
Volatility + Leverage = Dynamite

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Nearly 15 years ago, in April 1994—at a time when absolutely no one was reading my memos—I published one called “Risk in Today’s Markets Revisited.” That is when I first proposed the formula Volatility + Leverage = Dynamite. I recycled it in “Genius Isn’t Enough,” on the subject of Long-Term Capital Management (October 1998).

The last few years have provided a great demonstration of how dangerous it can be to combine leverage with risky assets, and that is the subject of this memo. It will also pick up on some ideas from my last memo, “The Limits to Negativism” (15 October 2008).

My memo “Plan B” on the bailout proposal went out on 24 September 2008, and as I lay in bed later that night, I realized that I had not taken one part of it nearly far enough. In discussing a prime cause of the credit crisis, I wrote the following:

I’ll keep it simple. Suppose you have \$1 million in equity capital. You borrow \$29 million and buy \$30 million of mortgage loans. Twenty percent (or \$6 million) of the mortgages go into default, and the recovery on them turns out to be only two-thirds (\$4 million). Thus you’ve lost \$2 million . . . your equity capital twice over. Now you have equity capital of minus \$1 million, with assets of \$28 million and debt of \$29 million. Everyone realizes that there’ll be nothing left for the people who’re last in line to withdraw their money, so there’s a run on the bank. And you slide into bankruptcy.

That is true as far as it goes, but I am going to devote this memo to things that could have followed that paragraph.

The Problem at Financial Institutions

It is no coincidence that today’s financial crisis was kicked off at highly leveraged banks and investment banks. The block quote above shows why that is true and why the problem is as big as it is. As I wrote in “Plan B”:

Because of the high regard in which financial institutions were held; because of the implied government backing of Fannie Mae and Freddie Mac; and because permissible leverage increased over time, financial institutions’ equity capital was permitted to become highly inadequate given the riskiness of the assets they held. Or perhaps I should say institutions took on too many risky assets given the limitations of their equity capital. That, in a nutshell, is why institutions have disappeared.

Editor’s Note: Reprinted here with permission from Oaktree Capital Management is a memo dated 17 December 2008 that Howard Marks, CFA, wrote to Oaktree clients.

So, what exactly did these institutions do wrong? Here are a few examples using Bank X, with \$10 billion of capital, to illustrate:

- Bank X uses leverage to buy \$100 billion of triple-A mortgage-related debt, under the assumption that it cannot lose more than 1 percent. Instead, home prices decline nationwide, causing it to write down its holdings by 10 percent, or \$10 billion. Its capital is gone.
- Alternatively (but in fact probably simultaneously), Bank X sells Hedge Fund G \$10 billion of credit default swaps on the bonds of Company A, and it buys \$10 billion of the same credit protection from Investment Bank H. Company A goes bankrupt, and Bank X pays Hedge Fund G \$10 billion. But Investment Bank H goes bankrupt, too, so Bank X cannot collect the \$10 billion it is due. Its capital is gone.
- Bank X lends \$50 billion to Hedge Fund P with equity of \$10 billion, which then buys \$60 billion of securities. The value of the fund's portfolio falls to \$50 billion; the bank sends a margin call; no additional collateral can be posted; so the bank seizes and sells out the portfolio. But in the downward-spiraling market, the bank only realizes \$40 billion. Its capital is gone.
- Hedge Fund Q also borrowed to buy securities. When Hedge Fund P got its margin call and its portfolio was sold out, that forced securities prices downward. So, Fund Q—which holds many of the same positions—also receives a margin call, perpetuating the downward spiral and bringing more losses to more institutions.

All of these scenarios, and many others, are connected by a common thread: the combination of leverage and illusory safety, which allowed institutions to take on too much risk for the amount of capital they had.

First, it should be clear from the above that the amount of borrowed money—leverage—that it is prudent to use is purely a function of the riskiness and volatility of the assets it is used to purchase. The more stable the assets, the more leverage it's safe to use. Riskier assets, less leverage. It is that simple.

