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# An Overview of Leverage

The challenge with any portfolio-level leverage measure is that we cannot be sure what it is telling us about the specific risks (whether market, credit, or liquidity risks) in a portfolio.

## Introduction

This paper provides an overview of the basic concepts of leverage, together with some examples of how leverage is used in both traditional investments and in different hedge fund strategies.<sup>1</sup> Most importantly, we distinguish between the concepts of leverage and risk, as there is a common misconception that a levered asset is always riskier than an unlevered asset.

Leverage is a tool, and like all tools it can be used prudently or not. For example, many investors believe that owning shares in a major commercial bank is a prudent investment. But how do commercial banks generate profits? A typical commercial bank's mandate can be defined as an "absolute return strategy using a portfolio of debt securities leveraged 10-to-1 or more, where the investment style seeks to realize a consistent spread on the assets in excess of the cost of leverage."<sup>2</sup> So why are investors confident about investing in a commercial bank, yet when a similar investment strategy is applied by a hedge fund, any use of leverage is deemed to be very risky?

Banks typically use significant leverage in commercial transactions, and many of us use leverage personally for our family home, which is often levered initially at 4 to 1 (e.g., a house valued at \$400,000, a down-payment of \$100,000 and a mortgage loan for the balance). In this context, leverage is defined in balance-sheet terms, where it refers to the ratio of assets (the house's value of \$400,000) to capital (the \$100,000 down-payment), hence 4 to 1. Alternatively (and more useful from an investor's perspective), leverage can be defined as the financial risk relative to the invested capital (or equity). In this context, leverage is the aggregate level of risk an investor should anticipate relative to the capital invested.

This paper, together with *An Overview of Short Stock Selling* and *The Role of a Prime Broker*, is designed as a companion to AIMA Canada's Strategy Paper Series. Please refer to [www.aima-canada.org](http://www.aima-canada.org) for details regarding the Series.

<sup>1</sup> This paper does *not* provide a comprehensive analysis of leverage. For further discussion on the topic of leverage, refer to the *Bibliography on Hedge Funds and Leverage* at the end of this paper.

<sup>2</sup> "Perspectives on Hedge Fund Investing, February 2005," by Ed Easterling, Crestmont Research; see <http://www.crestmontresearch.com/content/hedgefunds.htm>



## Types of Leverage

There are three primary types of leverage:<sup>3</sup>

1. **Financial Leverage:** This is created through *borrowing leverage* and/or *notional leverage*, both of which allow investors to gain cash-equivalent risk exposures greater than those that could be funded only by investing the capital in cash instruments.
2. **Construction Leverage:** This is created by combining securities in a portfolio in a certain manner. How one constructs a portfolio will have a significant effect on overall portfolio risk, depending on the amount and type of diversification in the portfolio, *and* the type of hedging applied (e.g., offsetting some or all of the long positions with short positions).
3. **Instrument Leverage:** This reflects the intrinsic risk of the specific securities selected, as different instruments have different levels of internal leverage (e.g., \$100,000 invested in equity options versus \$100,000 invested in government bonds).

The following two questions relating to stocks and bonds illustrate these types of leverage.<sup>4</sup>

**Question 1 (Stocks):** Which of the four equity portfolios below has the greatest risk, if risk is defined by the portfolio's stock market risk (beta)? Assume each portfolio has the same capital, and that the stock betas do not change for the analysis period.

- **Portfolio 1:** Uses all of its capital to buy a stock with a beta of 2.
- **Portfolio 2:** Borrows funds equal to its capital and invests all of the money (initial capital plus borrowed funds) in a stock with a beta of 1.
- **Portfolio 3:** Buys single stock futures with a beta of 1, which is 50% cash funded (employs all of its capital) and 50% notionally funded (i.e., uses 50% margin for the futures contract).

- **Portfolio 4:** Buys a stock (employs all of its capital) with a beta of 3 and sells short a stock with a beta of 1.

