McGRAW-HILL FINANCE & INVESTING

QUANTITATIVE STRATEGIES FOR ACHIEVING ALPHA

RICHARD TORTORIELLO

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To Theresa M. N., who always thought her son would become an author, but never imagined a book like this.

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LIST OF ABBREVIATIONS

CAGR	compound annual growth rate
capex	capital expenditures
CAPM	capital asset pricing model
EBIT	earnings before interest and taxes
EBITDA	earnings before interest, taxes, depreciation, and amortization
EPS	earnings per share
EV	enterprise value
EVA	Economic Value Added
FCF	free cash flow
FY	fiscal year
GAAP	generally accepted accounting principles
GARP	growth at a reasonable price
GICS	Global Industry Classification Standard
LTCM	Long-Term Capital Management
NOPAT	net operating profit after tax
P/E	price/earnings
PP&E	property, plant, and equipment
P/S	price/sales
R&D	research and development
ROA	return on assets
ROCE	return on capital employed
ROE	return on equity
ROIC	return on invested capital
RSI	Relative Strength Index
SEC	Securities and Exchange Commission
S&P 500	Standard & Poor's 500 Index

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CHAPTER 1

Introduction: In Search of Alpha

I do not know what I may appear to the world; but to myself I seem to have been like a boy playing on the sea-shore, and diverting myself now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.

Sir Isaac Newton

Don Quixote: Dost thou see? A monstrous giant of infamous repute whom I intend to encounter.
Sancho Panza: It's a windmill.
Don Quixote: A giant! Canst thou not see the four great arms whirling at his back?
Sancho Panza: A giant?
Don Quixote: Exactly!

From *Man of La Mancha*, Dale Wasserman, Miguel de Cervantes

I've read with interest the journals of Meriwether Lewis and William Clark as they undertook, at the request of Thomas Jefferson, to explore the unknown western frontier and to find a route to the Pacific. These journeys contained as many dangers as they held wonders (and were financed by Congress for $2,500—the dollar went further back then). Their expedition, which did much to open the West to further exploration and settlement, became known as the Corps of Discovery. Although the greatest dangers faced by the author of this work were perhaps fatigue and eye strain—a far cry from grizzly bear, white-water rapids, and belligerent natives—the same spirit of discovery motivated the undertaking of the tests and explorations that form the basis of this book.

Unlike the western United States in the early 1800s, the frontiers of finance have been well charted. Many of the investment field's greatest minds have put their ideas and methods, earned through years of hard work and experience, down on paper for anyone

with a few dollars or a library card to explore. The student of common stock investing can find hundreds of books covering almost every imaginable topic, from valuation analysis, to risk arbitrage, to day trading. With such a vast literature, developed by thousands of market participants over many decades, one might ask What is there left to discover?

One answer, I believe, is that, while investment theory has been mapped out well qualitatively—based on the experiences and insights of market participants—it has yet to be mapped out comprehensively from an *empirical* point of view. The reason for the wealth of qualitative literature and dearth of quantitative (outside of the university) is quite simply that investing is more art than science. Some of the best investment strategies are too dependent on the capabilities of the human mind to be reduced to a few lines of computer code. However, the advent of the personal computer and the database has provided a wonderful tool with which many investment strategies can be effectively modeled and tested. Numerous individual quantitative studies have been published, particularly in academia. Most, however, have been specialized, and some have been of questionable practical value. Quantitative professionals, on the other hand, have primarily written technical volumes (how-to guides for quantitative analysis), when they have written anything at all.

My quest began with two primary goals: to create a series of quantitative stock selection models for the Standard & Poor's Equity Research department and to provide myself and others with a "map" of the market from a quantitative point of view. This book presents investors with this map, as far as I have been able to draw it. Specifically, the work seeks to determine *empirically* the major fundamental and market-based drivers of future stock market returns. To arrive at this empirically drawn investment map, we tested well over 1,200 investment strategies: some worked well, and others didn't. Some of the strategies presented here are well known and widely employed; others are less well known and much less used outside of the world of professional money management. However, all of the factors presented in this book *work*, from a quantitative standpoint.

