



**LEVERAGING PORTFOLIOS  
EFFICIENTLY**

# Fiduciary Insights

**WHETHER TO USE LEVERAGE AND HOW BEST TO USE IT TO IMPROVE THE EFFICIENCY AND RISK-ADJUSTED RETURNS OF PORTFOLIOS ARE AMONG THE MOST RELEVANT AND LEAST UNDERSTOOD QUESTIONS CONFRONTING INVESTORS.** The optimal leveraged portfolio has a different asset allocation than the optimal unleveraged portfolio because of differences in the costs of borrowing against the underlying asset classes.

# Leverage Can Boost Portfolio Efficiency

**B**orrowing can increase risk, but it can be a good thing if used prudently in the pursuit of higher portfolio efficiency.

When Sharpe et al. developed efficient market theory, the ability to borrow, lend, or sell short was a necessary (although not sufficient) condition for market and portfolio efficiency. Therefore, it follows that markets and portfolios would be inefficient if borrowing and short selling were not used by investors to design optimal strategies. Today's low return environment makes it especially important to consider using leverage to maximize portfolio efficiency. But leverage, like cholesterol, can come in two forms: good and bad.

Quantitatively, there can be only one optimal portfolio for all investors. The fact that all investors do not hold the same optimal portfolio has more to do with institutional and behavioral constraints than with efficient market theory. Investors and regulators place limits, sometimes rather arbitrarily, on certain

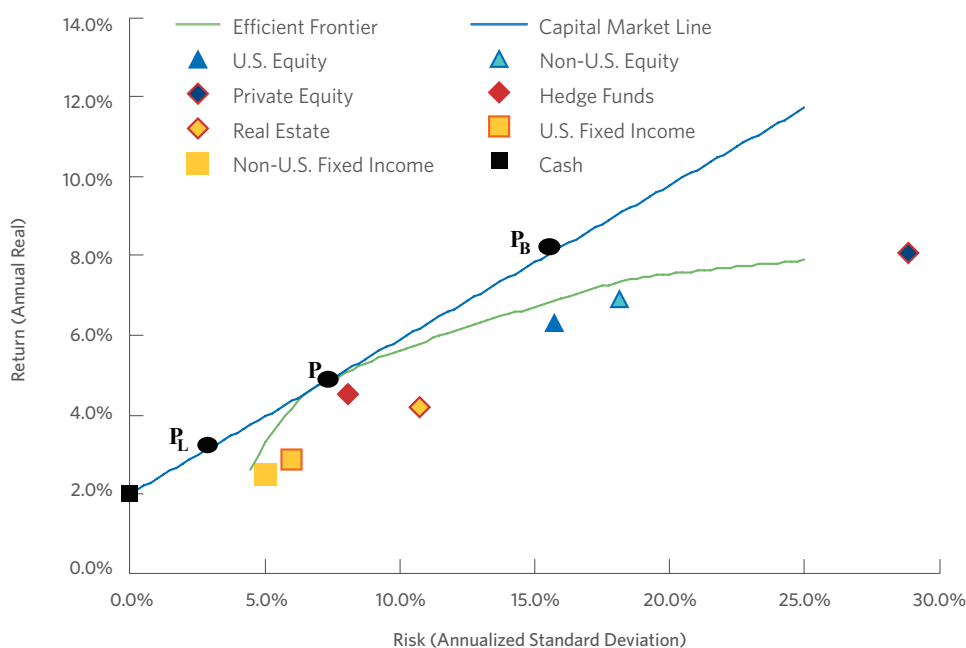
types of securities and strategies. By doing so, they attempt to reduce their risk of underperforming peers or address their concerns about liquidity needs, volatility of pension expense, investment horizon, and other variable elements of investment policy. In the parlance of investment theory, investors maximize their individual utility by imposing constraints which reflect trade-offs between return and perceived risks.

Any investor can modify the optimal portfolio to suit his own risk tolerance by either reducing the portfolio's return and risk by lending, or increasing its return and risk by borrowing. As an illustration, consider an investor who has constructed the optimal, efficiently diversified portfolio, shown in Exhibit 1 as portfolio P. This is the most efficient unleveraged portfolio of available asset classes. But rather than invest exactly 100% of his assets in portfolio P, the investor can use the portfolio to meet a broad range of risk and return objectives by either lending as shown in portfolio PL, which has lower return and lower risk, or borrowing, as shown in portfolio PB, which has higher return and higher risk. (Return, risk, and covariance assumptions throughout are based on long-term equilibrium estimates, set forth in the Appendix as Capital Market Assumptions.)

