

Alpha and the Paradox of Skill

Results Reflect Your Skill and the Game You Are Playing

July 15, 2013

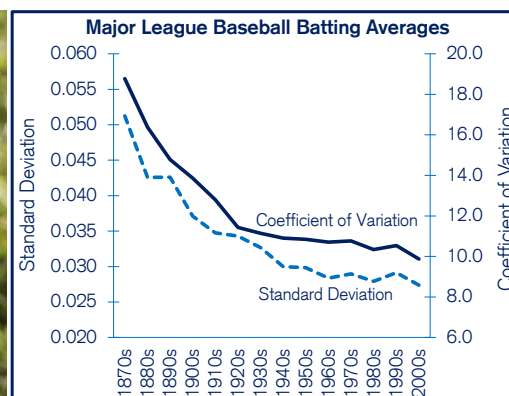
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Source: Michael J. Mauboussin, *The Success Equation: Untangling Skill and Luck in Business, Sports, and Investing* (Boston, MA: Harvard Business Review Press, 2012), 55.

- There are two aspects to success in investing: proficiency and choosing an attractive game. The key to an attractive game is dispersion in skill, where more skillful participants can benefit at the expense of less skillful ones.
- The paradox of skill says that in activities where results combine luck and skill, luck is often more important in shaping outcomes even as skill improves. In many competitive interactions it is the relative level of skill that matters, not the absolute level of skill. In many fields, including investing, the dispersion of skill is shrinking, which leaves more to luck.
- There is a positive correlation between the breadth of opportunities and the dispersion of fund returns.
- Pockets of inefficiency persist. These include diversity breakdowns, institutions competing with individuals, and trading with distressed counterparties.

Introduction

Jim Rutt, formerly both the chief executive officer of Network Solutions and chairman of the board at the Santa Fe Institute, recently gave a talk about his experience in business. He mentioned that he played a lot of poker when he was young, became pretty good at it, and made some money.

Rutt assumed that the best way to ensure continued success was to improve his skill, so he worked diligently at honing his game by learning the probabilities for each hand and studying other players for clues about the strength of their position. At that point, an uncle pulled him aside and doled out some advice. “Jim, I wouldn’t spend my time getting better,” he advised, “I’d spend my time finding weak games.”

Success in investing has two aspects. The first is skill, which requires you to be technically proficient. Technical skills include the ability to find mispriced securities (based on capabilities in modeling, financial statement analysis, competitive strategy analysis, and valuation all while sidestepping behavioral biases) and a good framework for portfolio construction. The second aspect is the game in which you choose to compete. Some games are highly competitive and others are not. You want to find games where your skill is greater than that of the other players. Your absolute skill is not what matters; it’s your *relative* skill.

Think about it this way. Say I invited you over to my house to play poker on Saturday night—and that you like to win. Your first question should be, “Who else will be there?” If I tell you that there will be some players that are as skilled as you and a couple of rich players who don’t play well, your response should be: “I’ll be right over.” Why? While you know the amount of money entering the house at the beginning of the evening and leaving at the end of the night is the same, you can see how your gain will come at the expense of the weaker players.

On the other hand, if I tell you that the players expected that evening have skill that is equivalent to yours, the response should be: “No thanks, I’m busy.” In this case, there’s no reason to believe that you will come out a winner because there is no mismatch in relative skill. And if you find yourself in a game unsure of which players are weak or strong, learn a lesson from Warren Buffett: “If you’ve been in the game 30 minutes and you don’t know who the patsy is, *you’re* the patsy.”¹

In cases where two or more players have the same level of skill—whether that skill is high or low doesn’t matter—the skills of the players offset one another and luck becomes the primary determinant of the outcome. “Players” can be athletes, investors, or business executives. In many competitive realms, including investing, the skills of the participants have improved on an absolute basis but have shrunk on a relative basis. Today’s investor has vastly more resources and training than his or her predecessor from years past. The problem is that investors, broadly speaking, have gotten much better which means that the difference between the skill of the best and the average participant isn’t as great as it used to be.

