

Should I Include Leveraged ETFs In My Portfolio?

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1 Introduction

In finance, leveraging means obtaining an exposition to an asset that surpasses one's stake. For instance, with a $2\times$ (or "2:1") leveraged ETF (LETF), an investment of 1 euro grants 2-euro worth of exposition to the underlying asset of the LETF.

The [Lifecycle Investing](#) study showed that adopting a leveraged position on stocks may be interesting for retirement planning in a first section of one's career. The goal of such leveraging is to increase the expected returns given that, at that stage of life, one's total portfolio is overwhelmingly dominated by bond-like assets (futures savings from wages) thus

causing one's exposition to risky assets to be far below what one's level of risk aversion (or utility function) recommends.

Fundamentally, several methods make this possible, of which borrowing (e.g., mortgage loans, margin loans) is the most obvious one. But those methods also include more sophisticated schemes involving stock options (namely box spreads on future contracts).

In this study, we will explore the intricacies of one LETF – [Amundi ETF Leveraged MSCI USA Daily UCITS ETF - EUR](#), whose ticker is “CL2” – which is designed to provide, at the scale of each trading day, a $2\times$, long exposition to the performance of the [MSCI USA index](#) (Net Return).

- This LETF uses short-term, interbank borrowing to turn an investor's 1 euro stake into 2 euros of exposition. This gymnastic is solely managed by the fund.
- The fund is eligible to the [Plan Epargne en Action \(PEA\)](#) even though the index it tracks is entirely focused on the US. That is because it uses a *total return swap* between (i) a set of eligible assets (assets based in the European Union) it owns and (ii) the actual set of stocks in the MSCI USA Index owned by another company.
- And CL2 also happens to be capitalizing which allows dividends to compound without reduced tax interference and grants the investor full control on their fiscal events.

These characteristics make CL2 and similar LETFs the easiest solution to gain leverage on stocks in France.

Nonetheless, this form of leverage implies certain additional risk factors compared to the equivalent, but unleveraged, scenario (namely a classic long, unleveraged, buy-and-hold strategy on [ESE](#) – a popular ETF tracking the S&P 500 index which is similar to the MSCI USA index):

- the cost of the borrowing carried out by the fund evolves unpredictably over time and has a direct, negative impact on the performance of the LETF;
- the daily rebalancing (daily reset of the leverage) increases the negative impact of the underlying index's volatility on the performance of the LETF – this negative impact is called beta slippage. LETFs with a daily rebalancing are only marketed for detention periods of 1 trading day at most because funds want to discourage investors from exposing themselves to the daily rebalancings.

Those weaknesses can make LETFs greatly underperform equivalent unleveraged ETFs (e.g., CL2 vs. ESE) if borrowing costs and/or volatility are high.

The choice of an investment essentially rests on its expected risk-adjusted return or, in other words, on the amount of return it will provide for each unit of volatility (risk). Compared to unleveraged ETFs like ESE, the risk-adjusted return of LETFs like CL2 are more vulnerable to the underlying index's volatility and require borrowing costs not being too high (while unleveraged ETFs are not directly affected by interest rates). Hence, while LETFs are easy to *use*, the *choice to invest* in them is much more complex. That is what we will explore herein.

2 Materials

The time series used in this study are listed in Table 1.

Table 1: Materials of the study

Time series	Source
MSCI USA index (Net, USD)	https://www.msci.com/indexes/index/984000
Euro Short-Term Rate (ESTER)	https://www.boursorama.com/bourse/taux/cours/1xESTER/
USD/EUR	https://finance.yahoo.com/quote/USDEUR=X/
CL2	https://finance.yahoo.com/quote/CL2.PA/

3 Understanding beta slippage

Let's first have a look at a putative $2\times$ leveraged investment without rebalancing. That corresponds to a situation where one invested €100 and got €200 worth of the asset (an index fund) thanks to borrowing (i.e., with a €100 loan), for instance. For the sake of this example, we will consider a constant daily return of 2% on the index fund and ignore borrowing costs and fees. Figure 1 shows that the cumulative return of the $2\times$ leveraged investment is constantly equal to the cumulative return of the index fund multiplied by two.

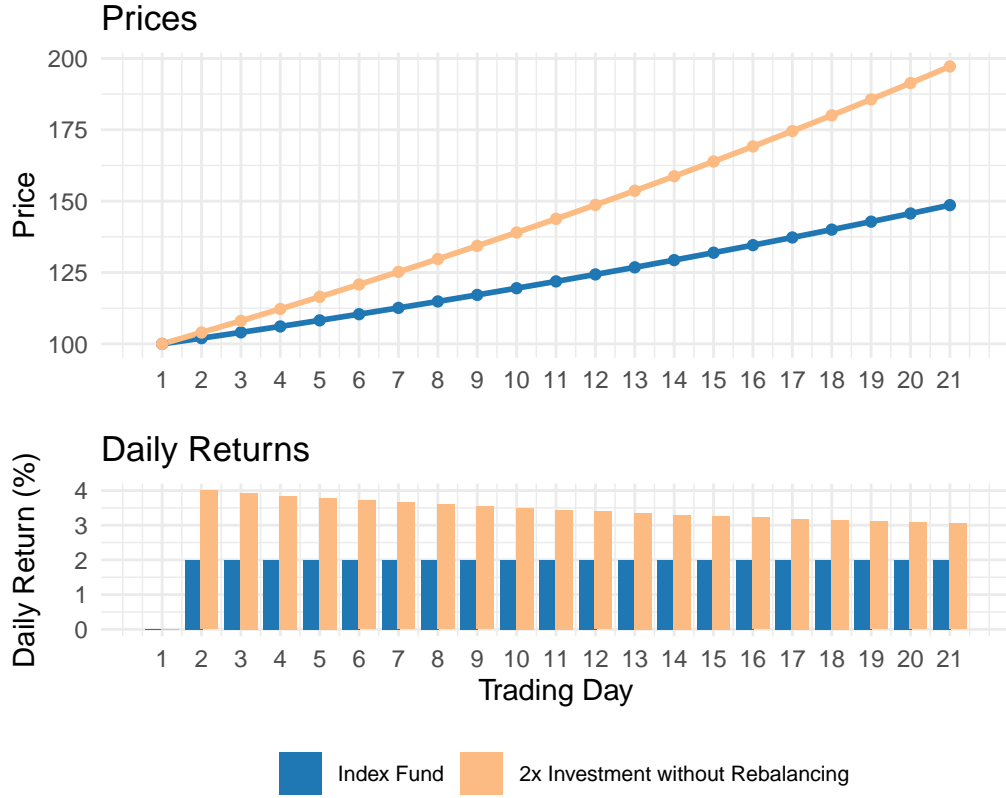


Figure 1: Leverage without rebalancing

We also notice on Figure 1 that the daily returns gradually converge: the one of the index fund was set to a constant 2%, but that translates to a daily return on the leveraged investment that starts at 4% and converges asymptotically to 2%. This is because, while the value of the initial €200 worth of index fund shares grows by 2% daily, the value of the debt stays constant. As the total value of the position (= value of the asset) increases, the debt (= €100) becomes negligible relative to the steadily growing equity (= position - debt). Hence, in the limit of infinitely many trading days, the leverage – which is the position to equity ratio (Equation 1) – approaches 1 and the daily returns asymptotically approach 2%, like the unleveraged, underlying index fund. Equation 2 demonstrates this.