*Any investor can modify the optimal portfolio to suit his own risk tolerance by either lending or borrowing.*

## EXHIBIT 1: Efficient Frontier, with Lending or Borrowing

**Key assumptions:** Risk targets can be met by lending or borrowing.



*Borrow first against liquid U.S. assets before borrowing against a diversified portfolio of international equities or hedge funds.*

The capital market line, which is the line drawn from the risk-less asset (cash) through portfolio P on the efficient frontier, shows the combinations of risk and return that would result from lending or borrowing in various proportions. If the investor is too risk-averse to hold the optimal portfolio, he can increase cash (effectively lending at the risk-free rate) and proportionately decrease the holdings of all other risky assets in the optimal portfolio. If the investor can tolerate more risk in the pursuit of higher returns, he can borrow and proportionately increase the holdings of all risky assets in the optimal portfolio. If liquidity requirements force the investor to hold more liquid asset exposure than implied by portfolio P, loan proceeds can be used to fund a higher allocation to riskier, illiquid assets to arrive at the preferred efficient portfolio (for example, more of portfolio PL's risky assets can be venture capital).

Note that in Exhibit 1, by placing portfolio PB precisely on the capital market line, we implicitly assumed that we can leverage the return of portfolio P with 100% efficiency—but that will happen only if we can borrow money at the riskfree rate (e.g., the LIBOR rate). In the real world, our return will be reduced by the cost of borrowing above the risk-free rate, so that portfolio PB will fall somewhere below the capital market line. How far below will depend on how much it costs to borrow against our assets.

## Setting Reasonable Limits on Leverage

Although borrowing increases investment efficiency, it has its limits. Two investment principles govern how much investors should borrow to improve the risk and return efficiency of their portfolios.

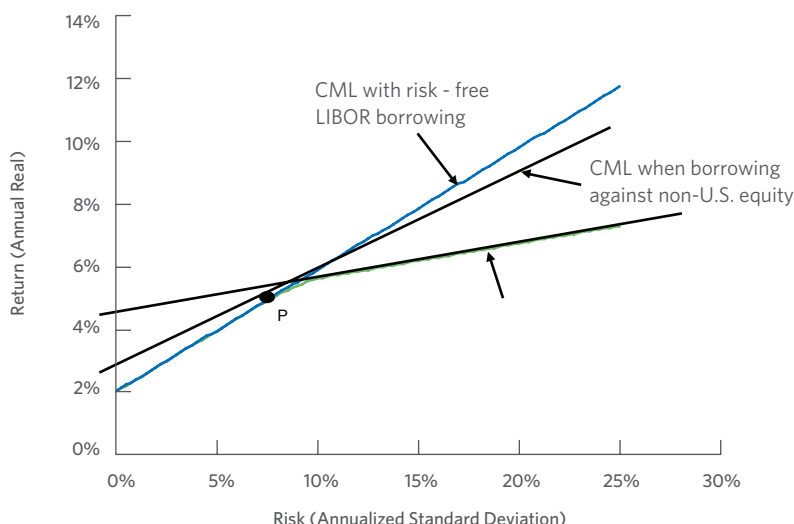
The first principle is based on risk tolerance. According to this rule, investors should borrow as much as they feel comfortable borrowing given their tolerance for volatility, or as much as needed to reach targeted levels of returns (again assuming they can tolerate the volatility associated with leveraged returns).

The second principle links borrowing to incremental profitability. By this rule, investors should borrow as long as their certainty-equivalent return<sup>1</sup> exceeds borrowing costs.

Both rules should be observed in every case. Borrowing should create neither intolerable levels of risk nor inadequate rewards for taking risks.

### EXHIBIT 2: Optimal Portfolio, Sub-Optimally Leveraged

**Key assumptions:** Using illiquid assets for borrowing is inefficient.



<sup>1</sup> The certainty-equivalent return is the return that, if an individual were to receive it with certainty, would be regarded as equivalent to an uncertain return. The same idea is expressed in the old saying that “a bird in the hand is worth two in the bush.”

# Borrowing Costs Depend on Collateral

Borrowing costs vary with the volatility and liquidity of the actual or implied collateral. Today, if the actual or implied collateral is highly liquid stocks and bonds, institutional borrowing rates quoted by broker-dealers will range from LIBOR to the Fed Funds Effective Rate plus 10-40 basis points. Included in these costs are additional services provided by broker-dealers, such as custody, corporate actions, and accounting.

Without these additional services, the borrowing cost is near 90-day LIBOR rates. The LIBOR borrowing costs also apply to stock and bond futures, which can be bought using margin as low as 5% of total assets (thus allowing for up to 20X leverage).

