LEVERAGE, HEDGE FUNDS AND RISK

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Executive Summary

The current market environment has led investors to reexamine the components of their investment programs, particularly in light of the impact of the credit crisis and its accompanying elevated market volatility. Hedge funds represent an investment category that has experienced significant challenges, yet we feel they remain an important component of the investment structure for many long-term investors[1]. A key element when evaluating hedge funds is to assess the use of borrowed capital, or leverage, as a part of their investment strategies and the contribution of leverage to expected return and risk. This topic is especially important given the investment climate of late, characterized by constrained availability of leverage and higher borrowing costs, and the contribution of leverage to certain fund blowups in the recent past.

Key takeaways from this paper include:

- Leverage should be an important consideration in the evaluation of hedge fund managers. While leverage generally amplifies both return and risk, higher leverage does not always indicate higher risk, as it must be understood in the context of other features of an investment strategy.
- We do not believe that it is prudent to use leverage to magnify the returns of a low-return position or strategy, or to increase the size of the hedge fund balance sheet without having a great deal of conviction in the underlying investment ideas.
- There are many ways for funds to obtain leverage, each of which offer unique attributes with respect to term, stability, cost, and availability. The amount of leverage used by hedge funds can vary substantially, dictated by the strategy being utilized and several other variables.
- Analyzing hedge fund balance sheets can help an investor understand how difficult market circumstances can affect funds differently, with some funds able to weather such environments while others suffer greatly or even go out of business.

While the hedge fund community's access to and use of leverage is evolving, we believe that it continues to represent a valid tool in the hedge fund manager's toolbox and that managers with better access to it may benefit. Furthermore, while the use of leverage has in many cases augmented the ability of certain managers and strategies to generate attractive returns, we do not believe that in most cases access to leverage is a prerequisite to alpha generation within the hedge fund space.

A. How Leverage Works

We define financial leverage as the level of gross assets greater than equity capital invested. Lev-

[1] For a general assessment of hedge funds in the current environment please see our recent research note: "Hedge Funds: Broken or Damaged?"

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erage allows for the magnification of the return, and the risk, of the original equity investment. Leverage exists throughout the economy and financial markets. In the case of a company, issuing additional debt rather than equity has the effect of amplifying the impact of revenue growth on EPS. Here are a couple instances of this.

- A bank provides a common example of a company that issues debt, often representing a multiple of more than ten times tangible book equity. Before the current crisis, banks felt confident doing so because they believed that their mix of assets had relatively low volatility (more on this idea later).
- The purchase of a house usually involves leverage. An equity investment of, say, $100k (20%) and a loan of $400k (80%) to buy a $500k house, represents a four times ("4x") leveraged purchase (Debt/Equity).
- Individual investors can also apply the principles of financial leverage to their investment portfolios. A margin account allows an investor to borrow against the value of the securities and cash held in the account, effectively leveraging the return and risk of those securities 100% or 1x (known as the "Reg T" limit).

Let's look at the math behind how leverage impacts an investment (see Table 1).

In the case of rising asset prices, one can see that leverage has a dramatically positive effect on the return on equity (ROE), amplifying a return on assets (ROA) of 10% to an ROE of 26% when 2x leverage (Debt/Equity) is used. However, with a -10% ROA, 2x leverage has a very negative impact, with a -34% result in ROE. These examples illustrate the importance of handling leverage with care.

Table 1. The impact of leverage on investment returns

Asset Prices Rise		
Leverage (Debt/Equity)	**1.0x**	**2.0x**
Equity	$ 1,000,000	$ 1,000,000
Debt	$ 1,000,000	$ 2,000,000
Assets	$ 2,000,000	$ 3,000,000
Return on Assets (ROA)	10%	10%
Gross Profit/Loss (P&L)	$ 200,000	$ 300,000
Cost of Leverage (at risk-free rate of 2%)	$ (20,000)	$ (40,000)
Net Profit/Loss (P&L)	$ 180,000	$ 260,000
Return on Equity (ROE)	**18%**	**26%**
Asset Prices Fall		
Leverage (Debt/Equity)	**1.0x**	**2.0x**
Equity	$ 1,000,000	$ 1,000,000
Debt	$ 1,000,000	$ 2,000,000
Assets	$ 2,000,000	$ 3,000,000
Return on Assets (ROA)	-10%	-10%
Gross Profit/Loss (P&L)	$ (200,000)	$ (300,000)
Cost of Leverage (at risk-free rate of 2%)	$ (20,000)	$ (40,000)
Net Profit/Loss (P&L)	$ (220,000)	$ (340,000)
Return on Equity (ROE)	**-22%**	**-34%**

