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The recent volatility of global markets, not seen since the Great Depression of the 1930s, will serve as a catalyst to further change the way the institutional investment management industry labels the broad categories of active equity management. The evolution of techniques and distinctive elements we refer to as *quantitative* and *fundamental* approaches has been ongoing for many years.

It is perhaps tempting to generalize. Those labeled as quantitative managers are painted today with an inappropriately broad brush. This tendency emerged slowly over the 1985–2000 period and accelerated rapidly after 2000 in the professional equity arena. Simultaneously, a myriad of fundamental managers slowly converged with the adoption of quantitative signals and disciplines. The equity market liquidity crises experienced in the summer of 2007 were an abrupt alert for some market participants. Too many assets in a common strategy ultimately create market failures, albeit sometimes short lived, as in the spirit of dynamic hedging in 1987.

This article considers the future of active equity strategies. The scope of the analysis includes equity managers that hold publicly traded securities and seek to outperform easily replicable passive benchmarks on a risk-adjusted basis. Each portfolio holding comprises a very small percentage of the shares outstanding in a security, which renders the managers price takers, not price setters, insiders, or major holders of private equity.

What will define successful active equity management in the future? How will experts describe successful managers? Following is a brief reminder of several of the more important elements in the historical backdrop. A likely increase in the diversity of approaches across the active investment arena is visible on the horizon. Despite divergent styles, the variety of approaches to active equity management reduces to one common descriptor—information. Managers differ from each other in the ways they access and leverage information in terms of their information sources, information processing, and information implementation.

THE SUCCESS FACTOR

We believe future success will build on (and require) new levels of technological efficiency for three key asset management building blocks. Each building block has a rich history and at the same time is still evolving. The three essential building blocks are 1) examining uncommon information sources with modern technology; 2) evaluating this information with modern portfolio theory, practice, and security valuation; and 3) extracting valued-added results by processing information with expert systems to assist investor decision making in forming, controlling, and implementing portfolios.

The active management winners of tomorrow will have passion for these building blocks and will understand how to evolve them on a proprietary basis. In the future, we will leave behind simple categorical language, such as *stock-picking fundamental insight* and *four-factor quant model*. Catchy yet misleading phrases and fads, such as fundamental indices and computer-driven algorithms, will also come and go, as will the next batch of superficial marketing-driven and noise-creating buzz.

For the near term, institutions will continue to clump managers into arbitrary buckets—fundamental, quantitative, enhanced, hedge fund, stock pickers, price-driven technicians, and so on—because this practice makes categorization easier. Regardless of the label, the common goal is clear—to win. In the sometimes chaotic world of stock price bursts (busts), there is one unique stock every day (or trading interval)—the one with precisely median performance. For any investment interval, the median-performance stock stands as unique in that it separates the stocks above (i.e., the winners) from those below (i.e., the losers). Return dispersion is always an element of the contest and, ceteris paribus, the more the better. Better allocation to the winners and away from the losers determines success. The game will continue to be worth winning. However, will it also be worth playing?[1]

Qian, Hua, and Sorensen [2007] argued that in many instances the fundamental principles that guide quantitative modeling are no different from the principles that guide fundamental research and management; the distinction between the two is that "quantitative lies broadly in *perfecting the comprehensive* portfolio system, whereas fundamental management lies in deeply *comprehending the perfect* stock" (p. 7). One attribute of each will mark success for both—*creative subjectivity*. Yes, *subjectivity*, but only driven by true *creativity*. As managers, we are often asked: "What are your differentiators?" Our first answer should be: "We think. We innovate."[2] Strategists get to *think*. Fundamentalists get to *think*, as in "we think this stock will outperform."

Historically, much of the "mythology" surrounding the generic quant process simply paints over logical creativity. Among the list of assertions that compose *quantitative mythology*, the number one myth is: "All it takes is a computer and a math nerd." Just like the dejected caveman of the GEICO commercials: "Even a caveman can do it!"

