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FIN11 Trading and Market Microstructure

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FIN11 Trading and Market Microstructure

Leveraged ETFs as Trading and Investment Vehicles

Candidates:

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Abstract

The popularity of Leveraged exchange-traded funds (LETFs) experienced spectacular growth in retail investment portfolios, following the recognition of both ETFs and leveraged products in general among retail traders. This paper looks at the risk and performance of leveraged exchange traded funds for retail investors employing buy-and-hold strategies with a specific focus on the Amundi MSCI World 2x Leveraged UCITS ETF. This specific product is especially interesting to retail investors as the underlying MSCI World is a popular ETF among retail traders and might promise a less risky and stable performance. Using a mathematical model, empirical analysis and performance replication that captures the COVID-19 crisis, subsequent bear market and recovery periods, we demonstrate that LETFs bear specific risks making them possibly unsuitable for typical retail investor strategies. The daily rebalancing mechanism creates systematic performance drag in volatile markets, with our model revealing that the Amundi 2x LETF delivers inconsistent effective leverage over the full period versus the 2x target, representing a performance gap in specific periods. Critically, during crisis periods such as the 2020 COVID-19 crash, a retail investor investing in the 2x LETF could have experienced possible catastrophic downside amplification. Volatility drag also increases exponentially with specific market phases, holding length and leverage factor. We found a 44% outperformance over 26 years, but a significant underperformance during high-volatility sideways markets.

Candidates: 1002, 1039, 1071, 1053

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1. Introduction

In the last three decades exchange traded funds (ETFs) have shown exceptional growth on global markets, accounting for 37% of the total dollar volume of stock market trading in the US. (Gempesaw et al., 2023) Investors benefit from diversification, low cost and high liquidity. Retail investors have shown growing interest in this asset class, being the fastest growing product on retail investment platforms in the last five years (BlackRock, Inc, 2025). However, research suggests that retail investors tend to seek increasing amounts of risk. Leveraged ETFs as a higher-risk and possibly higher return investment vehicle have emerged as an increasingly popular product among retail traders. Leveraged and inverse ETFs provide leveraged daily returns of long or short investments of an underlying index, multiplying the performance (±2x or ±3x).

The widespread adoption of leveraged exchange-traded funds (LETFs) among retail traders has resulted in a significant shift in market dynamics. This surge is reflected not only in adoption rates but also in trading behavior, with retail investors exhibiting on average 12% higher dollar-volume participation in LETFs (Gempesaw et al., 2023). However, this enthusiasm raises critical questions about product suitability, investor understanding, and long-term performance implications.

The purpose of this paper is to clarify the risk of leveraged ETFs and the performance potential for retail investors by constructing a model that reconstructs the performance of a specific leveraged ETF over the past 26 years. Specifically, we focus on the Amundi MSCI World (2x) Leveraged UCITS ETF, which depicts the daily performance of the MSCI World Index with double leverage, as it is a relatively new product that has not been thoroughly analyzed yet. Because the Amundi fund itself is newly launched, historical performance must be reconstructed synthetically. We therefore built a complete replication model that mirrors the fund's daily rebalancing rules and synthetic exposure structure, allowing us to assess how the ETF would have behaved if it had existed during the past years.

The MSCI World is one of the most popular and widely diversified indices which gives it a broader base and potentially lower risk exposure. Retail investors might underestimate risk as the MSCI World is considered a stable asset and apply a hypothesis that a leveraged stable asset should have a great risk-to-return ratio.

The central question of this study is: to what extent does a 2x leveraged exposure to the MSCI World Index generate superior or inferior long-term performance for retail buy-and-hold investors, once volatility drag, path dependency, daily rebalancing effects, and financing costs are taken into account?

2. Mechanics of Leveraged ETFs

To understand the performance of an LETF based on the MSCI World Index, it is essential to explain how index-based returns for LETFs are calculated. The following subchapters outline the core concepts of LETFs in detail, including path dependency and the resulting phenomenon of volatility drag, as well as the regulatory framework and cost structure of LETFs. For Chapters 2.1 and 2.2, we exclude all investor fees, hidden LETF costs, and tracking errors and refer to the findings of Cheng and Madhavan (Cheng & Madhavan, 2009).

2.1 The Path Dependence of LETFs

A fundamental mechanism underlying the behavior of LETFs is the daily reset. Leveraged and inverse ETFs are rebalanced at the end of each trading day to achieve their stated leverage ratio. Therefore, rebalancing creates self-financing strategy where gains and losses are magnified by the leverage factor. Rebalancing introduces a path-dependent component to performance, as the fund must buy additional exposure after positive returns and sell exposure after negative returns. (Avellaneda & Zhang, 2010) This leads to LETFs not scaling linearly with the returns of the underlying index. While this allows the fund to deliver its target multiple on any single day, it introduces a dynamic known as path dependency over multi-day periods. The compounded return of an LETF over N days is the product of the daily leveraged returns, expressed as:

Equation 1: Compounded daily leveraged returns

$$\prod_{n=1}^{N}\left(1 + x r_{t_{n-1},t_n}\right) \; where \; r_{t_{n-1},t_n} = \frac{S_{t_n}}{S_{t_{n-1}}} - 1$$

- n ∈ {0, 1, 2, …, N} denotes the discrete number of trading days
- t_n is the calendar time of day n, measured as a real number (in years) from day 0, with $t_0 = 0$.
- S_{t_n} denotes the underlying index level at time t_n, on which the LETF is based.
- x is the leverage factor

A naive investor might expect the total return to simply be the index return multiplied by x. However, this intuition does not hold over periods longer than one day. The LETF's terminal value depends not just on the index's start and end points, but on the specific path taken.

As an illustrative example, consider a 2x LETF ($x = 2$) and its underlying index both starting at a value of 100.

- Day 1: The index falls 10% to 90. The LETF falls 20% to 80.
- Day 2: The index rises 10% to 99. The LETF rises 20% to 96.

While the index has lost only 1% cumulatively, the 2x LETF has lost 4%. This deviation occurs because the capital base for the recovery on Day 2 ($80) was disproportionately eroded by the previous day's leveraged loss.

From a recovery perspective, the index needs a gain of $\approx 11.11\%$ to return to 100. The LETF, having fallen to 80, requires a 25% gain to break even. Because the LETF provides $2x$ the daily return, the index would need to rise by 12.5% the next day for the LETF to recover. This "break-even gap" represents the cost of path dependence.