B. **Leverage in Hedge Funds...The Basics**

Hedge funds utilize leverage in a similar fashion to the way a bank, the buyer of a house, or a stock investor might. As seen above, leverage clearly decreases an investor's margin for error. That is, when a relatively small amount of capital controls a large amount of assets, the losses that can be sustained from those assets before the manager's capital becomes impaired can be small. Therefore, the greater the leverage, the less asset price volatility the manager will be able to endure. The incentive structure and competitive environment of hedge funds sometimes leads managers to shoot for a high return while ignoring the risk associated with achieving that return. This is a reason that manager selection in hedge funds, particularly those who use material levels of leverage, is so critical.

The past few years are filled with examples of hedge funds using leverage to amplify the return of securities with relatively low yields, or trades with modest expected returns. Indeed, if the returns that are achievable for a manager's style decrease, some managers may be tempted to increase leverage to make up the difference. One example of this phenomenon is that of hedge funds investing in bank loans throughout 2007 and 2008. Bank loans have historically been relatively stable investments, mainly because they sit

toward the top of the corporate capital structure and are secured by assets of the company. They have historically had low levels of default, and, in cases in which defaults did occur, high recovery rates. In recent years these loans traded at very narrow yield spreads as demand from Collateralized Loan Obligations (or "CLOs", a leveraged structure that buys bank loans), hedge funds (using leverage facilities called total return swaps, or TRS, more on those later), and other leveraged market participants bid up prices. The tighter spreads became, the more leverage was applied in order to make yields attractive to investors. The rest of the story is history, as they say, with investors in CLOs, hedge funds, and other leveraged vehicles losing money in bank loans beginning in the summer of 2007 as spreads widened with more and more market participants attempting to sell.

THE PAST FEW YEARS ARE FILLED WITH EXAMPLES OF HEDGE FUNDS USING LEVERAGE TO AMPLIFY THE RETURN OF SECURITIES WITH RELATIVELY LOW YIELDS, OR TRADES WITH MODEST EXPECTED RETURNS.

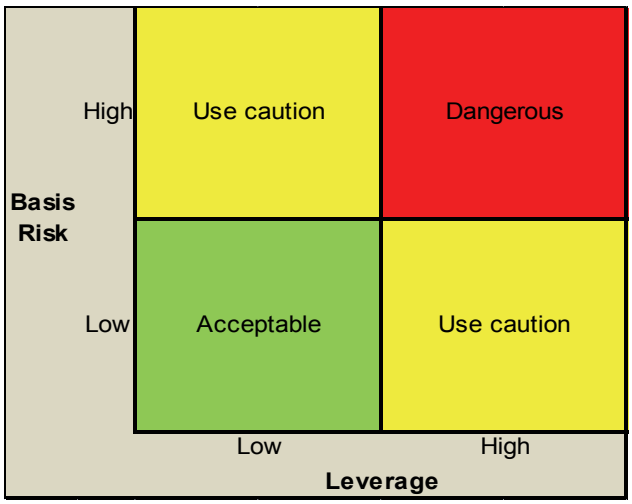
We view strategies that are dependent on significant leverage in order to generate adequate returns as generally less attractive. This is more true in today's environment, because leverage is not as easy to obtain as it was in the past. Conversely, due to the broad selloff of risky assets, in many cases less leverage is currently needed in order to obtain attractive returns. Certain hedge fund strategies do employ moderate leverage, and many well-implemented strategies can have good portfolio diversification effects and attractive risk/return dynamics. Generally, we are comfortable if a manager is using leverage in order to amplify the return of a compelling position or strategy or if the manager is seeing many high potential return opportunities.