If, instead of highly liquid stock or bond portfolios, the assets pledged as collateral are a broadly diversified portfolio of hedge funds, borrowing costs will reflect the lower liquidity of hedge funds, and range from roughly 150-400 basis points above LIBOR for 2X to 5X leverage ratios. Of course, all of these costs change over time, with capital market liquidity and systemic credit risk premia.

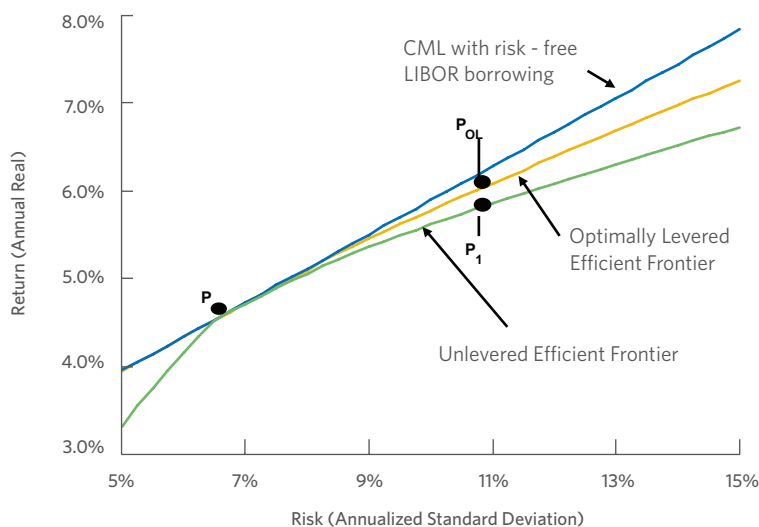
# Leverage the Liquid Assets First

We have developed a general guideline for how much we can borrow, given that investment returns have to clear borrowing costs on a certainty equivalent basis, and that volatility and liquidity affect borrowing costs and marginable assets. From our experience, we have found that we can borrow, with reasonable safety, up to 30% against a total portfolio's liquid assets (highly liquid U.S. stocks and bonds).

The expected volatility of the stock and bond portfolio will constrain the amount that can be safely borrowed, while mitigating the risk, in the event of worst-case market conditions, of having margin calls upset the portfolio's allocation between stocks and bonds. In borrowing against a pool of liquid assets, it is best in terms of liquidity and cost to use stock and bond futures, with proper trading controls in place.

An efficiently diversified and carefully selected portfolio of hedge funds with a low volatility and minimal market exposure can be safely leveraged. However, safety is not the

**EXHIBIT 3:**  
Optimal Portfolio, Optimally Leveraged  
Optimal leverage uses the most liquid assets.



*We must redesign our optimal portfolio so we can leverage it most efficiently.*

only consideration. Borrowing costs when using hedge funds for collateral are significantly higher than when using liquid assets. Exhibit 2 presents three capital market lines (CMLs) that show how expected return declines when non-U.S. equities or hedge funds are used as collateral instead of a theoretical cost-free alternative.

Hence it is clearly preferable to borrow first against liquid U.S. assets before borrowing against a diversified portfolio of international equities or hedge funds. Borrowing against hedge funds forces the lender to accept significant illiquidity, lack of transparency, and assets whose risks cannot be easily hedged to control volatility. Conversely, the borrower is exposed to unexpected, irreversible margin calls which might destroy an intricately constructed portfolio of hedge funds (and a few careers along the way), if there were to be losses forcing margin calls. Margin calls, of course, constrain the investor's ability to rebalance under extreme market volatility and illiquidity conditions, and could force asset liquidation at a market low and reduce the longer term compound return of the portfolio by locking in losses.

## Optimal Leverage Changes the Portfolio

To assume that the optimal leveraged portfolio is the same as the optimal unleveraged portfolio is to ignore important differences between the borrowing costs of different forms of collateral. Since our optimal unleveraged portfolio contains illiquid assets, and yet illiquid assets are more expensive to borrow against, we must redesign our optimal portfolio so we can leverage it most efficiently. Thus the optimal leveraged portfolio, designated POL in Exhibit 3, has a different asset makeup than an unleveraged portfolio of equivalent risk (P1) and lies on a higher efficient frontier.