One of the main reasons for the problem today at financial institutions is that they underestimated the risk inherent in such assets as home mortgages and, as a result, bought too much mortgage-backed paper with too much borrowed money.

Let us go back to the block quote on the first page. Here it is again:

I'll keep it simple. Suppose you have \$1 million in equity capital. You borrow \$29 million and buy \$30 million of mortgage loans. Twenty percent (or \$6 million) of the mortgages go into default, and the recovery on them turns out to be only two-thirds (\$4 million). Thus you've lost \$2 million . . . your equity capital twice over. Now you have equity capital of minus \$1 million, with assets of \$28 million and debt of \$29 million. Everyone realizes that there'll be nothing left for the people who're last in line to withdraw their money, so there's a run on the bank. And you slide into bankruptcy.

Suppose you set up your leveraged portfolio as described but only 2 percent of your mortgage holdings go bad, not 20 percent. Then, you only lose \$200,000 (not \$2 million) of your \$1 million of equity, and you are still solvent. Or, suppose 20 percent of your mortgages default as in the original example, but you only levered up 10 times, not 30. You lose the same 6.7 percent of your assets, but based on \$10 million, so it is just \$670,000, or two-thirds of your equity. You are still alive. The problem lies entirely in the fact that the institutions combined highly risky assets with a large amount of leverage.

By now, everyone recognizes (a) how silly it was for the financial modelers to be so sure there could not be a nationwide drop in home prices (they felt that way because there never had been one—but did their data include the Great Depression?) and (b) the terrible job the agencies did of rating mortgage-related securities. So, the risk was underestimated, permitting the leverage to become excessive: end of story. Reason number one for today's problem, then, is the mismatch institutions turned out to have made between asset risk and leverage.

The second reason is that, given the degree by which mortgage defaults have exceeded expectations, no one feels like taking a chance on how bad things will get. Everyone agrees it will be bad, but no one can say how bad.

As I said in October 2008 in "The Limits to Negativism," when things are going well, no assumption is too optimistic to be accepted. But when things turn down, none seems too pessimistic. Today, with the ability to lose money on mortgages having been demonstrated so painfully, investors consider themselves unable to say where the losses will stop.

So, if a highly leveraged financial institution has significant mortgage holdings, few people are willing to risk money in the belief that the losses will be bearable. If a financial institution has book equity of \$100 million and \$500 million of mortgage assets, no one will grant that future losses will be less than \$100 million—that is, that it will remain solvent. Maybe the write-downs will be \$100 million. Or \$300 million. Or \$500 million. There is no assumption too negative. As a result, investors will just keep their money in their pockets.

A few sovereign wealth funds and others jumped in a year ago, and based on results so far, it looks like they acted too soon. In July, Goldman Sachs reported that 52 banks had raised capital and the providers of that capital were underwater at 50 of them, by an average of 45 percent. Certainly, things are much worse now.

Most people are behaving as if there were no such thing as investing safely in a financial institution. This widespread belief has the ability to greatly delay the restoration of faith, capital, and viability. Peter Bernstein put it succinctly in the *New York Times* of 28 September 2008. (Peter is one of the very wisest men around, in part because he is one of the few who can talk about the Depression from experience. I recommend this op-ed piece, "What's Free About Free Enterprise?")

This time around, assets are evidently so rotten in so many places that no financial institution wants to risk doing business with any other financial institution without a government backstop.

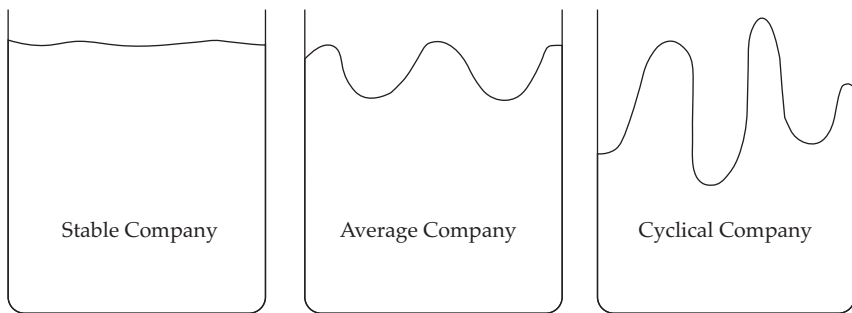
That is the reason why no buyer could be found for Lehman Brothers over the weekend preceding its bankruptcy. No one could assess its assets and get comfortable regarding the status of its highly levered net worth, so everyone required a government backstop . . . which was not forthcoming.