Consider quant myth number two: "They all do the same thing, and if they all do it, it won't work." But what if a manager has the creativity to bring innovative and evolving approaches and techniques to bear on the investment process? All managers use models. Fundamental stock analysts use earnings models based on cash flow concepts and accounting inputs. Similarly, quantitative skill with creativity enlarges into comprehensive expert systems utilizing models at several levels. In both cases, true experience and expertise require judgment, priors, conditioning, and nonlinear thinking. Subjectivity, on the one hand, and a disciplined rules-based process, on the other, should not dichotomize investment philosophies that are successful in the future. Managers are not all the same, which makes the game worth playing for those that combine creativity with modern information processing tools.[3]

FUNDAMENTAL PROCESSES: BEHAVIOR PROBLEMS

The floor plan of a fundamental investment shop conjures up a vision of rows of analysts with green eyeshades pouring over written material in order to "cover" lists of stocks. The material varies, but typically includes financial statements, notes on face-to-face interrogation of corporate officials, and various heuristic "models" of thought processes to determine relative security value. Two prime advantages of the fundamental approach are the riches of 1) depth of analysis and 2) human insight. Two disadvantages of the approach are 1) lack of breadth (limited capacity to cover enough securities) and 2) the potential for human behavioral biases.

Analysts often behave and even compete in ways that detract from the goal of objective value-added investment advice. Over 30 years ago, Treynor [1978] aptly characterized one behavioral problem that can emerge in an investment management organization. Securities (research) analysts have to compete to influence the portfolio makeup and their opinions often take the form of buy recommendations in order to accelerate the decision-making process. Given these biases, "analysts who get recognized and rewarded are those who 1) succeed in persuading portfolio managers to buy … and 2) whose recommended securities appreciate …, a process that transforms various analysts … into rivals" (Treynor [1978, p. 430]). Of course, many behavioral biases can creep into an analyst's mind. Examples of the pitfalls of free subjectivity, regardless of the objective data, include "falling in love with a stock" or "herding."

Over the past 35 years, large teams of sell-side and buy-side fundamental analysts have come and gone.[4] As if deciphering the accounting numbers was not a large enough challenge, understanding psychology and assessing management behavior have also become necessary skills in fundamental analysis. One problem is prevalent—corporate management often illusively articulates the fundamentals. As one analyst puts it, "I bring in a psychologist's couch more than a spreadsheet." More than one consulting firm has begun to conduct training that equips analysts in "detecting deception." The challenge is to identify verbal and nonverbal behavior that signals corporate management's attempts to obscure and/or misinform.[5] Management more often than not provides information that will obscure, at least until the corporate reports offer more clarity.

QUANTITATIVE PROCESSES: MATH PROBLEMS

Just as with judgments on fundamental approaches, observers have traditionally associated both strengths and weaknesses with quantitative methods. The prime advantages of quantitative methods are considered to be 1) breadth of analysis and 2) discipline. The disadvantages are considered to be 1) modeling that is overly dependent on past relationships and 2) perhaps excessive rigidity in implementation as market regimes shift.

Quantitative management is sometimes considered exclusively an exercise in risk analysis. This is certainly part of it, encompassing sources of volatility, tracking error, and so on. In the past 30 years, however, quantitative managers have devised sometimes simple, and sometimes more complex, mathematical and statistical methods (models) to forecast the future returns on large and broad universes of stocks.

Models that predict the future often rely on historical analyses to backtest theory. On the one hand, this produces a more scientific, data-rational result. On the other hand, it may lead to predictions that fail when the securities world becomes dynamic and/or volatile. Moreover, any observed success of simple models may make myth number two, discussed earlier, a reality. If more players replicate similar indicators and have common models for stock selection, overcapacity can become a problem. Some active managers experienced extraordinary volatility in the summer of 2007 when some leveraged funds were forced to liquidate. The liquidation brought abrupt selling of some quantitative equity positions. Clearly, breadth from quantitative signals has a potential downside. In contrast to fundamental managers who can manage a relatively narrow and/or specific portfolio that is somewhat unique to their proprietary research insights, some quants are exposed to unpredictable regime shifts because they hold positions that are common to other portfolios.