The Paradox of Skill

Think of results as the sum of a draw from a skill distribution and a draw from a luck distribution (treat both as independent random variables). It turns out that we can use a theorem from statistics to show that:

$$\text{Variance}(\text{skill}) + \text{Variance}(\text{luck}) = \text{Variance}(\text{result})$$

This is sometimes called the “Pythagorean Theorem of Statistics” because if you rewrite variance as standard deviation squared, you get a formula that looks very similar to the Pythagorean theorem in geometry.² Here’s

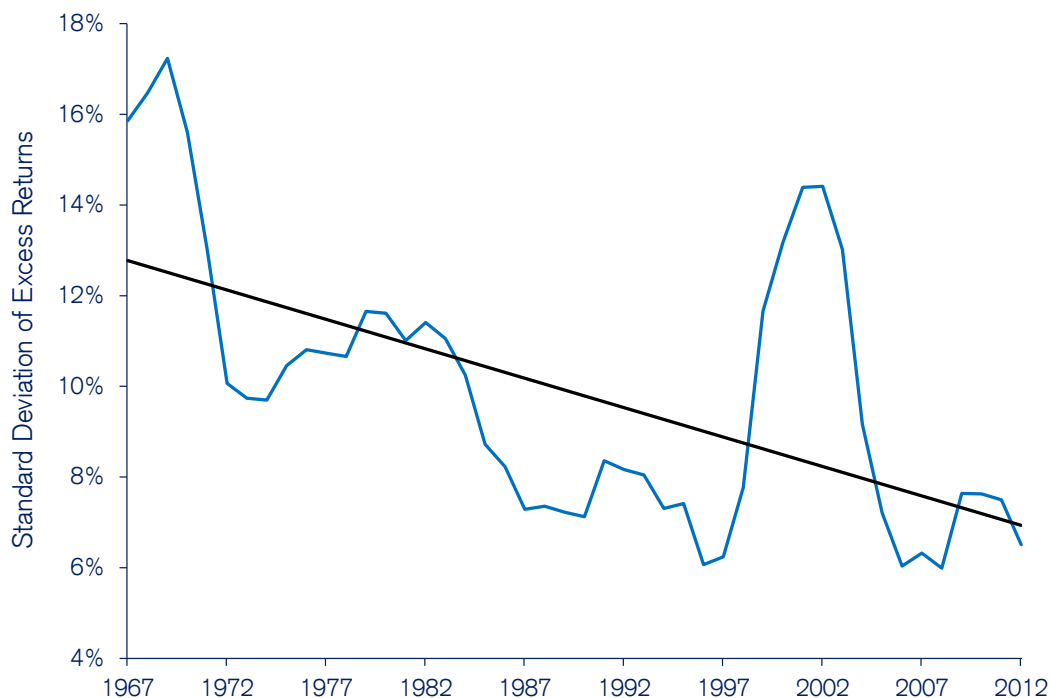
the crucial observation for our purpose: *If the variance in the skill distribution is shrinking and the variance in luck is stable, luck plays a growing role in shaping results.* An absolute improvement in skill, when combined with a relative decline in the range of skill, means that luck is more important than ever.³ This concept is called the “paradox of skill.”

The late Stephen Jay Gould, an evolutionary biologist at Harvard University, wrote about this to explain why no hitter in Major League Baseball has had a batting average over .400 since Ted Williams hit .406 in 1941.⁴ He showed that the coefficient of variation (standard deviation divided by the mean) declined steadily over the past century, which is consistent with a declining variance in skill and stable variance in luck. Gould concluded that the skill of modern players is better than ever but that the spread of skill has narrowed. Follow-up studies in baseball support this hypothesis.⁵

Peter Bernstein applied this approach to mutual funds and found that the margin of outperformance of the most successful funds had declined from the early 1960s through the late 1990s.⁶ Consistent with Bernstein’s results, Exhibit 1 shows that the standard deviation of excess returns has trended lower for U.S. large capitalization mutual funds over the past five decades. The exhibit shows the five-year, rolling standard deviation of excess returns for all funds that existed at that time. This also fits with the story of declining variance in skill along with steady variance in luck.

These analyses introduce the possibility that the aggregate amount of available alpha—a measure of risk-adjusted excess returns—has been shrinking over time as investors have become more skillful. Investing is a zero-sum game in the sense that one investor’s outperformance of a benchmark must match another investor’s underperformance. Add in the fact that in aggregate investors earn a rate of return less than that of the market as a consequence of fees, and the challenge for active managers becomes clear.⁷

Exhibit 1: Decline in Standard Deviation of Excess Returns for U.S. Large Capitalization Funds



Number of funds	69	109	135	159	244	372	679	1,136	1,233	1,024
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Source: Markov Processes International, Morningstar, and Credit Suisse.

