competitive returns while managing risk more effectively by diversifying their portfolios with a combination of equities and bonds. Asness shows how the use of leverage, when applied to a

traditional 60/40 strategy, could achieve similar volatility to the 100% equity exposure but could help improve the return. Asness's paper, based on data from 1926 through 1993, applied a 155% leverage rate to a 60/40 portfolio (applied monthly), where the borrowing rate used for leveraging his 60/40 portfolio was done at a cost of financing by the one-month T-bill rate. Figure 7 shows the results of that analysis directly from the paper and illustrates that a levered 60/40 would exhibit the same volatility as equities over the period (20%) but with improved returns of 11.1% per annum (versus 10.3%), thus solving the portfolio paradox.

Figure 7: Foundational results from 'Why Not 100% Equities', 1926–1993

EXHIBIT 3		
Effect of leverage (%)		
Portfolio	**Compound return**	**Standard deviation**
100% Stocks	10.3	20.0
100% Bonds	5.6	6.8
60% Stocks, 40% Bonds	8.9	12.9
Levered 60/40	11.1	20.0

Stocks are represented by the S&P 500. Bonds are represented by the Ibbotson total return series for long-term corporates. The 60/40 portfolio is a combination of 60% the S&P 500 and 40% long-term corporates, rebalanced back to 60/40 every month. The levered 60/40 portfolio invests 155% each month in the 60/40 portfolio, and -55% each month in the one-month T-bill.

Source: Exhibit 3 in 'Why not 100% Equities', *The Journal of Portfolio Management*, Volume 22, Number 2. Winter 1996.

Of course, those results are almost 30 years old now, and one may consider that the world has changed and those results are obsolete. In Figure 8, we decided to update those results to include the latest data available and see if time has changed those findings or not. We observe that the results are still very similar to the original results. The levered portfolio still outperforms equities with an improved Sharpe ratio and similar volatility.

0.8%

Excess return of the Levered 60/40 Portfolio compared to equities for the same volatility.

Figure 8: Extension of the results from "Why Not 100% Equities" (Asness, 1996), 1926–2023
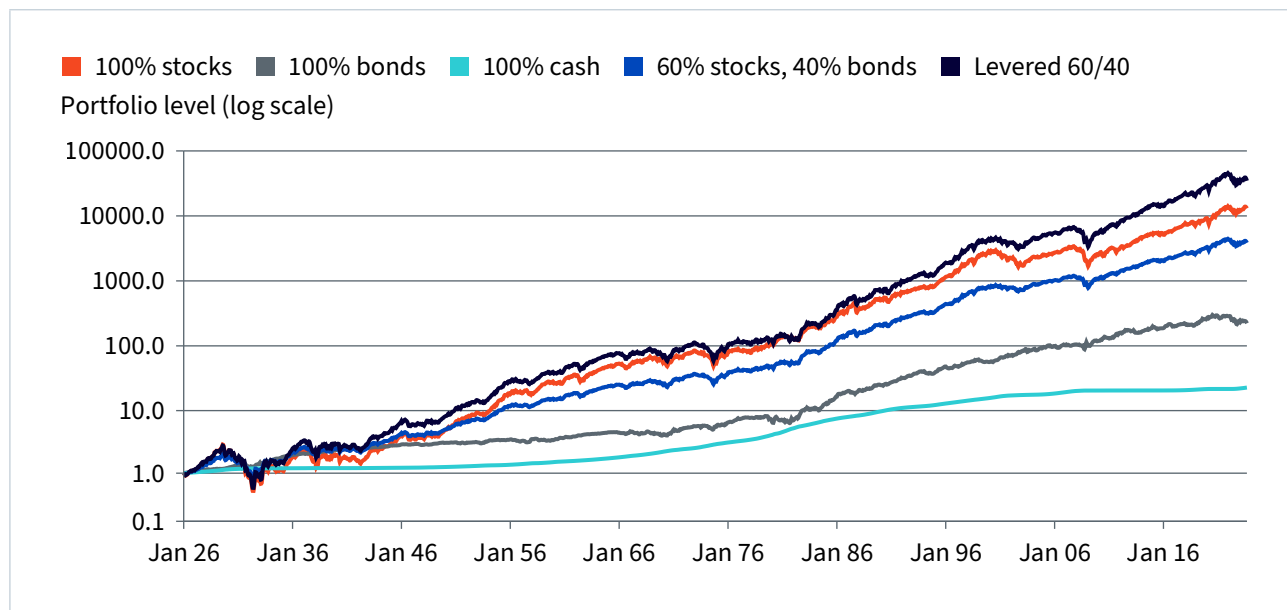
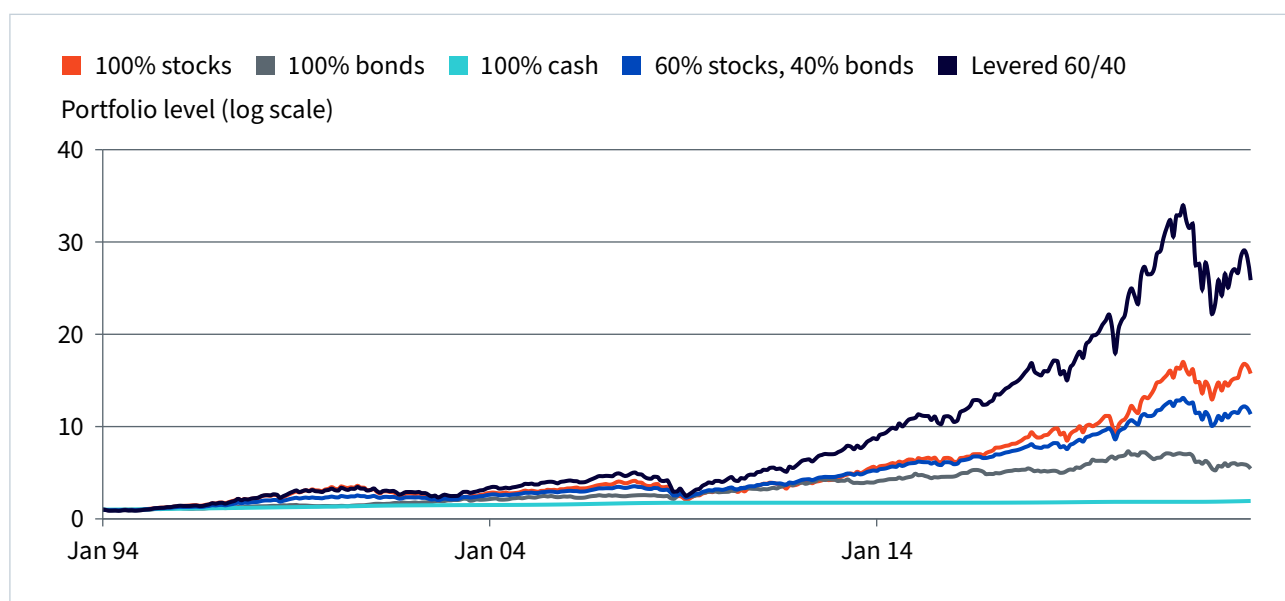|	100% stocks	100% bonds	100% cash	60% stocks, 40% bonds	Levered 60/40
Annualised returns	10.2%	5.7%	3.3%	8.8%	11.3%
Annualised volatility	18.6%	7.9%	0.9%	12.2%	18.9%
Sharpe ratio	0.37	0.31		0.46	0.43

Source: WisdomTree. December 1925 to September 2023. Monthly data in USD is used. US equities are proxied by the data series Ibbotson SBBI US Large Stock TR USD. US high investment-grade bonds are proxied by the series Ibbotson SBBI US LT Corp TR USD until February 2022. After that, the Bloomberg U.S. Long Credit Aa Total Return Index is used. Cash is proxied by the Ibbotson SBBI US 30-Day Tbill TR USD. The levered 60/40 portfolio invests 155% each month in the 60/40 portfolio and -55% each month in the cash portfolio. **Historical performance is not an indication of future performance and any investments may go down in value.**

1.9%

Excess return of the Levered 60/40 Portfolio compared to equities for similar volatility since Asness' paper.

Looking at Figure 9 at the extension only—that is, the results ex-post of Asness's theory—we observe that the results have been even stronger in this new period. The outperformance is higher, but more importantly, since the volatility of the levered portfolio is a bit higher than that of the stocks, the Sharpe ratio improvement is much bigger. The research worked better after Asness published his original results than it had in the prior 67 years. That seldom happens in the research world, where studies often 'fail to replicate' out of sample.

Figure 9: Extension only of the results from "Why Not 100% Equities" (Asness, 1996), 1993 to 2023

	100% stocks	100% bonds	100% cash	60% stocks, 40% bonds	Levered 60/40
Annualised returns	9.8%	5.9%	2.3%	8.6%	11.7%
Annualised volatility	15.2%	9.9%	0.6%	10.5%	16.4%
Sharpe ratio	0.50	0.37		0.60	0.58

Source: WisdomTree. December 1993 to September 2023. Monthly data in USD is used. US equities are proxied by the data series Ibbotson SBBI US Large Stock TR USD. US high investment-grade bonds are proxied by the series Ibbotson SBBI US LT Corp TR USD until February 2022. After that, the Bloomberg U.S. Long Credit Aa Total Return Index is used. Cash is proxied by the Ibbotson SBBI US 30-Day T-bill TR USD. The levered 60/40 portfolio invests 155% each month in the 60/40 portfolio and -55% each month in the cash portfolio. **Historical performance is not an indication of future performance and any investments may go down in value.**

We also extend the analyses to other regions to test the robustness of such results. While the history is not as deep, Figure 10 still reveals interesting results. Across all the tested regions, the returns and Sharpe ratio of the levered 60/40 portfolio exceed those of the equities alone. At the same time, the volatility is identical, and the max drawdown is reduced.

Note that we do not use a 155% leverage in all these analyses; we use the relevant leverage to match the volatility of the equities in the region. Having said that, the leverage remains very similar across regions as it oscillates between 161% for global equities and 169% for Japanese equities.

Figure 10: Leverage 60/40 in other geographies

	Equities	Bonds	60/40 Portfolio	Levered 60/40 Portfolio
European equities				
Annualised returns	6.5%	4.3%	6.1%	7.4%
Volatility	18.2%	4.1%	10.9%	18.2%
Sharpe ratio	0.19	0.29	0.28	0.24
Max drawdown	-60.5%	-21.7%	-36.0%	-57.6%
German equities				
Annualised returns	6.7%	4.3%	6.3%	7.6%
Volatility	20.7%	4.1%	12.4%	20.7%
Sharpe ratio	0.17	0.29	0.26	0.22
Max drawdown	-68.3%	-21.7%	-43.0%	-66.0%
Japanese equities				
Annualised returns	4.8%	1.3%	3.8%	5.7%
Volatility	18.5%	2.1%	10.9%	18.5%
Sharpe ratio	0.26	0.58	0.35	0.31
Max drawdown	-57.2%	-9.0%	-37.2%	-56.1%
Asia Pacific ex Japan equities				
Annualised returns	7.4%	5.0%	7.0%	8.9%
Volatility	20.3%	4.6%	12.2%	20.3%
Sharpe ratio	0.15	0.13	0.22	0.23
Max drawdown	-61.4%	-17.8%	-39.1%	-58.3%
Global developed equities				
Annualised returns	7.7%	6.3%	7.4%	8.8%
Volatility	15.1%	5.2%	9.4%	15.1%
Sharpe ratio	0.22	0.36	0.33	0.30
Max drawdown	-53.6%	-17.8%	-32.7%	-48.8%

Figure 10 (continued): Leverage 60/40 in other geographies

	Equities	Bonds	60/40 Portfolio	Levered 60/40 Portfolio
Emerging markets equities				
Annualised returns	8.7%	5.0%	7.9%	10.3%
Volatility	22.1%	4.6%	13.2%	22.1%
Sharpe ratio	0.19	0.13	0.27	0.27
Max drawdown	-61.4%	-17.8%	-38.9%	-58.7%

Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. As of 30 September 2023. Monthly data in the relevant currency (USD, EUR or JPY) is used. The levered 60/40 portfolio invests the relevant leverage each month in the 60/40 portfolio and one minus the relevant leverage each month in the cash portfolio. Global and US analyses started on 31 January 1973. Eurozone and German analyses started in December 1986. Emerging markets and Asia Pac ex-Japan analyses started in December 1987. Japan analysis started in July 2000. Global developed equities = MSCI World TR, Emerging markets equities = MSCI EM TR, Eurozone equities = EuroSTOXX 50 TR, German equities = DAX, Japan equities = Nikkei 225 TR, Asia Pacific ex Japan equities = MSCI AC Asia Pac ex Japan TR. US Treasury = Bloomberg US Treasury TR, EUR Treasury = ICE BofA German Government TR, JPY Treasury = Bloomberg Asian-Pacific Japan Treasury TR. **Historical performance is not an indication of future performance and any investments may go down in value.**

As demonstrated over time and across geographies, leveraging the 60/40 portfolio allows us to improve the return and the Sharpe ratio compared to a pure equity portfolio.

1.2%

Average excess return of the Levered 60/40 Portfolio compared to equities over different regions around the globe.

# D. Why portfolio scaling can improve the returns and Sharpe ratio of an equity position at the same time

From a theoretical point of view, the idea of focusing on the most efficient portfolio possible and leveraging it to create the most suited investment for a given investor is well anchored in financial theory. When he introduced the Modern Portfolio Theory ("MPT") in 1952, Harry Markowitz had already outlined the concept through the Capital Allocation Line (Markowitz, March 1952).

In MPT, portfolios are compared based on their returns and volatility. Every portfolio can be represented by a dot in the return-volatility space (that is, an XY graph where the X axis represents the volatility and the Y axis represents the risk through the returns). The left boundary of all possible combinations in that space is called the 'efficient frontier'. It represents for each level of volatility the portfolio with the highest return (or for every level of return) with the lowest risk. Figure 11 shows the efficient frontier for a mix of two assets: US equities and US high investment-grade bonds. Note that each portfolio on the efficient frontier is the most efficient for a given level of volatility. All portfolios are not equal and have, in fact, different Sharpe ratios. Along this efficient frontier, there is a portfolio with the highest Sharpe ratio of all, called the 'Tangential Portfolio'. This most efficient of all the efficient portfolios happens to be found where the capital allocation line 'touches' the efficient frontier. The capital allocation line is the line that is tangential to the efficient frontier and crosses the Y axis (the 0% volatility axis) at a return level equal to the risk-free rate.

