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## The Failure of Arbitrage

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### Leverage, Liquidity, and the Persistence of Inefficiency

It's like there are two businesses here—the old business, which works fine under normal conditions, and this stand-by business, when the world goes mad. And for that, you either need to buy insurance or have a pool of stand-by capital to take advantage of these opportunities.

Eric Rosenfeld <sup>1</sup>

### When Lead Steers Get Lost

Sometimes people aren't there when you need them the most.

Almost 30 years ago, investment firm J.F. Eckstein & Company bet that the gap between Treasury bill futures and the underlying securities would narrow. The trade, which Eckstein had successfully put on before, was particularly attractive, so the firm increased the size of its typical bet. But this time the gap widened, triggering margin calls and quickly slashing Eckstein's capital.

Eckstein had no choice but to seek help. His rescuer, as it turns out, was a thirty-something bond trader named John Meriwether. Meriwether, who had just set up a bond arbitrage desk at Salomon Brothers, immediately saw the virtue of the trade and agreed to take over a significant part of Eckstein's portfolio. Following some short-term pain, the trade unfolded as Eckstein had originally anticipated, providing a windfall for Salomon and launching Meriwether's career.

Ironically, Meriwether would find himself in Eckstein's position nearly 20 years later as Long-Term Capital Management's (LTCM) positions, attractive on paper, went south. Leveraged to the hilt, LTCM's capital bled quickly and profusely. But unlike Eckstein, LTCM found no savior. A consortium of LTCM's lenders injected capital and took over the firm's assets, eventually liquidating the firm at a modest profit. <sup>2</sup>

The existence of rational arbitrageurs is one of the theoretical planks supporting the efficient market hypothesis. The idea is simple and intuitive: a smart subset of investors cruise markets seeking discrepancies between price and value and make small profits closing those aberrant gaps. These arbitrageurs certainly exist, and undoubtedly contribute to market efficiency under normal circumstances. <sup>3</sup>

But what happens if circumstances aren't normal? As the Eckstein and LTCM stories show, arbitrageurs sometimes fail to show up. More to the point, they often fail to show up precisely when price-to-value gaps are unusually attractive. Some reflection on the failure of arbitrage provides insights into the shortcomings of the efficient market hypothesis, why attractive investment opportunities periodically arise, and what has occurred during the recent financial crisis.

## How to Play Emotion

Taking one large step back, there appear to be two empirically legitimate ways to play emotion to generate excess investment returns. The first is to ride emotion. This is momentum investing, and is at the core of trend-following strategies. The second is to exploit emotion, using fundamental analysis to find price-to-value gaps that arise from suboptimal group behavior. This notion is at the core of value investing and statistical arbitrage techniques.<sup>4</sup>

While the two camps often don't see eye-to-eye and are often critical of one another, they have both been shown to succeed.<sup>5</sup> Investors get in trouble when they fail to understand how these strategies seek to generate returns, including the practical and psychological challenges of each.

The choice of whether to ride or exploit emotion leads to two very different trading strategies. The simplest way to distinguish them is to ask what the strategy dictates in the case the trade works for, or against, you. In effect, the strategies have opposite responses. Trend following is about cutting losses and letting winners run, while value arbitrage dictates more capital going into a losing trade (provided the price-to-value gap has widened) and less capital going into a winning trade. Exhibit 1 summarizes the different strategies.

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### Exhibit 1: Trading Strategies—Trend Following versus Statistical Arbitrage

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	<u>Trade works for you</u>	<u>Trade works against you</u>
Trend following	Maintain/increase position	Reduce/eliminate position
Statistical arbitrage	Reduce/eliminate position	Maintain/increase position

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Source: LMCM analysis.

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In a trend-following strategy, every trade has a positive expectation based on analysis of price trend. The goal is to catch profitable price trends by responding to the market's moves. But the majority of trades lose money. For example, a trend-following simulation over 20-plus years shows that nearly 70 percent of the trades generate losses. Observers report similar hit rates for some of the greatest traders of all time.<sup>6</sup>

The key to the strategy's success is nipping losses at the bud and letting winners run. While there are more losing trades, the profits from the larger winning trades more than offset the many small losses from the unprofitable trades. For example, a trend-following trader explained a sequence where the system generated 28 total trades (average size \$10,000 - \$15,000) from April 1998 to February 1999, producing a total profit of \$56,000. But of the 28 trades, 24 were unprofitable (average loss of about \$930) while 4 were profitable (average gain of \$20,000). Even more difficult, the first 17 trades in a row lost money.<sup>7</sup>

This frequency and magnitude dynamic is one reason adopting a trend-following approach is so psychologically and practically hard. Normal people are uncomfortable being wrong such a high percentage of the time, and the probabilities of this approach assure periodic and sizeable capital drawdowns. Like most paths to success, trend following is easier said than done.