In an extreme scenario, if the underlying index drops by more than $1/x$ in a single day (e.g., 50% for a 2x LETF), the LETF's value would theoretically drop to zero, resulting in a total loss.

2.2 Volatility Drag of LETFs

To formalize the cost of daily rebalancing, the underlying index can be modeled as a Geometric Brownian Motion (GBM). (Cheng & Madhavan, 2009) While GBM assumptions, such as constant volatility σ and continuous paths, simplify real-world complexities like jumps or fat tails, they allow for a closed-form expression of LETF performance. The total return of an LETF over the period t_N can be decomposed into two distinct components:

Equation 2: Total Return of an LETF over a t_N-day period

$$\frac{A_{t_N}}{A_0} = \underbrace{\left(\frac{S_{t_N}}{S_0}\right)^x}_{\text{Leveraged Compounded Return}} \times \underbrace{exp\left(\frac{(x - x^2)\sigma^2 t_N}{2}\right)}_{\text{Volatility Effect (Scalar)}}$$

- A_{t_N} represents the LETF´s NAV at the time t_N
- S_{t_n} is the underlying index level at time t_N
- x is the leverage factor
- σ is the volatility parameter of the underlying index

Equation 2 breaks down the LETFs final value into two factors:

1. $\left(\frac{S_{t_N}}{S_0}\right)^x$ represents the idealized return of the index raised to the power of the leverage factor.
2. $\exp\left(\frac{(x-x^2)\sigma^2 t_N}{2}\right)$ captures the drag (or boost) caused by volatility. The direction of this effect depends entirely on the sign of $(x - x^2)$. In Figure 1 we depicted the scalar as a function of x with exemplary $\sigma = 0.2$ and $t_N = 1$.

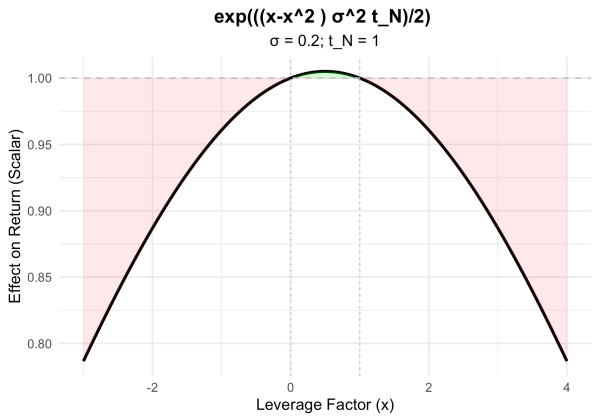


Figure 1: Plot of the scalar as function of the leverage factor

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As seen in Figure 1, for standard LETFs where $x > 1$ or inverse ETFs where $x < 0$, the negative exponent, causes the scalar to fall below 1 and reduce returns. The scalar is a mathematical illustration of *volatility drag*.

Accordingly, under condition $x < 0$ or $x > 1$:

$$\lim_{t_N \to \infty} \exp\left(\frac{(x-x^2)\sigma^2 t_N}{2}\right) = 0 \ , \lim_{\sigma \to \infty} \exp\left(\frac{(x-x^2)\sigma^2 t_N}{2}\right) = 0 \ , \lim_{x \to \infty} \exp\left(\frac{(x-x^2)\sigma^2 t_N}{2}\right) = 0$$

Hence, for leveraged factors outside the interval [0,1], the scalar tends to zero as any of σ, t_N, x grow large.

At first glance, this result may appear to be a strong argument against holding LETFs for long periods or holding them on highly volatile references.

A further analysis of Equation 2 and Figure 1 reveals that for leverage factors within the interval $0 < x < 1$, the term $(x - x^2)$ is positive. The leverage does not produce volatility drag, but a "volatility boost". However, this boost must be weighed against the gross, compounded return of the LETF's underlying index to the power x, which gets now reduced by the leverage, as leverage is in the interval $0 < x < 1$.

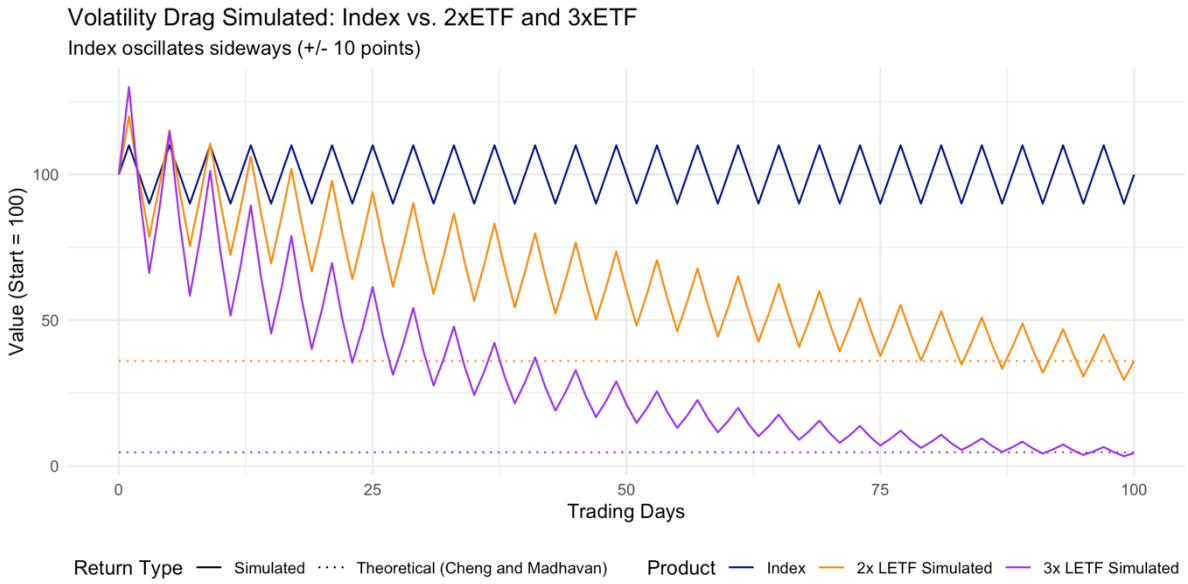


Figure 2: Volatility drag simulation for a hypothetical index

To illustrate the volatility drag we simulated a hypothetical index that repeats a short four-day pattern. Starting at $t = 0$ with $S_0 = 100$, the index moves to 110 at $t = 1$, back to 100 at $t = 2$, to 90 at $t = 3$, and returns to 100 at $t = 4$. This pattern is then repeated until the final simulation day $N = 100$. This is an unrealistic index behavior but illustrates how volatility alone affects the corresponding LETFs.