When it comes to building the most efficient portfolio for a given level of volatility, investors have two choices. Without leverage, they can pick the portfolio with the highest return for that volatility level on the efficient frontier. If investors look for strategies with a volatility level equal to equities, equities are the most efficient portfolio. Considering potential leverage, the answer is quite different. With leverage, an investor can pick the portfolio with the relevant volatility level (in this case, the equity volatility) on the capital allocation line. Portfolios on this line happen to have a Sharpe ratio equal to the Sharpe ratio of the Tangential Portfolio (that is, the best Sharpe ratio of all the portfolio combinations without leverage) but with any level of volatility that may be required. We called the portfolio on the capital allocation line with the same volatility as the equity portfolio the 'Leveraged Tangential Portfolio'. This portfolio is a 'more efficient portfolio'. The return is improved by almost 2% for the same volatility, leading to the Sharpe ratio to jump from 0.25 to 0.45.

Figure 11: Modern Portfolio Theory: The efficient frontier and the capital allocation line
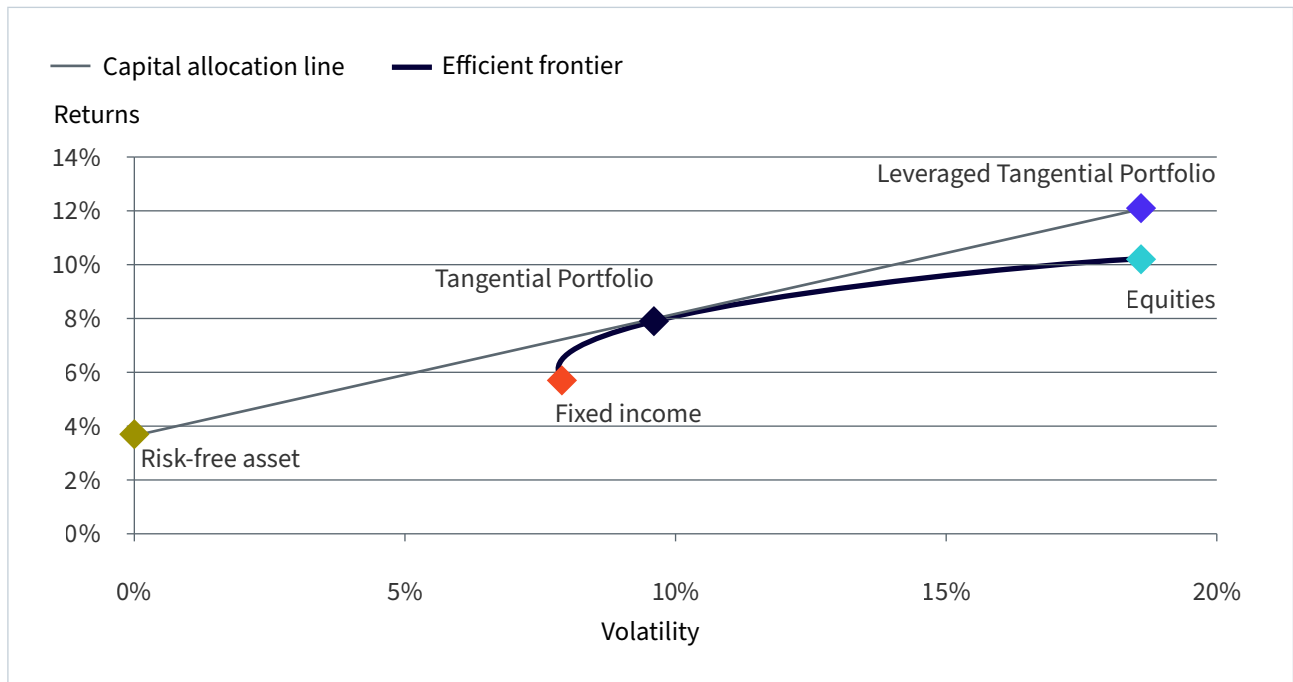
	Annualised returns	Volatility	Sharpe ratio
Equities	10.2%	18.6%	0.25
Fixed income	5.7%	7.9%	0.35
Tangential Portfolio	7.9%	9.6%	0.44
Risk-free asset	3.7%	0.0%	0.00
Leveraged Tangential Portfolio	12.1%	18.6%	0.45

Source: WisdomTree. December 1925 to September 2023. Monthly data in USD is used. US equities are proxied by the data series Ibbotson SBBI US Large Stock TR USD. US high investment-grade bonds are proxied by the series Ibbotson SBBI US LT Corp TR USD until February 2022. After that, the Bloomberg U.S. Long Credit Aa Total Return Index is used. Cash is proxied by Ibbotson SBBI US 30-Day T-bill TR USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

1.9%

Excess return of the Leveraged Tangency Portfolio versus equities.

'Diversification is the only free lunch in Finance.' Whether real or fake, H. Markowitz's quote epitomises the philosophy that underpins the 60/40 portfolio. It is also one of the main lessons from Markowitz's Nobel prize-winning work. Having said that, the second lesson has not been heeded as well: leveraging a good portfolio can make an even better portfolio.

Modern Portfolio Theory shows that leveraging a good portfolio can make an even better portfolio.

2.
WisdomTree Efficient Core: A practical example mixing leverage and diversification

In this section

Using leverage in a portfolio is more challenging risk-wise and operationally than using diversification. This is probably why many investors have been more focused on diversification than leverage when it comes to building efficient portfolios. To employ leverage in their portfolio, investors tend to face:

+ regulatory restrictions around borrowing or the use of derivatives

+ operational complexity or restrictions around borrowing money

+ operational complexity around the management of lending margin calls

+ a high cost of borrowing

Having said that, this is rapidly changing. While sophisticated investors have been using leverage in their portfolios for decades, the concept of 'portfolio scaling' is slowly gaining a larger user base. More and more turnkey solutions are available to investors which may improve their portfolios.

Concept 3: What is portfolio scaling?

It is a concept, also known as "stacking", that refers to the practice of combining multiple investment strategies or assets to generate higher returns and improve diversification.

A. Building a US equity-focused strategy: The Illustrative US Efficient Core Strategy

This chapter focuses on building efficient strategies that leverage the 60/40 portfolio using bond futures contracts to create the leverage. A bond futures overlay can add value, delivering the desired portfolio diversification without sacrificing potential equity upside.

The Illustrative US Efficient Core Strategy aims to deliver a 90% exposure to large-cap US equities and 60% to US Treasury bond futures, effectively delivering a leveraged position to the traditional 60/40 portfolio.

Figure 12: Exposure in the Illustrative US Efficient Core Strategy
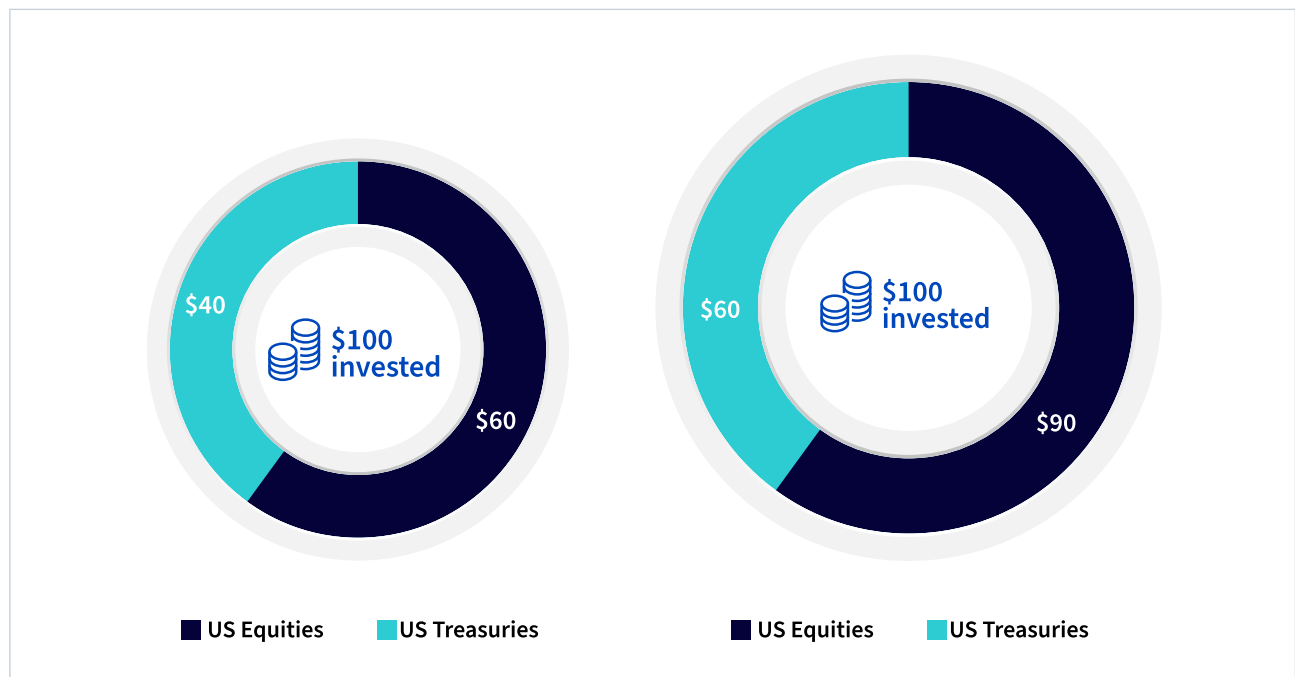
Source: WisdomTree.

The strategy is comprised of three key exposures:

+ Equity: The strategy invests 90% physically in a diversified basket of US large-capitalisation companies

+ Bond: The strategy has a 60% exposure in a diversified basket of US Treasury futures contracts

+ Cash collateral: The strategy has roughly 10% exposure in cash, which serves as collateral for the US Treasury future contracts

The equity exposure

The strategy invests 90% of its assets quarterly in the S&P 500 net total return.

The bond exposure

The strategy invests in a 60% exposure to liquid US Treasury futures contracts using the 10% of cash collateral to fund the margin account. The futures portfolio comprises an equal-weight basket of US Treasury futures contracts with maturities ranging from 2 to 30 years[1]. The index implements a 'rolling' methodology to replace the 'first near futures contract' (the front month contract) with the 'second near future contract', which occurs over a one-day rolling period every quarter.

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1   2-Year U.S. Treasury note futures, 5-Year U.S. Treasury note futures, 10-Year US Treasury note futures, 30-Year US bond futures and Ultra 10-Year U.S. Treasury note futures since launch in 2016.

The cash collateral

For the sake of the backtesting, the cash is considered to be fully invested in the Bloomberg US Treasury Bill: 1-3 Months Index.

All weights are rebalanced, and contracts are rolled every quarter on the last business day of February, May, August and November. The strategy allows intra-quarter exceptional rebalancing in case the equity/bond exposures deviate by more than 5% from the target weights.

In Figure 13, we run the backtest of the Illustrative US Efficient Core Strategy since December 1998. The results, of course, are in line with the earliest findings. The strategy outperforms a 100% equity investment by 0.9% a year, thanks to its leverage and the diversification brought upon by the bond futures. The volatility is also reduced by almost 3%. This translates into a Sharpe ratio of 0.34 compared to 0.25 for the S&P 500 alone.

Digging further into risk measures, we observe that the negative skewness and the Value at Risk are also reduced. Overall, 0.9% of outperformance is created through only a 4.3% tracking error, leading to a good information ratio of 0.22. To round up our analysis, we note that the Treynor measure is improved from 5 to 7, and the portfolio exhibits a Jensen alpha of 1.6%.

0.34

Sharpe ratio of the Illustrative US Efficient
Core Strategy versus 0.25 for S&P 500.

Concept 4: What is the Skewness of a distribution?

It refers to a statistical measure that quantifies the asymmetry in the probability distribution of returns of an asset or portfolio. It helps assess whether the distribution of returns is skewed to the left (negatively skewed), indicating more frequent and severe negative returns, or skewed to the right (positively skewed), indicating more frequent and pronounced positive returns.

Concept 5: What is the Treynor measure?

It is a financial metric that is used to evaluate the risk-adjusted performance of an investment portfolio or asset. It calculates the excess return of the portfolio or asset per unit of systematic risk (beta), typically relative to a market benchmark. The formula for the Treynor measure is:
Treynor Ratio = (Portfolio Return - Risk-Free Rate) / Portfolio Beta

Concept 6: What is Jensen's alpha?

It is a metric that calculates the excess return of a portfolio or asset compared to its expected return, taking into account its systematic risk (beta) as measured against a relevant market benchmark, such as a the S&P 500. A positive Jensen's Alpha suggests that the portfolio or asset has outperformed its expected returns, considering its level of risk, while a negative value indicates underperformance. It is calcualted as Jensen's alpha = Portfolio Return - [Risk-Free Rate + Portfolio Beta * (Market Return - Risk-Free Rate)].

Figure 13: The Illustrative US Efficient Core Strategy
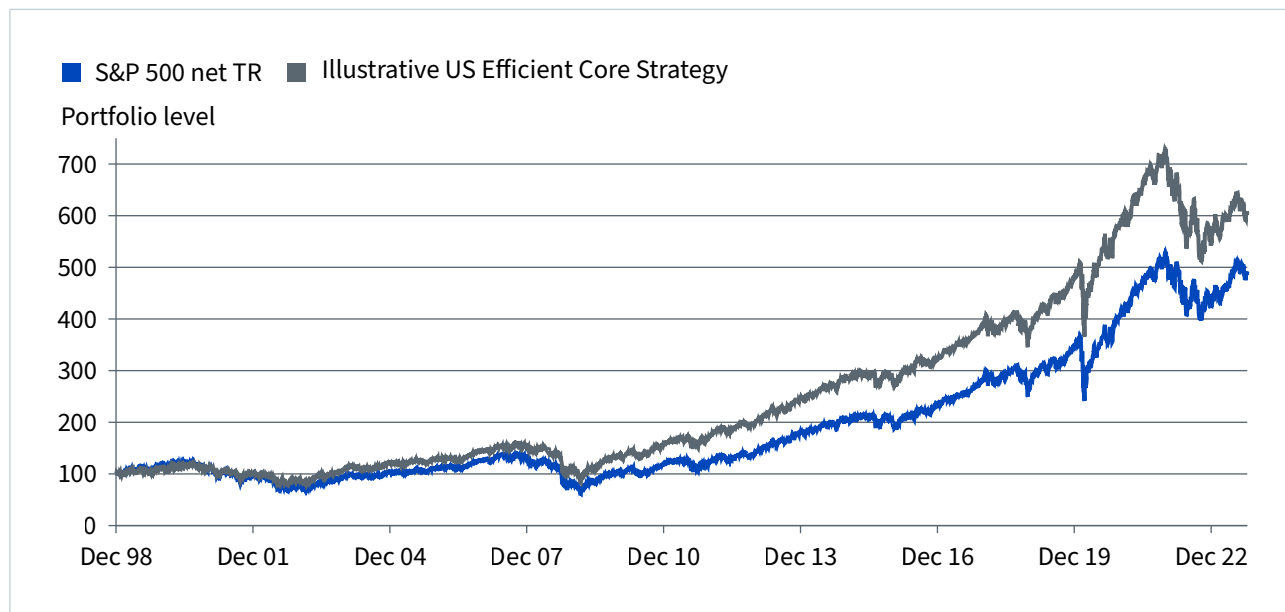
	Illustrative US Efficient Core Strategy	S&P 500 net TR
Return		
Total return	507.6%	391.4%
Total return (annualised)	7.5%	6.6%
Risk		
Standard deviation (annualised)	16.9%	19.6%
Skewness	-12.6%	-14.4%
Daily VaR 95%	-1.6%	-1.9%
Tracking error (annualised)	4.3%	
Risk return		
Sharpe ratio	0.34	0.25
Jensen alpha	1.6%	0.0%
Information ratio	0.22	
Treynor measure	6.76	4.83
Beta (ex post)	85.0%	100.0%
Correlation	98.3%	

Sources: Bloomberg, WisdomTree. From December 1998 to 17 October 2023. Daily data in USD. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Overall, by applying a thoughtful approach to asset stacking or portfolio scaling, it is possible to deliver a portfolio that outperforms equity over the long term with lower volatility and a higher Sharpe ratio.

