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The Efficient Market Theory and Evidence: Implications for Active Investment Management

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Abstract

The Efficient Market Hypothesis (EMH) asserts that, at all times, the price of a security reflects all available information about its fundamental value. The implication of the EMH for investors is that, to the extent that speculative trading is costly, speculation must be a loser's game. Hence, under the EMH, a passive strategy is bound eventually to beat a strategy that uses active management, where active management is characterized as trading that seeks to exploit mispriced assets relative to a risk-adjusted benchmark. The EMH has been refined over the past several decades to reflect the realism of the marketplace, including costly information, transactions costs, financing, agency costs, and other real-world frictions. The most recent expressions of the EMH thus allow a role for arbitrageurs in the market

who may profit from their comparative advantages. These advantages may include specialized knowledge, lower trading costs, low management fees or agency costs, and a financing structure that allows the arbitrageur to undertake trades with long verification periods. The actions of these arbitrageurs cause liquid securities markets to be generally fairly efficient with respect to information, despite some notable anomalies.

All modern investors are faced with the fundamental decision to use a passive management strategy, an active management strategy, or a combination of the two approaches. A passive management strategy is also known as indexing. Indexed assets are invested according to a pre-determined set of rules that seek to replicate the performance of an index of pooled securities whose positive historical performance and risk characteristics have been studied, and are known to match the goals of the investor. Passive indexation started in the late 1970s and grew very popular in the 1980s because of a theory prevalent in financial economics through most of the second half of the twentieth century — the Efficient Market Hypothesis [EMH].

In simple terms, the efficient market theory asserts that, at all times, the price of a security reflects all available information about its fundamental value. A consequence of the theory is that, if true, it is impossible for an investment manager — and hence the clients of the manager — to consistently beat the market. The underlying principle driving the EMH is elegant and intuitive. In a large, active marketplace for publicly traded securities, vigorous competition among scores of investors will drive speculative profits to zero. The implication of the EMH for investors is that, to the extent that speculative trading is costly, speculation must be a loser's game. Hence, an indexing strategy is bound to eventually beat a strategy that uses active management; where active management is characterized as trading that seeks to exploit mispriced assets. In the world of the EMH, there are no mispriced assets because the invisible hand of the marketplace moves faster than any single agent.

We review the extensive theoretical and empirical literature on the EMH. The academic literature on the EMH is vast. While a complete history of its theoretical development is intellectually interesting, we base our review on the implications of the EMH for the practice of active investment management. We begin with a brief discussion of current efficient market theory. Following this theoretical foundation we discuss the recent empirical evidence on efficiency as it pertains to a range of different markets — not simply the large, liquid public securities markets but also the private capital markets.

Our review of the empirical tests of the EMH is divided into two parts: tests on prices and tests on investment managers and institutions. Tests of the theory using past price behavior in the stock and bond markets have occasionally produced evidence contrary to the null hypothesis of efficiency, suggesting that the EMH may not hold for all markets and all times. The logical foundation for these tests is a pricing model that represents the "fair" price of a security in terms of its exposure to a set of common risk factors. The simplest of these models is the Capital Asset Pricing Model [CAPM], and the most commonly used in recent times is a multi-factor model derived from the Arbitrage Pricing Theory [APT]. The APT holds that the investor will be compensated by higher returns for accepting the risk implied by exposure to these factors.

Both the CAPM and the APT stress the important role that risk factors play in determining the expected future return of investment in an asset. Tests of the EMH in this framework are implicitly joint tests of the pricing model and market efficiency, however. Much recent debate has focused on whether such violations should be interpreted as inefficiency, or simply the inability of researchers to correctly identify and specify the risk factors relevant to the market.

If the benchmark is solely a market-weighted portfolio consisting of all traded securities, then active management (defined as deviations from these market weights) may be useful in accessing factor risk premiums which are not captured by market exposure. In the context of the APT this could also be interpreted as passive exposure to additional risk factors. Theory and empirical evidence suggests that investors are compensated for taking systematic risks — such as investing in "value" stocks vs. "growth" stocks and volatility risk — over the long term. In the presence of these multiple systematic risk factors, empirical tests overwhelmingly reject that the market portfolio is efficient and other static or time-varying combinations of assets result in higher reward-to-risk ratios.

The back-tests of trading strategies seeking pure alpha have suggested a wide array of potentially profitable investments. However, for a number of reasons these provide limited guidance to investors. They represent simulated (not actual) returns and do not account for

actual transactions costs, fees, and price impact. They also suffer from potential data-mining biases. Changing market conditions, including time-varying arbitrage activity, make it difficult to extrapolate future performance. Finally, many anomalies are not scalable and cannot be implemented in large position sizes.