We constructed a 2x LETF and a 3x LETF, that reference this index and that implement daily resets consistent with real-world LETFs (Appendix: Reference 1).

The simulation results (Figure 2) are in line with Equation 2. Although the reference index starts and ends at the same level. Both LETFs lose substantial value. The 2x LETF falls to 36.03967 at $t = 101$ (a loss of $\approx 63.96\%$) and the 3x ETF falls to 4.384658 at $t = 101$ (a loss of $\approx 95.62\%$).

Using Equation 2 to calculate the simulated NAVs leads to very similar numbers: $A_{t_N} \approx 35.95392$ for the 2x LETF and $A_{t_N} \approx 4.647706$ for the 3x LETF.

That confirms, that in volatile markets the underlying index must grow sufficiently to offset the effect of volatility drag, which results in positive returns for the investor.

2.3 Regulatory Treatment

The regulatory treatment of leveraged exchange-traded funds varies across jurisdictions, yet all major regulators impose significant restrictions due to the complex risk profile of these products. In the United States, LETFs are permitted but subject to strict oversight by the Securities and Exchange Commission (SEC) and the Financial Industry Regulatory Authority FINRA's Regulatory Notice 09-31 (Financial Industry Regulatory Authority, Inc., 2009) explicitly warns that leveraged and inverse ETFs are unsuitable for long-term investors and requires brokers to ensure that clients fully understand the mechanics and risks of daily-reset leverage. In 2020, the SEC adopted Rule 18f-4, which introduced a broad derivatives framework that limits leverage for most investment funds but provides targeted exemptions for daily-reset LETFs, while effectively preventing the approval of new products with leverage greater than 3x (U.S. Securities and Exchange Commission, 2020). In Europe, the regulatory environment is more restrictive: under the EU UCITS Directive and the European Securities and Markets Authority 2012 guidelines, synthetic leverage is limited such that daily leveraged ETFs cannot exceed 2x exposure, which is why no UCITS-compliant LETFs with 3x or higher leverage exist (European Securities and Markets Authority, 2012). Other jurisdictions impose similar or even stricter rules. Canadian securities regulation restricted retail funds to a maximum of 2x leverage till 2025, but allowed 3x leverage from there on. (Ontario Securities Commission, 2024) Hong Kong allows LETFs but requires one of the strictest regulations for leveraged ETFs. Under the SFC's 2025 circular (Securities and Futures Commission (Hong Kong), 2025), regulation further restricts eligible indices to liquid and broadly based non-Mainland equity benchmarks, requires synthetic replication, and warns that these products are intended solely for short-term, daily-reset trading rather than long-term investment.

Across all regions, regulators consistently emphasize that daily compounding, path dependency, and volatility drag create substantial divergence between short- and long-term returns, characteristics that are often misunderstood by retail investors, as documented by the SEC (U.S. Securities and Exchange Commission, Division of Economic and Risk Analysis (DERA), 2019) Accordingly, while LETFs remain legal in most markets, they operate under some of the most stringent derivative and disclosure regulations in the investment fund industry.

Candidates: 1002, 1039, 1071, 1053

2.4 Costs of LETFs

Leveraged ETFs aim to deliver a multiple of the daily return of their underlying index and therefore rely on derivatives, such as total-return swaps, which must be adjusted at the end of each trading day to restore the target leverage (Cheng & Madhavan, 2009). This daily rebalancing mechanism generates costs that differ from those of conventional, unleveraged ETFs and are directly relevant for understanding the performance of LETFs over longer periods. The most visible cost component is the Total Expense Ratio (TER). The Amundi MSCI World 2x LETF charges a TER of 0.60% per year, whereas a comparable non-leveraged Amundi MSCI World ETF charges 0.12%. (Amundi Investment Solutions, 2025b, 2025a) The TER includes ongoing expenses such as management, custodian and licensing fees, as well as distribution costs. However, it does not capture all expenses incurred by leveraged ETFs. (justETF, 2023)

Several cost elements fall outside the TER but still affect the fund's net performance. These include swap fees arising from synthetic replication, transaction costs associated with daily rebalancing, and bid-ask spreads or brokerage fees. For leveraged ETFs, these implicit costs accumulate more quickly than for standard ETFs because the derivative exposure must be adjusted every day to maintain the stated leverage ratio. As a result, the product's internal frictions are substantially higher and become particularly relevant to long-term retail investors.

The Amundi 2x LETF uses a total-return swap in which the swap counterparty delivers the index return, including dividends, in exchange for a fee and the return of the ETF’s collateral basket. Depending on the replication structure, swaps can be funded or unfunded, which determines how collateral is held and how counterparty risk is managed under UCITS regulation. Synthetic replication in broad international indices reduces tracking error but introduces additional cost components that do not appear in the TER. (justETF, n.d.)

A further central cost factor results from the financing rate embedded in the daily leveraged return. LETFs are exposed to short-term interest rates because the derivative transactions include a financing component. Historically, overnight financing in swap-based leveraged products was linked to LIBOR. (Redcliffe Training Associates Limited, 2025) Following the transition in global derivatives markets, the Secured Overnight Financing Rate (SOFR) has replaced the London Interbank Offered Rate (LIBOR) as the dominant reference rate (The

Alternative Reference Rates Committee, 2023). Higher short-term interest rates increase the financing drag and reduce the net return that the swap delivers to the fund. In low-rate environments, financing costs were comparatively small, whereas the current higher-rate environment increases their impact on long-term LETF performance.

Overall, the cost structure of leveraged ETFs consists of explicit fees, implicit trading and swap-related expenses, and financing costs that accumulate through daily compounding. These combined effects interact with the mechanisms described in the previous sections, particularly volatility drag and path dependency, and therefore play a central role in evaluating whether a 2x leveraged MSCI World exposure can perform favorably in long-term investment strategies.