Every trade in a statistical arbitrage strategy—or more broadly a value strategy—also has a positive expectation. The source of the edge is a perceived discrepancy between price and value. Naturally, the wider the gap between price and value, the more attractive the investment. So when a value investor puts on a trade and the price-to-value disparity expands, the right move is to put more money to work.

Trend followers, as emotion riders, are not concerned with price-to-value discrepancies. Price alone indicates whether a momentum investor is right or wrong.<sup>8</sup> So while trend followers care only about price, value investors care about the discrepancy between price and value. The distinction in the perceived source of edge in the strategies is crucial because it implies very different roles in the market ecosystem.<sup>9</sup>

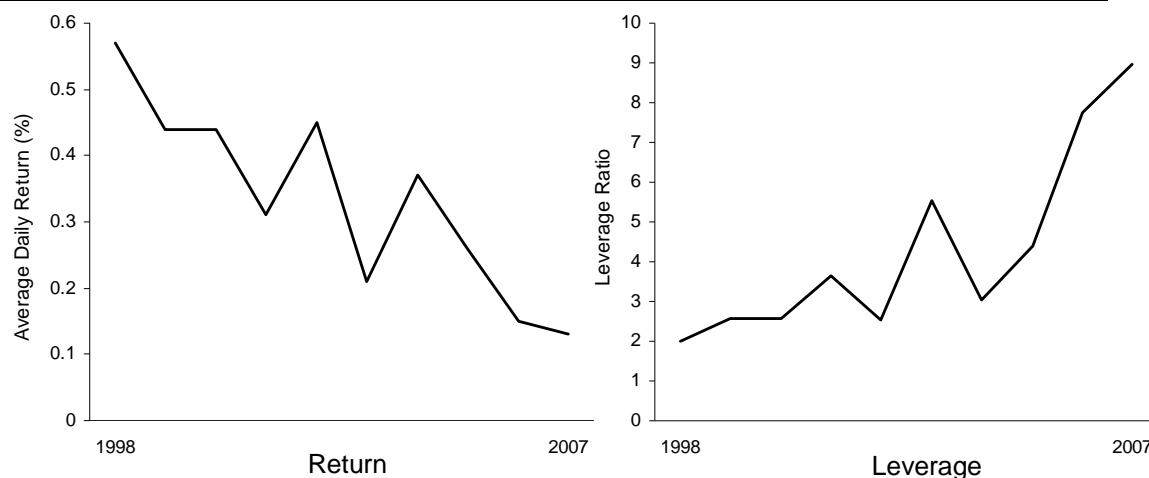
To assure market efficiency, arbitrageurs have to be willing and able to dedicate sufficient capital to close aberrant price-to-value gaps. As we have seen before, are witnessing today, and will undoubtedly see in the future, arbitrageurs frequently fail precisely when the opportunities are most attractive. We now explore why this occurs.

### The Role of Asset Price Changes, Leverage, and Collateral

While all financial crises are unique, they do tend to follow a similar pattern.<sup>10</sup> First, an asset or asset class does well. Next, some dose of bad news comes into the market that triggers an asset price decline. The most optimistic investors, those with loads of leverage and a large risk appetite, are hurt first. Their lenders then require more collateral and issue margins calls, sparking an additional round of selling. This initial wave creates a domino effect where selling leads to lower asset prices, sparking more margin calls, further depressing asset prices, and so forth. While financial crises almost always start where asset price performance has been good (arguably a state of overvaluation), the process invariably leads to asset prices dropping below any reasonable semblance of value.