Exhibit 4 shows the asset allocation of optimal portfolios that have been designed for optimal leverage, at various levels of risk and return. For example, U.S. equity futures are an

inexpensive form of leverage, so they are weighted more heavily in portfolios at higher risk levels obtained by higher leverage. The non-U.S. equity weight falls because of the higher expense of borrowing in the form of non-U.S. equity swaps. Fixed income futures are not expected to provide much in the way of a term or risk premium, yet they are emphasized because they are a cheap borrowing source, and fixed income serves as a diversifier and a source of ready liquidity and potential capital gains during an equity market downturn. Making heavy use of low cost liquid assets enables the investor to retain large amounts of illiquid private equity, hedge funds, and real assets.

Although efficient, these three leveraged portfolios suffer from vulnerabilities not considered in a mean-variance framework, namely default and liquidity risk. All three portfolios could be altered in such a way—by adding liquid assets—as to minimize the default risk of a significant market downturn. However, after meeting margin, sufficient excess liquidity is needed to rebalance the portfolio back to target weights. The leveraged portfolio with 12% risk, for example, although theoretically efficient, would not have enough cash or physical assets to rebalance to target after an extreme market shock. Even a properly designed portfolio, with enough cash and physical assets, is not sufficient in a significant market downturn. In addition, a robust governance structure, a clear rebalancing policy, and a borrowing facility must be in place to allow decision makers to rebalance by reallocating physical assets and by extending the leverage of liquid assets to the target policy, if required. All of these conditions, as well as experience and presence of mind, are necessary to ensure that during a market dislocation fiduciaries have both the capability and conviction to rebalance the portfolio.



**EXHIBIT 4:**  
**Asset Allocation for Optimal Leverage**

**Key assumptions:** Using illiquid assets for borrowing is inefficient.

Asset Class	Risk Level		
	8.0%	10.0%	12.0%
<b>U.S. Equity</b>	<b>6%</b>	<b>16%</b>	<b>34%</b>
<i>U.S. Equity Futures</i>	0%	16%	34%
<b>Non-U.S. Equity</b>	<b>16%</b>	<b>16%</b>	<b>8%</b>
<i>Non-U.S. Equity Swaps</i>	0%	0%	0%
<b>Private Equity</b>	<b>3%</b>	<b>6%</b>	<b>10%</b>
<b>Hedge Funds</b>	<b>50%</b>	<b>50%</b>	<b>50%</b>
<i>Hedge Funds Levered</i>	0%	0%	0%
<b>Real Assets</b>	<b>20%</b>	<b>22%</b>	<b>25%</b>
<b>Fixed Income</b>	<b>20%</b>	<b>30%</b>	<b>32%</b>
<i>Fixed Income Physicals</i>	5%	5%	7%
<i>Fixed Income Futures</i>	15%	25%	25%
<b>Non-U.S. Fixed Income</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>
<b>Cash</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>
<b>Total Leverage Ratio</b>	<b>1.15</b>	<b>1.40</b>	<b>1.59</b>
<b>Return</b>	<b>5.1%</b>	<b>5.7%</b>	<b>6.3%</b>
<b>Sharpe Ratio</b>	<b>0.39</b>	<b>0.37</b>	<b>0.36</b>

*The more efficient way to leverage alpha is to borrow against the most liquid assets first.*

## Conclusion

Borrowing from the cheapest source is basic. Individuals do it when they use home equity and senior mortgage loans for a variety of investment and consumption needs, in preference to more expensive sources (e.g., credit card debt, auto loans, and brokerage loans). This is a case in which retail investors might know better than some of their institutional counterparts who invest in structured leveraged funds of hedge funds. In effect, these institutional investors are leveraging a portfolio of hedge funds (at much higher cost, and higher liquidity and bankruptcy risk), rather than using their liquid assets as borrowing collateral, even when the proceeds could equally be used to double up on a pool of hedge funds.

The cost and illiquidity differences between these two alternatives are very large. We can only attribute the confusion about the optimal choice (to use futures or borrow against liquid assets) to the false perception that a leveraged “packaged” portfolio is “better” (safer after all costs) than a professionally managed futures account used in conjunction with a marginable portfolio of liquid assets. As we have shown, this is not the case. Broker-dealers and other financial intermediaries (banks and insurance companies) who sponsor these investments contribute to the confusion because they generate larger margins for themselves in packaged leveraged funds of funds, and in a worst-case scenario they get a senior call on the assets of the borrower. Let the buyer of leveraged funds of hedge funds beware: The more efficient way to leverage alpha is to borrow against the most liquid assets first.