In contrast, however, we feel it is imprudent when a manager uses leverage in an attempt to magnify the returns of a weak position or strategy, or grosses up the balance sheet without having a great deal of conviction in his positions. Investor skill and experience are required in order to distinguish between these two scenarios.

The level of leverage used by a hedge fund cannot be observed in isolation as an indicator of the riskiness of that fund or its underlying strategies. Understanding the details of each manager's trading style, the return drivers of the strategies implemented, and the construction of the portfolio are essential to the evaluation of a manager's leverage and risk profile. We attempt to determine an appropriate leverage level based on the strategies and sub-strategies employed, and based on our experience of what levels of leverage a manager should be utilizing in their portfolios given such a strategy.

The "riskiness" of leverage depends on what positions are being leveraged. When assets that are expected to move in conjunction instead diverge, this is a notion called "basis risk". This is the risk that two assets behave differently to one another and lose money at the same time. For example, if a manager applies leverage to a position consisting of two very similar securities, one long and one short (e.g. Long Nike stock, Short Reebok stock), this is much less risky than applying that same level of leverage to a position consisting of two dissimilar securities (Long Exxon stock, Short JetBlue stock). This is because the price of the similar assets will tend to move in tandem, with the gains on one offsetting the losses on the other.

Table 2. Hedge funds and Basis Risk



[source: NEPC]

A host of fundamental characteristics such as asset type, industry, maturity/duration, credit quality, and the like are useful in understanding the extent to which long and short positions will behave similarly or diverge. Leverage as it relates to hedge funds is indeed a bit trickier to conceptualize than in the cases of banks or houses since hedge funds can take both long and short positions. So, in many cases, leverage may not be a good indication of the riskiness of a portfolio, unless it is assessed in the context of other portfolio and strategy characteristics. High leverage with low basis risk may be less risky than low leverage with high basis risk. Importantly, strategies involving less basis risk will tend to call for more leverage in order to generate returns.

C. Measuring Leverage in Hedge Funds

There are a number of ways that leverage can be defined in the context of hedge funds. The first and most conservative way to measure leverage in hedge funds is to consider the gross value of assets controlled (longs plus shorts), divided by the total capital (Gross Market Value/Capital).

For example, a fund with $100 million in equity capital with $80 million invested long, and $70 million invested short for total gross assets of $150 million, would have gross leverage of 1.5x.The second way to think about leverage, for hedged or "relative value" strategies in particular (e.g. merger arbitrage, convertible arbitrage, capital structure arbitrage), is to look at the value of the long assets only, divided by the equity capital (Long Market Value/Capital). Generally, this is the easiest way to think about leverage and the most common way it is expressed. However, one should always consider both numbers. The latter method recognizes instances where short positions serve to decrease risk, that is, they are specific hedges for long positions or part of a relative value position. Sometimes, as referenced earlier, leverage is also expressed in terms of "turns" of leverage, indicating the multiple represented by the level of debt above the equity (Debt/Equity).

Some funds use little or no leverage. For instance, many distressed credit managers currently have 30% or more of their portfolio in cash (though the existence of cash on the balance sheet does not necessarily mean that no leverage is employed as margin financing or derivatives can provide leverage without the full use of all available cash). This is because the opportunities in that space are still developing. Other strategies do use significant leverage. Table 3 below provides a sense for leverage levels in various hedge fund strategies.