3. Data and Methodology

As the Amundi MSCI World (2x) Leveraged UCITS ETF (ISIN: FR0014010HV4) launched on 09/30/2025 and is therefore a relatively new investment vehicle with limited historical data, we developed a synthetic LETF model to simulate its performance prior to inception. Our methodology aligns closely with Amundi's product specifications and allows for an evaluation of the LETF's hypothetical historical trajectory. The analysis was performed using R; the source code is provided in the Appendix (Appendix: Reference 2). The model utilizes the Net Total Return variant of the underlying index (MSCI World (Appendix: Reference 5)) rather than Gross Total Return. The Net index accounts for dividend reinvestment after deducting applicable withholding taxes, yielding a more realistic performance estimate. (MSCI Inc., 2025)

The LETF return calculation follows the *MSCI Short and Leveraged Daily Indexes Methodology.* The daily leveraged index return is defined as:

Equation 3: Daily Leveraged Index Return

$$R = x * S + (1 - x) * r_f * \frac{T}{360}$$

- R denotes the leveraged daily index total return, between dates t-1 and t
- x denotes the leverage factor
- S is the underlying index total return, including gross dividends, between dates t-1 and t
- where t denotes the day of calculation and t-1 denotes the previous *business day*
- T is the number of actual calendar days between dates t-1 and t
- r_f is the annual overnight short-term rate

To reconstruct a realistic LETF performance trajectory, we incorporated the Total Expense Ratio (TER) into Equation 3 to account for the total cost of ownership as accurately as possible. Consequently, the final equation for calculating the daily return of the hypothetical LETF is:

Equation 4: Daily LETF Return

$$R = x * S + (1 - x) * r_f * \frac{T}{360} - r_{TER} * \frac{T}{360}$$

Where r_{TER} is the annual Total Expense Ratio of our hypothetical LETF.

It is important to note that input index data typically excludes non-trading days (e.g., weekends and holidays). Our algorithm addresses this by accumulating financing costs (r_f) and fees (r_{TER}) over non-trading periods (T), deducting them on the subsequent trading day.

For the short-term interest rate (r_f), we utilized the daily USD Secured Overnight Financing Rate (SOFR) beginning 04/03/2018 (Federal Reserve Bank of New York, 2025b). This aligns with MSCI's methodology, which adopted SOFR for leveraged daily index construction in August 2021 (MSCI Inc., 2024). Prior to this date, MSCI utilized the overnight USD London Interbank Offered Rate (LIBOR) (MSCI Inc., 2024). However, due to concerns regarding the validity of LIBOR data stemming from potential manipulation (Kuo et al., 2018) and limited data availability, we employed the Effective Federal Funds Rate (EFFR) as the proxy for r_f from 07/03/2000, to 04/02/2018 (Federal Reserve Bank of New York, 2025a).

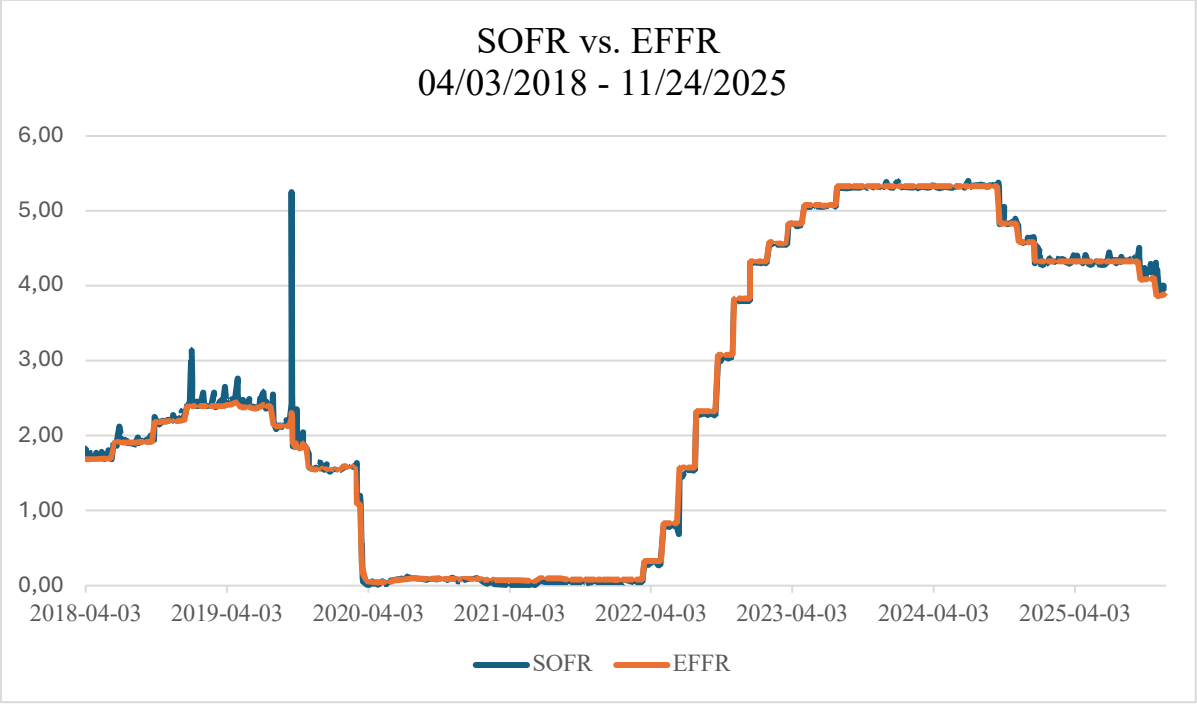


Figure 3: Comparison of SOFR and EFFR rates

Candidates: 1002, 1039, 1071, 1053

Figure 3 illustrates the tracking of SOFR and EFFR rates from April 2018 to November 2025. The rates track closely, with an average divergence of 0.013363 (Appendix: Reference 3). While the discrepancy between EFFR and LIBOR historically widened during periods of financial distress (Kuo et al., 2018), we consider EFFR to be a sufficient proxy for the purpose of this model.

Due to data limitations prior to 07/03/2000, we approximated r_f using the average SOFR observed between 04/03/2018, and 11/21/2025. The complete r_f dataset, comprising both EFFR and SOFR values, is provided in the Appendix (Appendix: Reference 4).

Finally, the model normalizes both the LETF and the underlying index to a base value of 100 at a user-defined inception date. While this model relies on synthetic approximations, it is adaptable to other underlying indices and leverage factors.

4. Findings

4.1 Historical performance comparison MSCI World vs synthetic 2xLETF

This chapter examines the historical performance of a synthetic 2x leveraged exposure to the MSCI World Index across different market environments, using daily observations and financing costs based on EFFR and SOFR (Appendix 4). The results demonstrate that the realized performance of leveraged exchange-traded funds (LETFs) diverges structurally from the theoretical multiple of the underlying index due to compounding effects, volatility, and borrowing costs. The empirical analysis is performed across three representative market periods. First, a long horizon from 01/01/1999 to 2025, second, the post-crisis expansion from 03/09/2009 to 2025 and third, the COVID-19 drawdown and recovery from 03/23/2020 to 2025. These windows capture varying combinations of drift, volatility, and macroeconomic conditions, providing a comprehensive perspective on LETF behavior.