A true quantitative investor uses sophisticated mathematical models to gain an edge, sometimes ever so slight, over the market. This edge is then magnified with lots of money and lots of leverage (borrowed money). This book is not written for the "quant." Indeed, I am not qualified to write such a book. Readers need neither a Ph.D. in math nor an advanced knowledge of statistics to understand any of the tests contained herein. What readers *do* need is some interest in quantitative analysis and a desire to understand the basic drivers of stock market returns. This book was written with *qualitative* investors in mind, particularly those who wish to "understand" the stock market from a quantitative (empirical) point of view and who desire to integrate quantitative screens, tests, or models into their investment process—or simply into their thinking. Such integration is where art meets science. My personal belief is that the

quantitative approaches outlined in this book can provide a proven way to generate investment ideas for the qualitative investor as well as a discipline that can help improve investment results.

QUANTITATIVE VERSUS QUALITATIVE ANALYSIS

Perhaps a couple definitions are in order here. Quantitative analysis differs from qualitative analysis in a variety of ways. In qualitative analysis, the investor typically focuses on a small number of individual companies and conducts research on each to determine its business strengths and weaknesses, its market opportunities and competitive position, the capabilities of management, and the comparative value offered by its stock relative to other stocks available for purchase.[1] Qualitative investors often use a company's historical record (income statement, balance sheet, cash flow statement, etc.) as a jumping off point to project future trends in earnings and cash flows. The focus in qualitative analysis, as in the stock market itself, is on the future. Analytical techniques are tailored to the company and industry in question, and the investor seeks to make large gains in individual stocks. In short, qualitative analysis favors depth over breadth and the art of investment over a more "scientific" approach.

Quantitative analysis, on the other hand, seeks to discover overall tendencies or trends in the investment markets, particularly those that are predictive of future "excess" returns.[2] To identify these trends, the quantitative analyst examines large numbers of companies over long periods of time. Analysis is by necessity standardized and depends entirely on the historical record: income statement, balance sheet, cash flow statement, and market-based data.[3] That is, unlike most qualitative research, quantitative tests primarily *look backward*. Quantitative analysis emphasizes breadth over depth and science (testing and observation) over art. The quantitative analyst may apply the art of investment analysis in devising investment models and backtests, but once the models are determined, they're often purely mechanical in their operation. In sum, quantitative analysis relies primarily on computer-assisted inquiry, while qualitative analysis relies primarily on the workings of the human mind.

Although there are many similarities between the computer and the human mind, there are also vast differences. Of the two, only the human being can stake any real claim

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[1] Or the value currently offered by its stock relative to its "intrinsic value," an investor's subjective estimate of the business value of a firm's assets at a given point in time.

[2] Quantitative analysts sometimes refer to such predictive factors as "market inefficiencies."

[3] Although these four data types are the only ones used in this book, quantitative analysis is not limited to these. A quantitative test might include, for example, macroeconomic data, industry statistics, or demographic data.

to intelligence. The mind has the ability to digest and synthesize a diversity of information (e.g., investors must consider everything from the industry, economic, and political climate to the individual products of a company and the demand for its shares in the stock market), an ability that even the most advanced computer can't come close to matching. By carefully weighing a variety of factors, the human being can make projections about events that have some probability of occurring in the future.

Computers, on the other hand, are in essence sophisticated adding machines: they "act" only according to instructions given them from the outside. It's taken decades to develop a computer capable of beating a champion at a chess game, and here the variables are limited to the moves available to 32 pieces on a 64-square board. So, in a field such as investing, where returns may be affected by almost any type of activity, human or natural, the computer seems to be disadvantaged.

