

**SPECIAL REPORT**  
**MARKET TURMOIL**



# The Myth of Non Correlation

● The ugly spillover of the U.S. subprime mess into bond and equity markets around the world should come as no surprise to investors. History has proven again and again that seemingly unrelated markets tend to move in lockstep during times of crisis.

**By Richard Bookstaber**

ILLUSTRATION BY BRIAN CAIRNS

# With the collapse of the U.S. subprime market

and the aftershocks that have been felt in credit and equity markets around the globe, there has been a lot of talk about fat tails, 20-standard-deviation moves and events that happen once every 100 years. We seem to hear such descriptions fairly frequently, which suggests that maybe all the talk isn't really about 100-year events. Maybe it is more a reflection of investors' market views than it is of market reality.

No market veteran should be surprised to see periods when securities prices move violently. The recent rise in credit spreads is nothing compared to what happened in 1998 leading up to and following the collapse of hedge fund Long-Term Capital Management or, for that matter, during the junk bond crisis earlier that decade, when spreads quadrupled. For more severe disruptions, consider the U.S. equity market's dropping more than 20 percent in a single day in October 1987, oil prices' soaring 50 percent in a matter of hours before the first Gulf War, the bursting of the technology stock bubble in 2000 and so on.

What catches many investors off guard and leads them to make the "100 year" sort of comment is not the behavior of individual markets but the concurrent big and unexpected moves among markets. It's the surprising linkages that suddenly appear between markets that should not have much to do with one other and the failed linkages between those that should march in tandem. That is, investors are not as dumbfounded when volatility skyrockets as when correlations go awry. This may be because investors depend on correlations to control their risk and to allow them to extend further out in their investment exposures. Correlation is the key for hedging and diversifying. And nothing hurts more than to think you are well hedged and then to discover you are not hedged at all.

We all know that the correlation between assets in the same market increases when a market is under stress. When risk and volatility ramp up, all the assets in a market start to look the same, so they all move the same. Correlations between markets, however, can shift wildly and in unanticipated ways — and usually at the worst possible time, when there is a crisis with volatility that is out of hand.

Here are some of the unexpected correlations that have haunted us in earlier market crises:

- The 1987 stock market crash: During the crash, Wall Street junk bond trading desks that had been using Treasury bonds as a hedge were surprised to find that their junk bonds tanked while Treasuries strengthened. They had the double whammy of losing on the junk bond inventory and on the hedge as well. The reason for this is easy to see in retrospect: Investors started to look at junk bonds more as stocklike risk than as interest rate vehicles and sold them indiscriminately. At the same time, Treasuries became safe havens during the flight to quality and so were bid up.
- The 1997 Asian crisis: The financial crisis that started in July 1997 with the collapse of the Thai baht sank equity markets across Asia and ended up enveloping Brazil as well. Emerging-markets fund managers who thought they had diversified portfolios — and might

have inched up their risk accordingly — found themselves losing on all fronts. The reason was not that these markets had suddenly become economically linked with Brazil, but rather that the banks that were in the middle of the crisis, and that were being forced to reduce leverage, could not do so effectively in the illiquid Asian markets, so they sold off other assets, including sizable holdings in Brazil.

- The fall of Long-Term Capital Management in 1998: When the LTCM crisis hit, volatility shot up everywhere, as would be expected. Everywhere, that is, but Germany. There, the implied volatility dropped to near historical lows. Not coincidentally, it was in Germany that LTCM and others had sizable long volatility bets; as they closed out of those positions, the derivatives they held dropped in price, and the implied volatility thus dropped as well. Chalk one up for the adage that markets move to inflict the most pain.

And now we get to the crazy markets of August 2007. Stresses in a minor part of the mortgage market — so minor that Federal Reserve Board chairman Ben Bernanke testified before Congress in March that the impact of the problem had been "moderate" — break out not only to affect other mortgages but also to widen credit spreads worldwide. And from there, subprime somehow links to the equity markets. Stock market volatility doubles, the major indexes tumble by 10 percent and, most improbable of all, a host of quantitative equity hedge funds — which use computer models to try scrupulously to be market neutral — are hit by a "100 year" event.

From the 1987 crash to the subprime meltdown of 2007, we see the same sort of thing happening. Our not very helpful reprise is to shake our heads as if we are looking over a fender bender and point the finger at statistical anomalies like fat tails — bigger, more frequent moves than would be predicted by a normal distribution of returns — and 100-year events. Rather than pull out statistical jargon that really says nothing more than that the event was a big surprise, we need to try to understand its source. I believe that the unexpected shifts in correlation are caused by the same elements that create market crises in the first place: complexity and tight coupling.

Complexity means that an event can propagate in nonlinear and unanticipated ways. An example of a complex system from the realm of engineering is the operation of a nuclear power plant, where a minor event like a clogged pressure-release valve (as occurred at Three Mile Island) or a shift in the combination of steam production and fuel temperature (as at Chernobyl) can cascade into a meltdown.

For financial markets, complexity is spelled d-e-r-i-v-a-t-i-v-e-s. Many derivatives have nonlinear payoffs, so that a small move in the market might lead to a small move in the price of the derivative in one instance and to a much larger move in the price in another. Many derivatives also lead to unexpected and sometimes unnatural linkages between instruments and markets. Thanks to collateralized debt obligations, this is what is at the root of the first leg of the contagion we observed from the subprime market.

