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Cost averaging: Invest now or temporarily hold your cash?

- Lump-sum investment strategies beat common cost averaging investment strategies two-thirds of the time, according to historical and simulated market data.
- Despite the expectation of lower returns, cost averaging might be considered for investors with very high aversion to both risk and losses who might be tempted to hold a lump sum entirely in cash.
- Even without a lump sum to invest, investors can benefit from maximizing their time in the market by using retirement account front-loading and withdrawal sequence strategies, or simply by not delaying when funds are available for investment.

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Imagine receiving a windfall due to an inheritance, a bonus payment, or the sale of a small business. How would you invest the cash? Would you immediately invest all of it as a lump sum? Or would you make a series of investments over time—a strategy known as cost averaging—to avoid the risk of investing the entire amount right before a market downturn?

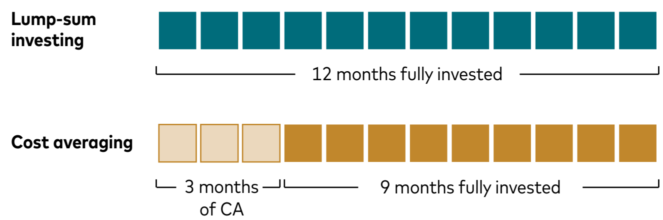
In this paper, we compare the performance of cost averaging (CA) with lump-sum investment (LS) across various markets, historical periods, and simulated return scenarios to determine which strategy most often works best.[1] We find that historically, LS outperformed CA roughly two-thirds of the time. This result is consistent with the fact that over the period 1976–2022, U.S. stocks and bonds outperformed cash—as proxied by the 3-month U.S. Treasury bill rate—76% of the time for stocks and 68% of the time for bonds. This highlights how a cash allocation, even if temporary, represents the opportunity cost of lost risk premium.

Figure 1 helps to visualize a three-month CA strategy, with the CA period at the beginning representing when the opportunity cost is incurred. Given that cost, most investors—particularly those without significant aversion to loss—should invest a lump sum immediately. We explore more about loss aversion later.

FIGURE 1

Lump-sum investing maximizes time in the market, and thus growth potential, versus cost averaging

Lump-sum (LS) versus cost averaging (CA) investment periods



Notes: This hypothetical depiction of the comparative lengths of the fully invested period for the two strategies is for illustrative purposes only. It does not represent any particular investment.

Source: Vanguard.

We take a closer look in this paper at how LS and CA strategies have performed given historical and simulated market returns, and we explore investor risk preferences that may make CA more palatable. Although the CA strategy won't, on average, produce higher returns, it is superior to remaining entirely in cash, and it temporarily lowers a portfolio's risk by systematically decreasing the cash allocation. Particularly for loss-averse investors, lowering risk could limit drawdown and the accompanying investor regret in a severe market downturn, thus preserving commitment to the investment plan. Still, shielding the investor from the possibility of regret with CA must be carefully weighed against the expectation of lower returns with that strategy.

Clarifying cost averaging

CA is also known as dollar-cost averaging in the U.S. and pound-cost averaging in the U.K., but the concept of cost averaging is not region-specific, making this analysis relevant for any investor around the globe. The term is also used to describe investing a fixed amount from each paycheck to consistently invest without regard for market timing. In contrast to that, we are examining here what to do with a lump sum that is available immediately.

1 The plethora of literature on cost averaging is generally in favor of lump-sum investing, most prominently Constantinides (1979); Rozeff (1994); Brennan, Li, and Torous (2005); and more recently Shtekhman, Tasapoulos, and Wimmer (2012).