So, who started this quant stuff anyway? In the early 1920s, Knight [1921], who was at the University of Chicago, defined risk as *quantifiable uncertainty*. Later, Von Neumann and Morgenstern [1944] presented a rational foundation for decision making under risk by identifying a number of *expected-utility* rules. Markowitz [1952] ushered in an analytical and normative paradigm for modern portfolio construction with his general framework for optimal exchanges of expected return (mean) for expected risk (covariance). All of this work led to formal equilibrium propositions that established theoretical linearity between expected return and risk (the *market price of risk*). Beta was born.

Parallel with the *science*, the financial community began to focus on securities analysis *technique*. The Investment Analysts Society of Chicago, formed in 1925, was followed by the establishment of the New York Society of Securities Analysts in 1937. The latter organization was motivated by Ben Graham and others who also launched the *Financial Analysts Journal* in 1945.

Ben Graham, thought by many practitioners to be the "father of securities analysis," threw in an active measure of value to drive the stock selection process. His managed portfolios were broad based and, therefore, more likely to resemble those of a modern quantitative practitioner than those of a rifle-shooting, narrowly focused fundamental stock picker.

PRICE EFFICIENCIES AND EARNINGS: COMMON REALITIES FOR ALL

In order to understand the challenges for active management and the intense competition to earn incremental returns, two key aspects of stock investing must be appreciated. First is the importance of market efficiency—predicting future prices is highly competitive, and it should be, because the rewards are high and the barriers to entry are relatively low. Second is the importance of information about future corporate earnings—predicting future earnings and cash flows can be the key to success.

The second half of the twentieth century witnessed the explosion of technology on many fronts. Modern investment research and practice grew with the combined influences of modern economic modeling, advances in computer technology, and publishing of vast amounts of academic work in empirical finance. The early empirical work emanated from the behavior of stock prices. Many academics made reference to Brownian motion, random walk, stochastic price changes, martingale efficiency, and the like.[6] A lay interpretation of these studies reduces to something like "prices have no memory"; if so, activities such as technical analysis should not produce abnormal returns.

Fama [1970] did the industry (and academic community) a great service by summarizing stock market pricing efficiencies in a pragmatic context. The financial and academic community finally had a straightforward definition and a testable hypothesis. In Fama's words, stock pricing is efficient if it precludes making abnormal profits (i.e., more profits than are justified by the investment risks) conditioned on some type of available information, such as past prices, fundamental data, insider information, and so forth. It stands to reason that if being a winner in stock investing is lucrative, multitudes of players will devote enormous energy and ingenuity to succeed. Volumes of direct academic study and formal research are available on this subject spanning the past 40 years.[7]

The value proposition of the professional money manager must rest heavily on the belief in a defined process that can overcome an efficient-market hurdle or obstacle and that essentially violates the notion of an efficient market. Despite the logical appeal (and early empirical evidence) that supported market efficiency, hundreds (and perhaps thousands) of institutions had success with the mission of disproving efficiencies for profit. For example, consider the acceleration in recent years of so-called high-frequency trading. Perhaps more than half of today's volume in global equity is high frequency (extremely short holding periods). Armed with high-speed computers, continuous market data feeds, proximity inside the market microstructure, and creative price-pattern algorithms, the new world of computer-driven trading has revolutionized the once visual chart mentality of the old-school market technician. One might argue that the high-volume, intraday trading by dealers (and hedge fund players) today does not create any true information, but rather it creates noise and, worse yet, creates instability and detracts from long-run equilibrium pricing. But, it evidently makes money for some (perhaps many) players and justifies the game.[8]

At the other end of the equilibrium spectrum, stock price behavior related to corporate earnings changes is likely to remain the single, most important emphasis in fundamental stock selection. It is also modeled in most quantitative approaches. Graham et al. [1962] were early articulators of this axiom: "The most important single factor determining a stock's value is now held to be the *indicated average future earning power*, i.e., the estimated average earnings for a future span of years" (p. 28). The concepts of growth in cash flow and of trend in profitability have come under such scrutiny by analysts, quants, and portfolio managers that they should reside at the epicenter of market efficiency. Indeed, Graham's main focus was to carefully consider the limit (value) that an investor should pay for future earnings. In the world of public corporate data analysis, all roads lead to *knowing* next period's (year's) earnings. This year's stock price winners (losers) are next year's earnings winners (losers). But the goal is more than forecasting big or small earnings growth moves; it is forecasting ex post growth relative to ex ante expectations. This observation is tantamount to being axiomatic.