B. Testing the Illustrative Efficient Core US Strategy: Bootstrapping results

Of course, this backtest is the result of one historical trajectory. In this section, we present an alternative framework to test the robustness of the approach using bootstrapping. The procedure is as follows: we randomly select 2,600 days (equivalent to 10 years of data) with replacement from the daily return time series for US equities, US bond futures contracts and cash. This simulation represents an investor's hypothetical situation, considering 10 years of investment within the past 25 years. We repeat this process 20,000 times.

Concept 7: What is bootstrapping?

It is a Monte Carlo simulation approach that uses existing historical data instead of generating random data. It is a technique that uses random sampling from historical returns series with replacement. It is similar to a Monte Carlo simulation, but the main difference lies in how the different series of returns used in the calculations are generated: Monte Carlo generates random data series for a specific probability distribution given its generic moments (average returns, volatility…), while the bootstrap creates random data series by resampling with replacement from the historical series of returns. In other words, bootstrapping creates new series of returns by reordering existing historical series. This makes the bootstrap samples inherit the same distribution as the original data, allowing estimation of the sampling distribution of various statistics.

For each hypothetical realisation, we can derive from the time series a new backtest for the Illustrative US Efficient Core Strategy. Subsequently, we can observe the distribution of statistics for the strategy across the 20,000 iterations.

For each iteration, we compare the annualised returns, the Sharpe ratio and the max drawdown of a 100% investment in equities and a 100% investment in the US Illustrative Efficient Core Strategy. In 95.2% of the trajectories, the Illustrative US Efficient Core Strategy exhibits a better Sharpe ratio than US equities. In 99.2%, it exhibits a better max drawdown. Therefore, from a risk and risk/return point of view, the results are extremely clear. Notably, the median for the Sharpe ratio improvement is around 0.1; that is, in 50% of the trajectories, the Sharpe ratio was improved by more than 0.1. For the max drawdown, the median is equal to 6.2%.

Looking at pure annualised returns, the Illustrative US Efficient Core Strategy exhibits better returns in 77.7% of trajectories with a median of 1.1%. While, on the face of it, the return statistics appear worse than the risk or efficiency ones, it is important to note that many active managers would love to be able to say that they outperformed in 77.7% of all 10-year periods.

99.2%

In 99.2% of the trajectories, the max drawdown of the Illustrative US Efficient Core Strategy is better than US Equities.

Figure 14: Statistics distribution across 20,000 bootstrapping iterations
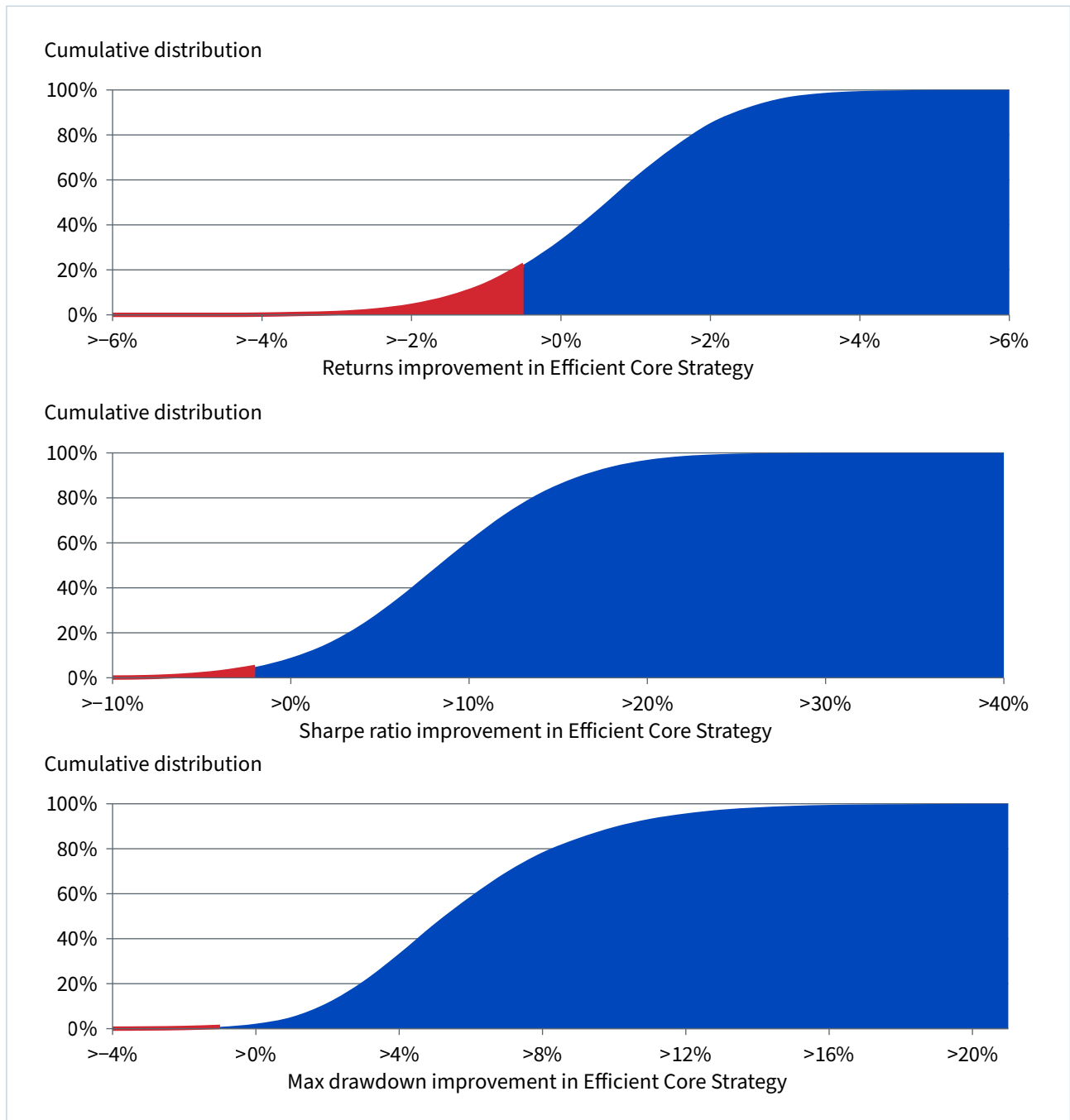
Sources: Bloomberg, WisdomTree. From December 1998 to September 2023. Daily data in USD. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Having tested Efficient Core not just on one historical trajectory but across many realistic scenarios, we proved the strategy's strong risk and efficiency credentials. The strategy also delivered strong return improvements in most trajectories, which is a nice bonus.

C. An optimal leverage analysis

In his thought experiment, Cliff Asness chose a leverage of 1.5 to match the leveraged balanced portfolio's volatility with the same volatility as the equity portfolio. This was instrumental in making the point for an investment not solely in equities. However, when considering a leveraged portfolio on a standalone basis, one could ask, 'Why stop at 1.5x leverage?'

The return on a leveraged investment is a nonlinear function. Up to a certain level, leverage can increase an investment's return. Still, beyond that point, it can be detrimental because a small drawdown combined with the leverage can lead to a complete wipeout of the portfolio and the impossibility of regaining losses.

Figure 15 analyses how the S&P 500 (light blue line) reacts to increased leverage. At zero leverage, we hold no S&P 500, and the return is the cash return. Moving to the right, we increase the S&P 500 weight to 1, where we are fully invested in the index. At this point, the final index value is simply the dollar amount an investor would get at the end of their investment by investing US$1 in the S&P on 30/04/1994, roughly US$20 at the end of the period (until 31/08/2023), which is when the light blue line crosses the dashed vertical line (no leverage). By investing US$1 in the NASDAQ 100, an investor would end up with approximately US$61 and approximately US$11 by investing US$1 in a 60/40 portfolio.

We note that:

+ The final value of the investment increases with the leverage until it reaches a maximum. (The maximum is hit for the S&P at roughly 3.2x leverage, for the balanced portfolio at roughly 6x).

+ The maximum leverage for the balanced portfolio is higher than for equities. Indeed, the maximum leverage is a function of the volatility/max drawdown of the asset. The less volatile an asset is, the more it can be leveraged.

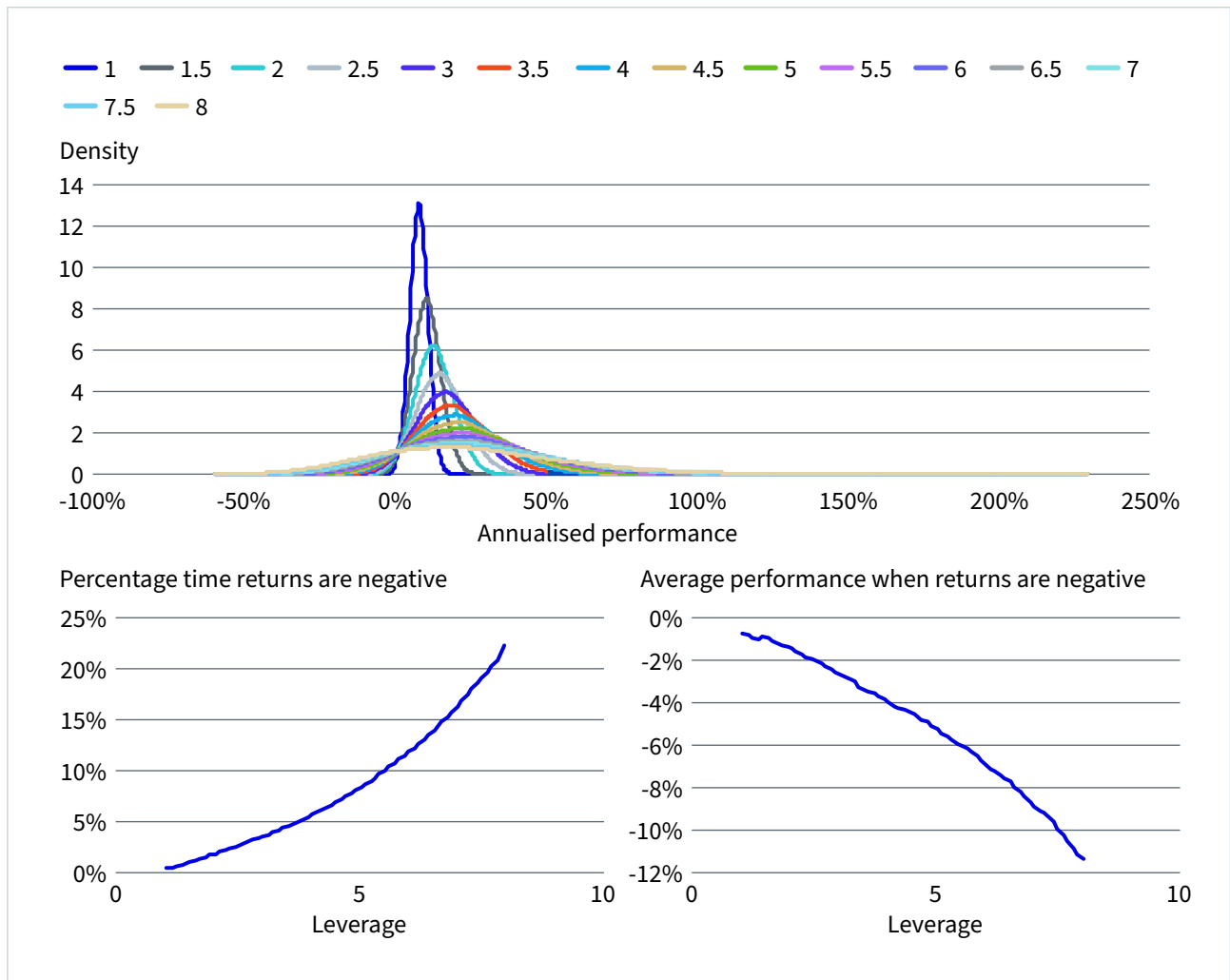## Figure 15: Leverage and total return for different assets
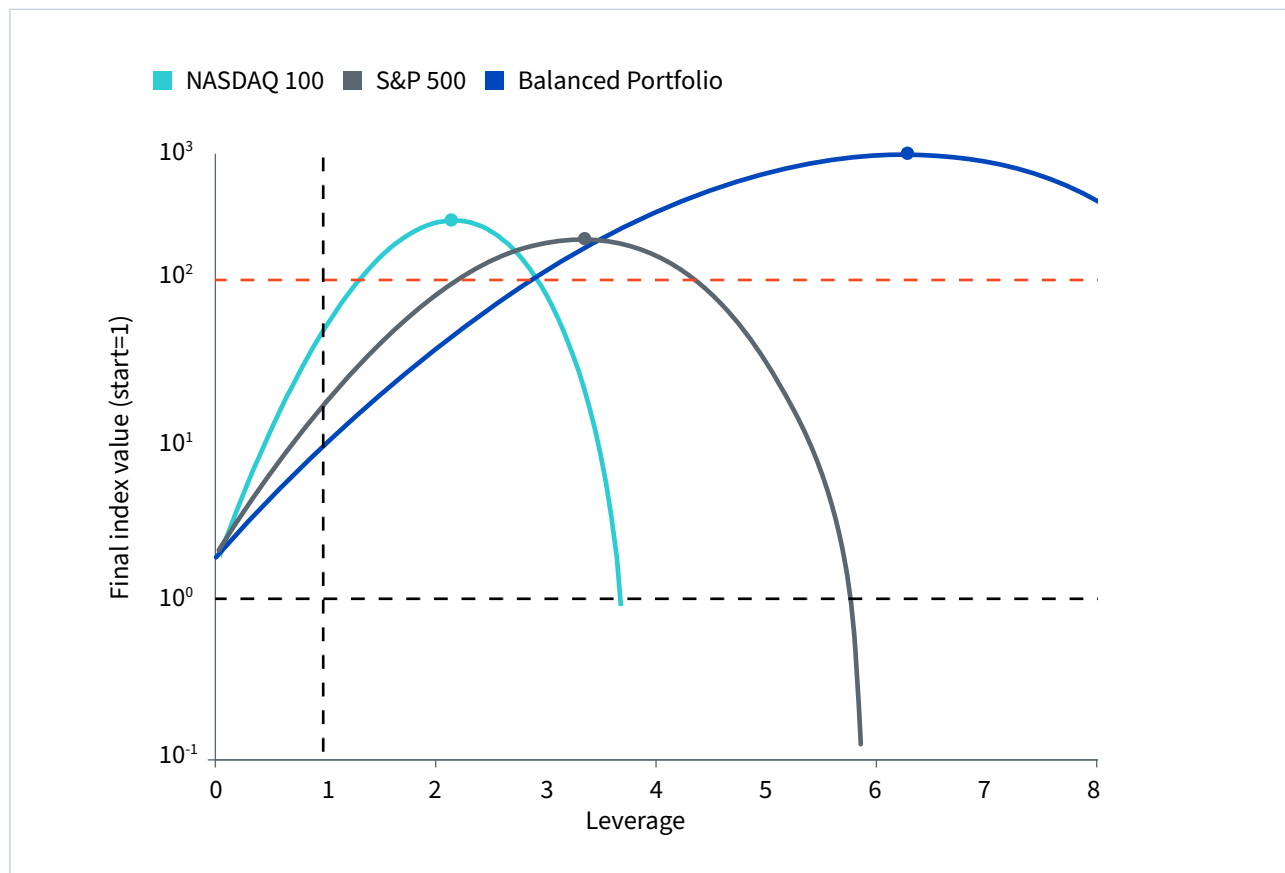
Sources: WisdomTree, Bloomberg. From 30/04/1994 to 30/09/2023, using monthly data. The numbers are computed using the gross total return indices. **Historical performance is not an indication of future performance and any investments may go down in value.**