$$\text{leverage} = \frac{\text{position}}{\text{equity}} = \frac{\text{position}}{\text{position} - \text{debt}} \quad (1)$$

$$\text{daily return} = \frac{200(1.02)^t - 200(1.02)^{t-1}}{200(1.02)^{t-1} - 100} \quad (2)$$

$$= \frac{200(1.02)^{t-1} \times (1.02 - 1)}{200(1.02)^{t-1} - 100}$$

$$\begin{aligned}
&= \frac{200(1.02)^{t-1} \times 0.02}{200(1.02)^{t-1} - 100} \\
&= \frac{(1.02)^{t-1} \times 0.02}{(1.02)^{t-1} - 0.5} \\
\lim_{t \rightarrow \infty} \text{daily return} &= \lim_{t \rightarrow \infty} \frac{(1.02)^{t-1} \times 0.02}{(1.02)^{t-1} - 0.5} \\
&= \frac{0.02 \times \infty}{\infty} = 0.02
\end{aligned}$$

A key information here is the fact that, unless the underlying asset doesn't change in value, leverage needs rebalancing in order to stay at a constant level. Without it, the leverage factor decreases when the returns are positive and it increases when the returns are negative.

But what is rebalancing exactly? It basically consists in readjusting the leverage factor after it has diverged because of the positive or negative evolution of the price of the asset. Keeping in mind Equation 1, in the case above where the leverage has decreased at the end of day 2 due to a 2% return (Equation 3), rebalancing would consist in borrowing more which reduces the *equity* term (Equation 4), in buying more shares without borrowing to increase the *position* (Equation 5), or in selling the 2% return to bring both the *position* and the *equity* back to their initial values (Equation 6).

$$\text{leverage}_{\text{day 2}} = \frac{200 \times 1.02}{200 \times 1.02 - 100} = \frac{2.04}{1.04} \approx 1.96 \quad (3)$$

$$\text{leverage}_{\text{day 2}} = \frac{200 \times 1.02}{200 \times 1.02 - 102} = \frac{2.04}{1.02} = 2 \quad (4)$$

$$\text{leverage}_{\text{day 2}} = \frac{200 \times 1.02 + .04}{200 \times 1.02 - 100} = \frac{2.08}{1.04} = 2 \quad (5)$$

$$\text{leverage}_{\text{day 2}} = \frac{200 \times 1.02 - 200 \times 0.02}{200 \times 1.02 - 100 - 200 \times 0.02} = \frac{2}{1} = 2 \quad (6)$$

LETFS with daily rebalancing automatically manage this rebalancing after the end of each trading day. Figure 2 draws the comparison between never rebalancing and rebalancing once a day. We can see that the daily rebalanced LETF keeps a steady daily return equal to two times the daily return of index fund, unlike the decaying daily return of the non-rebalanced investment. Hence, everyday, daily-rebalanced LETFs allow the same “bet” to be made. We also observe that if the LETF is held more than one day, its cumulative return exceeds two times the cumulative return of the index fund. That is thanks to compounding: the returns from day D are accounted for in the leverage on day D+1 and so on, basically.

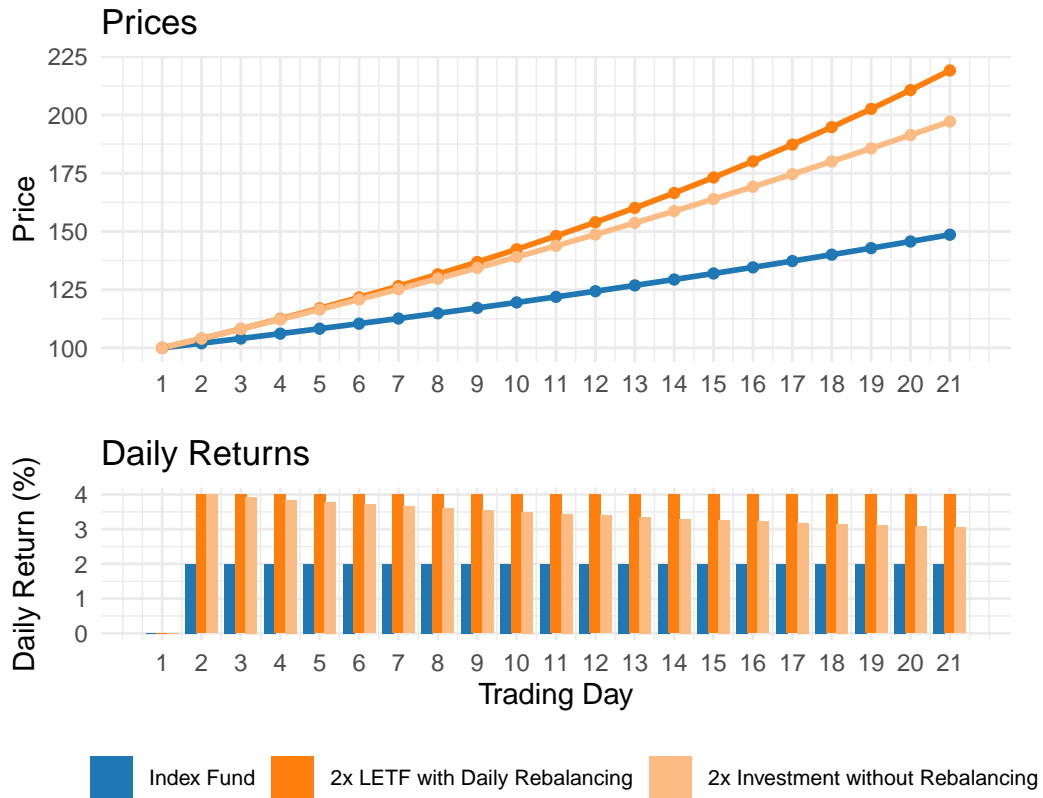


Figure 2: Leverage with or without rebalancing in an upward market

Of course, when the returns are negative, leverage expands the losses (Figure 3). Note that this figure is not symmetric relative to Figure 2: the LETF leads to less losses than the unbalanced, leveraged investment. This is due to the daily rebalancing: over time, a $2 \times 2\% = 4\%$ daily loss corresponds to a decreasing absolute sum of money lost.