It is little wonder that earnings trends, earnings fundamentals, and consensus earnings expectations analyses represent the cornerstone of fundamental and quantitative managers alike. Myriad studies fill finance and economics sections of libraries with testimonials.

One of the earliest, as well as most direct, graphic empirical analysis of *knowing* future earnings is simple and elegant. Niederhoffer and Regan [1972] calculated a straightforward metric to compare the top-performing stocks and the bottom-performing stocks in 1970. The winners were up an average of 48% and the losers were down an average of –57%. The differentiator was not ex ante forecasted earnings—the losers had twice the magnitude of forecasted growth than the winners. The differentiator was what actually happened ex post versus expectations; that is, the great stock performers reported earnings that, on average, grew three times faster than expected, whereas the losers reported big losses compared to prior expectations of positive growth of 15%.

Hundreds of research papers attest, and numerous earnings calculations evidence, broad exposure to future earnings across the investment practice landscape. We have earnings-surprise factors, earnings-revision metrics, earnings-momentum measures, and so on. On the one hand, quants have drawn criticism for data-mining databases that

aggregate analysts' consensus expectations. On the other hand, fundamental securities analysts have sometimes become too concerned with the forecasts of other analysts and avoid risk taking in their predictions by hugging the consensus.

A few general results about corporate earnings need be kept in mind. First, growth rates are often not as sustainable as one might hope. Forecasting earnings is difficult enough for CEOs and CFOs of a company, and even more so for analysts outside the firm. Second, the propensity exists for earnings and cash flow trends to mean revert, which means that forecasts are often biased (i.e., too high if trending up and too low if trending down.) This was first observed by Little and Rayner [1962] in U.K. firms 50 years ago.

Third, forecasting the consensus earnings expectation, and indeed any unexpected deviations from that expectation, is a natural determinant of the stock price evolution process. Fourth, the magnitude of stock price swings is a leveraged play on perceived fundamentals of the firm; that is, the prospect of risky earnings means fundamental volatility on steroids.

VALUATION, MISPRICING, AND THE FIRST FACTOR MODEL

Early in the evolution of quantitative modeling, valuation and pricing disparities appeared to be the hallmark of disciplined quantitative investing. Quants could screen large databases for "cheap" stocks and presumably play against the biased behavior of the traders and fundamental portfolio managers who accounted for the bulk of trading volume and volatility in single names. Mean reversion in fundamentals (and stock prices) dictated stock opportunities created by overly optimistic (pessimistic) market participants. Formal methods of achieving "low-priced" portfolios put academic valuation concepts into practice; for example, John Burr Williams authored *The Theory of Investment Value* in 1938, and from the 1960s through the 1980s quantitative practitioners based their dividend discount models on such present-value-of-future-earnings concepts. As noted earlier, Graham was likely the first to formally invest this way.

But what constitutes "cheapness?" Don't some stocks deserve higher prices for the general expectation of higher and/or safer future growth? That question was posed by Whitbeck and Kisor [1963] over 45 years ago when they published (in our opinion) the first multi-factor model. They estimated a rather simple model of a P/E ratio by fitting a linear cross-sectional regression of normalized P/E ratios as a function of growth rate, dividend payout, and risk (standard deviation of earnings). This simple scheme effectively establishes a normative benchmark to calibrate the attractiveness of a stock. Whitbeck and Kisor [1963] did ascribe the important role of the stock analyst: "the task of projection …, to assay the future prospects of individual firms … is not an easy one … for it involves a unique combination of analytical talent, sustained effort, and in some cases, intellectual wizardry" (p. 61).

But do we have to have the analysts? After all, each may have limited capacity—perhaps, 20 to 30 stocks—not to mention that a combination of analytical talent and intellectual wizardry probably costs a lot. Factor models evolved as a means to a more efficient way of identifying attractive stocks.