Therefore, one could conclude that the optimal leverage for the 60/40 is not 1.5 but roughly 6. That would be forgetting the risk of the investment being wiped out over the period. Let's consider the orange horizontal line when it crosses the S&P 500 parabola. A leverage of 2 and a leverage of 5 yield roughly the same return but employing a leverage of 2 is intuitively a much safer choice. It's clear then that it's better to stay on the left 'branch' of the parabola.

To assess the level of risk for each level of leverage, we employ bootstrapping once again. We select 120 months (equivalent to 10 years of data) with replacement from the monthly return time series 20,000 times, and we analyse the results. That way, we get a distribution of returns across all the bootstrap realisations for any given level of leverage.

Figure 16: Distribution of returns in the bootstrapping analysis depending on the leverage applied to the 60/40 portfolio

Sources: WisdomTree, Bloomberg. From 30/04/1994 to 30/09/2023, using monthly data. The numbers are computed using the gross total return indices. **Historical performance is not an indication of future performance and any investments may go down in value.**

Figure 16 shows the return distribution for a range of leverage, from 1 (fully invested in a balanced portfolio) to 8, from light blue to pink. With no leverage, the return is concentrated at an approximate 8% annualised return. As we increase the leverage, the distribution shifts to the right, but the left tail also fattens significantly. In the two sub-charts, we can analyse the outcome even further. On the left, we see that as we increase the leverage, the percentage of realisations with negative returns increases very quickly. (This corresponds to the area under the distributions to the left of the zero dashed vertical line). We are essentially trading a higher expected return for an increased probability of poor performance. But how poor? We see the investment's annualised return on the right, given that it has been negative. For a leverage of 4.5, roughly 10% of the realisations yielded a negative return, and this return has been approximately -6% annualised (given that it was negative).

Of course, there is no correct answer to determine the right amount of leverage; that depends on each investor's level of risk aversion. However, being positioned in a range between 1.5x and 2x allows for increased returns without incurring excessive risks.

D. Looking at other geographies

Another way used by academics to test the robustness of the strategy on top of looking at different periods of bootstrapping is to look at the consistency of returns across different markets. In this section, we build four different strategies using the same principles as for the Illustrative US Efficient Core Strategy:

+ **The Illustrative Global Efficient Core Strategy**

   The equity exposure used for this strategy is the MSCI World Net TR Index. The fixed income and cash exposure are the same as in the Illustrative US Efficient Core Strategy.

+ **The Illustrative Europe Efficient Core Strategy**

   The equity exposure used for this strategy is the Europe STOXX 600 net TR Index. The fixed income exposure comprises an equal-weight portfolio between three euro-denominated contracts: the Euro Schatz contract, the Euro Bobl contract and the Euro Bund contract.

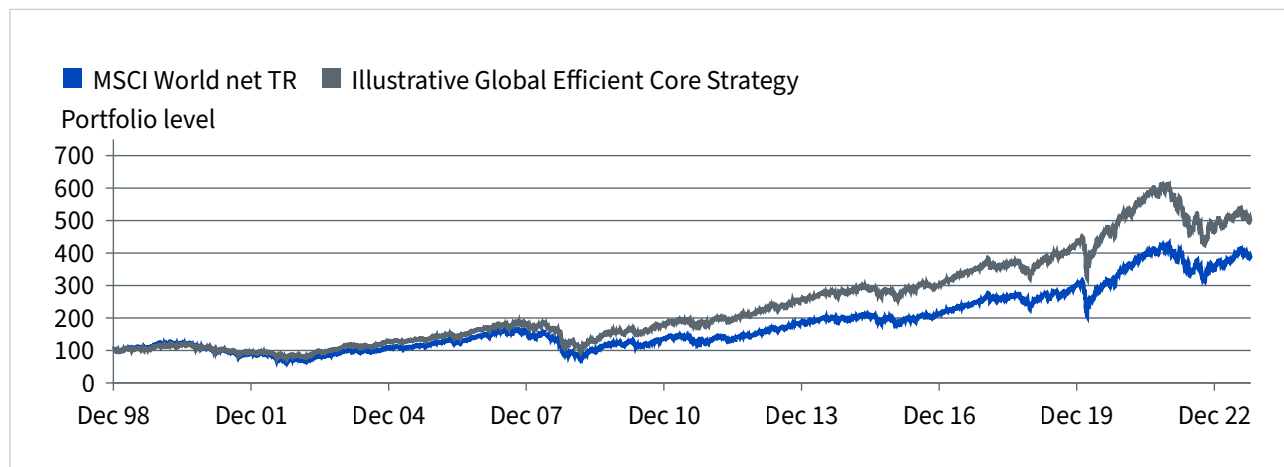+ **The Illustrative Japan Efficient Core Strategy**

   The equity exposure used for this strategy is the Nikkei 225 net TR Index. The fixed income exposure comprises an equal-weight portfolio between two yen-denominated contracts: the Japan Government 5Y Bond contract and the Japan Government 10Y Bond contract.

+ **The Illustrative Emerging Markets Efficient Core Strategy**

   The equity exposure used for this strategy is the MSCI Emerging Markets net TR Index. The fixed income and cash exposure are the same as in the Illustrative US Efficient Core Strategy.

Across the four new strategies, we observe very similar results and effects. Figure 17 exhibits the statistics for the Illustrative Global Efficient Core Strategy. We observe that the volatility is lowered by 2.3% annually while returns are higher by 1% annually. This leads to a Sharpe ratio of 0.35 an improvement of 0.12 compared to a 100% equity exposure. The remaining stats are also improved across the board.

Figure 17: The Illustrative Global Efficient Core Strategy

	Illustrative Global Efficient Core Strategy	MSCI World net TR
Return		
Total return	404.2%	291.4%
Total return (annualised)	6.7%	5.7%
Risk		
Standard deviation (annualised)	14.2%	16.5%
Skewness	-37.0%	-39.7%
Daily VaR 95%	-1.3%	-1.6%
Tracking error (annualised)	4.0%	
Risk return		
Sharpe ratio	0.35	0.23
Jensen alpha	1.7%	0.0%
Information ratio	0.27	
Treynor measure	5.87	3.86
Beta (ex post)	84.2%	100.0%
Correlation	97.6%	

Sources: Bloomberg, WisdomTree. From December 1998 to 17 October 2023. Daily data in USD. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

0.35

Sharpe ratio of the Illustrative Global Efficient Core Strategy versus 0.23 for MSCI World.

Figure 18 illustrates the same results for the Illustrative Europe Efficient Core Strategy. The volatility is lowered by 2.5%, the returns are up 0.8% and the Sharpe ratio rises from 0.17 to 0.25. Overall, risks are down across all measures, and efficiency is up.

Figure 18: The Illustrative Europe Efficient Core Strategy
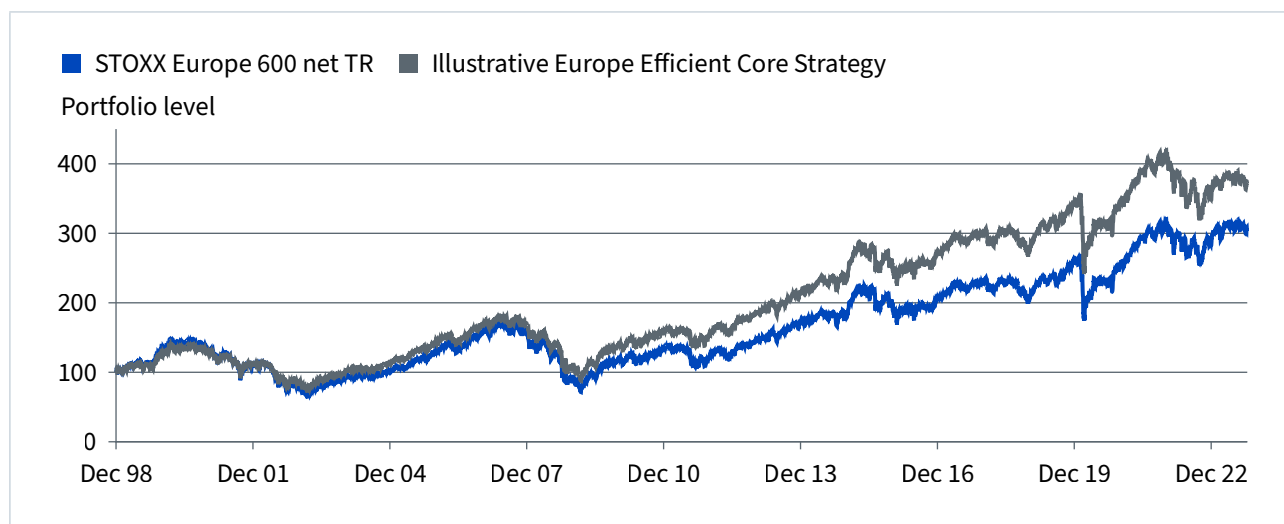
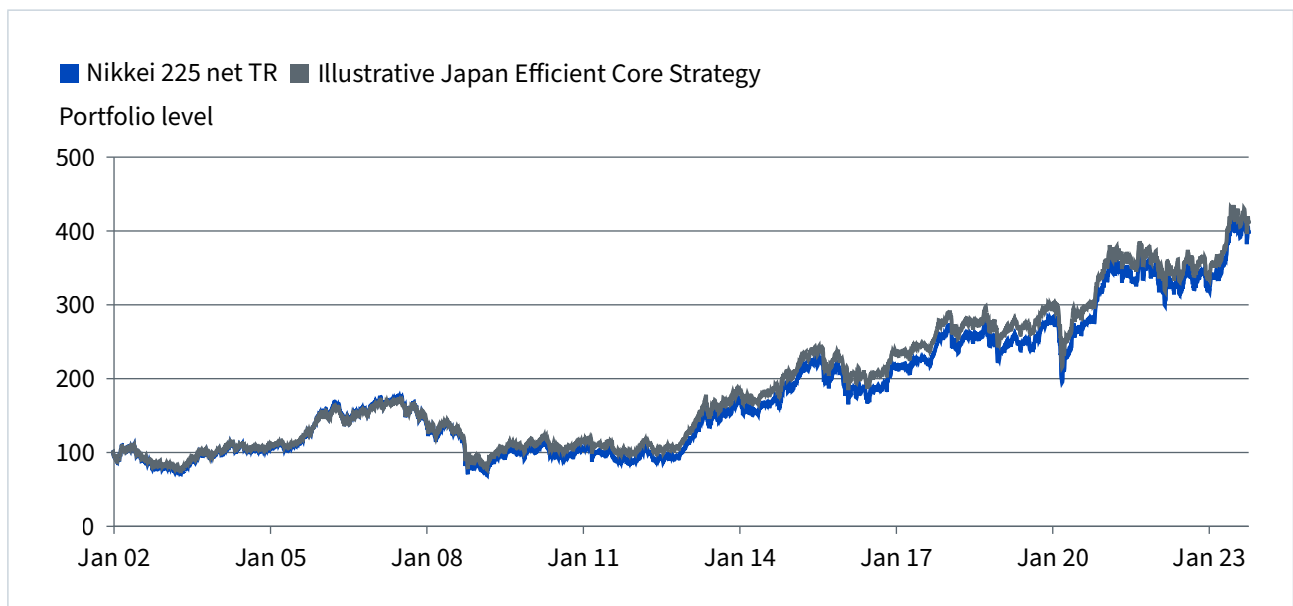|	Illustrative Europe Efficient Core Strategy	STOXX Europe 600 net TR
Return		
Total return	272.2%	206.2%
Total return (annualised)	5.4%	4.6%
Risk		
Standard deviation (annualised)	16.5%	19.0%
Skewness	-24.6%	-21.3%
Daily VaR 95%	-1.6%	-1.9%
Tracking error (annualised)	3.2%	
Risk return		
Sharpe ratio	0.25	0.17
Jensen alpha	1.3%	0.0%
Information ratio	0.25	
Treynor measure	4.69	3.22
Beta (ex post)	86.2%	100.0%
Correlation	99.3%	

Sources: Bloomberg, WisdomTree. From December 1998 to 17 October 2023. Daily data in EUR. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

0.25

Sharpe ratio of the Illustrative Europe Efficient Core Strategy versus 0.17 for Europe STOXX 600.

Japan is, of course, a bit different, having had only a low interest rate over the full period. With such low interest rates, the 'cushioning effect' of the bonds is more limited. Yet the Sharpe ratio has improved from 0.29 to 0.33, and the risk measure has decreased. The return of the Illustrative Japan Efficient Core Strategy is also up 0.1%. The tracking error is also smaller, with 2.7% instead of 4% for most of the other simulations.