The roles of leverage, diversification, and collateral deserve additional comments. First, most arbitrage strategies tend to show deteriorating returns over time, as investors exploit price-to-value disparities.<sup>11</sup> Statistical arbitrage investors face a choice: they can accept lower returns or use more leverage to achieve the same returns. Professor Andrew Lo illustrates that in order to achieve 1998's daily return, an investor in 2007 would have had to use a leverage ratio almost 4.5 times that of 1998. It is unclear whether investors pouring capital into statistical arbitrage strategies recognized that a higher percentage of recent returns were due to leverage.<sup>12</sup>

#### Exhibit 2: Lower Strategy Returns Require More Leverage to Maintain Investor Returns



Source: Andrew W. Lo, *Hedge Funds: An Analytic Perspective* (Princeton: Princeton University Press, 2008), 279.

Diversification works when asset prices are not too correlated. This is a reasonable assumption under normal conditions. But in periods of financial stress, margin calls force fund managers to sell assets. While managers want discretion in adjusting their portfolios, market reality may dictate they sell the portfolio's most liquid assets. This forced behavior can make previously uncorrelated assets more correlated.

For instance, prior to the 1998 crisis, LTCM's position correlations, based on five years of historical data, were less than 0.10. The firm used correlations of 0.30 in its stress tests, levels vastly higher than anything they believed were likely. But when the crisis unfolded, correlations shot to an inconceivable 0.70. With this level of correlation, diversification is an illusion, rendering popular risk management tools useless.<sup>13</sup>

Collateral requirements also play a prime role in financial crisis, even as the media focuses primarily on the effect of interest rates.<sup>14</sup> When asset prices are faring well, lending is easy and margin requirements are lax. Conversely, when a financial crisis is in full swing, margin requirements become much stricter. So in crisis mode, it is not the cost of money that is a problem (i.e., interest rates) but rather access to capital.

Prior to a financial crisis, asset prices are up, leverage levels are elevated, and lending standards are lax. The crisis reverses all of these conditions, leaving asset prices depressed, leverage levels too low, and lending standards unduly restrictive. And arbitrageurs, despite their mission, cannot change this outcome.

### **The Failure of Arbitrage**

There is solid literature on the limits of arbitrage under normal conditions, when arbitrage opportunities tend to be steady and small.<sup>15</sup> Our emphasis here is on the failure of arbitrage in periods of financial crisis, where price-to-value gaps are wide and investors can put substantial capital to work at attractive returns. In financial stress, we see:

- *Assets get mispriced.* Some bad news causes a retreat in an asset that had previously performed well, triggering losses for aggressive investors. The aggressive investor then sets into motion a feedback loop between lower asset prices and higher margin requirements. Buyers disappear, and liquidity dries up.
- *Arbitrageurs are hamstrung.* The deleveraging process incapacitates even those investors with attractive portfolios filled with attractive price-to-value gaps (as seen with Eckstein and LTCM). In fact, many investors with good assets are forced sellers reflecting the broader selloff and deleveraging. Because margin requirements rise, it is difficult for new capital to come in quickly to close price-to-value differences.
- *Markets remain inefficient for a period of time.* Even in the case where assets are objectively mispriced—for example, when mortgage pools discount excessively high foreclosure rates—the dearth of available capital means they stay cheap for some time. The rational arbitrageur fails as the guardian of market efficiency.
- *New investors step in, facing good return prospects.* One of the first rules of trading is “live to see another day.” To prop up returns prior to the recent crisis, many hedge funds overbetted, buying larger positions than the mathematical return warranted.<sup>16</sup> So the capital available from the traditional statistical arbitrageurs got thin. Now, as in the past, new groups are stepping in to close price-to-value gaps, including the private equity firms that were active debt issuers in 2006 and the first half of 2007.<sup>17</sup>

The efficient market hypothesis depends on rational arbitrageurs. Unfortunately, those arbitrageurs frequently have no money or access to capital precisely when markets need them most—when price-to-value gaps expand due to financial crisis. Eventually, though, capital flows find areas of opportunity. While the current financial crisis is unlikely to be over, capital is starting to move.

In his days at Salomon Brothers, when John Meriwether needed capital to put on a trade or shore up a short-term loss, he always got it. The firm’s brass provided him the capital and time to succeed. But funds or investment firms that rely on outside capital may not be so fortunate. Astute investors realize that today’s environment is akin to past crises: arbitrage opportunities following deleveraging tend to be attractive, and stepping in for the missing arbitrageurs can be profitable.