However, the computer has two distinct advantages that the human being does not. It can process large amounts of data very quickly (e.g., the way that IBM's "Deep Blue" supercomputer beat chess champion Garry Kasparov), and it lacks emotion. Both points are important, but the second especially so. Consider the following scenario (one that occurs frequently in real life):[4] You've bought $10,000 worth of Apple Computer common stock, which has advanced 20% since your purchase. Sales of iPods are going strong, and positive stories on Apple are in the press almost every day. You're feeling exuberant and thinking of purchasing more, despite a rather high market valuation for the shares. Before you do so, however, Apple announces that it has seen a "mix shift," in which unit volumes of iPods have decreased (i.e., it has shipped fewer iPods), but revenues and earnings growth have remained about the same because it is now shipping more high-end units than low-end ones. Over a period of a couple months following this news, the stock drops 22%, and your original shares are now selling well below their purchase price—you are now losing money, and euphoria (most likely) has given way to anxiety.

However, Apple's stock market valuation now looks much more reasonable, its business is doing well, and the untapped market for iPods seems large. Do you (1) sell your original shares, (2) hold your shares but buy no more, or (3) hold your original shares *and* buy more? On paper, this may all seem simple. If the business is doing well and its valuation looks attractive, *buy more.* But try to imagine yourself in this situation: You are now sitting on a $640 paper loss that used to be a $2,000 profit. News articles are appearing frequently, speculating on *why* Apple shares have declined, and you're wondering if there is some bad news on the horizon that hasn't yet been released.

[4] Although the example is hypothetical, the experienced investor will recognize the scenario of a good company that has reported temporarily "bad" news as one that occurs over and over again.

Under these circumstances many investors would *sell*. They sell not because there is a good reason, but because they are losing money, and emotions have the upper hand. Multiply the one investor in our example by thousands, and you'll understand why the psychological factor has such a strong influence on stock prices. In fact, the psychological factor in the stock market often creates opportunity, and it is here that our computer might come in handy.

The academic finance profession has struggled for decades to develop an "efficient market hypothesis" that works in practice. The EMH holds that financial markets quickly discount all available information, and thus that outperforming "the market" over any stretch of time simply isn't possible (or that such a stretch is just plain luck). Many professional investors, with long track records of consistently generating above-market returns, have proven that the EMH doesn't reflect the whole financial truth. The stock market is often efficient in rationally evaluating available information, but at other times its "judgment" becomes impaired by the psychological factors mentioned above. In other words, the market is also often inefficient. A quantitative example might illustrate the point. Over the 20 years from 1987 through 2006 (the period over which most of the backtests in this book were conducted), the average annual difference between the 52-week highs and 52-week lows of stocks in our Backtest Universe (about 2,000 of the largest publicly traded stocks) was 32%. Over the same period this same group of companies recorded compound annual growth in net income of just 9%. With income growing at an average rate of 9%, there is no reason that stock prices should jump up and down by 32% each year, yet they do.[5] Where money is concerned, emotion regularly overcomes rationality, and stocks go up and down for no other reasons than fear, greed, hope, or despair.

The quantitative tests presented in this book seek to uncover investment strategies that consistently outperform the market, based only on historical data. The strategies assume neither an efficient market nor an inefficient market. Rather, they exploit the two previously mentioned advantages of the computer—its lack of emotion and its ability to process large amounts of data—to determine which investment strategies hold the most promise for the investor. With a single inexpensive computer, an investor can now examine thousands of companies and hundreds of data items over several years in a matter of minutes or hours. In addition, the investor can model with the computer a strategy that applies perfect discipline. The model determines the strategy, and the computer follows the discipline of that strategy until instructed to do otherwise.

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[5] A colleague suggested that temporary imbalances in supply and demand could cause this price volatility. However, this begs the question of what caused the supply/demand imbalances. In an efficient market, a sudden (non-news-related) decline in a stock price would attract buyers, and a sudden rise in a stock price would attract sellers.