David Hsieh, a professor of finance at Duke University's Fuqua School of Business, made an effort to quantify the amount of alpha available to hedge funds. He started with total available returns and then subtracted the components of return that fund managers can easily replicate. After plugging in the numbers, he concluded that the average amount of available alpha is three percent of assets under management (AUM) for the hedge fund industry. He did his calculation in 2006, a time when AUM for the hedge fund industry were \$1 trillion. This suggested \$30 billion in available alpha. If we apply the same percentage today, available alpha for hedge funds is about \$65 billion.

Hsieh's approach anticipated that rapid growth in AUM in the hedge fund industry would lead to lower average excess returns. He said, "If that amount of alpha remains constant and is extracted from the market by hedge fund managers, it has to be extracted from another part of the market, most likely from such traditional managers as mutual funds. So, as more assets are allocated to the hedge fund industry, the average alpha per hedge fund dollar will decline—even though in aggregate, the total amount of market inefficiency will remain the same."⁸

Research shows that money managers are more likely to construct portfolios that mimic their benchmarks in markets that are efficient than in those that are less efficient. So there is more closet indexing in developed markets than in developing markets, in large stocks than in small stocks, and in the stocks of old firms than in young firms.⁹ Analysis suggests that closet indexers in the U.S. market, at over one-third of the AUM, run more money than pure index funds. Closet indexers ran less than two percent of the AUM in 1980.¹⁰ Further, the popularity of closet indexing is rising in almost all markets and segments.

Sorting causality in closet indexing is a challenge. It is not clear whether investors are hugging the benchmark because excess returns are difficult to achieve or whether excess returns are difficult to achieve because investors are hugging the benchmark. Causality probably runs in both directions. In the U.S., a couple of other factors are likely at play. Institutions, which tend to focus on performance relative to a benchmark, are increasingly dominating the investing landscape. And in 1998, the Securities and Exchange Commission required all mutual funds to disclose a benchmark in their prospectus. This disclosure may have heightened manager attention to results relative to a benchmark.

Differential Skill May Be Narrowing but It Still Exists

While most acknowledge that generating alpha is a challenge, it is important to avoid pressing the case for reduced relative skill too far. Careful studies of active managers, including work by the well-known professors of finance Eugene Fama and Kenneth French, show that some level of differential skill is necessary to fit the empirical record.¹¹ For example, Fama and French estimate that a normal distribution of true alpha with a mean of zero and a standard deviation of 1.25 percent fits the cross-sectional data on mutual fund returns. While differences in skill may be smaller than in past eras, they still exist.

Dispersion in asset returns also influences the dispersion in fund returns.¹² Research suggests that realized asset dispersion leverages manager skill. So returns for an active manager will be higher than expected when realized asset dispersion is high. The intuition behind this is that greater asset dispersion creates a larger opportunity set for an active manager.¹³ There is a positive correlation between the breadth of opportunities and the dispersion of fund returns. This relationship holds across twenty or so asset classes.¹⁴

The sharp run-up in the U.S. market in the late 1990s and into early 2000, as well as the 2008-2009 financial crisis, provides powerful evidence for the link between the dispersion in asset and fund returns. The decades-long downward trend in standard deviation in excess returns spiked violently, fed by a sharp rise in

stock price dispersion. But the popping of the dot-com bubble resulted in plummeting price dispersion and a return to the long-term trend of falling fund return dispersion.

David Swensen, the chief investment officer of Yale University's endowment, uses the dispersion of active managers as a proxy for market efficiency. He discusses the dispersion of returns—which he measures as the difference between the returns for first and third quartile funds—in various asset classes, suggesting that he seeks to invest in active managers only where dispersions are high. “You want to spend your time and energy pursuing the most inefficiently priced asset classes,” he told the students during a lecture, “because there’s an enormous reward for identifying the top quartile venture capitalist and almost no reward for being the top quartile of the high-quality bond universe.”¹⁵

One of the puzzles in finance is why active management remains such a large business when academics have argued for decades that markets are too efficient to beat. Indeed, U.S. equity funds went from \$25 billion in AUM in 1980 to \$3.5 trillion in 2010. Further, despite index funds and exchange-traded funds going from a negligible share in 1980 to about 30 percent of the market today, asset-weighted fees are actually higher today than they were in 1980.¹⁶ This doesn't consider the substantial growth in AUM for hedge funds, which charge higher fees on average than mutual funds do.