Figure 19: The Illustrative Japan Efficient Core Strategy

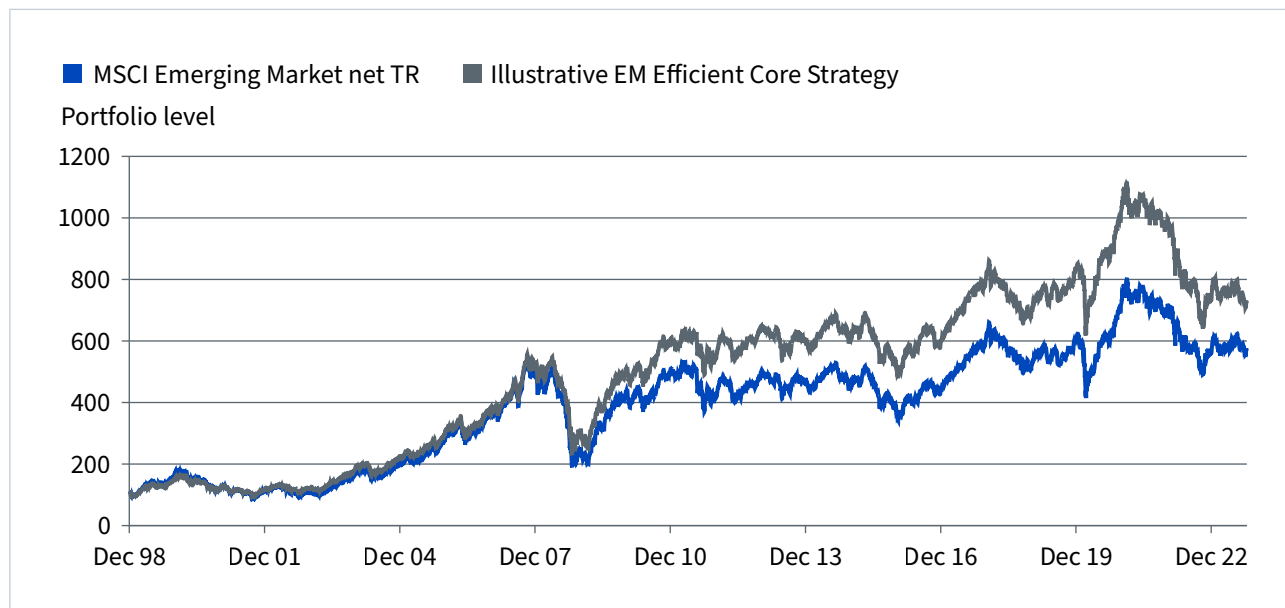|	Illustrative Japan Efficient Core Strategy	Nikkei 225 net TR
Return		
Total return	314.4%	301.1%
Total return (annualised)	6.7%	6.6%
Risk		
Standard deviation (annualised)	20.2%	22.7%
Skewness	-21.7%	-22.4%
Daily VaR 95%	-2.0%	-2.2%
Tracking error (annualised)	2.7%	
Risk return		
Sharpe ratio	0.33	0.29
Jensen alpha	0.9%	0.0%
Information ratio	0.06	
Treynor measure	7.57	6.55
Beta (ex post)	88.7%	100.0%
Correlation	99.9%	

Sources: Bloomberg, WisdomTree. From January 2002 to 17 October 2023. Daily data in JPY. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Finally, we observe these very robust results in emerging markets, with the volatility decreasing 2.3% and the Sharpe ratio gaining 0.1 to 0.39. Returns are also improved by 1.1%.

0.33

Sharpe ratio of the Illustrative Japan Efficient Core Strategy versus 0.29 for Nikkei 225.

Figure 20: The Illustrative Emerging Markets Efficient Core Strategy

	Illustrative EM Efficient Core Strategy	MSCI EM net TR
Return		
Total return	620.2%	466.2%
Total return (annualised)	8.3%	7.2%
Risk		
Standard deviation (annualised)	16.6%	18.9%
Skewness	-44.4%	-47.8%
Daily VaR 95%	-1.6%	-1.8%
Tracking error (annualised)	4.1%	
Risk return		
Sharpe ratio	0.39	0.29
Jensen alpha	1.8%	0.0%
Information ratio	0.26	
Treynor measure	7.52	5.44
Beta (ex post)	86.3%	100.0%
Correlation	98.2%	

Sources: Bloomberg, WisdomTree. From December 1998 to 17 October 2023. Daily data in USD. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

0.39

Sharpe ratio of the Illustrative EM Efficient Core Strategy versus 0.29 for MSCI EM.

Overall, Efficient Core strategies have proved robust across time and geographies, leading to our strong conviction that they can be used in multi-asset portfolio allocation. Leveraging a 60/40 portfolio gives investors a tool to enhance their equity return by improving the efficiency of that building block, limit drawdowns by reducing the risk in the riskiest investment and improve the capital efficiency of their portfolios to create space for more diversifiers and alternative assets.
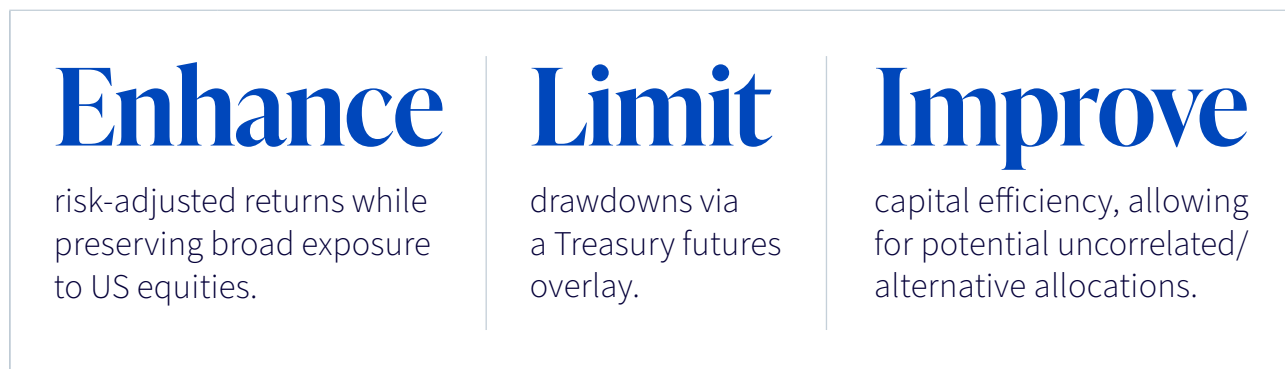
3.

How to use the Efficient Core concept in portfolios

In this section

A leveraged approach to the 60/40 can be used to create more optimal portfolio blends and magnify portfolio exposures through the same concept that drives asset allocation. Those strategies have the potential to enhance total returns while smoothing out volatility and reducing drawdown.

Figure 21: The characteristics of the Illustrative US Efficient Core Strategy

Enhance | Limit | Improve

risk-adjusted returns while preserving broad exposure to US equities.

drawdowns via a Treasury futures overlay.

capital efficiency, allowing for potential uncorrelated/ alternative allocations.

Efficient Core strategies can, therefore, be used widely in investors' multi-asset portfolios as:

An equity replacement

A core equity solution designed to replace existing core equity exposures. By offering return enhancement, improved risk management and diversification potential compared to a 100% equity portfolio, this strategy can also be used to complement existing equity exposures.
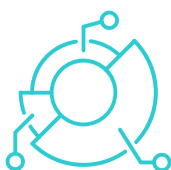
A capital efficiency tool

By delivering equity and bond exposure in a capital-efficient manner, those strategies can help free up space in the portfolio for alternatives and diversifiers. Allocating 10% of a portfolio to this strategy, investors get 9% exposure to US equities and 6% exposure to US Treasuries. This could allow investors to divest 6% from existing fixed income exposures and invest that in alternative assets (such as broad commodities, gold, carbon or other assets). This could be achieved without losing the diversifying benefits of their fixed income exposure.

A. A large-cap equity replacement

By delivering the same level of volatility with better returns and a higher Sharpe ratio in many market cycles, an Efficient Core strategy can be used to replace an equity position, whether a passive or an active one.

1. A replacement for passive trackers

Figure 22 shows the change in volatility and returns between a straight exposure in equities and an Efficient Core approach. In each region, the volatility is lowered, and the return is improved over the period, leading to a more efficient portfolio with a higher Sharpe ratio.

Efficient Core strategies can be used in multi-asset portfolios as Equity replacement or as a capital efficiency tool.

Figure 22: Higher returns and lower volatility across all the regions

Annualised returns
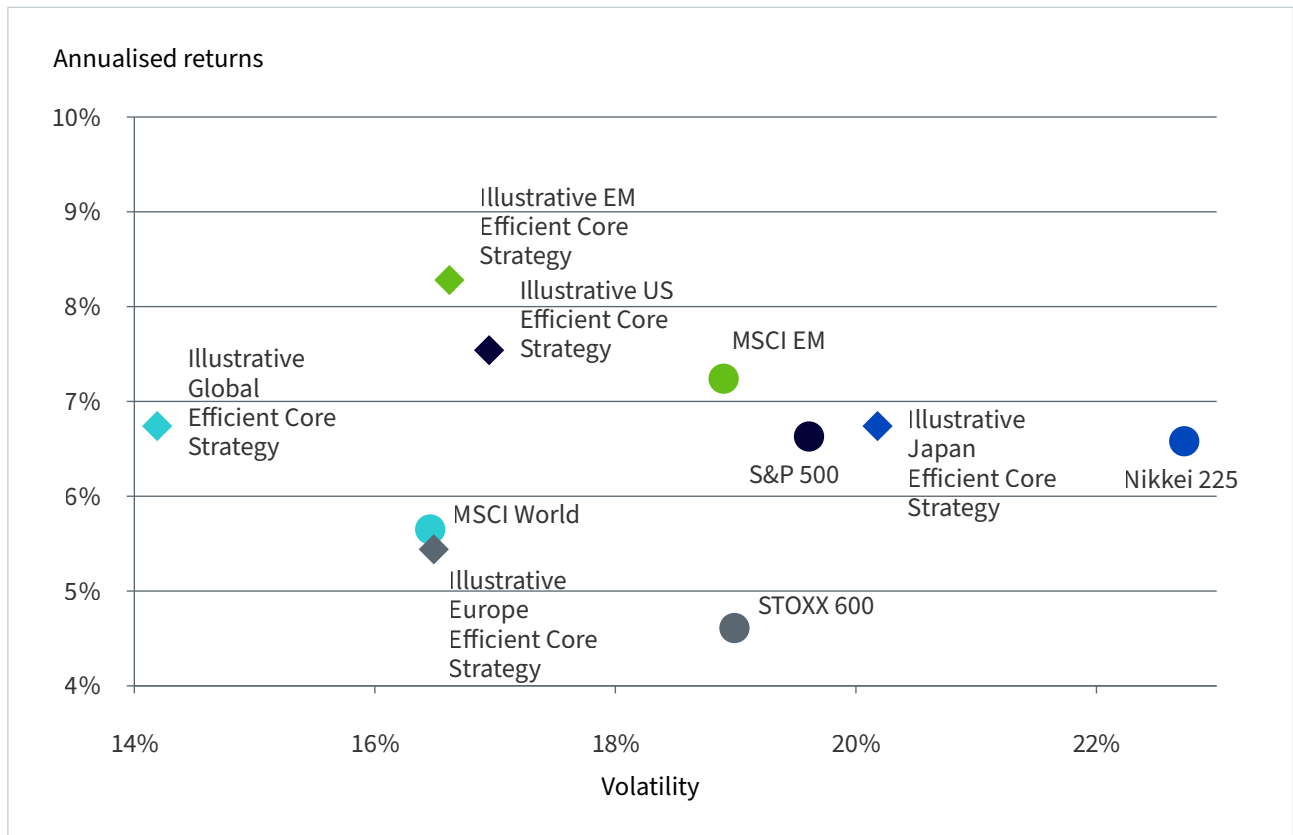
Sources: Morningstar Ibbotson, Bloomberg, WisdomTree. As of 17 October 2023. Daily data in the relevant currency (USD, EUR or JPY) is used. All analyses start on 31 December 1998 except for Japan, which starts in January 2002. Equity indices are net total returns. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Clearly, Efficient Core strategies can be very efficient replacements for passive or index equities exposure with higher return and lower volatility historically across many world and regional exposures.

## 2.   A replacement for actively managed strategies

The next question is whether an Efficient Core strategy can replace an actively managed strategy since it delivers better returns and lower volatility. In Figure 23, we compare the performance of the Illustrative US Efficient Core Strategy with all the exchange-traded funds (ETFs) and mutual funds domiciled in Europe that track US equities and have at least a five-year track record. This includes 647 ETFs and funds in the Morningstar US Large Cap Value peer group, the Morningstar US Large Cap Blend peer group, the Morningstar US Large Cap Growth peer group and the Morningstar US Equity Income peer group. To make this a fair comparison, we include a total expense ratio (TER) of 20 basis points (bps) in the strategy.

The Illustrative US Efficient Core Strategy beats 426 of those 635 funds and ETFs. The strategy is, therefore, in the top 33% when including 20 bps TER in our backtest. Furthermore, it has a better Sharpe than around half of the funds.

