

# When Seemingly Infallible Arbitrage Strategies Fail

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**T**he mystique of mathematics lures \$100 billion in investments into a seemingly infallible strategy based on arbitrage models. The strategy fails. Investors lose billions. Markets reel. Regulators step in. Sound familiar?

Long-Term Capital, a hedge fund with high-tech arbitrage models backed to the hilt with finance theory, not to mention the imprimatur of the Nobel awards committee, radiated the allure of infallibility. Infallible enough to warrant leveraging bets twenty-five (counting the nominal value of its derivatives positions, even 250) to one—but not infallible enough (or well-capitalized enough) to withstand the changing tides of market sentiment. When investors worldwide fled risky investments, seemingly sure bets turned into insurmountable margin calls that threatened the very stability of the global bond market.

In the 1980s, a trading strategy equally reliant on arbitrage models and seeming to offer equal assurance of infallibility did roil the equity markets of the world. “Portfolio insurance” relied on the option pricing model developed in the 1970s by LTC partners Myron Scholes and Robert Merton, together with the late Fischer Black, to create dynamically hedged portfolios that were supposed to be immune to market downturns (see Jacobs [1998]). Portfolio insurance was marketed as being tantamount to buying a put option on an underlying portfolio of risky assets; if stock prices began to fall, synthetic put protection

would provide a comfortable floor on the downside. By 1987, backed by the seeming ability of sophisticated finance theory to remove the risk from equity investing, portfolio insurance had amassed a U.S. equity market stake amounting to some \$100 billion.

But the dynamic hedging required to replicate a put option requires selling stocks, or stock index futures, as stock prices fall. When stock prices declined sharply in the week preceding the crash of October 19, 1987, all insurance strategies called for selling stock. Selling by insured portfolios, although it may not have ignited the equity market's decline, surely helped to push the decline into a crash by demanding more liquidity than the market was able to provide. With selling pressure overwhelming investor willingness to buy, equity prices fell discontinuously. The U.S. market crashed, wiping out over 20% of equity value and the promise of portfolio insurance along with it. Sales could not be executed at the prices required to prevent losses to insured portfolios.

Portfolio insurance is a reactive strategy, trend-following rather than anticipatory; it is hence inherently destabilizing. With arbitrage models like those at LTC and other hedge funds, trading is designed to take advantage of anticipated movements in asset prices. Furthermore, LTC-type arbitrage, unlike portfolio insurance trading, should in theory be a stabilizing influence, inasmuch as it narrows perceived mispricings between markets.

With arbitrage positions as heavily leveraged as LTC's, however, even relatively minor discrepancies between expectations and actual outcomes can force trading that threatens market stability. If mispricings grow, counter to the arbitrageur's bets, losses mount, requiring more and more infusions of capital. If the capital cannot be found, the strategies must be unwound.

When such strategies constitute a large enough fraction of the market (and are mirrored by the actions of other investment organizations, especially other hedge funds, following similar strategies), their instantaneous unwinding can devour market liquidity. This is especially true when the amount of positions that need to be traded comes as a surprise to other market participants (as was the case with LTC and with portfolio insurance before it). Arbitrage can then become destabilizing.

The extraordinary amount of leverage behind LTC's positions (in part reflecting the margin available in the derivatives market—the very market fostered by Black-Scholes-Merton option pricing theory) meant that, as market mispricings grew, LTC, its lenders, and its counterparties faced massive liquidations of positions. Had LTC not been bailed out, we could have seen in the bond market the same effects that the forced liquidations of insured stocks in 1987 and margined stocks in 1929 had on the equity market. Given the links between hedge funds and investment and commercial banks, and among different asset markets and different countries' markets, this selling may indeed have roiled the global financial system. The systemic risk much talked about in connection with the growth of the derivatives markets may have become a reality.

That the bailout nevertheless left a sour taste in the mouths of most investors owes much to the picture of the federal government interceding (if only indirectly) to save the assets of a handful of multimillionaires and something no doubt to the looming potential of more government regulation of financial markets. But what really rankles is the hubristic overreaching on the part of experts who had every reason to know better.

LTC may have relied on the global diversity of its positions, lured into the illusion that such diversity somehow translates into shockproof diversification. But correlations between global markets tend to spike upward in times of crisis, reflecting not only real economic linkages between markets, but investor psychology as well. Fear begets fear.

In 1987, the U.S. equity market crash spread to stock markets around the world; virtually all of them fell

in reaction to the U.S. market's decline. In 1997, the devaluation in Thailand ignited currency crises across Asia. In 1998, economic malaise in Asia led to the collapse of commodity markets in emerging countries and eventually to the Russian debacle that set off the flight to quality that threatened to bring LTC down. Under such conditions, bets that seem well-diversified in normal market environments have a tendency to collapse into a single big bet.

LTC undoubtedly fell prey to the illusion of liquidity. Either investors or lenders would be perennially available to underwrite its positions, even as gains turned into ever-increasing losses, or, failing that, markets would afford it the ability to unwind its positions in an orderly manner. But as 1987 demonstrated, strategies subject to forced selling can create just those conditions least hospitable to finding buyers—falling and discontinuous prices, investor panic, and front-running. Even as LTC attempted to unwind some of its positions in the aftermath of the bailout, its own trading, and trading by front-runners, contributed to price movements that ran counter to its interests.

But perhaps the biggest illusion that LTC fell for (and created) is that markets—bond, stock, or currency—offer such a thing as a sure bet; that markets are, by virtue of sheer brainpower and academic expertise, as “solvable” as a tough problem in mathematics. Markets have a way of confounding such expectations, just as they did with portfolio insurance in 1987, precisely because they are made up not of computers, but of human beings subject to behavior outside the realm of mathematics. In such a world, investors may find it wise to hedge their bets in more than name only.

## REFERENCE

Jacobs, Bruce I. “Option Pricing Theory and Its Unintended Consequences.” *The Journal of Investing*, Spring 1998.

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