Jonathan Berk and Richard Green, professors of finance, derived a model that may help explain the puzzle.¹⁷ They suggest a world where there are skillful investment managers who deliver positive, risk-adjusted excess returns. Both the managers themselves and investors recognize this skill. The manager's ability to deliver excess returns is limited, however, by AUM. In other words, each dollar investors add has the effect of reducing the expected return of the portfolio.

What would you expect in this world? Skillful managers attain more assets through positive inflows until their expected returns fall to a level roughly equal to that of the market.¹⁸ A point of equilibrium exists where all managers, irrespective of their level of skill, have identical expected returns. In this model, Berk and Green don't measure skill simply as excess return. Rather, they examine the expected value the fund adds, which is the abnormal return times the AUM.

Here's an example to make the idea more concrete.¹⁹ In his first five years running the Magellan Fund at Fidelity, Peter Lynch had monthly gross alpha of 2 percent on roughly \$40 million of AUM. In his final five years, he had 0.2 percent monthly gross alpha on \$10 billion of assets. So his value added went from \$800,000 per month ($.02 * \40 million) to \$20 million per month ($.002 * \10 billion). So while Lynch's percentage gross alpha decreased as his fund grew, his value added increased. As in other competitive labor markets, the portfolio manager captures most of the excess rents generated by his or her skill through higher compensation.²⁰

While more sophisticated than what is depicted here, the Berk and Green model explains many of the empirical facts and is consistent with the paradox of skill.

Picking Your Game

How do you find games where you have an edge in relative skill? The answer is complex but we will focus on three areas: diversity breakdowns, institutions versus individuals, and inefficiencies that arise from technical selling or buying. All areas represent pockets of inefficiencies that are likely to persist, but the opportunities move around across asset classes and geographies. As a result, style-box constraints can be limiting because a manager is relegated to a single game, whether or not opportunities exist.

There are three classic paths to market efficiency: rational investors, arbitrage, and the wisdom of crowds.²¹ In the rational framework, investors understand their preferences and correctly trade off risk and return. Because the model is based on the theory of general equilibrium, it assumes that asset prices are correct. Given the preponderance of evidence against both its assumptions and predictions, the “rational investors” approach has few supporters.

The arbitrage argument, which suggests that arbitrageurs cruise markets and close aberrant price gaps, is more compelling. Arbitrageurs do exist and their actions do narrow many price gaps. However, there are two problems with the argument. The first is that there are limits to arbitrage. Even if arbitrageurs see an opportunity, they may not be able to exploit it for technical reasons. For example, an arbitrage trade may require going long one security and short another. If shorting a stock, for instance, is prohibitively expensive, the arbitrageur will be unable to do her job.²²

Another problem is that arbitrageurs sometimes fail to act, for a host of possible reasons, even when wonderful opportunities exist. One well-documented example is the arbitrage between the “off-the-run” (29 ½-year maturity) and “on-the-run” (30-year maturity) Treasury bonds in August 1998. These are nearly identical securities, but the off-the-run bond used to trade a little cheaper than the on-the-run bond because it was slightly less liquid. So when the yield spread between the two bonds was sufficiently wide, arbitrageurs would buy the off-the-run and short the on-the-run bonds, almost a perfect arbitrage. Because the securities were so similar, arbitrageurs used leverage to bolster the returns from the trade.

However, in the summer of 1998 the spread widened and rather than arbitrageurs buying the cheap bond and selling the dear one, they fled the trade altogether. So the widening in the spread became “self-feeding rather than self-limiting” as arbitrageurs failed to play their typical role. This is one of the trades that led to the demise of Long-Term Capital Management.²³

The final way to get to market efficiency is through the wisdom of crowds.²⁴ More formally, we can describe markets as complex adaptive systems.²⁵ One advantage to this approach is that it sets out the conditions under which markets are efficient.