Arriving at Salomon Brothers from academia in 1986, we discovered "the first audited factor model" by Bower and Bower [1984], professors at the Dartmouth School of Business, who conducted a performance analysis of a factor model that had been created and used at Salomon Brothers. The *fundamental* utility analyst team had estimated and invested in a process that utilized several variables to *factor analyze* a universe of 93 electric utility stocks. The inputs were ROE, dividend yield, quality ranking, and regulatory environment ranking. In effect, Salomon's senior electric utility analyst had crossed over into the world of quantitative factor modeling. During the test period from 1977 to 1981, portfolios of undervalued stocks, as determined by the model, outperformed portfolios of overvalued stocks, ceteris paribus. This was probably the first published performance evaluation of a live quant model with real dollars invested.

As head of Quantitative Equity Research at Salomon Brothers, early on we developed and produced multifactor models for large-cap and small-cap U.S. stocks. Several pension funds used these models in implementing quantitative portfolios that would otherwise have been allocated to index funds (or run with fundamental analysts). The basic approach was called the E Model and represented the level, risk, and projection of earnings per share for each company. The model was rather simple with a one-size-fits-all approach, except for the separation between large-cap S&P 500-like stocks from Russell 2000-like stocks. We used portfolio optimization to tilt the active stock exposures toward the high-ranking securities.[9]

Today's quantitative ranking systems are sometimes much more sophisticated than the 1980s E Model. Over the years, however, extended periods have existed in which some of the basic fundamental ingredients tended to enhance portfolio returns. These ingredients measured stock factors or attributes associated with alpha and were mostly consistent with the preferences of good fundamental investors—buy good quality, buy at attractive prices, and buy when consensus opinions are improving, as reflected in price and/or earnings forecasts. In a recent Nomura research publication, Mezrich [2009] again documented the long-term positive contribution to performance of a simple blend of value and price momentum. His "cheap loser" portfolio consisted of highest book-to-price (B/P) and lowest price-momentum deciles in the Russell 1000, rebalanced monthly. This portfolio roared ahead during 2009, a major reversal considering that high momentum had dominated the scene for most of the last decade.

Practitioners have made many improvements in modeling and implementation over the past two decades, including better inputs, better factor specification (i.e., nonlinear), better optimal-weighting algorithms (i.e., contextual modeling), and so on. However, we are always faced with the likelihood that additional managers will invoke increasingly similar techniques.

In contrast to advancing the search for new ingredients to add to quantitative approaches, some managers choose to stick to simple criteria. Although these managers may represent that they are conducting incremental research, they have found that adhering to a basic combination of price momentum and value has been adequate to run their portfolios. Yet other managers have worked to create techniques to dynamically weight the relative importance of factor categories over an economic (investment) cycle.

WHEN WE ALL LOOK THE SAME

In the history of financial markets, when we all look (behave) the same, we ultimately become quite ugly. Opportunity to make money attracts a crowd. To generalize, the progression has four phases and has been repeated many times in the history of capital markets: 1) innovative risk takers *create*, 2) copiers *converge* on the scene and crowd in, 3) the masses stretch *capacity*, and 4) when the strategy is strained, *collective capitulation* brings demise.

Phases 2 and 3 can last much longer and be much more rewarding to the mediocrity than one might imagine. The latest example is the credit risk bubble that slowly built up in bank, insurance, dealer, and hedge fund portfolios. The specific strategy in question differs, but the behavioral drivers are always the same. In an interview in the *Financial Times*, on July 9, 2007 one prominent bank CEO said in an uncannily timely prelude to Phase 4, "But as long as the music is playing you've got to get up and dance." And dance we do. The attraction of the music has an insidious onset like a jet pilot who unknowingly experiences hypoxia (lack of oxygen). Two elements are always present: 1) greed motivates and 2) leverage facilitates.

Other examples in recent history of collective capitulation include the 1987 stock market crash and the debt and currency crisis of 1997 and 1998. The 1987 portfolio insurance (dynamic hedging) debacle was a simple strategy; use one signal (the level of the S&P 500) to trade one instrument (S&P 500 futures), and do it quickly. As volume grew rapidly, capacity was reached in October 1987, culminating in a 22% decline in the market, literally overnight.