The Right Level of Leverage

Although I communicate primarily in words, I tend to think a lot in pictures—certainly more than in numbers. My concept of appropriate leverage can easily be demonstrated through a few diagrams. I am going to overlook the differences between accounting value, market value, and economic value and confuse the terms. But I think you will get the idea.

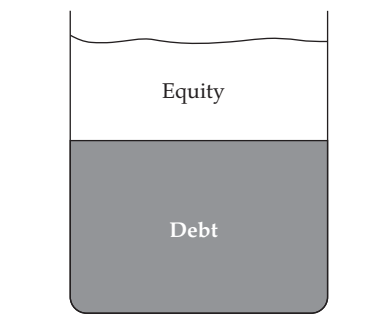
The drawings below show the value of companies of different types. Due to the variability of their earnings, the values fluctuate differently over time (**Figure 1**).

Figure 1.



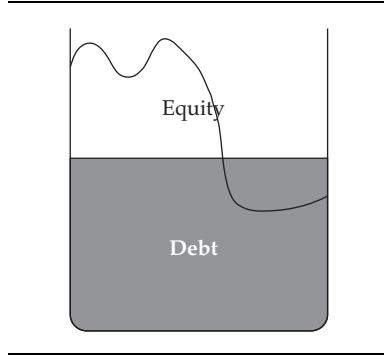
Here is a financial structure, except with the equity above the debt, not below as it would be on a balance sheet (**Figure 2**).

Figure 2.



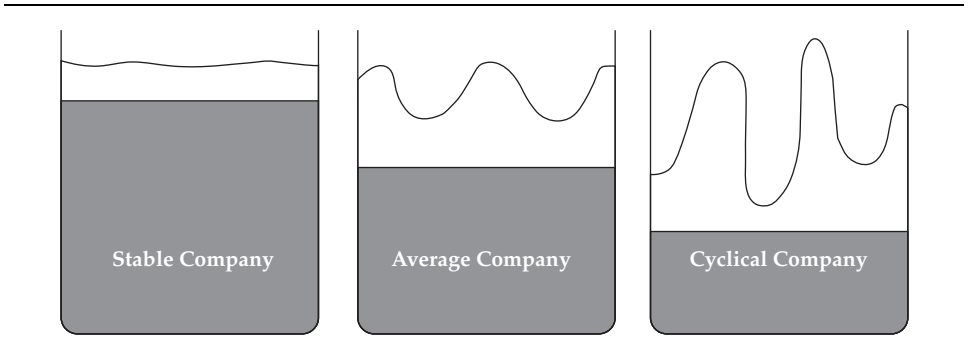
Now let us combine the two concepts. The bottom line is that in order for a company to avoid insolvency, its financial structure has to be such that its value will not fall through the equity and into the debt. In naive and far-from-technically correct terms, when the amount of debt exceeds the value of the company, it is insolvent (**Figure 3**).

Figure 3.



What the following doodles illustrate is that for every level of riskiness and volatility, there is an appropriate limit on leverage in the capital structure (**Figure 4**).

Figure 4.



During the first leveraged buyout boom in the late 1970s and the 1980s, it was a watchword that they should be done only with stable companies. But in bullish times, rules like that are forgotten or ignored, and we get buyouts of companies in cyclical industries, like semiconductors or autos.

Extremely leveraged companies have existed for more than a century. They are called utilities. Because their profits are regulated by public commissions and fixed as a percentage of their stable asset bases, they have been extremely dependable. This shows that high leverage is not necessarily risky, just the wrong level of leverage given the company's stability.