Using our R Code, we can adjust for specific periods and can show if and at what time an investment would have been useful. For our calculation we apply a TER of 0.6% and show the results of the leveraged returns on the end day of our observation, which is always 11/21/2025.

4.1.1 Overview: 1999 – 2025

The 01/01/1999-2025 horizon includes several structural drawdowns, notably the dotcom bubble burst, the 2008-2009 global financial crisis, and the COVID-19 crash in early 2020. In addition, extended periods of high-volatility sideways movement appear, particularly between 2000-2012 and again 2020 onwards. Market uncertainty in 2022, driven by recession fears, inflation peaks, and slowing GDP growth, adds another short but significant drawdown.

Figure 4 shows that the index grows to a value of 589, while the simulated 2x leveraged ETF reaches 849. This means that the LETF outperforms the index by 44.14%, which is far above the unleveraged result, although still below the theoretical doubling of the index. The finding

is interesting, since the long-term use of leveraged products is often discouraged due to volatility drag and the compounding of losses caused by daily rebalancing.

Looking at the trajectory of the LETF over this long horizon, we see several periods where drawdowns were large enough to bring the 2x product close to, or even below, the unleveraged index. This aligns with theoretical expectations that LETFs lose more during downturns and need disproportionately stronger recoveries to compensate for these losses. However, because global equity markets trend upward over longer periods, this positive drift dominates over time, and the LETF ends above the index despite the crises included in the sample. Still, this result should be interpreted carefully, as the overall performance is highly dependent on the specific starting point and on the path the market takes over years.

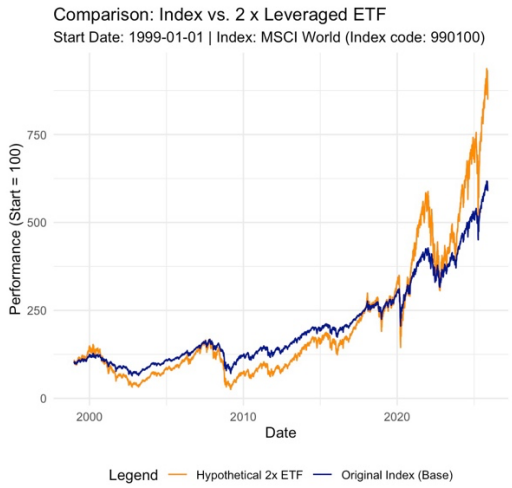


Figure 4: Comparison between the Index and the 2x leveraged ETF of the MSCI World. Starting Date 01/01/1999 – 11/20/2025

4.1.2 Post Financial Crisis: 2009-2025

During the extended low-rate and low-volatility expansion following the global financial crisis in 2009, the 2x strategy significantly outperforms the unlevered index. When entering at the low point of the crisis on 03/09/2009, global equity markets experienced a strong and sustained recovery until the COVID-19 crisis, which significantly benefits the 2x LETF. As section 2.2 predicted, when the expected mean return dominates observed variance, compounding works in favor of the leveraged investors.

Figure 5 shows that the LETF increases strongly during post-2009 expansion but falls back toward index-level performance during the COVID-19 decline. Following the crisis, markets

recovered quickly, supported by strong performance in 2021 and renewed momentum during the AI-driven rally in late 2022. Because market volatility during the period between these shocks is relatively moderate, volatility drag remains limited, and daily compounding advantages the leveraged product. By the end of the period, the index reaches 836, while the LETF ends at 3357. This corresponds to a 301.56% outperformance relative to the index, meaning that the LETF returns more than its theoretical 2x multiple over this path. Although such perfect timing is rare, this scenario highlights how leveraged ETFs can outperform significantly in long, upward-moving markets with relatively mild volatility.

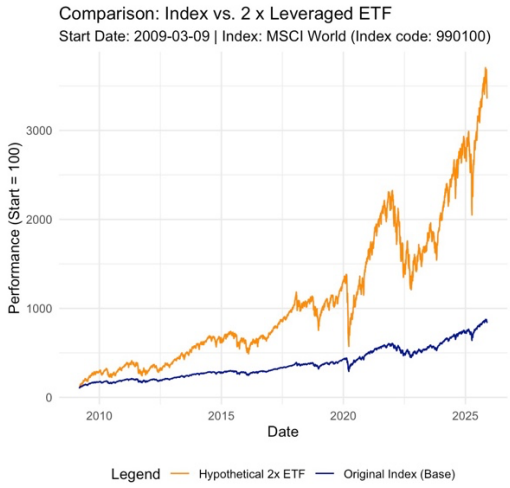


Figure 5: Comparison between the Index and the 2x Leveraged ETF of the MSCI World Starting Date 03/09/2009 – 11/20/2025

4.1.3 COVID-19 Episode: Timing and Path Dependency (2020-2025)

The COVID-19 crisis provides another interesting observation window due to the extremely sharp and short-lived downturn followed by a strong recovery. This period is especially relevant, as many new investors began investing during or shortly after the pandemic. (Maggie Fitzgerald, 2021)

Using the lowest point of the crisis 03/23/2020 (Figure 6) as the start date, the index grows to 287 and the LETF reaches 586. This corresponds to an outperformance of 104.18%, which aligns well with the 2x leverage factor. The results reflect the strong upward movement following the COVID downturn and the limited volatility throughout most of the recovery phase.

Candidates: 1002, 1039, 1071, 1053

If we shift the starting point only slightly backward to 02/01/2020 (Figure 7), the outcome changes significantly. The decline in March increases volatility considerably, producing substantial volatility drag. In this case, the LETF ends at 260 and the index at 196 which an outperformance of only 32.65%. This sharp difference demonstrates how strongly leveraged ETF performance depends on timing and the volatility profile of the chosen window. These findings reinforce that leverage does not automatically result in double the return of the underlying index, even over medium-term horizon.