**Answer:** All four equity portfolios have the same market risk as each portfolio has an aggregate beta of 2. The key point is that the same risk level is achieved through different types of leverage: Portfolio 1 invested in a risky stock with a beta of 2 (i.e., it used instrument leverage), Portfolio 2 used borrowing leverage, Portfolio 3 used notional leverage and Portfolio 4 used construction leverage.

**Question 2 (Bonds):** Which of the following four bond portfolios below has the greatest risk, if risk is defined as sensitivity to a parallel shift in the yield curve? Assume each portfolio has the same capital.

- **Portfolio 1:** Holds a 1-year zero-coupon government bond levered 30-to-1
- **Portfolio 2:** Holds a 3-year zero-coupon government bond levered 10-to-1
- **Portfolio 3:** Holds a 10-year zero-coupon government bond levered 3-to-1
- **Portfolio 4:** Holds a 30-year zero-coupon government bond

**Answer:** All four bond portfolios have the same aggregate interest rate risk, based on their sensitivity to parallel interest rate changes. In effect, the leverage used makes the dollar duration the same in each portfolio, assuming the same amount of capital is invested in each bond.<sup>5</sup>

As the above questions highlight, the relationship between risk and leverage is complex. In particular, when comparing different investments, a higher degree of leverage does *not* necessarily imply a higher degree of risk. Therefore, it is essential that we understand what is meant by "leverage," whether in a traditional portfolio or in a hedge fund portfolio, before we judge its effect on portfolio risk.

<sup>3</sup> "Hedge Fund Risk Fundamentals: Solving the Risk Management and Transparency Challenge," by Richard Horwitz, Bloomberg Press, Princeton, 2004, Chapter 3, Page 37.

<sup>4</sup> *Ibid.*, Pages 38-39. For simplicity, the questions focus on the key concepts of leverage and risk, and ignore certain assumptions regarding the specific attributes of the stocks and the bonds (e.g., we ignore issues relating to large-cap stocks vs. small-cap stocks, value vs. growth, etc.)

<sup>5</sup> We ignore the effects of convexity, which is the change in duration as interest rates change.



## Definitions and Measures of Leverage

There are numerous ways leverage is defined in the investment industry, and there is no consensus on exactly how to measure it. Leverage can be defined as the creation of exposure greater in magnitude than the initial cash amount posted to an investment, where leverage is created through borrowing, investing the proceeds from short sales, or through the use of derivatives.<sup>6</sup> Thus

leverage may be broadly defined as any means of increasing expected return or value without increasing out-of-pocket investment.

Table 1 below summarizes some of the key measures of leverage, with examples that focus on a long/short equity strategy.

**Table 1: Different Measures of Leverage**

**How Leverage is Quoted:** Leverage may be quoted as a ratio of assets to capital or equity (e.g., 4 to 1), as a percentage (e.g., 400%), or as an incremental percentage (e.g., 300%). Note that a ratio of assets to capital of 1:1 or less, or a leverage percentage of 100% or less, means that NO leverage is used. Therefore, any incremental percentage greater than 100% means that leverage is employed.

Measure	Example
<p><b>Measure 1:</b>  <b>Gross Market Exposure = <math>\frac{(\text{Longs} + \text{Shorts})}{\text{Capital or Equity}} \times 100\%</math></b></p> <p><i>May also be defined as:</i></p> <p><i>Gross Leverage = <math>\frac{(\text{Longs} + \text{Shorts})}{\text{Net Asset Value}^7}</math></i></p> <p><u>OR</u></p> <p><i>Leverage = Ratio of "X" times Capital or Equity</i></p>	<p>Hedge Fund A has \$1 million of capital, borrows \$250,000, and invests the full \$1,250,000 in a portfolio of stocks (i.e., the Fund is long \$1.25 million). At the same time, Hedge Fund A sells short \$750,000 of stocks.</p> <p>Gross Market Exposure = <math>\frac{\\$1.25 \text{ million} + \\$0.75 \text{ million}}{\\$1 \text{ million}} \times 100\%</math>  = <math>\frac{\\$2 \text{ million}}{\\$1 \text{ million}} \times 100\% = \mathbf{200\%}</math></p> <p><i>Leverage = 2:1 (i.e., 2 X capital or equity)</i></p>