It can be safe for life insurance companies to take risk on limited capital, because their operations are steady and their risks can be anticipated. They know everyone will die and roughly when (on average). But if a firm like MBIA was going to guarantee mortgage securities, it should have recognized their instability and unpredictability and limited its leverage. The insurance industry's way of saying that is that its capital should have been higher as a percentage of the risks assumed. MBIA insured \$75 billion of residential and commercial mortgage paper on the basis of total capital—not capital devoted to its insuring mortgage securities, but total capital—of only \$3 billion. Did anyone worry about the possibility that 5 percent of the mortgages would default?

Leverage is always seductive. If you have \$1 million of capital and write \$25 million of insurance at a 1 percent annual premium, you bring in \$250,000 of premiums, for a 25 percent return on capital (before losses and expenses). But why not write \$50 million of insurance and bring in \$500,000? The answer is that policy losses might exceed 2 percent of the insurance written, in which case your losses would be greater than the capital you have to pay them with . . . and you might be insolvent. But in order to resist using maximum available leverage, you need discipline and an appreciation for the risks involved. In recent years, few firms had both.

Why Mortgages?

Why is it that residential mortgage-related paper set off the process endangering our institutions? Why not high-yield bonds or leveraged loans or even equities? One reason, of course, is the sheer size of the residential mortgage-related securities market: \$11 trillion. But there are two others.

The first is the inability to value the underlying collateral. I feel comfortable when Oaktree's analysts value the debt or equity of a cash flow-producing company. To the extent an asset produces a stream of cash flows, and assuming they are somewhat predictable, the asset can reasonably be valued. But assets that do not produce cash flows cannot be valued as readily (this has been a regular theme of mine of late).

What's a barrel of oil worth: \$33 in January 2004, \$147 in mid-2008, or \$42 earlier this month? Which price was "right?" All of them? Or none of them? We all know about the things that will influence the price of oil, such as finite supply, growing demand, and the unreliability of some of the producing nations. But what do those factors make it worth? No one can convert these intangibles into a fair price. That is why, a few months ago at \$147, we were seeing predictions of \$200 oil. And now, with the price down two-thirds, there is talk of \$25.

The same is true of commodities, gold, currencies, art, and diamonds. And houses. What is a house worth? What it cost to build? What it would cost to replace today? What it last sold for? What the one next door sold for? The amount that was borrowed against it? (Certainly not.) Some multiple of what it could be rented

for? What about when there are no renters? The answer is “none of these.” On a given day, houses—and all of the things just listed—are worth only what someone will pay for them. Well, that is true in the short run for corporate securities, too, as we have seen in the last few months. But in the long run, you can expect security prices to gravitate toward the discounted present value of their future cash flows. There is no such lodestone for houses.

Think about one of the biggest jokes, the home appraisal. If a house doesn't have a “value,” what do mortgage appraisers do? They research recent sales of similar houses nearby and apply those values on a per-square-foot basis. But such an appraisal obviously says nothing about what a house will bring after being repossessed a few years later.

Nevertheless, in recent years, a purchase price of $\$X$, supported by an appraisal of $\$X$, was used to justify lending 95 percent of $\$X$ —or maybe 100 percent or 105 percent—when a home was bought or refinanced. No wonder homes valued in the biggest boom in history have turned out to be unreliable collateral.

Second, these overrated mortgages were packaged into the most alchemical and fantastic leveraged structures. It is these, not mortgages themselves, that have jeopardized our institutions. There was a limited market for whole mortgage loans; they were considered a specialist market entailing risk and requiring expertise. But supposedly those worries would be obviated if one bought the debt of structured entities that invested in residential mortgage-backed securities (RMBS).