Indeed, the level of leverage used by hedge fund managers varies greatly depending on the strategy employed, for example:

- Merger arbitrage tends to utilize no or little leverage, typically in the range of 1-2x (Long Market Value/Capital), depending largely on the spread at which the equities of merger candidates trade in the market.
- Fundamental long/short equity also tends to run between 1-2x, with strategies involving less basis risk tending to utilize higher levels of leverage.
- Convertible arbitrage tends to run between 2-6x, utilizing some leverage to magnify the arbitrage between the convertible bond and equity portion of a company's capital structure.
- Fixed income arbitrage tends to utilize a high amount of leverage, from 5x to 10x or more because the discrepancies being arbitraged

Table 3. Typical leverage in hedge fund strategies

Leverage Guideline (LMV/Capital)	Typical Leverage	Typical Maximum	Current Range
Convertible Arbitrage	4x	6x	1-3x
Corporate Credit	1.5x	3x	0.8-2x
Distressed Debt	1x	1.5x	0.3-0.8x
Event-Driven Equity and Merger Arbitrage	1.3x	2x	0.3-1x
Fixed Income Arbitrage	8x	15x	2.0-10x
Global Macro	5x	10x	1-8x
Long/Short Equity - Fundamental	1.3x	2x	0.3-1x
Long/Short Equity - Quantitative	2.5x	5x	1.5-5x
Multi-Strategy	3.5x	6x	1-3x

[source: NEPC, based on data from hedge funds, funds of hedge funds, prime brokers]

are very small (LMV/Capital is used since there is generally considered to be low basis risk in this arbitrage). This is a good example of a strategy in which leverage used is not comparable to other strategies in trying to ascertain riskiness, due to the low basis risk and since the underlying securities typically have lower default probabilities and/or are highly liquid instruments (sovereigns, agencies, etc). Having said this, certain funds have had poor performance as a result of basis risk volatility.

Hedge fund leverage levels have varied significantly over time. Generally, levels have dropped during market turbulence as leverage became more difficult and costly to obtain. In the current environment, larger, well-established hedge funds utilizing a variety of strategies are finding it easier to obtain somewhat attractive financing terms. Table 4 below shows aggregate leverage levels for one of the leading prime brokers on Wall Street since early 2008. It clearly shows the historical trend mentioned above, with prime brokerage financing dropping to a low in the post-Lehman bankruptcy period of Autumn 2008.

While hedge funds are constrained by the financing environment and must react in accordance with it, many funds have shown a pattern of proactively reducing leverage before difficult market environments transpired and assets lost value. Said differently, we have observed that many hedge funds have been effective in varying leverage levels throughout the market cycle, utilizing more leverage when opportunities were plentiful and valuations attractive, and less when opposite conditions existed. However, the dynamics of the most recent cycle, to some extent, beg a question relating to cause and effect, with the deleveraging of hedge funds in many cases likely contributing to price declines across various asset types.

Another wrinkle is how the treatment of derivative exposure impacts the calculation of hedge fund leverage. While this issue can be complex, the basic approach generally used is to "notionalize" all derivative exposures; meaning that the dollar value used to express the leverage associated with the derivative is based on how much value the derivative controls.

- In a simple case, if one option is purchased for a premium (cost) of $5 and the option controls 100 shares of a stock trading at $50, then the value used to calculate leverage would be $5000 ($50 x 100), not the premium of $5. The value used would generally be $5000 irrespective of whether the option was, for example, a call (long) or a put (short), and that

Table 4. Prime broker leverage (Gross market value/Capital)*

** This table refers to gross market value divided by capital. It includes margin financing and some types of swap financing only. It also does not include financing received by hedge funds from other counterparties.*

[source: a large prime broker]

these options have very different return profiles, though in reality they would trade at slightly different prices.

- Another example is a currency forward contract in which cash flows are exchanged based on movements in that currency multiplied by a theoretical, pre-determined notional dollar amount. In this case the notional value is generally used in the leverage calculation.

- Using the notional value of the derivative can be misleading and may not fully capture the risk of the derivative, particularly when selling an option (as opposed to buying one), because the worst case loss on such a trade can be large and the payoff profile asymmetric. For example, if one sells credit default swap protection (analogous to selling insurance on the default risk of a corporate entity) and collects a premium, and the company defaults, the seller has a loss equal to the value of the security ensured minus the premiums collected. Alternatively, if one buys an option the downside is generally capped at the premium paid. In other cases the loss is theoretically unlimited (e.g. short a call).