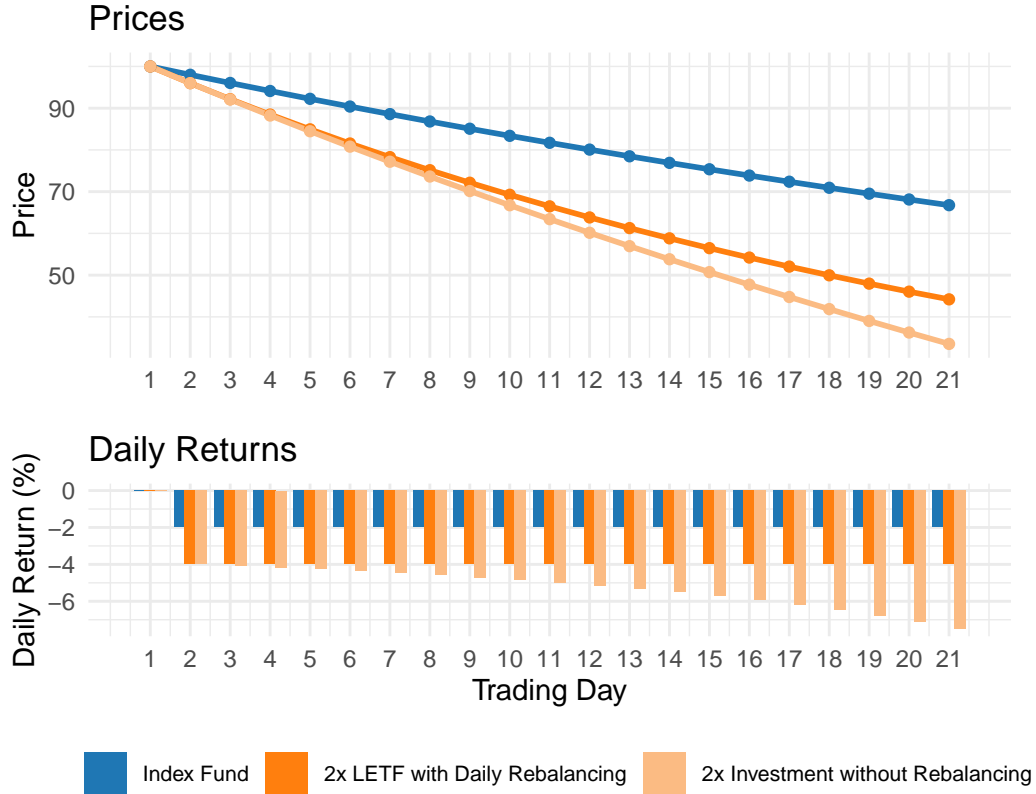


Figure 3: Leverage with or without rebalancing in a downward market

So far, we have only looked at highly-unrealistic scenarios with constant daily returns. By introducing some volatility, we will notice that a new phenomenon appears.

Let an index fund with an initial share price of €100 on trading day 1. On day 2, the price dropped to 90% constituting a 10% drop. To make up for this loss and come back to €100, a 10% gain is not enough ($€90 \times 1.1 = €99$), we need a ~11% gain ($€90 \times (1 + €10/€90) \approx €90 \times 1.11 \approx €100$). This is simply because the difference in value (€10) corresponds to a different proportion of the share price before (10%) and after (11%) the loss.

Now let's consider a 2x LETF on that index fund with a €100 initial value and daily rebalancing. At the end of day 2, it lost $10 \times 2 = €20$ and closes at €80. If on the next day, the index returns ~11% which is enough for it to breakeven, this won't be enough for the LETF to breakeven: $€80 \times (1 + €10/€90 \times 2) \approx €97.78$. To breakeven, the LETF needs the underlying index fund not only to breakeven but to overperform its initial price with a 12.5% return: $€80 \times (1 + €20/€80) = €80 \times (1 + €11.25/€90 \times 2) = €80 \times (1 + 0.125 \times 2) = €100$.

In other words, the return that was enough to bring the index back to €100 (~11%), when multiplied by two (~22%), is not enough to bring back the 2x LETF back to €100. That's because shares of the LETF lost more worth than those of the index fund: after the loss on day 2, one percent of a share of the index fund is worth $90 \times 0.01 = 0.9$ cents, while one

percent of a share of the $2\times$ ETF is only worth $80 \times 0.01 = 0.8$ cents. This is the crux of beta slippage. Note that beta slippage affects all investment, as shown in the anteprevious paragraph, but it is amplified by leverage and volatility as we will explain.

Figure 4 illustrates beta slippage. We have an index fund whose share value oscillates between €102 & €98 constituting a volatile sideways market. The price of a share of the associated $2\times$ ETF with daily rebalancing gradually drifts instead staying centered on its initial value like the index fund. We can also note that, without rebalancing, beta slippage doesn't occur since compounding is a necessary condition for beta slippage.