## Endnotes

- <sup>1</sup> Michael Lewis, "How the Eggheads Cracked," *The New York Times*, January 24, 1999.
- <sup>2</sup> Gretchen Morgenson, "John Meriwether: Hedge Fund Wizard or Wall Street Gambler Run Amok?" *The New York Times*, October 2, 1998; Roger Lowenstein, *When Genius Failed: The Rise and Fall of Long-Term Capital Management* (New York: Random House, 2000), 3-4.
- <sup>3</sup> Andrei Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance* (Oxford: Oxford University Press, 2000); Stephen A. Ross, *Neoclassical Finance* (Princeton, NJ: Princeton University Press, 2005).
- <sup>4</sup> See Richard Pzena, "Pzena Management's Richard Pzena," *Outstanding Investor Digest*, February 29, 2008.
- <sup>5</sup> See for example Michael Covell, *Trend Following: How Great Investors Make Millions in Up or Down Markets* (London: Financial Times Prentice Hall, 2004); Louis Lowenstein, *The Investor's Dilemma: How Mutual Funds are Betraying Your Trust and What to Do About It* (New York: John Wiley & Sons, 2008).
- <sup>6</sup> For simulation results, see Curtis M. Faith, *Way of the Turtles: The Secret Methods that Turned Ordinary People into Legendary Traders* (New York: McGraw Hill, 2007), 56-60; for the batting average of George Soros, see Steven Drobny, *Inside the House of Money: Top Hedge Fund Traders on Profiting in Global Markets* (New York: John Wiley & Sons, 2006), 278.
- <sup>7</sup> Faith, 51.
- <sup>8</sup> We are acutely aware of Ben Graham's distinction between investing and speculating. See Benjamin Graham, *The Intelligent Investor: A Book of Practical Counsel*, 4<sup>th</sup> ed. (New York: Harper & Row, 1973), 1. According to Graham, "An investment operation is one which, upon thorough analysis promises safety of principal and an adequate return. Operations not meeting those requirements are speculative."
- <sup>9</sup> We suspect most of our readers are in the value camp. But there is evidence, at least in some markets, that trend following yields better returns than a fundamental approach. See Paul De Grauwe and Marianna Grimaldi, *The Exchange Rate in a Behavioral Finance Framework* (Princeton: Princeton University Press, 2006), 43-44.
- <sup>10</sup> Michael J. Mauboussin, "Anatomy of a Market Crash," *Forbes.com*, October 25, 2007. See [http://www.forbes.com/2007/10/25/michael-mauboussin-crash-markets-marketsp07-cx\\_mm\\_1025mauboussin.html](http://www.forbes.com/2007/10/25/michael-mauboussin-crash-markets-marketsp07-cx_mm_1025mauboussin.html).
- <sup>11</sup> For example, see Andrew W. Lo, *Hedge Funds: An Analytic Perspective* (Princeton: Princeton University Press, 2008), plate 10. For a balanced perspective, see J. Doyne Farmer and John Geanakoplos, "The Virtues and Vices of Equilibrium and the Future of Financial Economics," *Santa Fe Institute Working Paper*, March 20, 2008. Markets are dynamic, of course, so price-to-value gaps come and go. The constant search and exploitation of anomalies leads to the paradox of efficient markets: the very act of seeking and profiting from price-to-value gaps makes markets more efficient under normal conditions.
- <sup>12</sup> Lo, 278-279. This assumes the application of 1998 trading strategies in 2007.
- <sup>13</sup> Donald MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets* (Cambridge, MA: MIT Press, 2006), 233.
- <sup>14</sup> John Geanakoplos, "Liquidity, Default, and Crashes," *Cowles Foundation Paper No. 1074*, 2003.
- <sup>15</sup> See Shleifer; also Nicholas Barberis and Richard Thaler, "A Survey of Behavioral Finance," in George M. Constantinides, Milton Harris, and Rene M. Stulz, eds., *Handbook of The Economics of Finance: Volume 1B, Financial Markets and Asset Pricing* (Amsterdam: Elsevier North Holland, 2003), 1053-1123.
- <sup>16</sup> William Poundstone, *Fortune's Formula: The Untold Story of the Scientific Betting System That Beat the Casinos and Wall Street* (New York: Hill and Wang, 2005).
- <sup>17</sup> See, for example, Hanah Cho, "'Opportunity' for Carlyle," *The Baltimore Sun*, April 29, 2008.

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