To create CDOs, Wall Street firms package together debt instruments with varying credit ratings and then break them up into tranches with credit ratings that range from triple-A to junk levels based on the likelihood that the underlying bonds or mortgages will default. CDOs can create correlation between segments of the bond market that would otherwise remain remote cousins. What happened to subprime mortgages is a case in point. Subprimes were included in various CDOs, as were other types of mortgages and corporate bonds. Like a kid with a cold at a birthday party, the

sickly subprime mortgages mingled with these other instruments.

The derivative, rather than fundamentals and default probabilities, can end up driving the prices of the bonds in the CDO package. And, not unexpectedly, the higher correlation is most likely to emerge during a credit-based event like the subprime meltdown. Investors that have to reduce their derivatives exposure or hedge their exposure by taking positions in the underlying bonds will look at them as part of a CDO. It doesn't matter if one of the underlying bonds is issued by a AA-rated energy company and another by a BB financial; the bonds in a given package will move in lockstep. And although subprime happens to be the culprit this time around, any one of the markets involved in the CDO packaging could have started things off.

Tight coupling is a term I have borrowed from systems engineering. A tightly coupled process progresses from one stage to the next with no opportunity to intervene. If things are moving out of control, you can't pull an emergency lever and stop the process while a committee convenes to analyze the situation. Examples of tightly coupled processes include a space shuttle launch, a nuclear power plant moving toward criticality and even something as prosaic as making bread.

In financial markets tight coupling comes from the feedback between mechanistic trading, price changes and subsequent trading based on the price changes. The mechanistic trading can result from a computer-based program or contractual requirements to reduce leverage when things turn bad.

In the '87 crash there was tight coupling from the computer-based trading of those running portfolio insurance programs. The trade decisions were based on variants of the Black-Scholes option pricing formula programmed into the computers of the portfolio insurance hedgers. On Monday, October 19, in response to a nearly 10 percent drop in the U.S. market the previous week, these programs triggered a flood of trades to sell futures to increase the hedge. As those trades hit the market, prices dropped, feeding back to the computers, which ordered yet more rounds of trading. All of which led to a nearly 23 percent one-day drop in the Dow Jones industrial average.

More commonly, the tight coupling comes from leverage. When things start to go badly for a highly leveraged fund and its collateral drops to the point that it no longer has enough assets to meet margin calls, its manager has to start selling assets. This drops prices, so the collateral declines further, forcing yet more sales. The resulting downward cycle is exactly what we saw with the demise of LTCM.

And it gets worse. Just like complexity, the tight coupling born of leverage can lead to surprising linkages between markets. High leverage in one market can end up devastating another, unrelated, perfectly healthy market. This happens when a market under stress becomes illiquid and fund managers must look to other markets: If you can't sell what you want to sell, you sell what you can. This puts pressure on markets that have nothing to do with the original problem, other than that they happened to be home to securities held by a fund in trouble. Now other highly leveraged funds with similar exposure in these markets are forced to sell, and the cycle continues.

This is how the subprime mess expanded beyond mortgages and credit markets to end up stressing quantitative equity hedge funds. Some of these

funds, such as Goldman, Sachs & Co.'s vaunted Global Alpha Fund, saw their net asset value drop by 20 percent or more in just a few weeks. These funds had nothing to do with subprime mortgages; their losses came from the stock market. Their positions might have been good from a valuation and fundamental standpoint, but once the subprime-induced selling spilled over into the equity markets, it didn't matter what was fundamentally weak or strong. All that mattered was who was under pressure and what else they owned. The quant hedge funds are so large — by some estimates they manage nearly \$250 billion before leverage, which in the case of one of Goldman's hedge funds was six to one — that when the dominoes fell in their direction, what started out as troubles in the backwaters of the mortgage market quickly became a much bigger problem.

For investors the best advice is not to put too much stock in correlations. That means not to depend on diversification or hedges to keep risks under control under all scenarios. When a hedge really matters the most, it may not work.

What can regulators do to limit the potential damage from tight coupling and complexity? The first step is to reduce the amount of leverage in the system. Step two is to control the arms race of new and ever-more-complicated derivatives that pour out of the investment banks. Just because someone can turn a cash flow into a structured product or design a new derivative doesn't mean it should be done. There are externalities to this sort of innovation. Although the innovative security might find a home, on the margin it adds complexity and therefore risk to the market.

Making such changes is itself an exercise in complexity. The linkages that occur between markets depend on leverage (because that determines who is likely to be under pressure) and investment positions (since they determine which markets will likely be affected). And no one — not even the regulators — has adequate information on leverage and positions. So any regulation would need to start by gathering these raw materials to monitor the risk.

One reason leverage gets piled on is that the underlying strategies generate small returns. This is typical of many spread, arbitrage and carry trades. If a strategy is generating only 50 to 200 basis points, it must be amplified to produce satisfactory returns. That means adding leverage while relying on the correlation structure to be sure hedges keep the leveraged risk under control. So avoiding leverage might mean leaving some nickels untouched ahead of the steamroller.

The good news is that correlations that come from the market structure and the crises that accompany them are short-lived, sometimes lasting only a matter of weeks. If you have a long time horizon and can stand back as a crisis unfolds — that is, if you are not forced to liquidate in the midst of the problems by dint of leverage, nervousness or investors breathing down your neck — things should be fine.

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