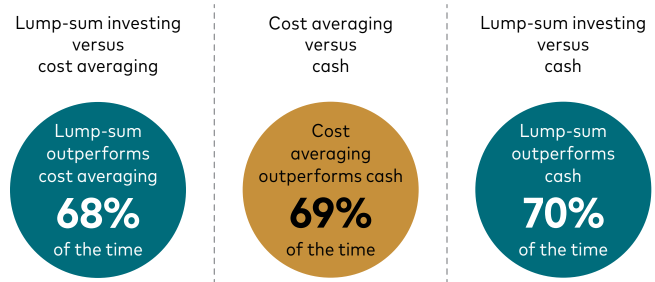
History shows that LS outperforms CA on average

A historical comparison of CA and LS methods across regions shows that LS has outperformed on average, suggesting you are usually better off investing immediately instead of holding back a portion of the potential investment. Across global markets—including the United States, the United Kingdom, Australia, Canada, and the European Union—we see similar results, but we show a single global market index in **Figure 2** for illustrative purposes. As the figure shows, LS is a better option than CA, outperforming 68% of the time, but CA is better than remaining completely in cash, having outperformed cash 69% of the time. Outperformance is determined by comparing wealth between the two strategies after one year. For a more detailed analysis across global markets, see **Appendix 1** on page 9.

FIGURE 2

LS mostly outperforms CA, but CA still largely beats staying in cash

Historical probability of outperformance



Notes: This figure is for illustrative purposes only and does not represent any particular investment. Outperformance is based on comparing wealth after a one-year investment horizon with a lump-sum strategy versus a three-month cost averaging split (splitting a lump sum into three equal parts and investing each one a month apart). The investment is assumed to be 100% equity, with no interest earned on any uninvested portion, and performance is measured on a rolling basis after one year. The cash-only strategy is approximated by the 3-month U.S. Treasury bill rate. Calculations are made using MSCI World Index returns for 1976–2022.

Source: Vanguard.

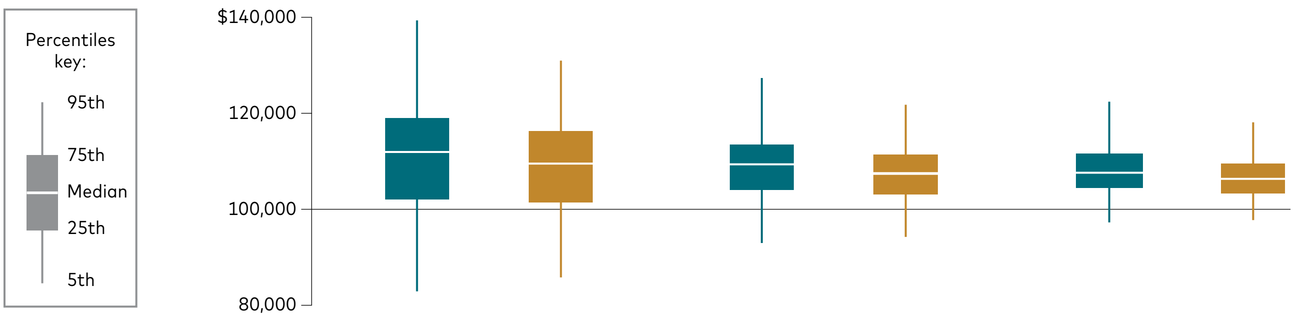
Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

To quantify the magnitude of LS outperformance, **Figure 3** calculates the wealth, after a one-year investment horizon, of a $100,000 initial investment for portfolios of 100% equity, 60% stocks/40% bonds, and 40% stocks/60% bonds. As in the historical comparison above, we use the MSCI World Index to represent global equity markets, along with the Bloomberg U.S. Aggregate Bond Index to represent the bond market. The lower percentiles in the figure represent the worst historical outcomes, and the higher percentiles represent the best outcomes.