- There are other techniques that can, in some cases, be overlaid on this calculation to try to account for these limitations, including accounting for the "delta" or sensitivity of an option to changes in the value of the underlying security (this applies to options in particular due to their convex payoff profiles).

D. How Hedge Funds Obtain Leverage

Our hedge fund manager due diligence not only looks at the level of leverage used, but also, importantly, its source and nature. These details are critical, since the sudden withdrawal of financing can force liquidation of positions, generally at the least opportune time. It is also important to understand how much total leverage is at the disposal of the manager, to get a handle on how much "gas" the manager can apply to the portfolio. Let's look at some of the methods and instruments hedge funds use to obtain leverage.

- **Prime brokerage:** The simplest and most common source of hedge fund financing is borrowing from a prime broker who provides a form of margin financing, generally at either the position or portfolio level. Prime brokerage financing is generally easy to obtain but financing terms can be changed on short notice. Prime brokerage financing is also typically of short duration, resulting in a potential mismatch between the duration of the firm's assets (take longer to liquidate) and liabilities (can be called quickly). In order to mitigate this risk, hedge funds often seek to add "term structure" to their prime brokerage margin facilities. If a fund has, for example, a 90 day notice built into their agreement with a prime broker, this keeps the prime broker from cutting financing on a position or terminating a relationship with a fund altogether on short notice and most likely at the worst possible time. This is a significant concern for hedge funds using leverage. In the current environment, not all hedge funds have been able to add term financing to their balance sheet, and prime brokers are being very selective about extending credit. Better treatment accrues to larger, more established funds with steady returns, diverse assets and strategies, and locked-up equity capital.

  When a security is borrowed from a broker and sold short, a hedge fund receives cash proceeds from the sale, on which it is paid interest at prevailing rates (there is also a cost associated with borrowing the security that is a function of how difficult the security is to obtain, known as the cost of borrow, with the difference between the two known as the short sale rebate). Certain prime brokerage arrangements allow the borrower to reinvest these proceeds to purchase additional securities long. Prime brokerage is limited in terms of the level of leverage it can provide (though certain forms of prime brokerage financing allow leverage to exceed Reg T limits), thus banks and hedge funds have over the years developed creative structures to provide greater levels of borrowing.

- **Repurchase agreements (aka "repo"):** Another source of hedge fund financing, particularly for those trading fixed income instru-

ments, is repurchase agreements, or repos. In a repo transaction, a hedge fund typically delivers a security that it owns to a lender as collateral in exchange for a loan. Repo transactions are generally of a fixed, short term nature ranging from one night to one month. With the perception of counterparty risk currently at relative high levels, though, most repo transactions are of the overnight variety, limiting their value in the current environment.

IT IS ALSO IMPORTANT TO UNDERSTAND HOW MUCH TOTAL LEVERAGE IS AT THE DISPOSAL OF THE MANAGER, TO GET A HANDLE ON HOW MUCH "GAS" THE MANAGER CAN APPLY TO THE PORTFOLIO.

- **Total return swaps ("TRS"):** Hedge funds can also obtain financing through TRS facilities with banks. A TRS allows a hedge fund to receive the leveraged 'total return' of an underlying asset or pool of assets. Bank loans and equities have historically been the most common security financed through TRS. TRS transactions are typically structured in such a way that is tailored to the specifics of the underlying asset pool. TRS facilities in place around banks loans and other types of collateral can be an attractive source of term financing, though many of these have safeguards in place that allow the bank to take away the financing if, for example, the market value of the collateral were to deteriorate.
- **Secured credit line:** A secured line of credit, though difficult to obtain at fair financing rates in the current environment, is another source of financing for hedge funds. This is typically structured as a committed revolving line of credit that is renewable on a periodic basis supported by certain assets held in the fund. A hedge fund who has obtained this source of financing has an advantage in the marketplace today as it allows them to purchase assets with a longer duration with little fear of being forced to sell at the wrong time, though banks have in a few cases found ways to back out of these financing lines.
- **Structured financing vehicles:** The most sophisticated hedge fund managers were able to structure transactions to provide longer term financing for their portfolios. These vehicles, structurally similar to CLOs or CDOs, were a creation of the leveraged economy, and are difficult to issue in the current environment, since few investors are willing to purchase their debt. Those funds that created these structures and purchased portfolio assets with the proceeds have a long term, stable, cheap form of financing for their portfolios.
- **Derivatives:** Derivatives of all kinds, including options, futures, and forward contracts, contain implicit leverage. As discussed above, utilizing a relatively small amount of margin, these contracts allow the investor to "control" a much larger level of notional assets. This is slightly different in the sense that derivatives allow for leverage without the fund having to actually borrow money to finance their positions (off balance sheet).