**Note on Gross Market Exposure:** Many investors do not consider the 200% Gross Market Exposure in the above example to be leverage per se. For example, assume Hedge Fund A has capital of \$1 million and is \$1 million long and \$1 million short. This results in Gross Market Exposure of 200%, but Net Market Exposure of zero, which is the typical exposure of an equity market-neutral fund. (See Measure 2 below for Net Market Exposure.)

Also note that some market practitioners express leverage as Gross Market Exposure - 100%.

<sup>6</sup> See "The Impact of Leverage on Hedge Fund Risk and Return," by Thomas Schneeweis, George Martin, Hossein Kazemi and Vassilis Karavas, Center for International Securities & Derivatives Markets, 2004, Pages 5-6.

<sup>7</sup> Net Asset Value (NAV) refers to the Fund's NAV.



**Table 1: Different Measures of Leverage (Cont.)**

<p><b>Measure 2:</b>  <b>Net Market Exposure = <math>\frac{(\text{Longs} - \text{Shorts})}{\text{Capital or Equity}} \times 100\%</math></b></p> <p><i>May also be defined as:</i></p> <p><i>Net Leverage = <math>\frac{(\text{Longs} - \text{Shorts})}{\text{Net Asset Value}}</math></i></p> <p><b>OR</b></p> <p><i>Leverage = Ratio of "X" times Capital or Equity</i></p>	<p>Hedge Fund A has \$1 million of capital, borrows \$250,000, and invests the full \$1,250,000 million in a portfolio of stocks (i.e., long \$1.25 million). At the same time, Hedge Fund A sells short \$750,000 of stocks.</p> <p>Net Market Exposure = <math>\frac{\\$1.25 \text{ million} - \\$0.75 \text{ million}}{\\$1 \text{ million}} \times 100\%</math>  = <math>\frac{\\$0.5 \text{ million}}{\\$1 \text{ million}} = 50\%</math></p> <p><i>Therefore, in this example there is NO leverage used under Measure 2, as the percentage is less than 100%.</i></p>
<p><b>Quick Pointers on Leverage:</b> One should ask hedge fund managers the following types of questions regarding leverage:</p> <ul style="list-style-type: none"> <li>▪ Does the manager have prescribed limits for <i>net market exposure</i> and for <i>gross market exposure</i>?<sup>8</sup></li> <li>▪ What drives the decision to go long or short, and to use more or less leverage?</li> <li>▪ What leverage and net market exposure was used to generate the manager's track record?</li> <li>▪ What is the attribution of return between security selection, market timing and the use of leverage?</li> </ul>	

<sup>8</sup> Both the net exposure and the gross exposure numbers are important; with *net exposure* one gets a rough sense of what a manager's exposure is to market movements, and with *gross exposure* one gets a rough sense of the degree of stock-specific risk the manager is undertaking. For example, take two managers (Manager A and Manager B) with the same stock holdings and the same net exposure, say zero, and assume that Manager A has *gross exposure of 600* and Manager B has a *gross exposure of 200*. Manager A has significantly more risk to stock-specific movements. In general, quantitative managers (e.g., statistical arbitrage funds) tend to have relatively high gross exposures. However, they typically hold lots of positions, and thus stock-specific risk is spread out.



## Leverage and Risk

It is essential to distinguish between the concepts of leverage and risk. Unfortunately, there is a common misconception that a levered asset is always riskier than an unlevered asset, even if the levered asset has low risk, and the unlevered asset is highly risky. Leverage is the link between the underlying or inherent risk of an asset and the actual risk of the investor's exposure to that asset. Thus, the investor's actual risk has two components:

1. The market risk (beta) of the asset being purchased; and
2. The leverage that is applied to the investment.<sup>9</sup>

The key question to consider: Which is more "risky"—a fund with low net market exposure and "borrowing leverage" of 1.5 times capital, or a fund with 100% market exposure and a beta of 1.5 but no "borrowing leverage?"