Markets yield proper values when investors hold diverse views, there is a properly functioning aggregation mechanism to extract information from investors, and when incentives reward smarter participants. When one or more of those conditions are violated, there is inefficiency. Diversity is by far the most likely condition to be compromised. Rather than investors thinking and behaving independently, they correlate their behavior and create excesses in markets.

Most booms and busts start with a kernel of truth and run to extremes. The peak of the dot-com bubble in March 2000 or the lows of the S&P 500 in March 2009 following the financial crisis are but two recent illustrations. Crucially, the relationship between the degradation of diversity and a change in asset prices is not linear. Following a period of diversity loss, a small incremental change in diversity can lead to a large-scale change in asset price.²⁶ Crowded trades can stay crowded for a while before there is a violent move in the opposite direction.

So the first game to find is one where you can take the other side of a diversity breakdown. Seth Klarman, founder of the successful hedge fund The Baupost Group, has a wonderful line that can guide action: “Value investing is at its core the marriage of a contrarian streak and a calculator.”²⁷ The “contrarian streak” part ensures that you are in a game where you can take the other side of a popular trade. But there are occasions when the consensus is correct. The “calculator” part allows you to assess whether the one-sided trade has led to a mispriced asset, hence presenting attractive upside with a proper margin of safety.

Note that diversity breakdowns can last for a long time and can be on a large scale. For instance, buying U.S. large capitalization stocks in 1982 following a dismal decade and proclamations of the death of equities would have led to tidy returns over the better part of the subsequent two decades. Part of the definition of skill includes finding asset classes that are likely to do well, or poorly, for an extended period of time. That provides a favorable backdrop for attractive absolute returns.

The second game is when you, as an institution, compete with individuals. This is similar to a professional poker player going against an amateur. The professional has the edge over the long haul, but it's hard to predict who will come out ahead in the short run. Individuals are particularly vulnerable at market extremes. There is good evidence that institutions are more skillful than individuals.

One example is participation in the market for initial public offerings (IPOs). Research suggests that IPOs with high institutional ownership do better than those with low ownership because institutions are better at interpreting public information.²⁸ That more IPOs take place following good returns in the market likely plays a role as well, suggesting that both technical skill and a reduction in diversity play a role in this finding.

A similar thread of research reveals that institutions do a more effective job of interpreting news than individuals do. One well-known finding is that markets tend to underreact to news about future cash flows. When the news is good institutions buy stocks from individuals, and when the news is bad the institutions sell to individuals. As a result, institutions earn a premium to individuals in these cases.²⁹

This game of institution versus individual has become scarcer, as institutions have come to dominate markets. Check out this quotation:

In just ten years, the market activities of the investing institutions have gone from only 30 percent of total public transactions to a whopping 70 per cent. And that has made all the difference. No longer are the "New Breed on Wall Street" in the minority; they are now the majority. The professional money manager isn't competing any longer with amateurs who are out of touch with the market; now he competes with other experts.³⁰

That comes from Charley Ellis's famous paper, "The Loser's Game," *published in 1975*. Ellis provided an early articulation of the paradox of skill in investing, and it remains one of the best. In the last half century, the role of individuals has diminished substantially in the United States. In 1950, individuals held over 92 percent of equities. Today, they hold less than half. Individuals do tend to get more active at extremes—especially after strong up moves—but day to day it's the institutions slugging it out against one another.

Other markets are less developed than the U.S., which means that institutions have more of an opportunity to compete with individuals. In a study that included all investors in Taiwan over a five-year period ended in 1999, researchers found that institutions earned excess returns of 1.5 percentage points while individuals suffered an annual performance drag of 3.8 percentage points. Most of the poor performance by individuals was the result of aggressive, and unprofitable, trading. As the study concludes starkly, "Individuals lose, institutions win."³¹

So the games where institutions compete with individuals are vanishing, but appear when markets are at extremes and in markets that have yet to develop fully. When institutions go head-to-head with individuals, they tend to fare well.

The final pocket of inefficiency is taking advantage of investors who need to buy or sell for non-fundamental reasons. In these cases, the disadvantaged investors have an incentive, or are forced, to buy or sell with little or no regard for the fundamental asset value.