33%

Illustrative US Efficient Core is among the 33% best
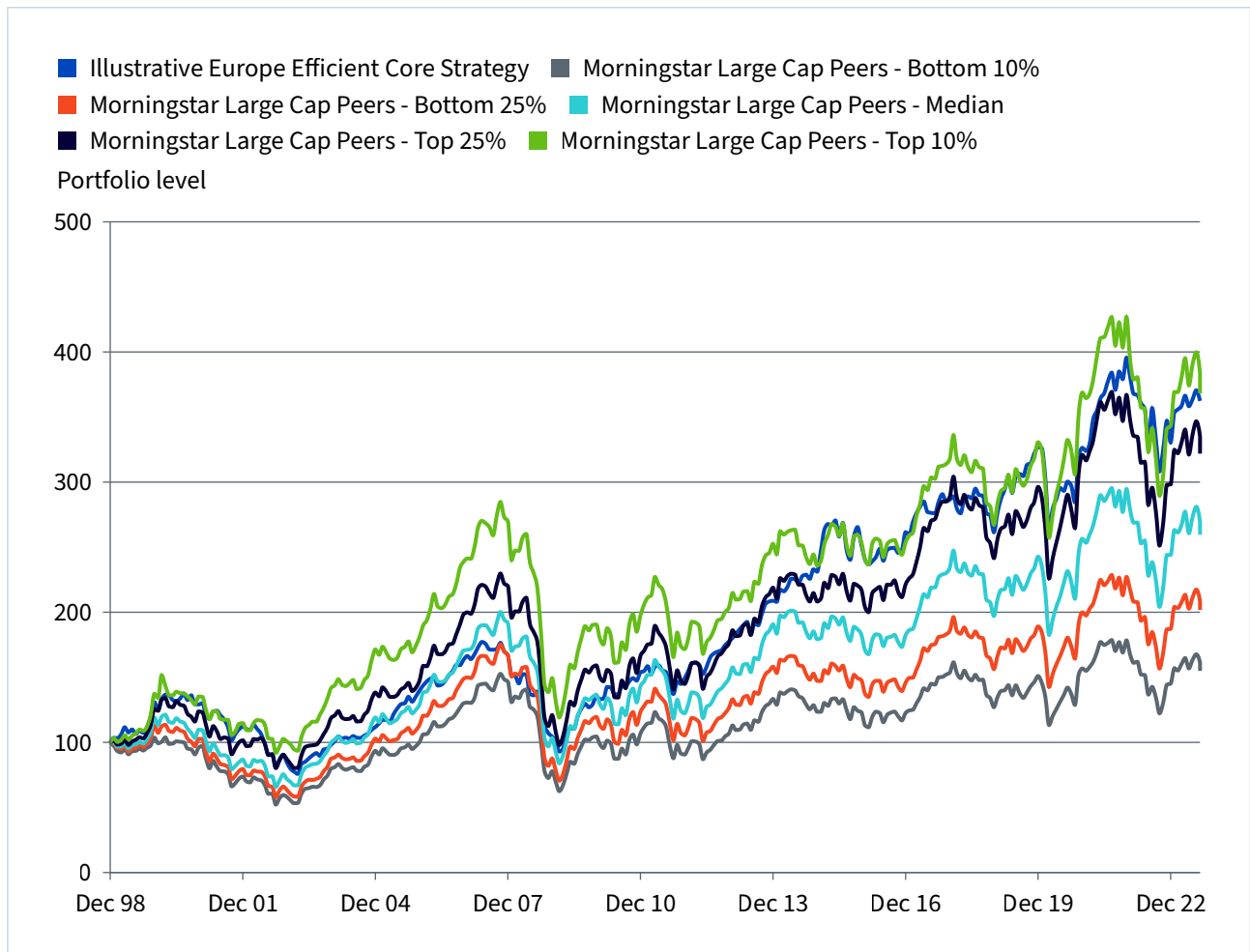US Equity Funds and ETFs.

Figure 23: US Efficient Core versus all passive and active funds in Morningstar US Large Cap peer groups (Value, Blend, Growth, Equity Income)
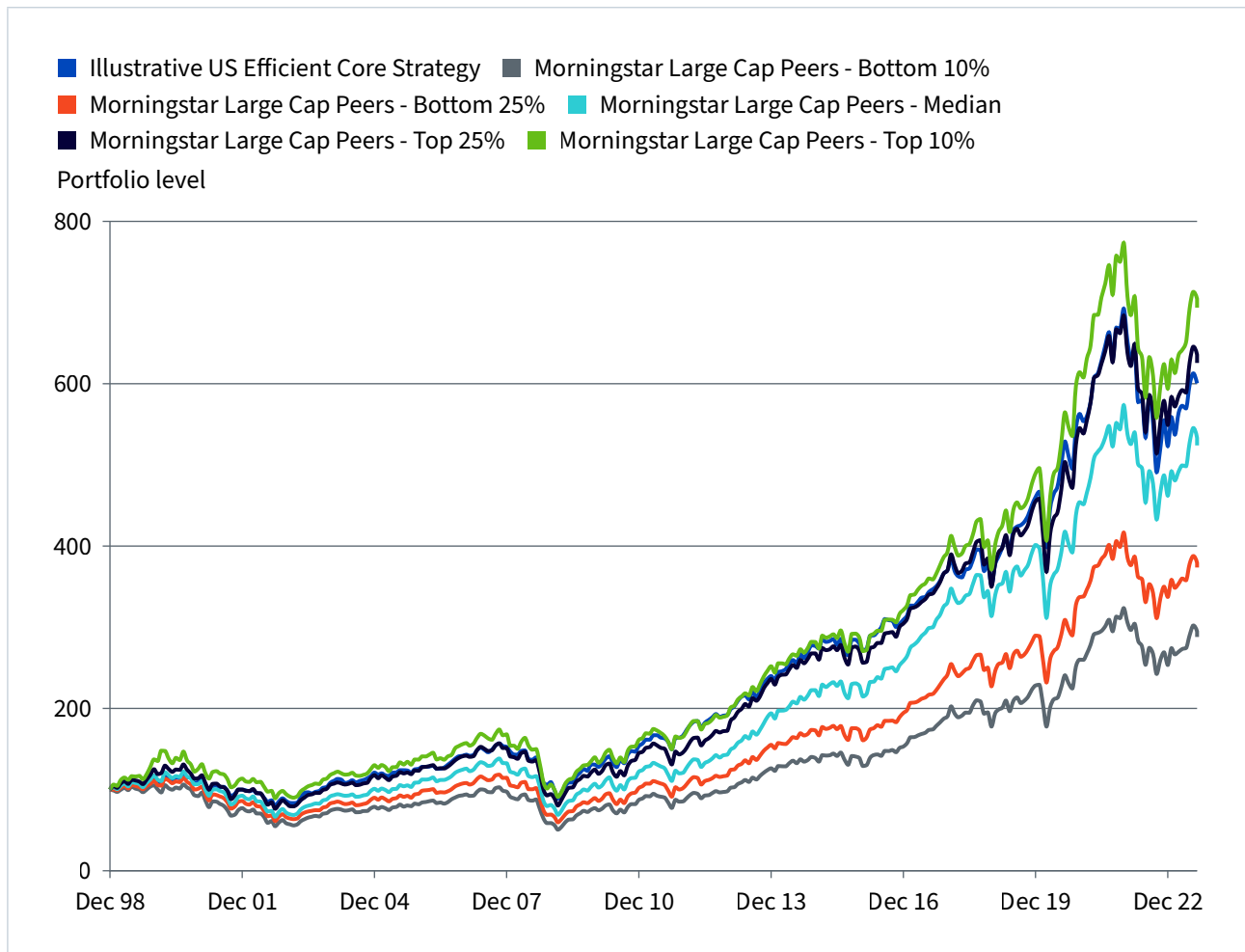
Sources: Morningstar, WisdomTree. December 1998 to September 2023. In USD. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

We know that the US is a difficult market for active managers and that most fail to outperform the market. So, we decided to look at other geographies as well. We ran the same analysis in Europe and found 713 ETFs and funds with a five-year track record or more in the four Morningstar Europe Large Cap peer groups. Overall, the Illustrative Europe Efficient Core Strategy beat 629 of them. The strategy is in the top 12% among all those competing strategies. So, this works even better than in US equities.

Figure 24: Europe Efficient Core versus all passive and active funds in Morningstar Europe Large Cap peer groups (Value, Blend, Growth, Equity Income)

Legend:
- Illustrative Europe Efficient Core Strategy
- Morningstar Large Cap Peers - Bottom 10%
- Morningstar Large Cap Peers - Bottom 25%
- Morningstar Large Cap Peers - Median
- Morningstar Large Cap Peers - Top 25%
- Morningstar Large Cap Peers - Top 10%

Sources: Morningstar, WisdomTree. December 1998 to September 2023. In EUR. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

In emerging markets, results are similar. The Illustrative Emerging Markets Efficient Core Strategy beats 337 out of 521 funds and ETFs, meaning that the strategy would be in the top 35% of all active and passive funds. Interestingly, the strategy has a better Sharpe ratio than 98% of all the funds in the peer groups.

Figure 25: Emerging Markets Efficient Core versus all passive and active funds in Morningstar Emerging Markets Large Cap Peer Group
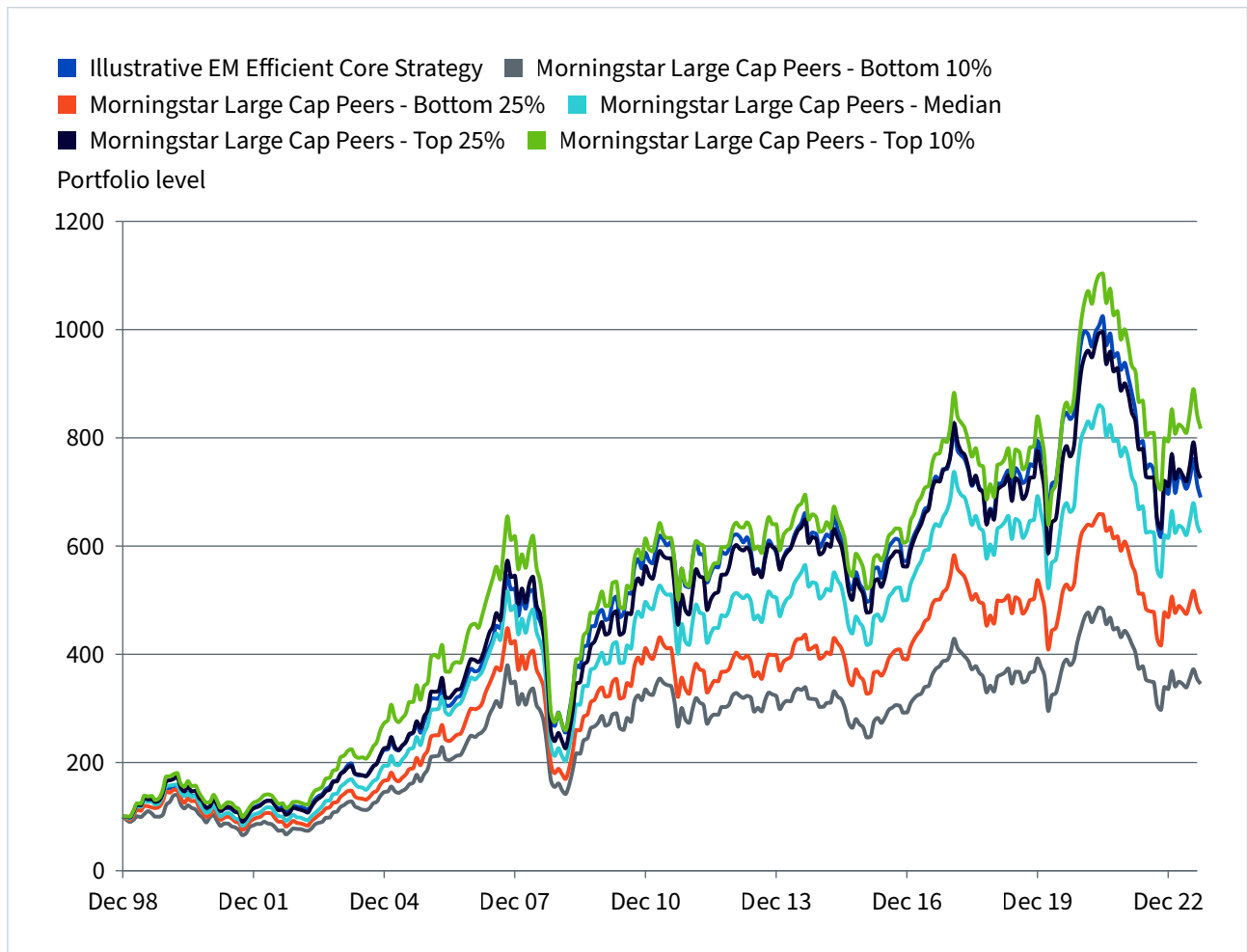
Sources: Morningstar, WisdomTree. December 1998 to September 2023. In USD. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Overall, the Efficient Core strategies compare very positively versus active managers in the different regions. They deliver lower volatility and better returns than the benchmark but also feature in the top third of the peer groups with interesting Sharpe ratios.

3.   A low-risk approach

One of the interesting features of the Efficient Core strategies is their capacity to lower daily risk (that is, lower the volatility) but also to limit the overall risk (that is, lower the max drawdown and Value at Risk).

Looking at the recent and less recent market drawdowns, in Figure 26, we observe that during the dot-com drawdown in 2000, the financial crisis in 2008 and the COVID-19 drawdown in 2020, all the Efficient Core strategies cushioned the equity loss, reducing the max drawdown by up to 13%. This is key for long-term investors, as large drawdowns take a long time to overcome.

Taking the example of US equities in 2000, an investor would have lost -51%. This means that their portfolio would need to grow by 104% in the subsequent year just to come back to the initial value. It is a long time lost to recover losses. Having invested in the Illustrative US Efficient Core Strategy, the same investor would have lost only -38%, meaning that a 61% rebound would have been sufficient to recover from this reduced drawdown. Quite a big difference!
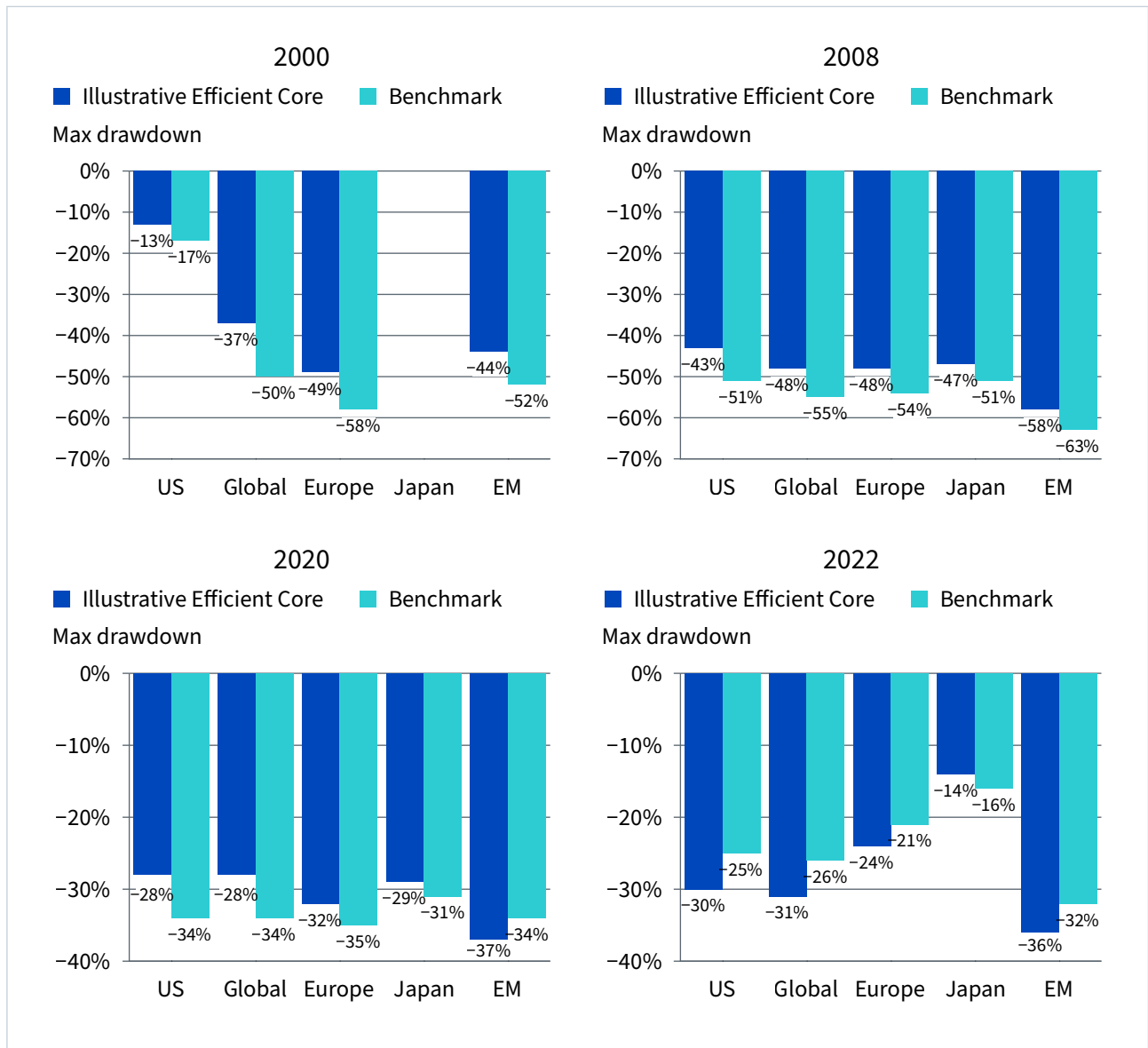
6%

Efficient Core strategies would have cut the drawdown of equity investment across regions by 6% on average in **2008**.