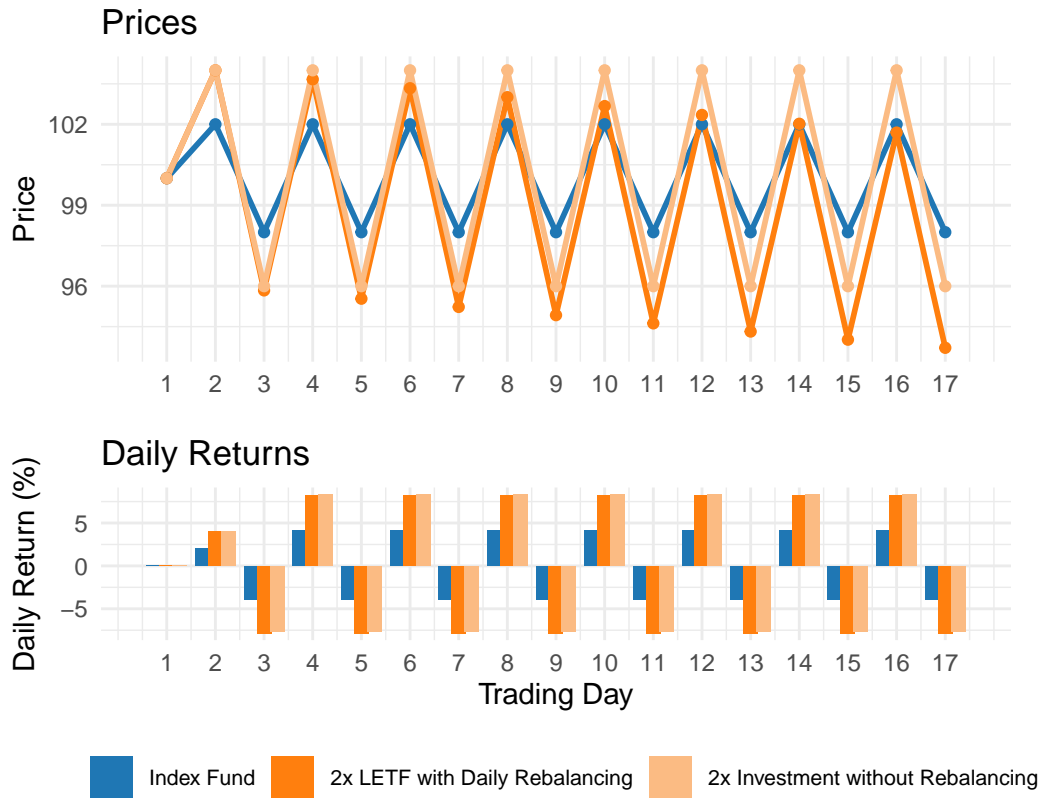


Figure 4: Beta slippage with a 2x daily-rebalanced ETF and with a 2x leveraged investment in a volatile sideways market

And Figure 5 shows that beta slippage is accentuated by the leverage factor.

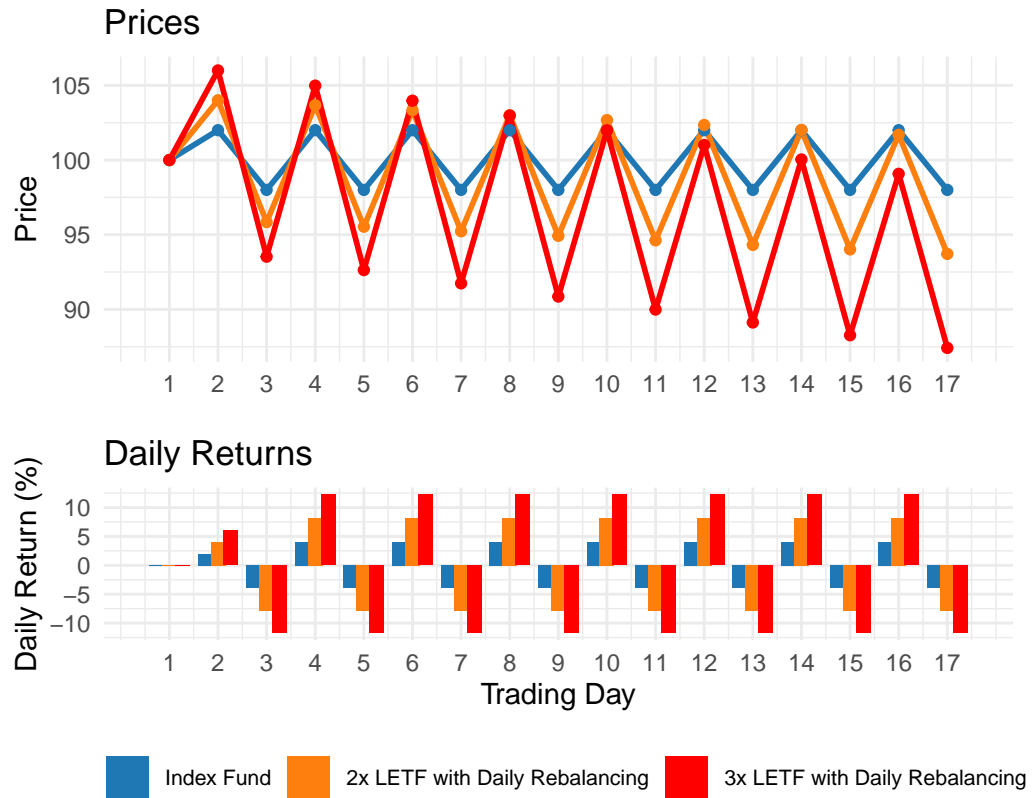


Figure 5: Beta slippage with 2x and 3x daily-rebalanced LETFs in a volatile sideways market

If the daily returns are volatile but positive (or positive and null), beta slippage will cause the daily-rebalanced LETFs to have a return that surpasses the return of the underlying asset multiplied by the leverage (Figure 2 & Figure 6). In such cases, the compounding is in the investor's interest.