Take corporate spin-offs as an example. In a spin-off, a company distributes the shares of a subsidiary to its shareholders. For instance, Time Warner spun off Time Warner Cable to its shareholders in 2009. The academic research supports the view that spin-offs generate attractive returns.³²

The basic story is that large institutions that own a particular stock frequently do not want to own the shares of the company being spun off, generally because it is smaller than the parent and has weaker financial characteristics. Further, these institutions often have constraints based on investment style. So they spend little time doing research and simply jettison the spin-off.³³

Distressed selling is another illustration of this form of inefficiency. John Geanakoplos, a professor of economics at Yale and an external professor at the Santa Fe Institute, has developed what he calls the “leverage cycle.”³⁴ He notes that as an asset price is rising, the cost to borrow is low but so is the margin requirement. For example, Ellington Capital, a hedge fund specializing in mortgage securities, was able to buy \$100 of collateralized mortgage obligations in 2006 by putting up \$15 and borrowing \$85. So its margin requirement was 15 percent.

Indeed, the margin requirement can *decline* as the asset price rises. This is what happened in the U.S. residential housing market. Geanakoplos notes that of the \$2.5 trillion in “toxic” mortgage securities in 2006, the buyers put down \$150 billion and borrowed \$2.35 trillion for about a 16-to-1 leverage ratio. Buyers put up only 6 percent of the purchase price of a home, in contrast to a historical norm closer to 20 percent. The easy access to credit exaggerated the upward price move in homes and created the conditions for a powerful tumble when the process reversed.

Once the asset price starts to drop, there are two effects that feed one another. First, the lower asset price triggers a margin call, which leads to forced selling. Second, lenders raise the margin requirement, accelerating the virulence of the feedback loop. As the financial crisis started to unfold, Ellington Capital saw its margin requirements jump to 40 percent, only to reach a peak of 70 percent in the second quarter of 2009.

The violence of the move on the downside, compounded by a rising margin requirement and hence margin calls, forces some investors to sell assets that they don’t want to sell. That creates an opportunity for the buyer on the other side. Geanakoplos’s idea is to use margin requirements more proactively and counter-cyclically. That is, make borrowing harder as an asset climbs in price and easier as the price falls.

Even leaving aside the amplifying effects of leverage, there is evidence that some investors benefit at the expense of others in distress. Research suggests, for instance, that some hedge funds generate profits by targeting mutual funds that are suffering outflows.³⁵ Further, and consistent with the literature on the limits of arbitrage, short sellers can get caught in situations where they have to buy for non-fundamental reasons.

This discussion of inefficiencies—places where you want to play the game—would be incomplete without a comment about the permanence of investor capital. Exploiting inefficiencies is easy to discuss intellectually, but difficult to execute emotionally. Investors in a fund are likely to be most scared precisely when the opportunities are best, and if they choose to withdraw capital they ensure that both their returns, and the returns of the manager to whom they had entrusted their funds, will suffer.

Seth Klarman suggests that one of the characteristics of an ideal client is “when we call to say there is an unprecedented opportunity set, we would like to know that they will at least consider adding capital rather than redeeming.”³⁶ These clients are rare and very valuable. This, too, is where permanent capital from founders or families can provide a substantial edge. These investment firms can find and play the right games.

Summary

In investing, as in many other activities, the skill of investors is improving on an absolute basis but shrinking on a relative basis. As a consequence, the variance of excess returns has declined over time and luck has become more important than ever. Still, differential skill continues to exist. This process is called the paradox of skill.

The key to generating excess returns is to not only be skillful but to find attractive “games”—situations where you can see where your excess returns are likely to come from. This report touched on three of those pockets of inefficiencies—diversity breakdowns, institutions versus individuals, and trading with investors who are buying for non-fundamental reasons—but there are undoubtedly more. The main lessons are that sometimes it’s more important to worry about the game you’re in than the skill you bring, and that you should always try to avoid being the patsy.

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We offer special thanks to John Lloyd and Chetan Jadhav, Private Banking Americas Managed Accounts, for providing data and for their valuable input into this discussion.

Endnotes:

¹ A person who is easy to take advantage of is called a “patsy.” Quote is from Warren E. Buffett, “Letter to Shareholders,” 1987 *Berkshire Hathaway Annual Report*.