3%

Efficient Core strategies would have cut the drawdown of equity investment across regions by 3% on average in **2020**.

Figure 26: Efficient Core drawdown vs. market over the last 20 years

Sources: Bloomberg, WisdomTree. Daily data in the relevant currency (USD, EUR or JPY) is used. All analyses start on 31 December 1998 except for Japan, which starts in January 2002. Equity indices are net total returns. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Of course, 2022 tells a different story. With the fastest rate hike cycle in history in most developed markets, 2022 yielded both an equity and bond bear market. While not a unique situation, this is only the sixth time since the 1920s. With such a market, the 60/40 delivered a deeper drawdown than equities in almost all regions. Japan is always the exception since rates did not shoot up as much. The next section will discuss this 'negative' situation in more detail.

Despite the unique situation of 2022, Efficient Core strategies are overall defensive strategies and can, therefore, be compared to minimum and low-volatility strategies. Those strategies are designed to offer downside protection during market downturns but also often offer lower upside participation during bull markets. Figure 27 compares the upside and downside capture of both styles of strategies. We observe that both strategies are asymmetric; that is, they exhibit a higher upside capture ratio than downside capture, which explains why both strategies tend to outperform the market over the long term. The Min Volatility strategies are very defensive, with an upside capture of around 75%, while the Efficient Core strategies offer an upside capture of around 90%.

90%

An Efficient Core strategy offers an upside capture of around 90% while being defensive.

Figure 27: Upside and downside capture for Efficient Core and Min Volatility strategies
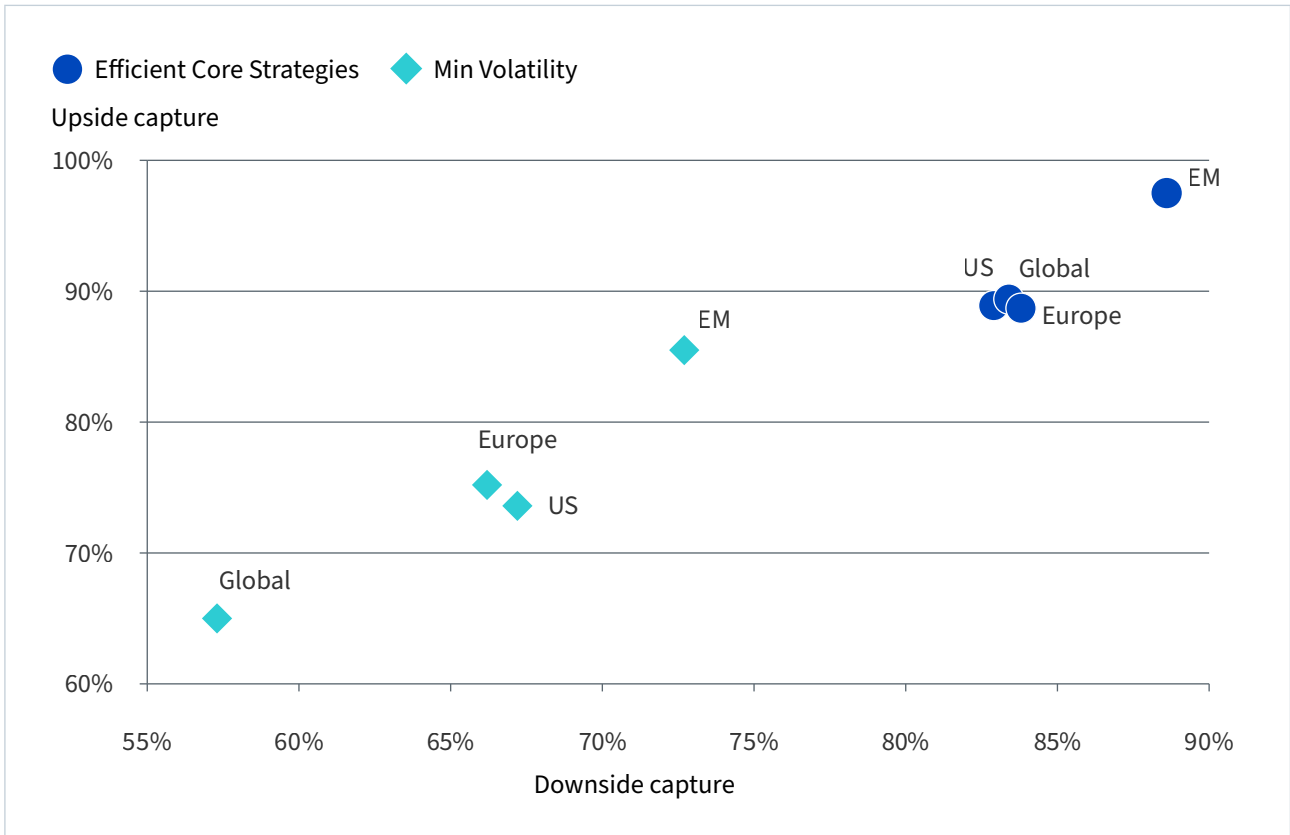
Sources: Bloomberg, WisdomTree. As of September 2023. Monthly data in the relevant currency is used (USD or EUR). All analyses start on 31 December 1998 except Europe, which starts in December 2001. Min Volatility strategies are proxied by the MSCI Min Vol TR net Index in the relevant geography. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

If we continue and compare the overall returns and max drawdowns of both strategies (Figure 28), we observe the same type of results. The Efficient Core strategies have slightly higher drawdowns (significantly lower than the market, though), but the overall returns are historically higher across most regions.

Figure 28: Annualised returns and max drawdown for Efficient Core and Min Volatility strategies

	Annualised returns	Max drawdown
Illustrative US Efficient Core Strategy	7.5%	-47.2%
MSCI US Min Vol	7.0%	-48.6%
Illustrative Global Efficient Core Strategy	**6.7%**	**-49.5%**
MSCI Global Min Vol	**6.2%**	**-48.2%**
Illustrative Europe Efficient Core Strategy	7.7%	-51.6%
MSCI Europe Min Vol	7.1%	-50.5%
Illustrative EM Efficient Core Strategy	**8.4%**	**-58.8%**
MSCI EM Min Vol	**8.7%**	**-54.2%**

Sources: Bloomberg, WisdomTree. As of September 2023. Monthly data in the relevant currency is used (USD or EUR). All analyses start on 31 December 1998 except Europe, which starts in December 2001. Min Volatility strategies are proxied by the MSCI Min Vol TR net Index in the relevant geography. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Overall, Efficient Core strategies are quite defensive, offering lower drawdown, lower volatility and lower downside capture. But at the same time, they also deliver above-market returns and interesting upside capture. Compared to the Min Volatility Strategy, they offer the same asymmetry but with high upside capture and overall returns.

4.   When can the strategy break?

The Efficient Core strategies have historically performed best during periods of sustained equity market gains combined with falling interest rates, much like we saw in 2019. Of course, the most likely cause of the underperformance of the strategy versus direct equity investments is the negative performance of bonds. Figure 29 shows the yearly performance of US equities and US high investment-grade bonds since 1927, when the bond performance is negative. (Simulations used are the extension of C. Asness's paper in US equities, as it gives us 92 years of data to study.) It happened 22 times. In 16 of those years, equity performed positively, and therefore, the levered 60/40 portfolio underperformed equities. However, and it is important, in 11 out of those 16 years, the levered portfolio outperformed the 60/40 portfolio, and in 15 of those years, the returns of the levered portfolio were positive.

The real Kryptonite for this strategy is rising yields and falling equities, as we have encountered in 2022. This scenario can generate negative returns for the strategy. Fortunately, they have been very rare. Only six times in the last 100 years or so, US equities and US high-grade bonds have lost money in the same year. In all those years, the levered portfolio underperformed the 60/40, of course. In one of those years, the levered portfolio and the 60/40 outperformed equities. So, all in all, there are only five years out of 92 where equity and bonds performed negatively, leading to the levered portfolio posting a negative performance worse than equities. 2022 is the worst year ever when looking at the depth of the underperformance versus equities (-28.7% versus -18.1%).

Figure 29: US equities and US high investment-grade bonds' yearly performance

	Equities	Bonds	60/40 Portfolio	Levered 60/40 Portfolio
1931	-43.3%	-1.9%	-27.4%	-41.7%
1947	5.7%	-2.3%	2.5%	3.5%
1951	24.0%	-2.7%	12.7%	19.0%
1956	6.6%	-6.8%	1.3%	0.4%
1958	43.4%	-2.2%	23.3%	36.9%
1959	12.0%	-1.0%	6.7%	8.7%
1965	12.5%	-0.5%	7.2%	8.9%
1967	24.0%	-5.0%	11.6%	15.5%
1969	-8.5%	-8.1%	-8.2%	-15.7%
1974	-26.5%	-3.1%	-17.5%	-29.9%
1978	6.6%	-0.1%	4.1%	2.0%
1979	18.6%	-4.2%	9.1%	7.7%
1980	32.5%	-2.8%	18.1%	21.1%
1981	-4.9%	-1.2%	-3.2%	-12.7%
1987	5.3%	-0.3%	4.5%	2.6%
1994	1.3%	-5.8%	-1.5%	-4.6%
1999	21.0%	-7.4%	9.0%	11.1%
2013	32.4%	-7.1%	15.2%	24.2%
2015	1.4%	-1.0%	0.8%	0.9%
2018	-4.4%	-4.7%	-4.2%	-7.7%
2021	28.7%	-2.7%	15.4%	24.4%
2022	-18.1%	-19.3%	-18.3%	-28.7%

Source: WisdomTree. December 1925 to September 2023. Monthly data in USD is used. US equities are proxied by the data series Ibbotson SBBI US Large Stock TR USD. US high investment-grade bonds are proxied by the series Ibbotson SBBI US LT Corp TR USD until February 2022. After that, the Bloomberg U.S. Long Credit Aa Total Return Index is used. Cash is proxied by Ibbotson SBBI US 30-Day T-bill TR USD. The levered 60/40 portfolio invests 155% each month in the 60/40 portfolio and -55% each month in the cash portfolio. **Backtested data used. Historical performance is not an indication of future performance and any investments may go down in value.**

Overall, the Efficient Core Strategy provides a strong alternative to delta one and active investment in equities. Those strategies deliver strong defensiveness with a good upside ratio, allowing them to historically outperform the market in almost any market scenario and to outperform many active managers as well.

B. Leverage and diversification, a powerful combination for portfolio construction

By delivering equity and bond exposure in a capital-efficient manner, Efficient Core strategies can also help free up space in the portfolio for alternatives and diversifiers. In a classic 60/40 portfolio, there is no space for diversifiers. If an investor wants to add broad commodities, gold or other alpha strategies, they will have to sell some bond or equity positions. However, by investing 67% of the portfolio in an Efficient Core Strategy, the investor can get 60% notional exposure to equities and 40% notional exposure to bonds, delivering a 60/40 portfolio with a third of the cash remaining free. This leaves one-third of the portfolio for diversifiers. Therefore, the enhanced portfolio's Sharpe ratio can be improved without missing out on potential returns. In such a portfolio, it is, therefore, possible to maximise the impact of Markowitz's teachings by using both diversification and leverage to their full potential.

1. Using Efficient Core in a portfolio: Pushing the efficient frontier upwards

Diversification is a powerful tool that can improve portfolios. As discussed earlier, mixing bonds and equities makes improving a portfolio's risk efficiency possible. By adding alternative assets and diversifiers, it is possible to improve this efficiency even higher.

In Figure 30, we compare the efficient frontier for portfolios investing only in US equities and US Treasuries (in grey) with the efficient frontier for portfolios allowed to diversify as well into broad commodities, gold and US real estate investment trusts (REITs). Clearly, the second frontier is much better, with up to 0.7% of returns per annum added for the same level of volatility.

Moving one step further, we create a third efficient frontier that exhibits the best portfolios, combining the five assets above and the Illustrative US Efficient Core Strategy. For most levels of volatility, the best return achieved is even better. The return is, in fact, improved by up to 1.18% per annum.