E. Hedge Funds and Leverage...What Can Go Wrong?

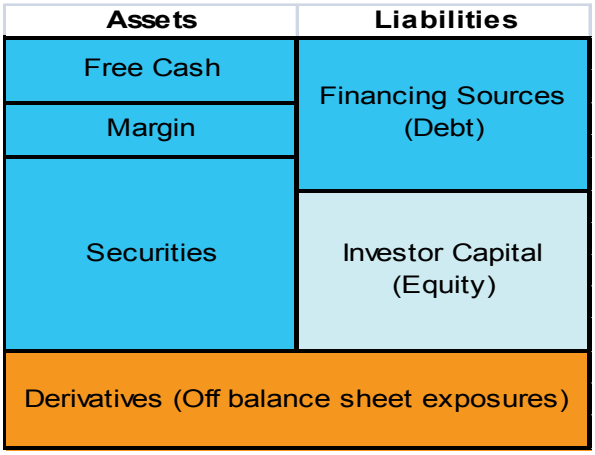
We have addressed how hedge funds apply leverage, how investors can measure it, and how leverage is obtained. Let us now tie this all together in an attempt to understand the practical risks of leverage in hedge funds. It is critical to recognize in what circumstances leverage can be an appropriate tool used to generate attractive returns and, on the flipside, how leverage can interact with and feed on other risks, becoming quite dangerous. To do so, we will look at some real world examples.

To understand what can go wrong, we must first look at a typical leveraged hedge fund balance sheet (see next page).

On the right hand side of the balance sheet we have the liabilities, known as the "capital structure" of the fund. In light blue, we have the investor capital, or equity. At the top, in darker blue,

are the financing sources, or debt. This financing could take the form of prime brokerage margin, a secured credit line or other credit facility, as discussed earlier. In addition, the right side of the balance sheet includes shorted securities, since these are borrowed and then sold, representing a liability. In many cases, the cash obtained from the sale can then be used to purchase additional securities long. Derivatives, in orange, can be either an asset or a liability, depending on whether the fund is long or short the derivative. In a case in which the fund is selling credit default swap protection, for example, this would be a contingent liability of the fund (though in this example the liability moves to zero if default does not occur). In some cases, the notional value of derivatives can be of significant size relative to the overall size of the fund balance sheet.

Table 5. The hedge fund balance sheet



[source: NEPC]

On the left side of the balance sheet, the asset side, the largest blue box is represented by the securities held by the fund. Note that this box is larger than the light blue box on the right side representing investor capital; this indicates that the fund is using leverage, otherwise it would only be able to purchase securities up to the value of the equity provided by its investors. As mentioned, derivatives can represent either an asset or a liability on a fund's balance sheet. In a case in which the fund is buying protection on CDS, this would be considered an asset of the fund (though the asset value moves to zero if default does not occur). We also have cash and margin. Margin is the collateral or "haircut" required by a lender in order to extend credit. It provides a buffer for volatility in the assets being leveraged. If the volatility or the probability of loss in these assets is high, larger margin levels will be required. For example, a portfolio of government bonds will require much less margin than one of high yield bonds. Hedge funds are currently making every attempt to maintain the least amount of margin with their lenders in order to minimize counterparty risk. This brings us to the last piece of the asset side of the balance sheet, which is cash. Depending on the strategy, most funds will be able to hold some level of cash on their balance sheet. Hedge funds have also been careful as of late in terms of where and with whom cash is held, again in order to minimize counterparty risk.