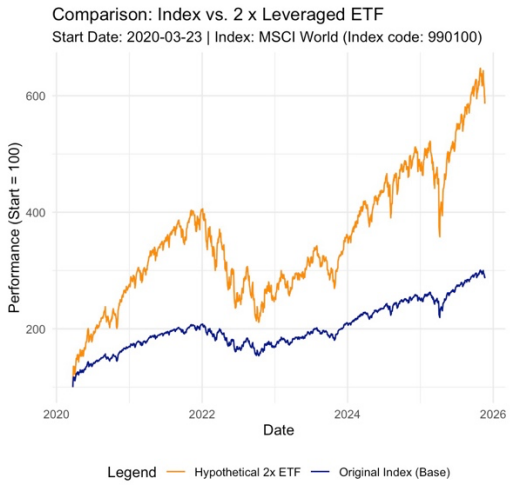


Figure 6: Comparison Between the Index and the 2x Leveraged ETF of the MSCI World Starting Date: 03/23/2020 – 11/20/2025

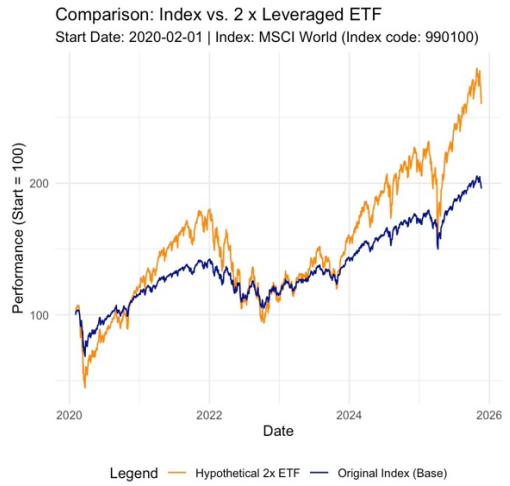


Figure 7: Comparison between the Index and the 2x Leveraged ETF of the MSCI World Starting Date: 02/01/2020 – 11/20/2025

Candidates: 1002, 1039, 1071, 1053

4.1.4 COVID Crash and Recovery 2023-2025

After the COVID recovery and the inflation-related downturn in 2022, markets entered a period of relatively low volatility in 2023 and 2024. To illustrate how the LETF behaves in such an environment, we examine a randomly chosen starting point within this period. Both the index and the leveraged ETF show stable upward movements throughout most of the window.
The short downturn in April 2025 - driven by uncertainty surrounding newly announced U.S. tariff policies - affects the leveraged ETF more strongly. Because leveraged ETFs amplify losses and require higher subsequent returns to recover, the temporary shock results in noticeably underperformance relative to the theoretical leverage factor. Once markets stabilize, the LETF again accelerates faster than the index, but the short volatility spike leaves a visible effect on its long-term value.
This section highlights that leverage can perform well in calm and trending markets but remains vulnerable to volatility spikes, even if they are brief.

4.2 When leverage helps - and when it harms

Leverage provides clear benefits in markets with strong upward momentum and relatively low volatility. Examples in our data include the post-2009 expansion and the 2023-2024 period, where positive returns compound and the leveraged structure enhances performance. After large downturns, leverage can also accelerate recoveries because percentage gains from lower levels translate into proportionally stronger effects.

However, leverage becomes detrimental in high-volatility sideways markets. When markets move up and down without clear direction, alternating gains and losses compound negatively, causing decay in leveraged ETFs even if the underlying index ends flat. This effect is particularly pronounced between 2000-2012 in our data. In bear markets, losses compound multiplicatively, and leveraged ETFs require disproportionately larger recoveries to return to previous values.
Daily rebalancing further amplifies these disadvantages. Since LETFs are forced to rebalance every day to maintain their leverage ratio, they systematically buy after price increases and

sell after price declines, generating additional losses in volatile environments. Higher financing costs also reduce performance, especially when interest rates increase.

4.3 Sensitivity analysis

To understand why the 2x leveraged ETF deviates from a simple doubling of the MSCI World Index, we extend our analysis with a sensitivity assessment that incorporates key performance metrics as annualized returns, annualized volatility, variance and Sharpe ratio. These indicators help quantify the effects of volatility drag, daily rebalancing, financing costs, and leverage. Table 1 summarizes these statistics for the different subperiods analyzed. The annualized values and Sharpe ratios clearly show that the leveraged ETF experiences higher volatility and variance across all time periods, while the relative increase in returns depends strongly on the underlying market conditions and on the return path.

A central observation is that volatility drag increases with both leverage and variance. As explained earlier, leveraged ETFs lose value disproportionately in volatile environments, because alternating gains and losses compound multiplicatively. In periods with elevated volatility, such as early 2020, this drag becomes clearly visible in our results: although both the index and the LETF experience strong recoveries, LETF's return falls short of the theoretical 2x multiple when volatility is high.

To illustrate the sensitivity of the leveraged product to financing costs, we re-estimate the February 2020 window (Figure 7) by setting SOFR equal to zero (Figure 8). Without interest-rate costs, the LETF reaches a terminal value of 328 instead of 260, outperforming the index (196) by 67.35% compared to the previously observed 32.65%. This highlights that interest-rate movements meaningfully affect leveraged ETF performance, especially during periods of rising rates. The comparison of Figures 7 and 8 demonstrates that higher SOFR rates directly reduce the realized leverage effect, while low or zero borrowing costs enable the LETF to more closely approach its theoretical target.

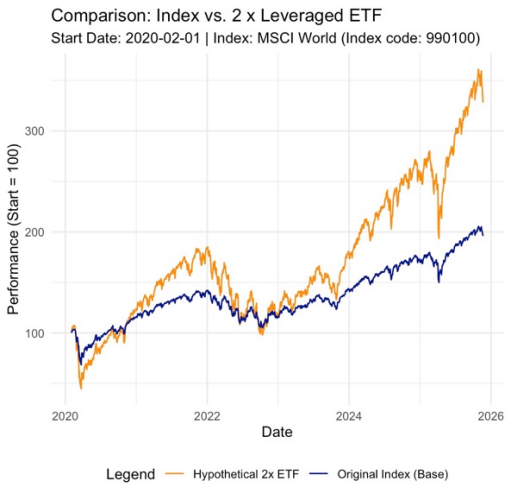


Figure 8: Comparison between the Index and the 2x Leveraged ETF of the MSCI World
Starting Date: 02/01/2020 – 11/20/2025
Financing Costs (SOFR) are equal to 0