# Appendix

## Capital Market Assumptions

	Standard Deviation	Real Expected Return	Active Alpha	Correlations								
				U.S. Equity	Non-U.S. Equity	U.S. Fixed Income	Non-U.S. Fixed Income	Real Estate	Private Equity	Hedge Funds	U.S. Dollar	FX
U.S. Equity	15.6%	5.8%	0.5%	1.0	0.9	0.3	0.2	0.2	0.4	0.4	0.0	0.1
Non-U.S. Equity	16.6%	5.9%	1.0%	0.9	1.0	0.1	0.1	0.3	0.5	0.4	0.0	0.0
U.S. Fixed Income	6.0%	2.7%	0.2%	0.3	0.1	1.0	0.8	0.0	0.0	0.3	0.0	0.1
Non-U.S. Fixed Income	4.8%	2.5%	0.0%	0.2	0.1	0.8	1.0	0.0	0.0	0.6	0.0	0.1
Real Estate	10.0%	3.1%	1.1%	0.2	0.3	0.0	0.0	1.0	0.1	0.2	0.0	0.1
Private Equity	27.0%	6.6%	1.5%	0.4	0.5	0.0	0.0	0.1	1.0	0.6	0.0	-0.2
Hedge Funds	7.0%	2.9%	1.6%	0.4	0.4	0.3	0.6	0.2	0.6	1.0	0.0	-0.1
U.S. Dollar	0.0%	0.0%	0.0%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	-1.0
FX	7.1%	0.0%	0.0%	0.1	0.0	0.1	0.1	0.1	-0.2	0.1	-1.0	1.0

“Alpha” represents the assumed alpha used for purposes of analyzing alternative hypothetical portfolios and should not be construed as a promise of future performance. Please see below for important information regarding expected return, correlations and alpha and important risk information. The matrix is provided for illustrative purposes only and is subject to change at the sole discretion of Strategic.

### Disclosures

Expected returns are based on Strategic’s estimate of equilibrium asset class returns, volatility and correlations.

### Limitations

It is important to note that the expected returns should not be interpreted to represent a promise of future performance under any of the scenarios described herein. Because the capital market statistics and expected return data were constructed with Strategic’s judgment and knowledge of history in mind, they may not adequately capture the influence of future market conditions on investment returns. As a result, actual returns may differ substantially from the returns shown in this analysis. In addition, the expected returns do not represent actual trading and, therefore, do not account for the impact of financial risk on actual trading, such as the ability to adhere to a particular strategy in spite of significant trading losses.

Hypothetical or simulated performance results have many inherent limitations, some of which are described below. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. In fact, there are frequent sharp differences between hypothetical performance results and the actual results subsequently achieved by any particular trading program. One of the limitations of hypothetical performance results is that they are generally prepared with the benefit of hindsight. In addition, hypothetical trading does not involve financial risk, and no hypothetical trading record can completely account for the impact of financial risk in actual trading. For example, the ability to withstand losses or to adhere to a particular trading program in spite of trading losses are material points that can also affect actual trading results. There are numerous other factors relating to the markets in general or to the implementation of any specific trading program that cannot be fully accounted for in the preparation of hypothetical performance results and all of which can adversely affect actual trading results. Furthermore, these hypothetical results do not contain any calculations of transaction costs that may be applicable to the described strategies.

Where applicable, alpha is shown to illustrate how the potential for value-added relative to other portfolios would impact risks and returns. In no way should the inclusion of alpha in the portfolio be construed as a promise of value-added within the portfolio.

Leverage may increase the risk of investment loss. If an investor uses leverage to make an investment and the investment moves against the investor, the loss is much greater than it would have been if the investment had not been leveraged.



# Strategic Investment Group

Strategic, a pioneer in dedicated Outsourced CIO (OCIO) solutions since 1987, offers a comprehensive service platform for managing customized portfolios for institutional and private investors. Our proprietary process combines active portfolio management, rigorous risk management, and open architecture manager selection.

Strategic functions as our clients' investment partner and co-fiduciary, effectively becoming an extension of their resources. Clients are then free to focus on their core businesses, while we focus on providing the highly specialized portfolio management expertise that clients need to meet their investment goals. Depending on a client's needs and preferences, Strategic can orchestrate the management of an entire portfolio comprising multiple asset classes, focus on specific asset classes, such as alternatives (e.g., hedge funds, real estate, and/or private equity) or international investments, or manage strategies with high potential for adding value (e.g., portable alpha through investor-friendly turnkey structures). Customized liability-driven investing (LDI) solutions, whether through an integrated total portfolio approach or a targeted long-duration strategy, are also available, as are solutions that address mission-related investment objectives.

We strive to build enduring partnerships with our clients by strengthening their investment programs through a dynamic, value-enhancing investment process, sound governance framework, and world class client service. Our mission is to empower investors through experience, innovation, and excellence.

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