In 1998, the Long-Term Capital Management hedge fund (and innumerable dealer copycats) overcrowded and overleveraged the supposedly hedged trades in emerging market debt. Only after the crisis in the fall of 1998 did the world discover how excessive the notional exposure to a common strategy stretched the market's capacity. An alternative title to Lowenstein's [2001] excellent book on the subject, *When Genius Failed …*, would be *When Greed Succeeded … .*

As stated earlier, quantitative equity once had such growing success that it was sufficient to create a type of market failure. The summer of 2007 was punctuated with volatility in the equity markets related to the deleveraging of some rather large long–short equity funds for which both sides of the portfolio had been populated using quantitative attributes. As these funds liquated to generate the cash needed by investment management firms, many long-only U.S. equity managers with large dependence on traditional quant factors (but who are still considered fundamental managers) suffered large daily swings in performance. Such swift capitulation helped redefine the meaning of product capacity. Creeping convergence by the many on a capacity-constrained winning strategy will result in declining effective capacity for any one manager, even the innovative creators.

The creative early innovators of winning strategies make the most profit as others copy (converge), but stand

to lose with the masses if they stay too long. Add leverage and greed to the equation and the cycle is exacerbated. This is precisely the scenario of the most recent (and perhaps most violent) of such phenomena—the global mortgage default and insurance/financial intermediation collapse of 2007, 2008, and beyond.[10]

THE FUTURE: SHINING THE LIGHT IN THE RIGHT SPOT

Today the realm of successful quantitative equity portfolio investing is moving ahead in some new ways. The "light" used to see the way is improving. The "spot" to which it is directed has increased focus. To be effective, quantitative management must pursue the elements that work best among the fundamental techniques and continually improve the quantitative methods that consistently add value. Recall the advantages of fundamental analysis: 1) depth of information leading to unique portfolios, theoretically creating a large set of non-overlapping portfolios that win (and lose) each horizon period, and 2) insight into market dynamics to prevent model-specification errors or poor timing.

Effective quantitative management will also require much more sophisticated approaches to understanding, modeling, and taking advantage of high-frequency (and real-time) stock price dependencies. Practitioners will be increasingly competing in a world of high-frequency traders—who create volatility. The two sides of this new volatility are 1) alpha-destructive trading costs and 2) alpha-enhancing opportunity costs.

With today's technology, a deeper focus and better vision are possible, and many differentiators are available to help make value-added investment decisions. We now know more about how to optimally combine alpha sources (Sorensen, Hua, and Qian [2004]), and we have created innovative approaches to measure the importance of alpha sources based on their context. Contextual modeling provides deeper fundamental insight by formally ascribing the importance of a set of model inputs based on the homogeneity of a set of stocks within a group according to risk fundamentals and characteristics (Sorensen et al. [2005]).

The successful manager should always search for more insightful data. With access to the Internet and other mediums, we can find uncommon databases that refine our calibration of future earnings and risks for companies without sacrificing breadth. Today, we have access to industry databases, both micro and macro. We can test these data for information content with much greater efficiency than ever before.

We can craft new business models that better differentiate between winners and losers within an industry or sector. Consider the following hypothetical example. After in-depth interviews of airline industry experts, including securities analysts and corporate officials, we believe the following is important in valuing an airline—the number of lost bags per month is inversely related to future earnings and, therefore, to stock performance. This relationship can be thought of as a risk factor, quality factor, cost factor, or management-efficiency factor. We then locate data sources that allow for testing the variable's importance with respect to past stock price performance. We also identify proprietary data sources that can be obtained in an efficient and high-tech manner. Within weeks of the new insight into airline industry performance, we can include this new ingredient, optimally weighted as part of a logical, dynamic portfolio management system.