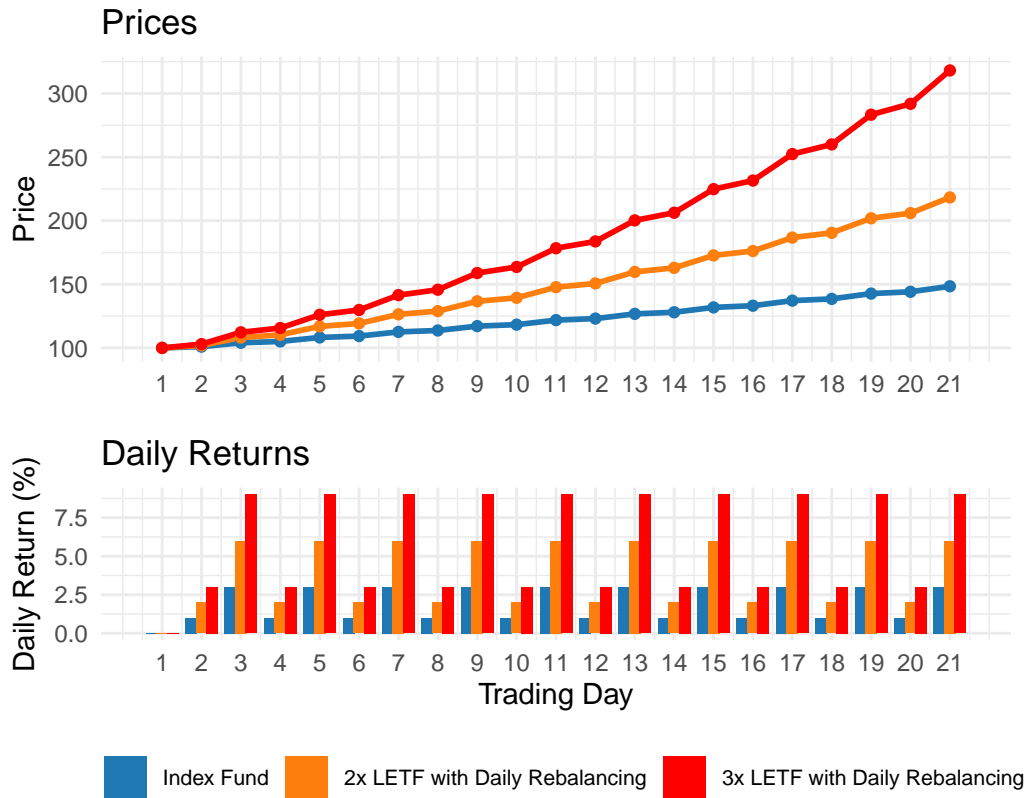


Figure 6: Beta slippage with 2x and 3x daily-rebalanced LETFs in a volatile upward market

And in the case of volatile but negative (or negative and null) daily returns, the daily-rebalancing keeps the losses of the LETF below the loss of the underlying asset multiplied by the leverage.

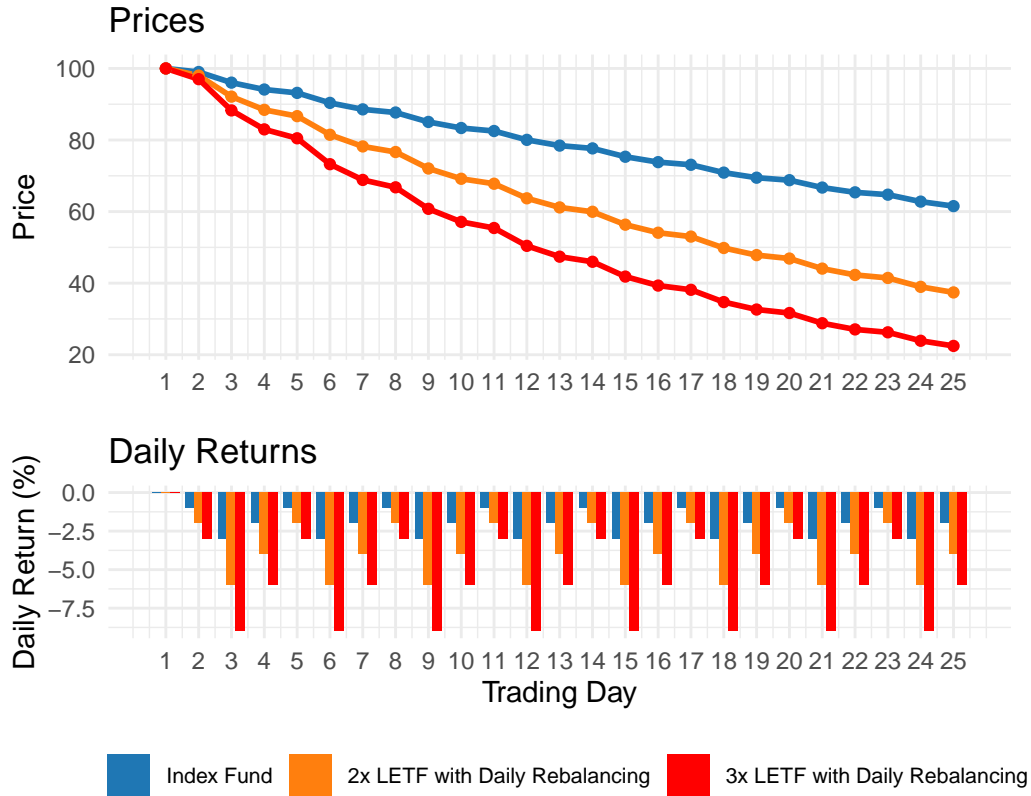


Figure 7: Beta slippage with 2x and 3x daily-rebalanced LETFs in a volatile downward market

Let *positive beta slippage* describe the situation where a daily-rebalanced LETF of leverage L has a cumulative return that is superior to the cumulative return of the underlying asset multiplied by L . And vice versa for *negative beta slippage*. We have seen that beta slippage is positive when the daily returns are positive (or positive and null) and negative one when they are negative (or negative and null). But in practice, daily returns on a stock or index fund fluctuate between negative and positive values. In that case, the beta slippage can be positive or negative depending on the specific path the share price took – this is path-dependance: it's not only the starting and ending prices of the underlying that dictate the cumulative return, but also the path taken.

4 MSCI USA's Volatility

As we've seen, because of beta slippage, the volatility of the underlying asset is a key determinant of the cumulative return of daily-rebalanced LETFs when held for more than a day. Figure 8 shows the annual volatility of the daily changes of the MSCI USA index (net) converted from USD to EUR. Volatility is below 20 % points most years. But we can

see multiple peaks above that threshold: following the global financial crisis (2008, 51%), during the Covid crisis (2020, 35%), at the start of the Russo-Ukrainian War (2022, 25%), and following Trump's re-election (2025, 28%), namely. Past observations don't allow us to predict the future but they paint a picture where volatility is mostly low but peaks frequently in response to global incidents.