An asset-liability mismatch is one of the most serious problems that can occur with a hedge fund, most notably in the context of liquidity and/or duration. Most often this mismatch is coupled with an increase in volatility and correlation in the market. 2008 was a year that saw many examples of this phenomenon.

Let's look at two funds, Fund A and Fund B. Here are the basic attributes of each fund:

Fund A

- Invests in diversified long and short portfolio of 60-80 large cap equities, roughly balanced but with a modest long bias
- Portfolio is financed through prime broker margin
- Has $100m in equity capital from 10 pension funds with long investment time horizons
- Redemption terms are quarterly with 90 days required notice before the redemption date
- Leverage is low at 1.3x (LMV/Capital), the fund has gross long assets of $130m
- The fund is 130% long and 100% short
- 10% of the fund's NAV is in cash

Fund B

- Invests in a concentrated credit strategy with

20 long stressed and distressed bond positions and 10 short positions, including some equity index shorts and some corporate credit index (CDX) buy protection

- Cash positions are financed with prime broker margin and derivatives are used
- Has $100m in equity capital from two funds of hedge funds
- The two fund of funds who invest in Fund B obtained their capital from several Swiss dentists
- Redemption terms are monthly with 30 days required notice before the redemption date
- Leverage is moderate at 3x (LMV/Capital), the fund has gross long assets of $300m
- The fund is 300% long and 250% short
- 10% of the fund's NAV is in cash

Now let's put each fund through a perfect storm, much like the one witnessed in the fall of 2008, with the following basic parameters:

- Equity and bond markets sell off materially
- Market volatility spikes
- Correlation amongst similar securities spikes
- Typically less liquid securities become impossibly illiquid, with no bids
- Idiosyncratic risk increases
- Default probability increases
- Investors, particularly Swiss dentists, become very skittish and move to cash (cash is king!)

Which fund is most likely to be able to survive this type of market? Fund A is diversified, trades liquid securities, uses little leverage, and appears to have a stable capital base. Fund B is quite different. First, the latter fund is concentrated with only 20 longs and 10 shorts. With $300 million invested across only 20 long positions, the average position size is $15 million, or 15% of NAV (equity capital). Secondly, the fund has significant basis risk between its long and short positions.

This is a problem in that the long and short books may behave very differently. Conceivably, over any particular period, the fund could, for example, lose money on its longs and also lose money on its shorts. Thirdly, the fund's 3x leverage is obtained through prime broker margin and repo without built-in term structure Given the nature of the assets, less liquid distressed securities, it is questionable as to whether a prime broker would in the current environment provide financing up to 3x, but let's say this is possible for the sake of argument.

Here is how things might unfold:

Fund A

- The perfect storm hits but the fund remains flexible; it can reduce, add, or eliminate positions. The fund suffers idiosyncratic events in 3 positions that are down between 30% and 50%. The fund eliminates two of these and adds to one. The vast majority of the fund's long and short positions are financed with cash. Most of the positions financed with margin turn out to be some of the less volatile positions in the portfolio; the fund receives margin calls on a few of these positions but easily meets these with cash from other positions it sold.
- The investors of the fund are concerned, but the manager is able to explain that it sees the current market conditions as a temporary aberration, that the fund remains very nimble, and that most of the losses are mark to market only and not realized. Most investors seem to be on board, with only 8% of fund capital requesting withdrawal for next quarter.
- The fund is hurt on the long portfolio but the short portfolio moves up, as expected. The fund loses 4% over the course of a month, down -12% on its longs and gaining +8% on its shorts.
- Though the fund performed poorly during the storm, it will live to fight another day, and may even be in a position to pick up some bargains in the beaten up market. Its financing providers are comfortable with the current portfolio

and continue to extend credit to the fund. Investors are not happy about losing money, but still believe in the fund.

Fund B

- The fund is in a dire situation. It suffers idiosyncratic events in 6 positions that are down between 30% and 60%. The fund receives margin calls on these and other positions. It uses cash on hand to meet a few margin calls and attempts to sell some of its more liquid positions to meet the others, but in the market's flight to quality there is a lack of bids for their positions and prices gap down. The fund lacks flexibility and is forced to sell positions at fire sale prices, even though it believes these will ultimately recover, in order to meet margin calls. Some securities are impossible to sell as there are absolutely no bids.