Many such examples are available if analysts dare to innovate. On the one hand, fundamental analysts may possess the insight, but lack the efficiency and scientific rigor in assigning it the appropriate level of importance. On the other hand, quantitative managers might miss the insight altogether. An early anecdote of true insight—but one that was inefficiently deployed—was a set of Pacific Northwest forest products analyses in the early 1970s. Inventory control of lumber was critical to manufacturers in the boom–bust interest rate cycles following World War II. So, one analyst employed a helicopter to fly over lumber yards to confirm the veracity of management information, but problem weather and geographic distance between inventory sites made the execution of this plan quite difficult. Moreover, any insight was perhaps only a small part of the puzzle. For example, the flyovers gave no information about upstream suppliers and downstream customers or who had pricing power and who had cost pressures. Today, modern quantitative systems and electronic access to key data help to resolve complex problems in a more tractable, comprehensive, and efficiently modeled way.

New research with fundamental depth and focus will be the hallmark of tomorrow's successful active equity managers. We will see the evolution of quantitative equity investing marked by small, diversified, and additive elements of innovative information analysis. Much of this

information will be in sync with modern economic and data-rational thought. It will also be essential to modernize the use of high-frequency price patterns. The goal is to efficiently transform information into seamless forecasts of the winners and losers across the global stock markets, and also add value in the implementation. In the end, the technological and informational innovators will simply be labeled "good investors."

ENDNOTES

[1]In order for the game to be worth playing, the professional equity manager must embrace and apply the three essential building blocks. If the manager is unwilling to do so, it would be wise to pursue an alternative career. Realistic career counseling might include the following: 1) without an undergirding of sound theory, join the journalistic media; 2) without a love for technological advance, join a library staff assigned to literature; and 3) without a desire for speed, efficiency, and accuracy, join a leisure cruise ship.

[2]We often ask prospective clients if they would like to know what we think about the markets. On more than one occasion, the response has been roughly, "You're quants. You don't have to think."

[3]In Michael Korda's [2009] recent book, *With Wings Like Eagles*, about the World War II air war between Britain and Germany, he recounts that the RAF and Luftwaffe fighter pilots and their respective aircraft (Spitfires versus Messerschmitts) were more or less equally matched in the summer of 1940. The difference was that Hugh Dowding, the meticulous and visionary commander of the RAF, implemented a remarkable network comprising air crew, command posts, highly integrated civilian ground teams, and the latest (yet untested) technology—radar. Dowding built a comprehensive "expert system" to mimic and anticipate the Luftwaffe's movements, and it worked.

[4]The author has extensive first-hand work experience with fundamental research as a researcher, professor of securities analyses, and most importantly living in large organizations with major commitments to fundamental analyses on both the sell side and the buy side.

[5]One such firm that coaches analyst groups is Business Intelligence Advisors, Inc. Their website at www.biadvisors.com states that "BIA's proprietary detection of deception, strategic interviewing, and investment intelligence collection models enable our clients to obtain, evaluate, and act on information essential to their investment processes. BIA's unique services are delivered by world-class intelligence experts, who provide independent research, analysis, consulting, and training."

[6]For example, see Cootner [1964], Osborne [1962], and Mandelbrot [1966].

[7]Our summary review of 40 years of empirical study of the efficient market hypothesis (EMH) loosely comprises four phases: Phase 1 when it was impossible to publish if the researcher's conclusion disproved or violated EMH; Phase 2 when it was possible to publish on the topic of market inefficiency if the researcher's finding was labeled as an "anomaly" and probably would not be repeatable in the future; Phase 3 when it was possible to publish a refutation of EMH if it included roughly 30 pages of statistical support in a 40-page finance journal; and Phase 4 when the research addressed "why" EMH did not hold and the explanation was behavioral finance.

[8]For good or bad, many of today's players have more regard for creating personal wealth than for seeking the truth.

[9]One specific public fund ran the E Model tilt for several years with consultant-audited performance metrics during the 1987–1995 period. The portfolios were internally referred to as the S&P 500 Tilt fund and the Russell 2000 Tilt Fund, for large- and small-cap stocks, respectively.

[10]Interestingly, this debacle was also assisted by overly powerful legislators in the U.S. Congress and certain complicit regulators. They effectively influenced artificially cheap supply (sources) of financial intermediation incentives toward nonproductive, consumer-oriented uses. A number of public officials in positions of authority over the financial system engineered an unnatural growth in both supply and demand for credit risk centered on consumer housing that quickly spread to other sectors.

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