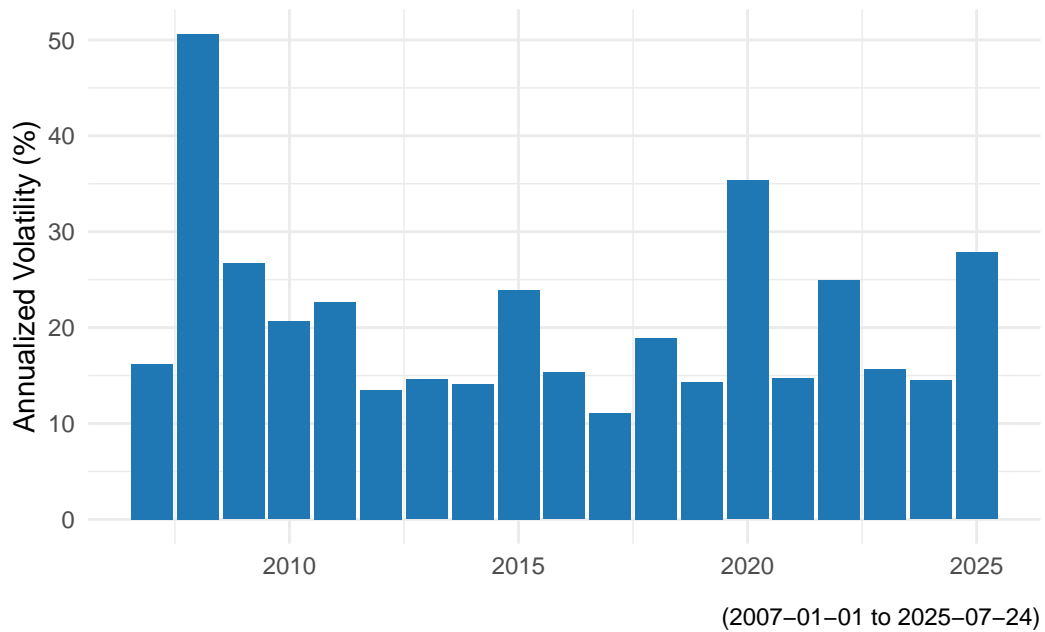


Figure 8: Annual volatility of the daily changes of the MSCI USA index (net, EUR)

5 MSCI USA & CL2 Return

Figure 9 shows the cumulative return of the index since 2007-01-01 up to 2025-07-24. Over that period, it had a CAGR of 11.8%.

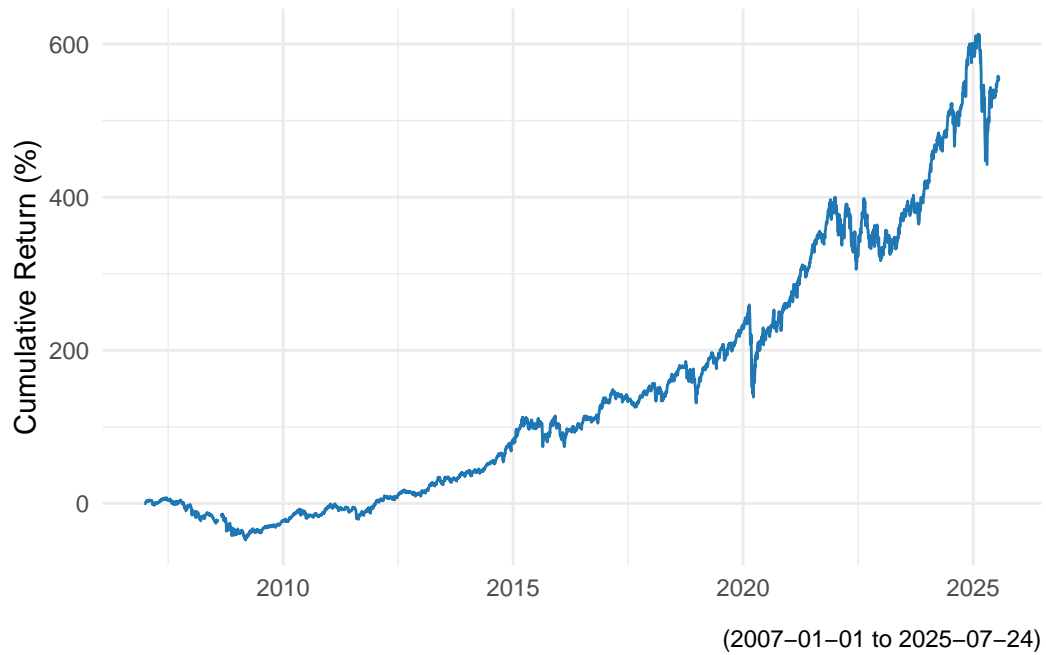


Figure 9: Cumuative return of the MSCI USA index (net, EUR)

Figure 10 shows the cumulative return of CL2 and of the index (both in EUR) over their shared period of existence. Over this period the index had a CAGR of 13.6% and CL2 had a CAGR of 21.2%.

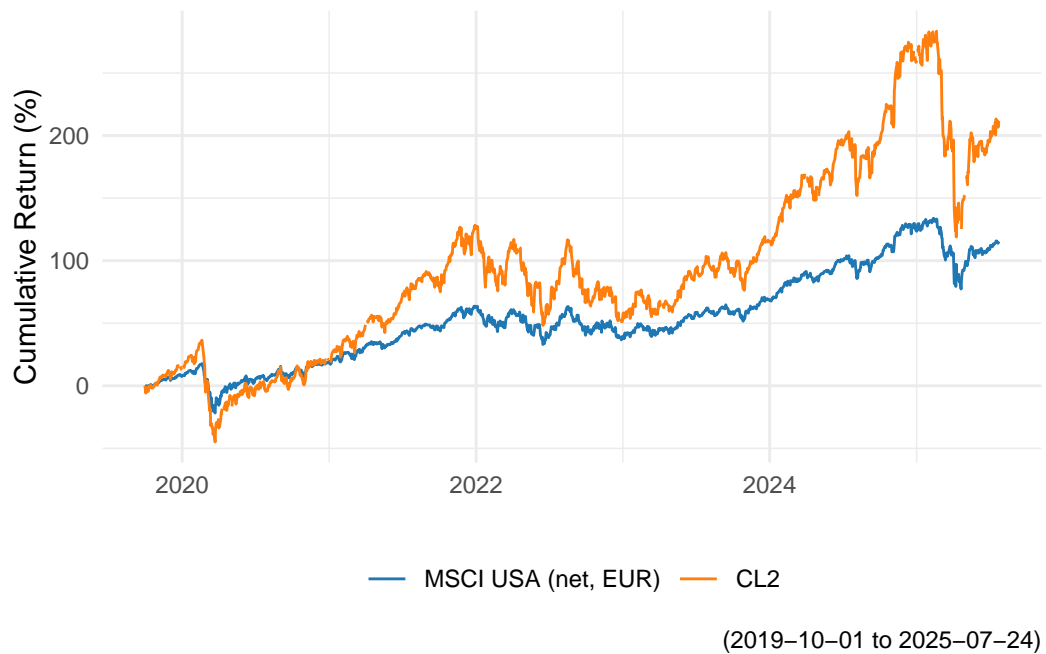


Figure 10: Cumuative return of the MSCI USA index (net, EUR) & of the CL2

From 2020-01-01 to 2025-07-27, Table 2 summarizes the risk-adjusted returns of the index and of CL2, each year. (The Sharpe ratios are computed without a risk-free rate.) In 2020, we can see that, due to negative beta slippage from high volatility (34% annualized), CL2 was far from delivering a return near two times the return of the underlying index, hence a lower Sharpe ratio (0.09 vs 0.26). In 2021 though, when volatility was low (13%) and the market was trending up, CL2 improved its Sharpe ratio relative to the unleveraged index – it more than doubled the return thanks to positive beta slippage. Borrowing costs and fees also play their role. The former peaked in 2024 (around 3.9%, cf. Figure 11) which could contribute to explaining why, despite an upward market and low volatility, the Sharpe ratio was not substantially raised by the LETF relative to the underlying. The latter is constant (0.5% per year). Note that 2025 figures represent annualized returns based on partial year data through July.