First question: Where did the risk go? We were told it disappeared thanks to the magic of structuring, tranching, and diversifying—permitting vast amounts of leverage to be applied safely. Second question: How reliable was the diversification? Answer: Again we were told, highly reliable; there had never been a national decline in home prices, so mortgages could be considered uncorrelated with each other. The performance of a mortgage on a house in Detroit would be unaffected by what went on in Florida or California. (Well, so much for what we were told.)

The institutions' write-downs generally are in collateralized debt obligations (CDOs), debt issued by special-purpose entities that borrowed huge amounts relative to their equity in order to purchase mortgage-related securities. As described earlier, underestimated risk led to the use of unwise amounts of leverage. But interestingly, the key losses are not in the riskier junior tranches of CDO debt, about which there was some leering. Rather, they are in the triple-A-rated tranches. It is to buy those tranches that our leading institutions took on too much leverage. Once again, greatly underestimated risk led to great leverage and thus great losses.

What did you need to steer clear of CDO debt? Computers, sophisticated programs, and exceptional analysis? Genius? No: skepticism and common sense. In RMBS, CDOs, and CDO-squareds (entities that borrowed to buy CDO debt), 90 percent or so of their capital structure was rated higher than the underlying collateral, all based on the linchpin assumption that mortgages were uncorrelated. That is all you had to know.

How good a piece of collateral is a subprime mortgage covering 100 percent of the purchase price of a house bought in a soaring market by an applicant who will pay a higher interest rate to be able to skip documenting income or employment? That is not a secured loan; it is an option on future appreciation. If the house goes up in price, the buyer makes the mortgage payments and continues to own it. If it goes down, the buyer walks away, in which case the lender gains ownership of a house worth less than the amount loaned against it. Thus, the viability of the mortgages was entirely dependent on continued home price appreciation.

Given the above, what was the credit quality of subprime mortgages? I'd say double-B at best. (I would much rather buy even the single-B "junk bonds" of profitable companies that we have held over the last 30 years than this inflated "home option" paper.) And yet, in a typical CDO, 80 percent of the debt was rated triple-A and 97 percent was rated investment grade (triple-B or better). Those high ratings made CDO debt very attractive to financial institutions that were able to borrow cheaply to buy high-rated assets, satisfying the strict rules regarding the "quality" of their portfolio holdings.

Financial engineers and investment bankers took unreliable collateral and packaged it into highly leveraged structures supporting debt that was rated high enough to attract financial institutions. What a superb example of the imprudent use of leverage. And what a simple explanation of how our highly leveraged institutions got into trouble.

How Bad Is Bad?

One of the prime lessons that must be learned from this experience is that in determining how much leverage to put on, you had better make generous assumptions about how risky your assets might turn out to be.

The example in the paragraph on the first page demonstrates the role of risk in the equation. The more your assets are prone to permanent loss, the less leverage you should employ. But it's also important to recognize the role of volatility. Even if losses are not permanent, a downward fluctuation can bring risk of ruin if a portfolio is highly leveraged and (a) the lenders can cut off credit, (b) investors can be frightened into withdrawing their equity, or (c) the violation of regulatory or contractual standards can trigger forced selling.

The problem is that extreme volatility and loss surface only infrequently. And as time passes without that happening, it appears more and more likely that it will never happen—that assumptions regarding risk were too conservative. Thus, it

becomes tempting to relax rules and increase leverage. And often this is done just before the risk finally rears its head. As Nassim Nicholas Taleb wrote in *Fooled by Randomness* (2001):

Reality is far more vicious than Russian roulette. First, it delivers the fatal bullet rather infrequently, like a revolver that would have hundreds, even thousands, of chambers instead of six. After a few dozen tries, one forgets about the existence of a bullet, under a numbing false sense of security . . . Second, unlike a well-defined precise game like Russian roulette, where the risks are visible to anyone capable of multiplying and dividing by six, one does not observe the barrel of reality. . . . *One is thus capable of unwittingly playing Russian roulette—and calling it by some alternative “low-risk” name.* (p. 28; italics added for emphasis)

The financial institutions played a high-risk game thinking it was a low-risk game, all because their assumptions on losses and volatility were too low. We would be watching an entirely different picture if only they had said, “This stuff is potentially risky. Since home prices have gone up so much and mortgages have been available so easily, there just might be widespread declines in home prices this time. So, we are only going to lever up half as much as past performance might suggest.”