For a given capital base, leverage allows investors to build up a larger investment position and thus a higher exposure to specific risks. Buying riskier assets or increasing the leverage ratio applied to a given set of assets increases the risk of the overall investment, and hence the capital base. Therefore, if a portfolio has very low market risk (e.g., arbitrage/relative value hedge fund strategies often have very low market exposure), then higher leverage may be acceptable for these strategies than for strategies that have greater market exposure, such as long/short equity or global macro. For this reason, relative value strategies such as fixed-income arbitrage or convertible arbitrage may use leverage of 5-10 X capital and 3-4 X capital, respectively, while directional strategies, such as long/short equity, may restrict their leverage to 2 X capital.

In fact, a levered portfolio of *low-risk* assets may well carry *less risk* than an unlevered portfolio of *high-risk* assets. Therefore, investors should not concern themselves with leverage per se, but rather focus on the risk/return relationship that is associated with a particular portfolio construction. In this way, investors can determine the optimal allocation to a specific strategy in a diversified portfolio. As Ray Dalio comments: "If investors can get used to looking at leverage in a less prejudicial, black-and-white way – 'no leverage is good and any leverage is bad' – I believe that they will understand that a moderately leveraged, highly diversified portfolio is considerably *less* risky than an unlevered non-diversified one."<sup>10</sup>

## Conclusions

While the use of leverage is central to the hedge fund industry, hedge funds vary greatly in the degree and nature of their use of leverage. Leverage allows hedge funds to magnify their exposures and thus magnify their risks *and* returns. However, a hedge fund's use of leverage must consider margin and collateral requirements at the transaction level, and any credit limits imposed by trading counterparties such as prime brokers. Therefore, hedge funds are often limited in their use of leverage by the willingness of creditors and counterparties to provide the leverage.

Hedge funds' use of leverage, combined with illiquid positions, whose full value cannot be realized quickly, can make them vulnerable to "liquidity shocks" in the event of significant margin calls. While banks and securities firms often have trading desks with positions similar to those of hedge funds, these institutions have liquidity sources and other income sources that can minimize their vulnerability to liquidity shocks.

<sup>9</sup> "Measuring Off-Balance-Sheet Leverage," by Peter Breuer, International Monetary Fund (IMF)'s Working Paper (WP/00/202), Pages 6-8.

<sup>10</sup> "Engineering Targeted Returns and Risks," by Ray Dalio, Pension & Investments Magazine, August 18, 2004, Page 3.



Numerous studies and various market sources, such as prime brokers, have concluded that the overall leverage in the hedge fund industry has *not* increased markedly in the past few years, and is currently moderate relative to the 1997-98 period.<sup>11</sup> However, many analysts comment that a cursory assessment of industry leverage is *not* useful, as the data aggregation problem is significant, and the degree and nature of leverage has evolved over time. Also, some types of leverage may *not* be reliably captured by aggregate industry data.

In short, the problem with any portfolio-level leverage measure is that we cannot be sure what it is telling us about the specific risks (whether market, credit, or liquidity risks) in a portfolio. Therefore, investors should rather focus on assessing the type of leverage used by specific hedge fund managers, the amount of leverage, the dynamic character of the leverage employed, and the inherent risks of the assets being levered.

***Bernice Miedzinski, Managing Director,  
York Investment Strategies Inc.***<sup>12</sup>

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<sup>11</sup> "Recent Developments in the Hedge Fund Industry," by Philipp M. Hildebrand, Swiss National Bank, Quarterly Bulletin, 1, March 2005, Pages 53-56.

<sup>12</sup> Reviewed by Barry Schachter, Rutter Associates LLC, and by Financial Risk Management (FRM).