FIGURE 3

An LS strategy typically yields higher wealth compared with CA

Historical wealth ranges for LS versus CA strategies after a one-year investment period



Percentile	100% equity		60% equity/40% bonds		40% equity/60% bonds	
	Lump-sum	Cost averaging	Lump-sum	Cost averaging	Lump-sum	Cost averaging
95th	$139,453	$131,012	$127,631	$121,967	$122,673	$118,303
75th	119,063	116,286	113,661	111,545	111,686	109,640
50th	**111,940**	**109,580**	**109,360**	**107,453**	**107,648**	**106,400**
25th	102,070	101,531	104,082	103,134	104,420	103,290
5th	82,947	85,906	92,720	94,043	97,144	97,701

Notes: This figure is for illustrative purposes only and does not represent any particular investment. Percentiles are for a one-year rolling investment period with a starting wealth of $100,000 for each of three portfolios (100% equity, 60% equity/40% bonds, and 40% equity/60% bonds) using a lump-sum strategy versus a three-month cost averaging split (splitting a lump sum into three equal parts and investing each one a month apart). Calculations are made using MSCI World Index and Bloomberg U.S. Aggregate Bond Index returns for 1976–2022.

Source: Vanguard.

Past performance is no guarantee of future returns. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index.

LS outperforms in all but the worst outcomes (below the 25th percentile), showing that in most historical market environments, investors would have been better off investing the lump sum all at once. If invested in a 60/40 allocation, a three-month CA strategy led to an average ending value of $107,453, while LS led to an average ending value of $109,360, or 1.8% more. Figure 3 also shows the relationship between asset allocation and LS outperformance: The higher the equity allocation, the greater the percentage increase in wealth using the LS strategy versus CA. At the median, the 100% equity portfolio wealth after one year is 2.2% higher if invested with LS instead of CA, and in the 40/60 portfolio, LS yields 1.2% higher wealth than CA. This relationship is easily explained by lost risk premium. The months spent partly in cash represent lost risk premium, and the potential risk premium is greater in more heavily equity-weighted portfolios.

Comparing the extreme upside and downside percentiles in Figure 3 also reveals the relationship between risk and return. The added risk taken in the LS strategy pays off with higher outperformance versus the median in the 95th percentile; conversely, LS underperforms CA in the 5th percentile. This highlights that taking more risk can lead to greater payoff in upside scenarios but at the cost of additional losses in downside scenarios. Although studying the extreme scenarios is helpful, our recommendation to use LS is based on the more likely scenarios between the 25th and 75th percentiles, where LS outperforms CA.

Investors may wonder whether the holding period matters when comparing strategies. For instance, would our results change if we compared wealth after five years instead of one? Because the asset allocations of the CA and LS portfolios are identical at the end of the CA period, the portfolio with more assets at that point will stay ahead forever, assuming no changes are made to either portfolio. It is possible, however, for the holding period studied to affect the gap, in dollar terms, between the two portfolios. That's because a larger balance will have the potential for greater gains and losses over time—even though the return percentages of both portfolios are identical.

Another takeaway from our historical analysis is that the longer the CA horizon—the time it takes to fully invest cash—the greater the opportunity cost incurred. Splitting investments across a longer period further decreases CA's performance versus LS.

We also added cash interest to our analysis to determine how that changes the outcome. Even assuming reasonable interest for the amount left in cash, as proxied by the 3-month U.S. Treasury bill rate, our results are similar: LS outperforms the 3-month CA strategy 65% of the time for an all-equity portfolio. We also varied the cash interest rate to find that, unsurprisingly, as cash interest increases, LS's advantage diminishes, all other things being equal.

A simulation approach as a robustness check

Although historical analysis helps us understand what strategy worked better in past markets, using simulated returns serves as a robustness check and is forward-looking. We used 10,000 simulated-return scenarios and tested various types of portfolios and CA period lengths.[2] Our base case assumes equal investments over three consecutive months, in a 60/40 stock/bond portfolio with 0% cash interest. The 0% interest assumption is consistent with the investor leaving cash in a near-zero interest-bearing checking or savings account during the CA period. In line with our findings from the historical analysis, LS in most cases yields greater wealth after one year than CA, but LS strategies exhibit more drawdown in the worst market environments, in which the CA strategy has greater wealth after one year.