Figure 30: Historical efficient frontier's evolution when combining diversification and leverage
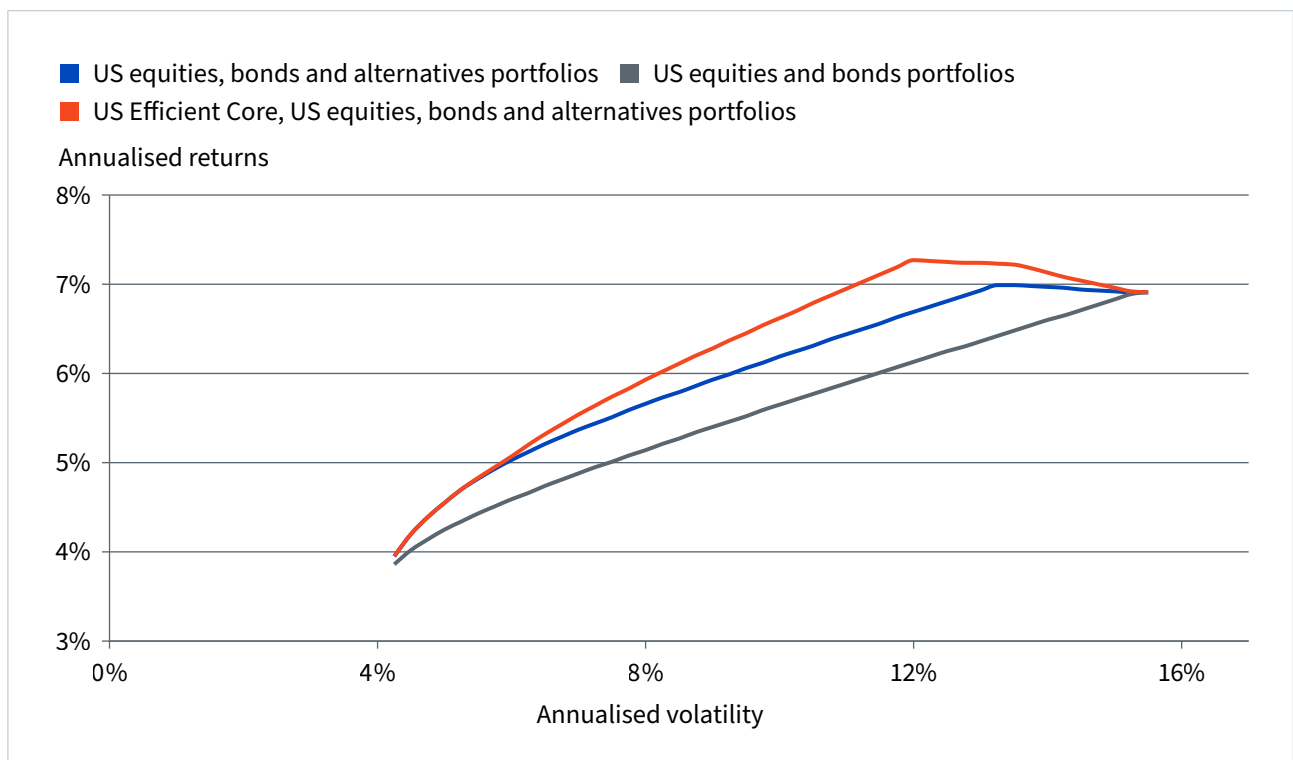
Source: WisdomTree. December 1998 to September 2023. Monthly data in USD is used. US equities are proxied by the S&P 500 net TR index. US bonds are proxied by the Bloomberg US Treasury TR index. Commodities are proxied by the Bloomberg Commodity Index TR. Gold is proxied by LBMA Gold Fixing. US REITs are proxied by FTSE NAREIT TR. **Historical performance is not an indication of future performance and any investments may go down in value.**

1.18%

By creating space in a portfolio with Efficient Core strategies and using that space for alternative assets, the return for a given level of volatility could be improved by 1.18%.

When building a multi-asset allocation, it is possible to improve the returns and the Sharpe ratio of the portfolio through diversification and/or leverage. By using the Efficient Core concept, it is possible to combine both approaches into very efficient portfolios.

2.   An efficient, fully diversified model portfolio for European investors

Over the past few years, we have researched in depth how to improve portfolios and how to use alternative assets and diversifiers to improve the overall long-term efficiency of portfolios. We highlighted through backward-looking and forward-looking analyses that:

+   Broad commodities could warrant up to 15% allocation in a multi-asset allocation (Shah & Debru, The Case for Investing in Broad Commodities), (Shah & Berlanda, The Role of Broad Commodities in a Portfolio, September 2023).

+   Most portfolios would benefit from a gold allocation of up to 10% or 15% (Shah & Berlanda, The role of gold in a portfolio, October 2023).

+   A crypto and carbon allocation of a few percent would improve diversification and could improve long-term returns. (Shah & Berlanda, The role of Carbon in a porfolio, November 2023) (DEBRU, et al., July 2022).

Combined, that is easily 30% of the portfolio allocated to alternatives and diversifiers. If investors use a delta one approach, then the allocation to equities and bonds would need to be reduced considerably to fit them in the portfolio.

Using the Efficient Core concept, it is possible to keep both the equity and bond allocation steady and to fit diversifiers. To do so, we need to look at the portfolio from a capital invested point of view but also from an exposure point of view. Figure 31 shows an illustrative portfolio that uses Efficient Core strategies to create space for diversifiers. The Illustrative WisdomTree Efficient Core Model Portfolio would invest two-thirds of its capital in Efficient Core strategies in a geographical split that mirrors the MSCI All Country World. The remaining 33% can then be invested in broad commodities, gold, bitcoin and carbon, delivering a very diversified portfolio.

Looking at it from a capital invested point of view, 33% is invested in diversifiers and 'only' 67% in bonds and equities. Without leverage, the portfolio would be under-invested in equities for sure. However, from an exposure point of view, thanks to the leverage in the Efficient Core strategies used, the portfolio delivers 60% to equities, 40% to bonds and 33% to diversifiers.

Figure 31: Capital allocation in the Illustrative WisdomTree Efficient Core Model Portfolio
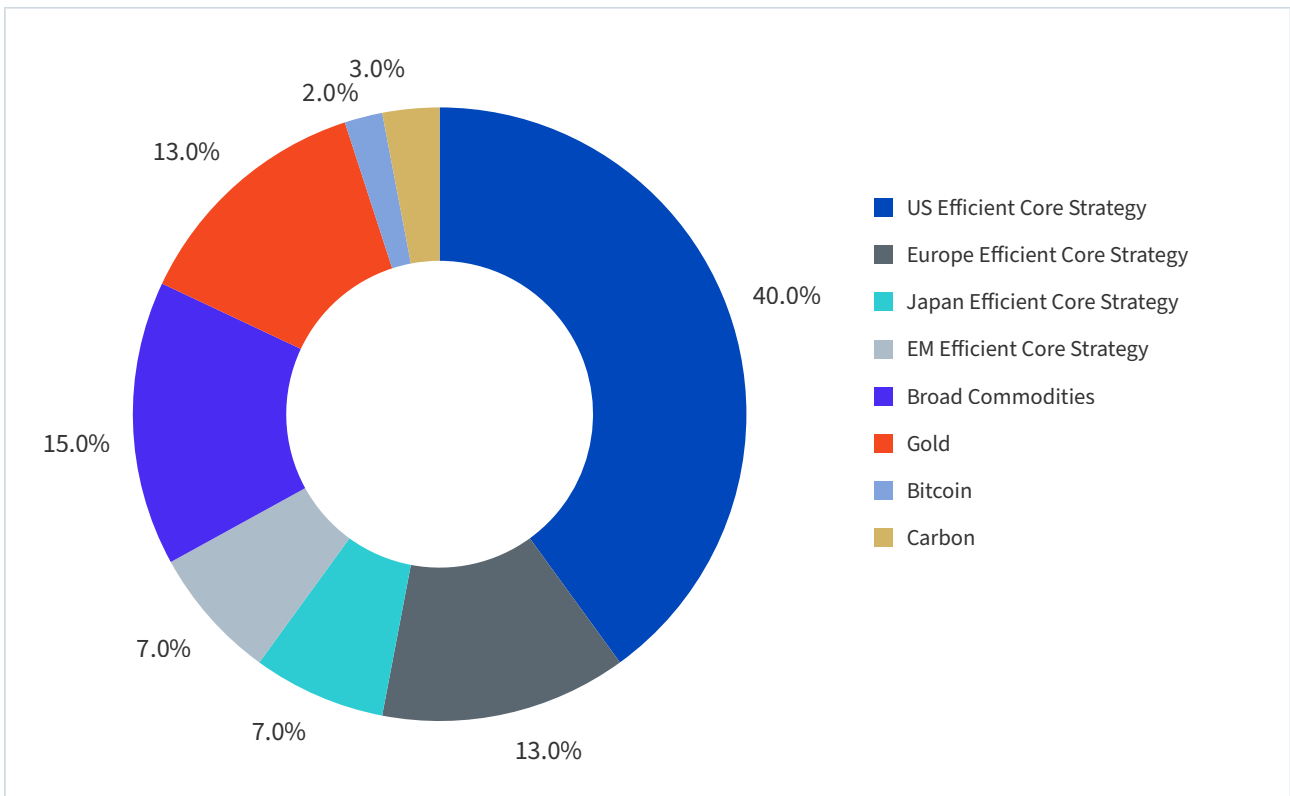
Source: WisdomTree. **Illustrative only.**

Figure 32: Exposure and capital allocation of the Illustrative WisdomTree Efficient Core Model Portfolio

|	Capital allocation	Exposures			
		Equity	Fixed Income	Commodities	Cryptocurrencies
US Efficient Core Strategy	40%	36%	24%		
Europe Efficient Core Strategy	13%	12%	8%		
Japan Efficient Core Strategy	7%	6%	4%		
EM Efficient Core Strategy	7%	6%	4%		
Broad Commodities	15%			15%	
Gold	13%			13%	
Bitcoin	2%				2%
Carbon	3%			3%	
Total	*100%*	*60%*	*40%*	*31%*	*2%*

Source: WisdomTree. **Illustrative only.**

Figure 33 exhibits the performance of the Illustrative WisdomTree Efficient Core Model Portfolio over the last 20 years, assuming a quarterly rebalancing. Note that the carbon allocation only started in 2008, and the allocation to Bitcoin only in 2017. The portfolio historically outperforms both the MSCI World and the Illustrative 60/40 Portfolio (60% in the MSCI World net TR Index and 40% in the Bloomberg Global Aggregate TR Index) over the period. What is striking is that this example Efficient Core Model Portfolio outperforms the 60/40 portfolio with lower volatility, lower drawdown and an improved Sharpe ratio.

The Illustrative Efficient Core Model Portfolio significantly improves the portfolio's efficiency by creating space for diversifiers.

By creating space for diversifiers, the Efficient Core Model Portfolio significantly improves the efficiency of the portfolio.

Figure 33: Illustrative WisdomTree Efficient Core Model Portfolio
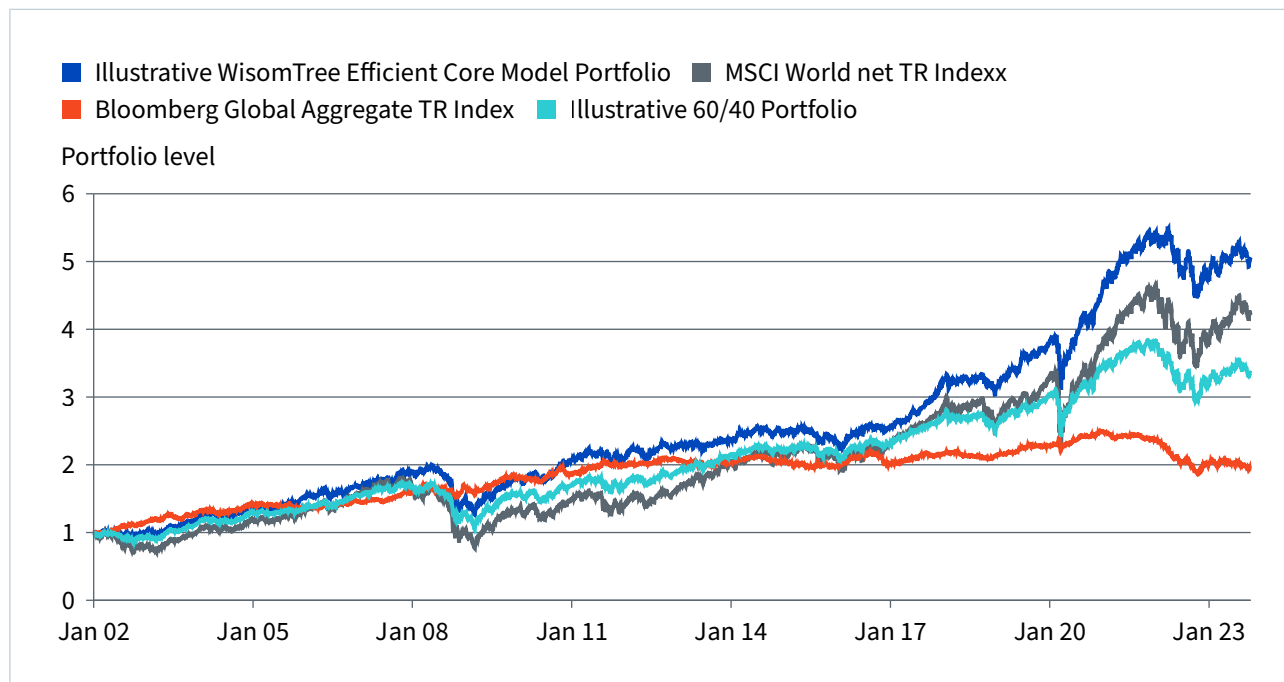
	Illustrative WisdomTree Efficient Core Model Portfolio	Illustrative 60/40 Portfolio	MSCI World net TR Index	Bloomberg Global Aggregate TR Index
Annualised returns	7.72%	5.72%	6.87%	3.08%
Annualised volatility	12.13%	10.35%	16.99%	5.59%
Sharpe ratio	0.52	0.42	0.32	0.31
Max drawdown	-36.3%	-39.0%	-57.8%	-25.7%

Sources: Bloomberg, WisdomTree. From January 2002 to September 2023. Daily data in USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

By offering investors more efficient building blocks, Efficient Core strategies may unlock many possibilities to improve portfolios. With, on average, higher returns and high Sharpe ratios, Efficient Core strategies could be used to replace existing equity exposure. With their use of leverage, Efficient Core strategies can create space in portfolios for well-needed diversifiers.

Conclusion

Balancing returns and risk is the core goal of most investors. By returning to basics, the Efficient Core concept aims to provide another powerful tool for all investors to push the boundaries of what is possible and improve their portfolio.

If there is one message you can carry with you as we end our journey together, it's that **leverage** is not this disaster-causing monster that we often hear about, but instead, when prudently and professionally managed, it is a fundamental part of the Modern Portfolio Theory. Combined with **diversification**, it can unlock even more efficient portfolios and create space for many alternative assets and diversifiers.

Through our analyses, we tried to illustrate the potential of Efficient Core strategies, but our approach is not prescriptive. There are many ways to use Efficient Core in a portfolio to deliver the right amount of risk and return for each investor. Do get in touch to show us how you've been using Efficient Core in your portfolios.

We hope this paper opened a new door through which you, the reader, can enter and experiment on your own.

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