Table 2: Risk-adjusted returns of the MSCI USA index (net, EUR) & of the CL2

Year	MSCI USA Annualized Return (%)	CL2 Annu- alized Return (%)	MSCI USA Annualized Volatility (%) points)	CL2 Annualized Volatility (%) points)	MSCI USA Sharpe Ratio	CL2 Sharpe Ratio
2020	9.01	5.08	33.77	54.74	0.27	0.09
2021	37.77	87.62	14.13	27.39	2.67	3.20
2022	-14.71	-32.63	24.18	39.27	-0.61	-0.83
2023	22.10	34.72	14.65	23.96	1.51	1.45
2024	32.44	64.84	13.48	24.95	2.41	2.60
2025	-6.94	-24.94	26.39	44.78	-0.26	-0.56

6 Borrowing cost

LETFs rely on borrowing to leverage their position. In the case of CL2, the ESTER is the best proxy of the interest rate paid by the fund as it replaced the Eonia rate reference by the [fund's prospectus](#).



Figure 11: Evolution of the ESTER (per month)

7 Forward simulations of CL2

7.1 The formula

Based on the work of Avellaneda and Zhang (2010), and of a Reddit contributor (2024) who focused specifically on CL2, we use the following expression for the expected annual return of a long LETF (Equation 10):

$$\mathbb{E}[R_L] \approx L \cdot \mu \quad (\text{expected return}) \quad (7)$$

$$- \frac{1}{2} L(L-1) \cdot \sigma^2 \quad (\text{beta slippage}) \quad (8)$$

$$- (L-1) \cdot r \quad (\text{cost of borrowing}) \quad (9)$$

$$- f \quad (\text{fund expense ratio}) \quad (10)$$

Where:

- L : leverage factor of the LETF,
- μ : annualized expected return of the underlying asset,
- σ : annualized volatility of the underlying asset,
- f : annual fund expense ratio of the LETF (fees),
- r : annual borrowing interest rate paid by the LETF,

- R_L : expected annual return of the LETF.

Before we use this formula to make forward predictions, let's assess how well it predicts the past annual returns of CL2. Table 3 gives the prediction inputs, outputs and predictions errors for each year. Figure 12 shows the predicted vs. actual annual returns of CL2. And Table 4 summarizes the prediction errors across all years.

Table 3: Accuracy of the CL2 annual return predictions over the years

Year	Actual Underlying Return (%)	Actual CL2 Return (%)	Predicted CL2 Return (%)	Underlying Volatility (% points)	Average Borrowing Rate (%)	Prediction Error (% points)	Absolute Error (% points)	Relative Error (%)
2020	9.41	4.88	7.38	33.9	-0.5470	2.51	2.51	51.40
2020	37.10	87.70	72.30	14.2	-0.5680	-15.40	15.40	17.50
2020	-14.80	-32.80	-36.00	24.1	-0.0121	-3.12	3.12	9.49
2020	22.40	35.20	38.90	14.7	3.2100	3.73	3.73	10.60
2020	33.00	67.50	60.00	13.5	3.6400	-7.48	7.48	11.10
2020	-10.60	-25.50	-31.00	26.4	2.3700	-5.48	5.48	21.50

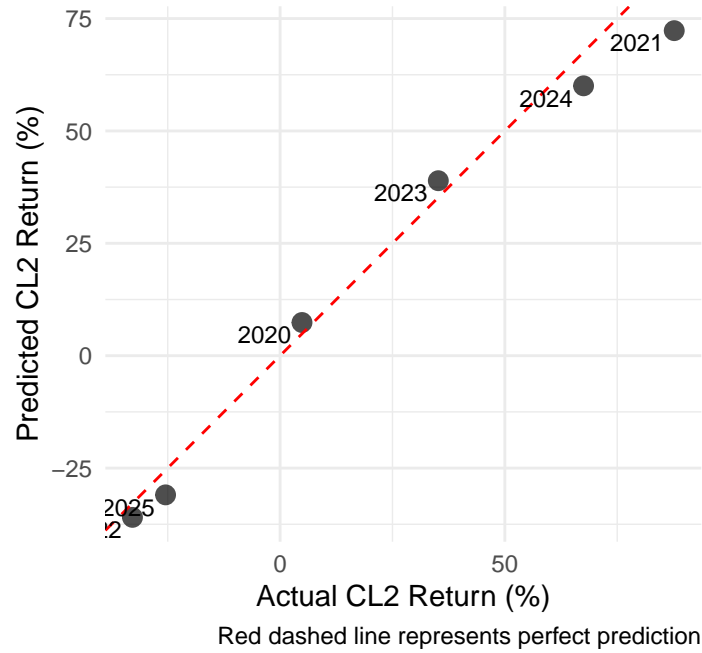
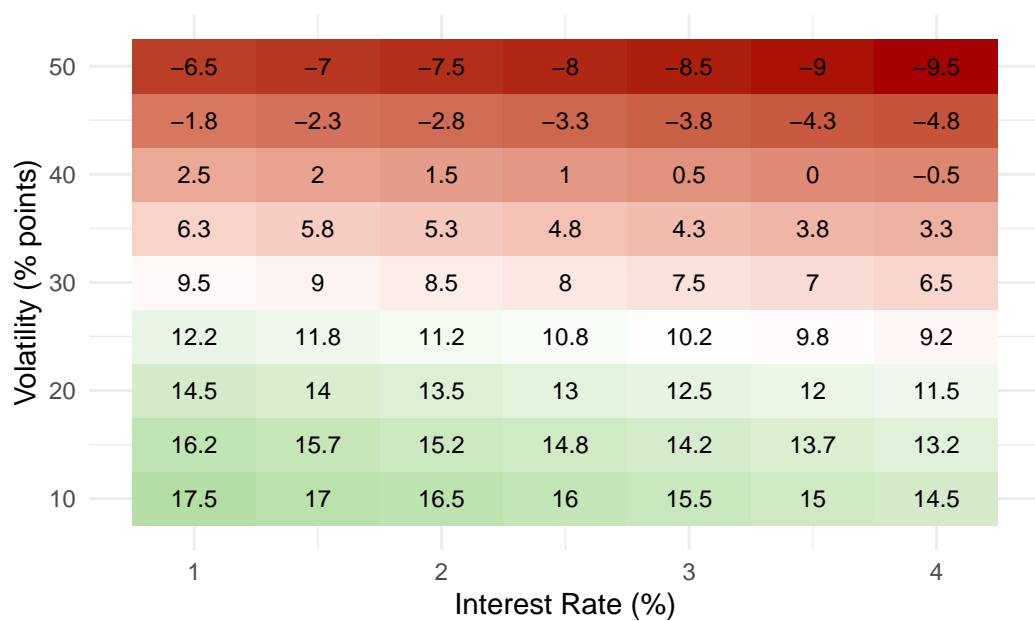