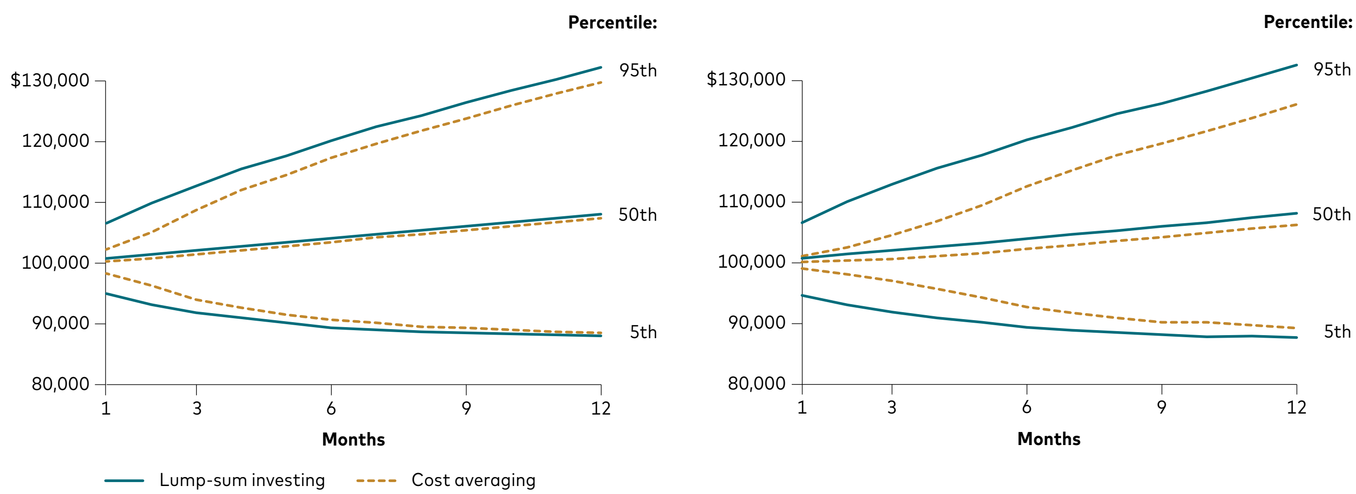
Figure 4 shows that LS has a wider distribution—namely, a higher 95th percentile than CA and a lower 5th percentile. Also, the gap between LS and CA portfolio values is particularly wide in the early months of the extreme upside and downside scenarios, demonstrating how the CA period can safeguard in extreme down markets but hinders portfolio growth in the best up markets. The relationship between increased return at the cost of additional risk-taking suggests that investors with higher loss aversion would be better off with CA.

FIGURE 4.

LS yields a higher median return with additional risk

a. LS versus CA with three equal investments made one month apart

b. LS versus CA with six equal investments made one month apart



Notes: This figure is for illustrative purposes only and does not represent any particular investment. The graphs show the differences in investment outcomes after a one-year investment period for both lump-sum and cost averaging approaches using simulated return paths. LS outperforms CA at the median, and the probability of LS outperformance is similar to the historical analysis presented in this paper. Starting at a portfolio value of $100,000, after a one-year investment, the three-month CA strategy yields $504 less than the LS strategy, and the six-month CA strategy yields $1,491 less than the LS strategy.

Source: Vanguard.

2 See **Appendix 2** on page 10 for more information about our simulation methodology.

Is CA preferable for some investors given their risk preferences?

Intuitively, we know that not all investors aim purely to maximize their wealth; for some, there is value in taking the slower path to portfolio growth if it helps to minimize big drawdowns.[3] Investors who would sacrifice some expected returns to avoid big losses can be described as loss-averse. We set out to quantify a loss-averse investor's preference for the lower-risk CA strategy. We constructed a utility model with loss aversion and compared utility between CA and LS strategies in terms of certainty equivalent. Certainty equivalent is the return that an investor will accept today rather than the higher but uncertain return in the future.[4] Our hypothesis was that an investor with significant loss aversion would prefer the CA strategy because of its temporarily lower risk, despite lower expected returns.