² Dave Bock, “Why Variances Add—And Why It Matters,” *AP Central: Collegeboard.com*. See also: <http://blog.philbirnbaum.com/2012/08/why-r-squared-works.html>.

³ Bradford Cornell, “Luck, Skill, and Investment Performance,” *Journal of Portfolio Management*, Vol. 35, No. 2, Winter 2009, 131-134. Cornell’s analysis “indicates that approximately 92% of the cross-sectional variation in annual performance is attributable to random chance.”

⁴ Stephen Jay Gould, *Triumph and Tragedy in Mudville: A Lifelong Passion for Baseball* (New York: W.W. Norton & Company, 2004), 151-172.

⁵ Wilbert M. Leonard, II, “The Decline of the .400 Hitter: An Explanation and a Test,” *Journal of Sport Behavior*, Vol. 18, No. 3, September 1995, 226-236.

⁶ Peter L. Bernstein, “Where, Oh Where Are the .400 Hitters of Yesteryear?” *Financial Analysts Journal*, Vol. 54, No. 6, November/December 1998, 6-14.

⁷ William F. Sharpe, “The Arithmetic of Active Management,” *Financial Analysts Journal*, Vol. 47, No. 1, January/February 1991, 7-9.

⁸ David A. Hsieh, “The Search for Alpha—Sources of Future Hedge Fund Returns,” *CFA Institute Conference Proceedings Quarterly*, September 2006, 79-89.

⁹ Utpal Bhattacharya and Neal Galpin, “The Global Rise of the Value-Weighted Portfolio,” *Journal of Financial and Quantitative Analysis*, Vol. 46, No. 3, June 2011, 737-756.

¹⁰ Antti Petajisto, “Active Share and Mutual Fund Performance,” *Working Paper*, January 15, 2013. Here’s an interesting fact: If you randomly choose 100 stocks from the S&P 500 and value weight them, the active share of that portfolio will be about 80 percent. See Martijn Cremers and Jess Gaspar, “Active Management vs. Closet Indexers,” *CommonFund Forum 2013*, March 11, 2013.

¹¹ Laurent Barras, Olivier Scaillet, and Russ Wermers, “False Discoveries in Mutual Fund Performance: Measuring Luck in Estimated Alphas,” *Journal of Finance*, Vol. 65, No. 1, February 2010, 179-216; also Eugene F. Fama and Kenneth R. French, “Luck versus Skill in the Cross-Section of Mutual Fund Returns,” *Journal of Finance*, Vol. 65, No. 5, October 2010, 1915-1947.

¹² Harindra de Silva, Steven Sapra, and Steven Thorley, “Return Dispersion and Active Management,” *The Financial Analysts Journal*, Vol. 57, No. 5, September/October 2001, 29-42.

¹³ Larry R. Gorman, Steven G. Sapra, and Robert A. Weigand, “The role of cross-sectional dispersion in active portfolio management,” *Investment Management and Financial Innovations*, Vol. 7, No. 3, 2010, 58-68.

¹⁴ Joop Huij and Simon Lansdorp, “Explaining Differences in Mutual Fund Performance,” *Working Paper*, October 2011.

¹⁵ David Swensen, “Guest Lecture for ECON-252-08: Financial Markets,” *Yale University*, February 13, 2008.

¹⁶ Burton G. Malkiel, “Asset Management Fees and the Growth of Finance,” *Journal of Economic Perspectives*, Vol. 27, No. 2, Spring 2013, 97-108. Note that fees rose and fell during this period, ending slightly higher in 2010 than in 1980.

¹⁷ Jonathan B. Berk and Richard C. Green, “Mutual Fund Flows and Performance in Rational Markets,” *Journal of Political Economy*, Vol. 112, No. 6, December 2004, 1269-1295. Also, see Jonathan B. Berk, “Five Myths of Active Portfolio Management,” *Journal of Portfolio Management*, Spring 2005, 27-31.

¹⁸ This aspect of the model remains open to debate. See Jonathan Reuter and Eric Zitzewitz, “How Much Does Size Erode Mutual Fund Performance? A Regression Discontinuity Approach,” *Working Paper*, March 2013. Also Ronald N. Kahn and J. Scott Shaffer, “The Surprisingly Small Impact of Asset Growth on Expected Alpha,” *Journal of Portfolio Management*, Fall 2005, 49-60.