Figure 12: Predicted vs. Actual CL2 Annual Returns

Table 4: Summary of the CL2 annual return predictions

Mean Absolute Error (% points)	Root Mean Square Error (% points)	Mean Relative Error (%)	Correlation (actual v. predicted)
6.28	7.66	20.26	0.99

7.2 Forward simulations



Underlying Return: 10%, Leverage Factor: 2, Fund Expense Ratio: 0.5%

Figure 13: Expected annual return of a 2x LETF on an underlying asset with an expected return of 10%

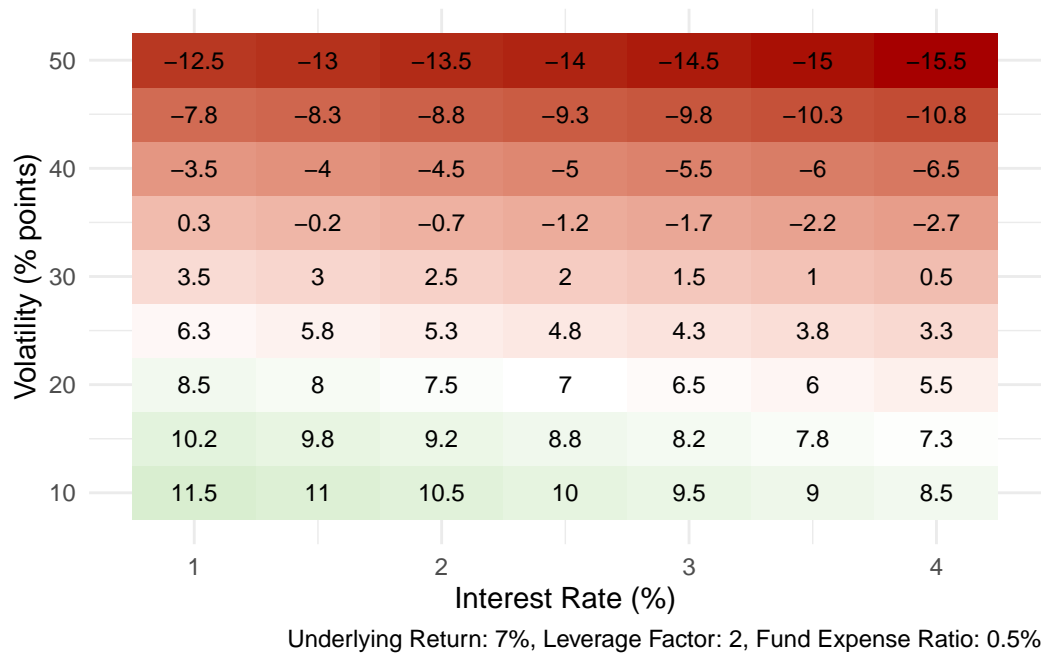


Figure 14: Expected annual return of a 2x LETF on an underlying asset with an expected return of 7%

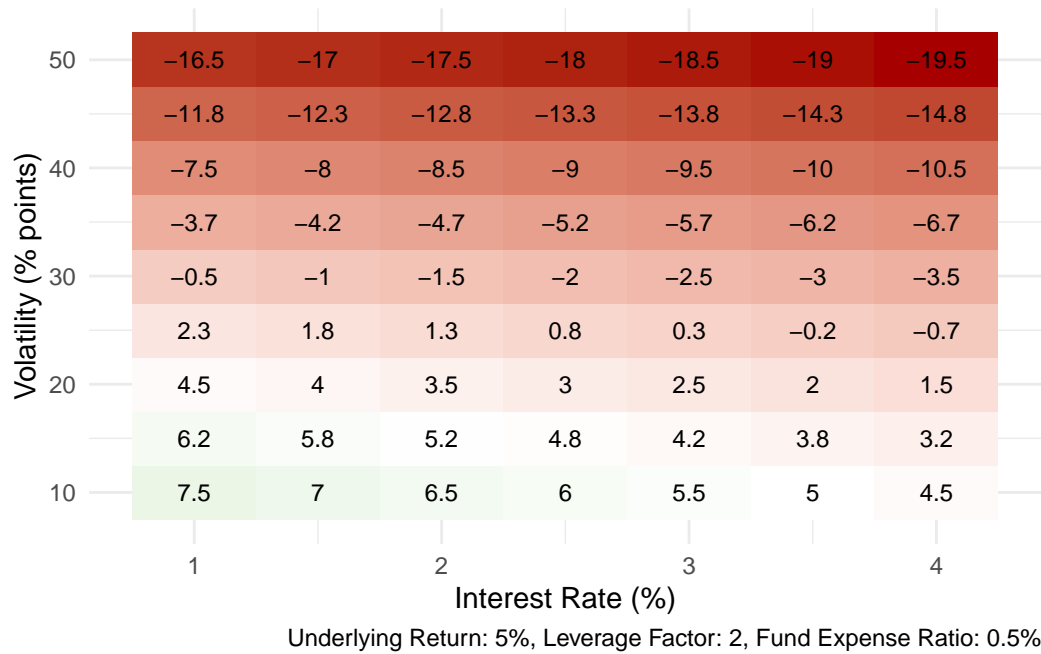


Figure 15: Expected annual return of a 2x LETF on an underlying asset with an expected return of 5%

8 Conclusions

Maybe.

9 Appendix

This qmd took 0 minutes to render. It was rendered in the following environment:

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Platform: x86_64-pc-linux-gnu
Running under: Ubuntu 24.04.2 LTS
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attached base packages:

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other attached packages:

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