Our utility model incorporates both risk aversion (a preference for more certain outcomes) and loss aversion (a penalty on negative outcomes), which are key components of the investor risk profile. We look at several investor personas, with varying levels of risk and loss aversion, and determine which strategy—CA or LS—each one prefers. Our comparison uses the utility model to calculate a certainty equivalent return for each persona. The higher the certainty equivalent return, the greater the investor's preference for the strategy.

Figure 5 shows preferences for LS or CA by investor persona; the only difference is that Figure 5a has no loss aversion and Figure 5b does. Comparing the moderately conservative risk-averse investor in Figure 5a without loss aversion to the moderately conservative risk-averse investor in Figure 5b with loss aversion, we see that the investor with loss aversion prefers CA, while the investor without loss aversion prefers LS. This indicates that investors with significant loss aversion may be better suited for a CA strategy.

FIGURE 5

For investors with high risk and loss aversion, CA might be more suitable

a. Preference for LS or CA by investor persona, without loss aversion

Risk tolerance	Lump-sum investing	Cost averaging
Adventurous	Yes	No
Moderately conservative	Yes	No
Very conservative	No	Yes

Notes: The assumed risk aversion levels are 3 for adventurous, 6 for moderately conservative, and 10 for very conservative. There is no loss aversion penalty. Strategy preference is assigned to the higher certainty equivalent return. The certainty equivalent return for the adventurous persona is 1.0603 for LS and 1.0559 for CA. For the moderately conservative persona, it is 1.0443 for LS and 1.0421 for CA. For the very conservative persona, it is 1.0232 for LS and 1.0237 for CA.

Source: Vanguard.

b. Preference for LS or CA by investor persona, with loss aversion

Risk tolerance	Lump-sum investing	Cost averaging
Adventurous	Yes	No
Moderately conservative	No	Yes
Very conservative	No	Yes

Notes: The assumed risk aversion levels are 3 for adventurous, 6 for moderately conservative, and 10 for very conservative. Loss aversion was set at 2.50. Strategy preference is assigned to the higher certainty equivalent return. The certainty equivalent return for the adventurous persona is 1.0321 for LS and 1.0296 for CA. For the moderately conservative persona, it is 1.0100 for LS and 1.0102 for CA. For the very conservative persona, it is 0.9836 for LS and 0.9869 for CA.

Source: Vanguard.

3 This behavioral concept is well-documented. See, more generally, Tversky and Kahneman (1992) or, in connection with cost averaging, Statman (1995).

4 See **Appendix 3** on page 10 for more information on utility and our utility model.

Even if you don't get a windfall, there are actionable ways to use LS

Front-loading a retirement or pension plan

Although most working adults will not win the lottery or inherit a substantial lump sum, the majority have the opportunity to save for retirement in a tax-advantaged investment account, such as a 401(k) plan in the U.S. or a pension in the U.K. As a thought experiment, we hypothesized that a front-loading strategy in which the investor makes the entire yearly contribution as early each year as possible would lead to higher wealth. Although this type of strategy means the investor would forgo income for the first few months, our lump-sum strategy research suggests that additional time in the market would lead to a higher retirement account balance on the median, which can be significant if this strategy is used year after year.

Retirement/pension withdrawal sequence

One circumstance when investors have to decide on lump sum versus monthly withdrawals is when they draw from a retirement account or pension wrapper. One could make the reverse cost averaging argument for withdrawals. Taking out a lump sum at the start of the year versus withdrawing each month might be suboptimal. Having a lump-sum amount ready for the whole year, though, adds some security in the event of market downturns. Deciding between the two strategies boils down, again, to opportunity cost, risk, and investor preferences.

Conclusion

We've seen how the opportunity cost of remaining in cash should deter most investors from using a cost averaging strategy. Even for investors with high loss aversion who find that strategy more palatable than lump-sum investing, opportunity cost should be minimized by keeping a relatively short CA period, such as three months. Recognizing the many considerations that factor into the CA or LS decision is the first step in establishing a plan for investing cash.