It is easy to say they should have made more conservative assumptions. But how conservative? You cannot run a business on the basis of worst-case assumptions. You would not be able to do anything. And anyway, a “worst-case assumption” is really a misnomer; there is no such thing, short of a total loss. Now we know the quants should not have assumed there could not be a nationwide decline in home prices. But once you grant that such a decline can happen—for the first time—what extent should you prepare for? Two percent? Ten? Fifty?

One of my favorite adages concerns the six-foot-tall man who drowned crossing the stream that was five feet deep on average. It is not enough to survive in the investment world on average; you have to survive every moment. The unusual turbulence of the last two years—and especially the last three months—made it possible for that six-foot-tall man to drown in a stream that was two feet deep on average. *Should the possibility of today’s events have been anticipated? It is hard to say it should have been. And yet, it is incumbent upon investors to prepare for adversity. The juxtaposition of these sentences introduces an interesting conundrum.*

Consider these tales from the front lines:

- There had never been a national decline in home prices, but now the Case–Shiller index is down 26 percent from its peak in July 2006, according to the *Financial Times* of 29 November 2008.
- In my 29 previous years with high-yield bonds, including four when more than 10 percent of all outstanding bonds defaulted, the index’s worst yearly decline was 7 percent. But in 2008, it is down 30 percent (even though the last 12 months’ default rate is only about 3 percent).

- Performing bank loans never traded much below par in the past, and holders received very substantial recoveries on any that defaulted. Now, even though there have been few defaults, the price of the average loan is in the 60s.

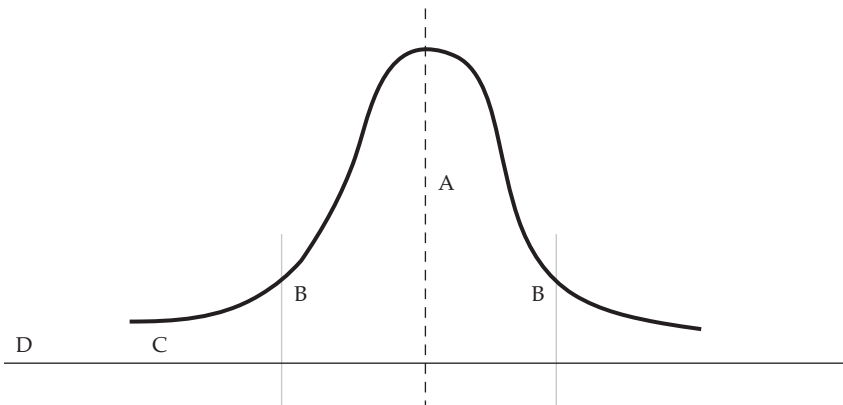
The headlines are full of entities that have seen massive losses, and perhaps meltdowns, because they bought assets using leverage. Going back to Figures 1–4, these investors put on leverage that might have been appropriate with moderate-volatility assets and ran into the greatest volatility ever seen. It is easy to say they made a mistake. But is it reasonable to expect them to have girded for unique events?

If every portfolio was required to be able to withstand declines on the scale we have witnessed this year, it is possible no leverage would ever be used. Is that a reasonable reaction? (In fact, it is possible that no one would ever invest in these asset classes, even on an unlevered basis.)

In all aspects of our lives, we base our decisions on what we think probably will happen. And, in turn, we base that to a great extent on what usually happened in the past. We expect results to be close to the norm (A) most of the time, but we know it is not unusual to see outcomes that are better or worse (B). Although we should bear in mind that, once in a while, a result will be outside the usual range (C), we tend to forget about the potential for outliers. And importantly, as illustrated by recent events, we rarely consider outcomes that have happened only once a century . . . or never (D) (Figure 5).