- To make matters worse, the fund's investors have learned of the fund's woes and have asked the manager to return 50% of the fund's capital before the 30 day redemption deadline expires. These funds of funds have their own pressures, as the Swiss dentists have lost confidence in them and are asking for their capital back. In a panic to raise additional capital, the manager continues to sell positions, realizing significant additional losses.

- The storm causes many of the fund's longs to gyrate wildly, losing a great deal of value, while other positions show little price discovery and liquidity and prices appear to fluctuate less. Generally, the fund's positions are much more volatile than the manager anticipated. In the end, the short book does fairly well, but unfortunately gains much less than what is lost on the long side. Within 4 weeks, the fund has lost 18% of its value, losing 25% on the long side and gaining only 7% on the short side.

- The fund's future is uncertain and it may be doomed. The fund has lost 18% of its value because it applied significant leverage to a risky, illiquid space and its portfolio had material imbedded basis risk. Due to pressure from financing providers and investors looking to redeem, the fund has no flexibility to hold its slumping positions, much less buy into opportunities. The prime broker is loathe to continue to finance the fund and, although leverage is now down to 1.5x (LMV/Capital), this number may be forced down further, especially if markets don't turn around. The prime broker is also watching to see how the redemption situation of the fund evolves, and most likely will shortly pull all of the fund's financing.

Table 6. Factors that determine appropriate hedge fund leverage levels

		Leverage Level		
		High	Moderate	Low
Asset credit quality/price	High			
	Moderate			
	Low			
Asset duration	High			
	Moderate			
	Low			
Asset liquidity	High			
	Moderate			
	Low			
Asset price correlations	High			
	Moderate			
	Low			
Asset price discovery	High			
	Moderate			
	Low			
Asset volatility	High			
	Moderate			
	Low			
Portfolio basis risk	High			
	Moderate			
	Low			
Position concentration	High			
	Moderate			
	Low			
Stability of capital base	High			
	Moderate			
	Low			
Term of financing base	High			
	Moderate			
	Low			

{source: NEPC]

Green	= Acceptable
Yellow	= Use caution
Red	= Dangerous

The table on the previous page summarizes a list of key factors that dictate the appropriateness of the leverage level used, coupled with examples where various factors are combined to create differing scenarios. Many hedge funds have lost material amounts or even all of their value by applying leverage to particular assets or a portfolio of assets in an inappropriate manner, such as in the "dangerous" scenario above (for instance, in the case of hedge funds run by Bear Stearns). Excessive growth of the capital base is also dangerous as it creates a situation where the manager must deploy assets, potentially growing the balance sheet using lower conviction ideas. In each case, the combination of factors causing the crisis has been unique. Finally, and perhaps most importantly, manager hubris has almost always been a factor in the demise of hedge funds. There is no doubt that the human element is a critical piece of analyzing hedge fund risk, making qualitative analysis, such as understanding the incentives of the investment professionals running a hedge fund, as important as understanding the quantitative aspects.

F. Conclusion

Hedge funds will continue to use leverage to enhance their alpha generation capabilities, and while we do not believe that leverage is a requirement, we do think that those funds that can obtain and use it appropriately may have a competitive advantage going forward. Indeed, recent market turbulence highlights the importance of focusing on high quality hedge fund firms that have developed well-structured, robust investment processes to address both investment risk and operational risks that can easily translate into investment risk, all while achieving their investment objective through a variety of market environments.

For many of these managers, leverage will remain an important tool for achieving their return goals. Now more than ever, investors must take a prudent and thoughtful approach to assessing not just leverage, but a variety of risks imbedded in hedge funds, and they must be prepared to address these complex topics directly with managers. Hedge fund managers, for their part, are realizing that it is also in their best interest to be sure that investors fully understand these risks, and that both sides should not focus solely on the reward side of the equation.