Although investors' risk preferences may vary, most would agree that risk-adjusted returns provided by equities and fixed income are more attractive than those of cash. In other words, having a plan for investing cash is the most important part; whether LS or CA is chosen will make only a marginal difference compared with permanently keeping a cash allocation. This is especially true if the lump sum constitutes a small fraction of an investor's overall wealth. Many investors hold too much cash as a result of indefinitely deferring the decision about how and when to invest. Whether this cash-hoarding is a result of indecision, risk aversion, or simply disengagement, we know that over long time horizons, investors will achieve superior outcomes by being fully invested according to their prescribed asset allocation. We hope that our framework for thinking about LS and CA investing will serve as a starting point for your investment plan.

References

Brennan, Michael J., Feifei Li, and Walter N. Torous, 2005. Dollar Cost Averaging. *Review of Finance* 9(4): 509–535.

Constantinides, G. M., 1979. A Note on the Suboptimality of Dollar-Cost Averaging as an Investment Policy. *Journal of Financial and Quantitative Analysis* 14(2): 443–450.

Rozeff, Michael S., 1994. Lump-Sum Investing Versus Dollar-Averaging. *Journal of Portfolio Management* (Winter): 45–50.

Shtekhman, Anatoly, Christos Tasapoulos, and Brian Wimmer, 2012. *Dollar-Cost Averaging Just Means Taking Risk Later.* Valley Forge, Pa.: The Vanguard Group.

Statman, Meir, 1995. A Behavioral Framework for Dollar-Cost Averaging. *The Journal of Portfolio Management* 22(1), 70–78.

Tversky, Amos, and Daniel Kahneman, 1992. Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty* 5(4), 297–323.

Appendix 1

Additional results show LS also outperforms CA in other markets

Figure 6 shows additional international evidence for selected equity markets comparing LS with CA approaches. The results demonstrate that our findings are applicable in other markets too, as LS beats CA most of the time even when we change the CA split from three parts to six parts.

FIGURE 6

International evidence for LS beating CA approaches

	Market								
	U.S.	U.K.	Canada	Europe	Australia	Emerging markets	Global	Global	Global
Currency	USD	GBP	CAD	EUR	AUS	USD	USD	EUR	GBP
Hit ratio for LS beating CA, 3-month split	66.4%	68.1%	67.2%	66.5%	67.5%	61.6%	67.7%	66.4%	67.8%
Hit ratio for LS beating CA, 4-month split	69.9	69.8	67.9	66.9	69.6	61.8	69.7	66.8	68.9
Hit ratio for LS beating CA, 5-month split	72.6	70.2	69.3	66.5	71.0	62.9	71.7	67.2	69.7
Hit ratio for LS beating CA, 6-month split	73.7	69.5	69.7	65.4	72.5	61.8	72.6	67.9	70.8

Notes: Hit ratio is defined as the outperformance of one strategy against the other after a one-year investment period. One-year rolling investment performance compares LS against CA. Our base case for CA is the three-month split, meaning splitting the investment into three equal parts and investing each one month apart. Data are based on: for the U.S., the Russell 3000 Index, 1979–2022; for the U.K., the FTSE All-Share Index, 1986–2022; for Canada, the S&P/TSX Composite Index, 1985–2022; for Europe, the MSCI Europe Index, 1998–2022; for Australia, the S&P/ASX 300, 1992–2022; for emerging markets, the MSCI Emerging Markets Index, 1988–2022; and for global returns, the MSCI World Index, 1976–2022 (for USD and GBP) and 1998–2022 (for EUR).

Source: Vanguard.

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Appendix 2

Simulation details

VAR(p) simulations

We use a standard VAR(p) model,

$$Y_t = \nu + A_1 Y_{t-1} + \cdots + A_p Y_{t-p} + u_t \quad \text{with} \quad u_t \sim \mathcal{N}(0, \Sigma_u),$$

where A_p is a $K \; x \; K$ matrix of coefficients. We then fit the model with lag order p using empirical equity and bond returns and forecast ahead using a random seed. We alternatively simulate iid data with a multivariate Normal distribution (MVN) using the empirical first two moments, $y \sim N(\mu, \Sigma)$.