We further assess how the Total Expense Ratio (TER) influences performance. Because TER is applied linearly daily, its effect is smaller than that of the volatility of financing rates. Increasing rates from 0% (Figure 9) to 1.2% (Figure 10) results in only a moderate decrease in terminal value from 270 to 251 in our simulations with the index remaining unchanged at 196. This confirms that TER plays a secondary role relative to volatility drag and financing costs. (Charupat & Miu, 2011)

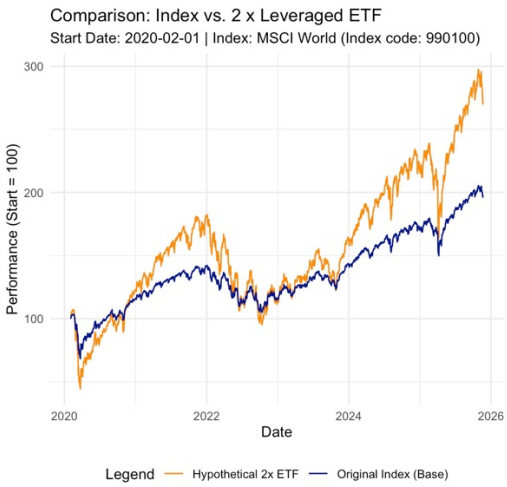


Figure 9: Comparison between the Index and the 2x Leveraged ETF of the MSCI World with Starting date: 02/01/2020, using a TER of 0 %

Candidates: 1002, 1039, 1071, 1053

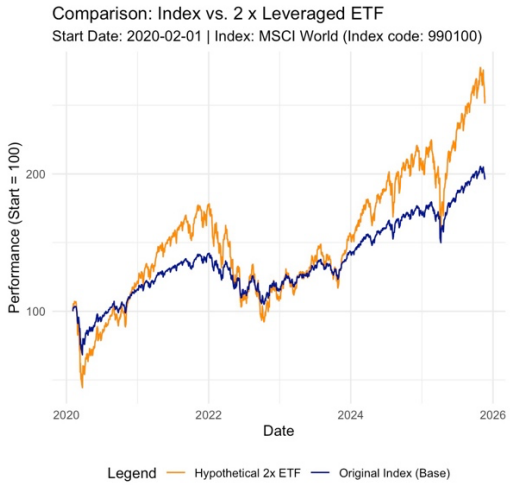


Figure 10: Comparison between the Index and the 2x Leveraged ETF of the MSCI World with Starting date: 02/01/2020, using a TER of 1.2 %

Finally, we analyze how changes in leverage affect outcomes by simulating a 3x LETF over the same 2020-2025 window (Figure 11). As expected, the 3x LETF reacts more strongly to both upward and downward movements, recovering more slowly from downturns but growing faster during positive trends. The 3x LETF ends at 286 compared to 260 for the 2x LETF (Figure 7). However, it does not outperform proportionally, because of volatility drag. This reinforces that increasing leverage does not guarantee higher realized returns, resulting in the return path and volatility being decisive.

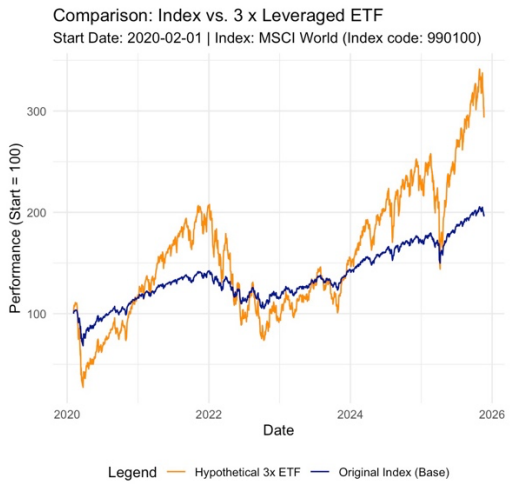


Figure 11: Comparison between the Index and the 3x Leveraged ETF of the MSCI World with Starting date: 02/01/2020

Candidates: 1002, 1039, 1071, 1053

Overall, the sensitivity analysis shows that the interplay between volatility, compounding, financing costs, TER, and leverage level shapes leveraged ETF performance. Volatility drag and path dependency are the dominant long-term effects, while TER and financing costs influence the realized leverage more moderately. The quantitative metrics confirm that the leverage effect is highly sensitive to timing and market path, making leveraged ETFs suitable primarily for short- to medium-term strategies rather than long-term buy-and-hold investing.

All results across windows are summarized in Table 1 below, which reports average annualized returns, annualized variance, Sharpe ratios, and annualized volatility.

	01/01/1999 - 2025		03/03/2009 - 2025		02/01/2020 - 2025		03/23/2020 - 2025	
Metric	Index	2x LETF	Index	2x LETF	Index	2x LETF	Index	2x LETF
Annualized Variance	0.03	0.1	0.02	0.09	0.03	0.13	0.02	0.1
Sharpe Ratio	0.37	0.37	0.8	0.85	0.66	0.65	1.17	1.22
Annualized Return (%)	7.93	13.61	14.13	27.8	13.69	25.1	20.54	40.56
Annualized Volatility (%)	15.87	31.75	15.21	30.42	17.7	35.4	15.79	31.58

Table 1: Summarized Data on Annualized Variance, Sharpe Ratio, Annualized Return (here = Average Annual Return) and Annualized Volatility in each observed period described and interpreted in Chapter 4

5. Discussion

In this chapter, we interpret the empirical results of our synthetic 2x MSCI World LETF considering the mechanisms outlined in Section 2 and discuss the implications for retail investors. The reconstruction allows us to link the formal properties of daily reset leverage to realised outcomes over distinct historical market environments.

5.1 Interpretation of results

Across all examined periods, the 2x MSCI World LETF does not evolve as a simple multiple of the underlying index, but instead follows a trajectory shaped by the order, size, and clustering of returns. This is consistent with the theoretical analysis of leveraged ETF dynamics, which shows that multi-period outcomes depend on the interaction between the index's drift and its fluctuations (Cheng & Madhavan, 2009).

Over the full sample from 1999 to 2025, the synthetic 2x LETF ends with a higher terminal value than the unleveraged MSCI World, outperforming it by 44.14%. This result illustrates that, over sufficiently long horizons, the upward tendency of global equity markets can dominate the frictions embedded in a daily reset leveraged structure. At the same time, the large drawdowns associated with events such as the dotcom bust, the global financial crisis, and the COVID-19 crash leave clear marks on the leveraged path, temporarily eroding much of this advantage.