Even if we realize that unusual, unlikely things can happen, in order to act, we make reasoned decisions and knowingly accept that risk when well paid to do so. Once in a while, a “black swan” will materialize. But if in the future we always said, “We can’t do such-and-such because we could see a repeat of 2007–08,” we would be frozen in inaction.

Figure 5.



So, in most things, you cannot prepare for the worst case. It should suffice to be prepared for once-in-a-generation events. But a generation is not forever, and there will be times when that standard is exceeded. What do you do about that? I have mused in the past about how much one should devote to preparing for the unlikely disaster. Among other things, the events of 2007–2008 prove there is no easy answer.

Are You Tall Enough to Use Leverage?

Clearly, it is difficult to always use the right amount of leverage because it is difficult to be sure you are allowing sufficiently for risk. Leverage should only be used on the basis of demonstrably cautious assumptions. And it should be noted that if you are doing something novel, unproven, risky, volatile, or potentially life threatening, you should not seek to maximize returns. Instead, err on the side of caution. The key to survival lies in what Warren Buffett constantly harps on: margin of safety. Using 100 percent of the leverage one's assets might justify is often incompatible with assuring survival when adverse outcomes materialize.

Leverage is neither good nor bad in and of itself. In the right amount, applied to the right assets, it is good. When used to excess given the underlying assets, it is bad. It does not add value; it merely magnifies both good and bad outcomes. So, leverage should not be treated as a silver bullet or magic solution. It is a tool that can be used wisely or unwisely.

Our attitude at Oaktree is that it can be wise to use leverage to take advantage of high offered returns and excessive risk premiums, but it is unwise to use it to try to turn low offered returns into high ones, as was done often in 2003–2007.

Once leverage is combined with risky or volatile assets, it can lead to unbearable losses. Thus, leverage should be used in prudent amounts, to finance the right assets, and with a great deal of respect. And it is better used in the trough of the cycle than after a long run of appreciation. Bottom line: handle with care.

I never want to give the impression that doing the things I discuss is easy, or that Oaktree always gets it right. This memo calls on investors to gauge risk and use only appropriate leverage. At Oaktree, we assess fundamental riskiness and look to history for how markets might behave, and we heavily emphasize trying to build in sufficient room for error. But history is not a perfect guide. Although we have made no use of leverage in the vast majority of our investment activities, three of our evergreen funds did borrow to buy bank loans: the senior-most debt of companies, which in the past always has traded around par. Another used it to buy low-priced Japanese small-cap stocks. The companies generally are doing fine, but the prices of their loans and equities have collapsed under current market conditions, causing the funds to suffer. This shows how tough it is to prepare for all eventualities . . . in other words, to know in advance how bad is bad. So, I apologize if I ever come across as holier-than-thou. We have tried to use leverage only when it is wise, but no one is perfect. Certainly not us.

The financial markets have delivered a lifetime of lessons in just the last five years. Some of the most important ones center on the use and abuse of leverage.

- Leverage does not add value or make an investment better. Like everything else in the investment world other than pure skill, leverage is a two-edged sword—in fact, probably the ultimate two-edged sword. It helps when you are right and hurts when you are wrong.
- The riskier the underlying assets, the less leverage should be used to buy them. Conservative assumptions on this subject will keep you from maximizing gains but may possibly save your financial life in bad times.
- A levered entity can be caught in a downward spiral of asset price declines, market-value tests, margin calls, and forced selling. Thus, in addition to thinking about the right amount of leverage, it is important to note that there are two different kinds: permanent leverage, with its magnifying effect, and leverage that can be withdrawn, which can introduce collateral tests and the risk of ruin. Both should be considered independently. Leverage achieved with secure capital is not nearly as risky as situations where you are subject to margin calls or cannot bar the door against capital withdrawals.

Leverage was too easily accessed as recently as two years ago, and now it is virtually unavailable. And just as its use was often unwise a few years ago, this might be just the right time to employ some if you can get it . . . and if you can arrange things so you will not drown if the streambed dips ahead.

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