¹⁹ Jonathan B. Berk and Jules H. van Binsbergen, “Measuring Skill in the Mutual Fund Industry,” *Working Paper*, February 1, 2013.

- ²⁰ James Ang, Beni Lauterbach, and Joseph Vu, "Efficient Labor and Capital Markets: Evidence from CEO Appointments," *Financial Management*, Vol. 32, No. 2, Summer 2003, 27-52.
- ²¹ Andrei Shleifer, *Inefficient Markets: An Introduction to Behavioral Finance* (Oxford, UK: Oxford University Press, 2000), 2.
- ²² Nicholas Barberis and Richard Thaler, "A Survey of Behavioral Finance," in *The Handbook of The Economics of Finance*, Constantinides, Harris, and Stulz, eds. (Amsterdam: Elsevier, 2003), 1054-1063.
- ²³ Donald MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets* (Cambridge, MA: MIT Press, 2006), 230-231.
- ²⁴ James Surowiecki, *The Wisdom of Crowds: Why the Many Are Smarter than the Few and How Collective Wisdom Shapes Business, Economies, Societies, and Nations* (New York: Doubleday, 2004).
- ²⁵ Michael J. Mauboussin, "Revisiting Market Efficiency: The Stock Market as a Complex Adaptive System," *Journal of Applied Corporate Finance*, Vol. 14, No. 4, Winter 2002, 8-16.
- ²⁶ Michael J. Mauboussin, *Think Twice: Harnessing the Power of Counterintuition* (Boston, MA: Harvard Business Press, 2009), 101-118.
- ²⁷ From Seth Klarman's speech at Columbia Business School on October 2, 2008. Reproduced in *Outstanding Investor Digest*, Vol. 22, No. 1 & 2, March 17, 2009, 3.
- ²⁸ Laura Casares Field and Michelle Lowry, "Institutional versus Individual Investment in IPOs: The Importance of Firm Fundamentals," *Journal of Financial and Quantitative Analysis*, Vol. 44, No. 3, June 2009, 489-516.
- ²⁹ Randolph B. Cohen, Paul A. Gompers, and Tuomo Vuolteenaho, "Who underreacts to cash-flow news? Evidence from trading between individuals and institutions," *Journal of Financial Economics*, Vol. 66, No. 2-3, November-December 2002, 409-462.
- ³⁰ Charles D. Ellis, "The Loser's Game," *Financial Analysts Journal*, Vol. 31, No. 4, July/August 1975, 19-26.
- ³¹ Brad M. Barber, Yi-Tsung Lee, Yu-Jane Liu, and Terrance Odean, "Just How Much Do Individual Investors Lose by Trading?" *Review of Financial Studies*, Vol. 22, No. 2, February 2009, 609-632.
- ³² Chris Veld and Yulia V. Veld-Merkoulova, "Value creation through spin-offs: A review of the empirical evidence," *International Journal of Management Reviews*, Vol. 11, No. 4, December 2009, 407-420. For a popular account, see Joel Greenblatt, *You Can Be a Stock Market Genius: Uncovering the Secret Hiding Places of Stock Market Profits* (New York: Simon & Schuster, 1997).
- ³³ Keith C. Brown and Bryce A. Brooke, "Institutional Demand and Security Price Pressure: The Case of Corporate Spinoffs," *Financial Analysts Journal*, Vol. 49, No. 5, September/October 1993, 53-62. Also, Jeffrey S. Abarbanell, Brian J. Bushee, and Jana Smith Raedy, "Institutional Investor Preferences and Price Pressure: The Case of Corporate Spinoffs," *Journal of Business*, Vol. 76, No. 2, April 2003, 233-261.
- ³⁴ John Geanakoplos, "The Leverage Cycle," *Cowles Foundation Discussion Paper No. 1715R*, January 2010.
- ³⁵ Joseph Chen, Samuel Hanson, Harrison Hong, and Jeremy C. Stein, "Do Hedge Funds Profit from Mutual-Fund Distress?" *NBER Working Paper 13786*, February 2008.
- ³⁶ Seth A. Klarman and Jason Zweig, "Opportunities for Patient Investors," *Financial Analysts Journal*, Vol. 66, No. 5, September/October 2010, 1-11.

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