Subperiod analyses reveal how sensitive the leveraged outcome is to the prevailing market regime. In phases characterized by frequent reversals and periods of indecision, such as the early 2000s or parts of 2020-2022, the LETF's cumulative performance falls well short of what a naive doubling of index returns would suggest. The pattern observed in these periods matches the mechanism where alternating positive and negative returns create a cumulative shortfall relative to a simple multiple of the underlying.

By contrast, during the extended expansion that followed the financial crisis and the recovery after the COVID-19 low, the leveraged product performed markedly better. When initiated at the trough points in March 2009 and March 2020, the LETF's terminal value exceeded that of

the MSCI World by 301.56% and 104.18%, respectively. These cases illustrate the potential of leverage in environments where strong index advances are accompanied by relatively well-behaved volatility.

The comparison of entry dates in early February and late March 2020 highlights the importance of initial conditions. Moving the start of the investment by only a few weeks alters exposure to the sharpest part of the COVID-19 drawdown and yields noticeably different long-run outcomes. In high-volatile environments, even periods where the underlying index ends flat can produce negative returns for leveraged products. These findings emphasize that timing and volatility dynamics are central determinants of performance. This gap between the two scenarios, despite the same underlying index and end date, illustrates how leveraged funds are highly sensitive to the early part of the investment path, a feature emphasized in theoretical literature (Cheng & Madhavan, 2009).

Short-term interest rates contribute an additional layer. Our model incorporates the Effective Federal Funds Rate and the Secured Overnight Financing Rate in line with MSCI's leveraged index methodology (MSCI Inc., 2024; Federal Reserve Bank of New York, 2025a, 2025b). The sensitivity analysis shows that removing these funding costs materially raises the LETF's terminal value in the February 2020 period, indicating that the rate environment since 2022 has become an important determinant of realized leveraged performance rather than a negligible detail.

Simulations with a 3x leverage factor confirm that higher nominal leverage multiplies both gains and losses but does not scale long-term outperformance proportionally. The 3x variant reacts more strongly to favorable periods yet also suffers more from unfavorable sequences than the 2x structure. This pattern may be a contributing factor to restrict leveraged funds to a maximum of 2x exposure in Europe and Hong Kong. (European Securities and Markets Authority, 2012; Securities and Futures Commission (Hong Kong), 2025)

5.2 Implications for retail investors

These findings have direct implications for retail investors, whose behaviour is typically characterised by long-term saving and limited scope for active timing. (Garay & Pulga, 2021) On the one hand, our reconstruction shows that a 2x leveraged MSCI World exposure can outperform an unleveraged position over long horizons and in specific subperiods. On the other hand, this outperformance is contingent on the path markets take and cannot be inferred from the index's long-run performance alone.

Regulators such as FINRA and the SEC have repeatedly expressed concerns that non-professional investors may not fully understand how leveraged ETFs behave when held for more than a single day (Financial Industry Regulatory Authority, Inc., 2009; U.S. Securities and Exchange Commission, Division of Economic and Risk Analysis (DERA), 2019).

For investors with clearly defined, shorter-term horizons and a willingness to adjust positions in response to market conditions, leveraged ETFs can still serve as proper instruments. The strong results achieved when entering at the 2009 and 2020 troughs illustrate that these products can be effective when used in a targeted way and under specific conditions..

At the same time, the simulations underscore that the downside of sharp market declines is amplified and that the ability to recover from significant losses becomes increasingly difficult. Combined with the influence of funding costs and the sensitivity to early-path movements, this makes 2x ETFs poorly suited as core building blocks for long term buy and hold portfolios or recurring savings plans.

Overall, the evidence suggests that the 2x MSCI World LETF can deliver powerful results in specific environments, but that these outcomes depend on factors which typical retail investors cannot reliably control. For long-term, broadly diversified investing, conventional unleveraged ETFs remain more closely aligned with the objectives and constraints of this investor group.

6. Conclusion

This paper investigated whether a 2x leveraged exposure to the MSCI World Index can enhance long-term performance for retail investors. Because the Amundi MSCI World 2x Leveraged UCITS ETF was launched only recently, we constructed a complete synthetic replication of the product from 1999 to 2025, following the methodology of MSCI's Short and Leveraged Daily Indexes and incorporating realistic financing rates and total expenses. The reconstruction allowed us to evaluate how a daily-reset leveraged structure would have behaved across multiple major market environments, including the dot-com bust, the global financial crisis, the COVID-19 crash, and the subsequent recoveries.

Our results show that surprisingly, the 2x leveraged fund can outperform the unleveraged index over extended horizons. Across the whole 1999–2025 period, the leveraged portfolio ends with a cumulative return approximately 44% higher than the MSCI World. In some distinct subperiods, most notably the long post-2009 expansion and the rebound following the COVID-19 trough in March 2020, the leveraged exposure exceeds not only the unleveraged index but, at times, even its theoretical 2x target. These outcomes confirm that in sustained appreciation phases with broadly stable return dynamics, daily leverage can generate substantial long-term advantages.

At the same time, this paper demonstrates that this outperformance is not universal. Several periods in the historical sample exhibit characteristics that weaken or temporarily offset the effect of leverage, such as the prolonged, uneven market behavior between 2000 and 2012, the sharp breaks in early 2020, and the elevated financing rates observed after 2022. The comparison of different 2020 entry dates highlight how strongly the long-term result depends on the segment of the market cycle captured at the beginning of the investment. Similarly, the sensitivity analysis shows that short-term funding costs, modelled via EFFR and SOFR in accordance with MSCI methodology (Federal Reserve Bank of New York, 2025a; 2025b), meaningfully influence realized returns in the higher-rate environment of recent years.

The synthesis of these findings indicates that a 2x MSCI World exposure can deliver superior long-term returns, but only under certain market conditions. The favorable outcomes documented in this study arise from specific combinations of market drift, fluctuation patterns, and Candidates: 1002, 1039, 1071, 1053

rate conditions rather than from a stable structural advantage. For retail investors who typically follow passive, long-term accumulation strategies, these dependencies introduce considerable uncertainty, as they cannot be managed through simple buy-and-hold behavior.

In conclusion, while a 2x leveraged MSCI World exposure can deliver significantly higher long-term returns than the unleveraged index, as our reconstruction clearly demonstrates, this advantage is conditional on market pathways that are unlikely to be anticipated by typical retail investors. Understanding the conditions under which leverage adds value and the risks associated with its mechanics is essential for determining when and how these products can be used appropriately.

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