Appendix 3

Utility function and certainty equivalent

Consider the following power utility function to model constant relative risk aversion (CRRA), $U(W_s) = \frac{W^{1-\gamma} - 1}{1-\gamma}$ where γ is the risk-aversion coefficient and W denotes wealth. The expected utility of wealth for s simulations Sim reads:

$$E[U(W_s)] = \frac{1}{sim} \sum_{s=1}^{sim} \left(U(W_s)\right) = \frac{1}{sim} \sum_{s=1}^{sim} \left(\frac{W_s^{1-\gamma} - 1}{1-\gamma}\right).$$

Certainty equivalent

A certainty equivalent, or certainty equivalent return (CER), is the riskless level of return that would result in the same utility score an investor would expect from a risky investment. In other words, for a given utility function, a utility-maximizing investor would expect the same level of utility from investing in the risky portfolio and investing in the riskless asset.

To solve for the CER, we express the utility of wealth arising from it to be equal to the expected utility function above, $U(CER) = E[U(W)]$. For the CRRA function, we can find a closed form expression by expanding and rearranging,

$$\frac{CER^{1-\gamma} - 1}{(1-\gamma)} = E[U(W)], \; CER = \left[1 + \left(E[U(W)](1-\gamma)\right)\right]^{\frac{1}{1-\gamma}}.$$

Following Brennan, Li, and Torous (2005), we can define CER as the amount of wealth to be received with certainty at time T that would make the investor as well off as following strategy (simulation) s.

$$CER_{(T)} = \left(\frac{1}{Sim}\left[\sum_{s=1}^{Sim} W_{s,T}^{1-\gamma}\right]\right)^{\frac{1}{1-\gamma}}$$

Certainty equivalent with loss aversion

To incorporate loss aversion into a certainty equivalent measure, we proceeded as follows. Reconsider the usual expression of CER in relation to expected utility, $\frac{CER^{1-\gamma} - 1}{(1-\gamma)} = E[U(W)]$.

We now need to expand this expression by prospect theory concepts of different weighting of losses versus gains. Following Tversky and Kahneman (1992), we can define utility as follows:

$$U(W) = \begin{cases} u(W_s) \; if \; W_s \geq 0 \\ \lambda \, u(W_s) \; if \; W_s < 0 \end{cases}.$$

Note that W_s here denotes the change in wealth. We can divide utility into two components, positive and negative change in wealth,

$$\frac{CER^{1-\gamma} - 1}{(1-\gamma)} = E\left[\frac{W_s^{1-\gamma-1}}{1-\gamma} \mathbb{1}_{W_s \geq 0}\right] + \lambda \, E\left[\frac{W_s^{1-\gamma-1}}{1-\gamma} \mathbb{1}_{W_s < 0}\right],$$

where $\mathbb{1}_{W_s}$ is the indicator function that distinguishes between that positive and negative change in wealth.

Rearranging,

$$CER = \left(1 + E[(W_s^{1-\gamma} - 1)\mathbb{1}_{W_s \geq 0}] + \lambda \, E[(W_s^{1-\gamma} - 1)\mathbb{1}_{W_s < 0}]\right)^{\frac{1}{1-\gamma}}.$$

The discretized solution to calculate CER for risk aversion parameter γ and loss aversion λ:

$$CER_{(T)} = \left(1 + \frac{1}{Sim}\left[\sum_{s=1}^{Sim} (W_{s,T}^{1-\gamma} - 1)\mathbb{1}_{W_s \geq 0}\right] + \lambda \left[\sum_{s=1}^{Sim} (W_{s,T}^{1-\gamma} - 1)\mathbb{1}_{W_s < 0}\right]\right)^{\frac{1}{1-\gamma}}$$

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