The second part of the review on empirical tests of the EMH focuses on returns generated by active managers and institutions. Recent theory and empirical evidence suggests that some fund managers may have talent and out-perform market benchmarks before fees. However, the evidence does not support the conclusion that superior ability filters predictably through to the ultimate investors in those funds. In the mutual fund industry, after-fee returns and alphas are, on average, zero or negative. While the average mutual fund typically underperforms a passive portfolio on an after-fee risk-adjusted basis, there is evidence that under certain conditions better managers can be identified.

Turning to the non-retail sector, there is some evidence of positive post-fee risk-adjusted returns in hedge funds where highly paid managers actively trade marketable securities. One caveat is that the quality and duration of these data, as well as the changing institutional marketplace for hedge fund services, make it difficult to extrapolate such conclusions to future performance. By contrast, there is little convincing evidence of superior risk-adjusted returns to private equity and venture capital. Although some studies suggest skill persistence, the current data are not conclusive on this point. In the real estate sector there is simply not enough information to evaluate whether managers have added value on a risk-adjusted basis.

In other institutional investment sectors, such as large-scale endowments, pension funds and sovereign funds, there is even less evidence about the capability of active management to generate positive risk-adjusted returns. Some U.S. endowments performed exceedingly well prior to the recent crisis using alternative investments as the basis for their strategy. It is often noted that a long-horizon perspective allowed these endowments to focus on alternative asset classes. Most research suggests that pension fund managers are not able to identify top managers *ex ante* and the managers who serve the pension fund sector show little evidence of skill on a risk-adjusted basis. Finally, the few studies

of sovereign fund trades in public securities provide evidence that, while stock prices respond positively when a sovereign fund invests, the long-term performance of these investments is not particularly good.

In summary, the EMH has been refined over the past several decades to reflect information, transactions, financing and agency costs. Tests of the theory on prices have produced violations suggestive of the potential for active management to add value to a multi-asset portfolio, but finding consistent out-performing active managers is difficult. Since the most recent versions of the EMH emphasize the comparative advantages of specialized arbitrageurs due to better information, skill, lower trading costs, and better access to financing, the balance between indexation and active management is a choice variable for which the optimum depends on general beliefs about the existence and potential of manager skill, the pricing opportunities afforded within a given market, the time preferences and risk aversion of the investor, and the expertise and incentive contract of the specific manager.

1

Theory

1.1 Early Theoretical Foundations

The early theoretical articulations of the EMH focused on arguments that future changes in security prices should be unpredictable. The earliest clearly articulated proposition of the random walk hypothesis was by French stock broker Regnault (1863), which included the proposition that the market of a publicly traded asset aggregates all value-relevant information. Regnault constructed an empirical test of the random walk using French government bond data which was roughly equivalent to a variance-ratio test.[1] In the twentieth century, the seminal paper by Cowles (1933) tested whether professional market forecasters could beat random stock selection. His follow-up paper, Cowles and Jones (1937) developed a theory of the random walk of stock prices. Among the first to develop the random walk theory rigorously was the iconoclastic mathematician and father of fractal geometry, Mandelbrot (1963) who showed that, even in a very general framework allowing for discontinuities and extreme events, changes in security prices should be unpredictable. Two years later at the University of

[1] Cf. Jovanovic and Le Gall (2001).

Chicago, Fama (1965) formalized and extended the argument using the law of iterated expectations, arguing that security prices should follow a random walk. The same year, Nobel laureate Paul Samuelson published a famous paper, "A Proof that Properly Anticipated Prices Fluctuate Randomly." In it, he refined the random walk model using the framework of futures prices, showing that spot market prices need not wander randomly, nor should the sequence of daily changes in prices even be uncorrelated with each other. Rather, the EMH implies only that, "The market quotation ... already contains in itself all that can be known about the future and in that sense has discounted future contingencies as much as humanly possible..." In short, futures prices should be unbiased, and that speculation should be a "fair game" with an expected reward of zero or, more generally, an amount that reflects a normal risk premium.

These early theories about market efficiency motivated a number of empirical studies of prices in various asset markets chiefly focused on whether security returns were serially uncorrelated — i.e., whether past price changes could predict future price changes. Although we will not go into these in any detail, the evidence resulting from these "random walk" tests was mixed. Empirical evidence of predictability frequently cropped up in market data, but it was generally dismissed as weak or unexploitable by a speculator due to transactions costs. To some extent, the theoretical logic of the EMH articulated by Regnault, Cowles, Fama, Samuelson, and Mandelbrot was so compelling and ultimately so useful as a tool for the development of asset pricing models that it became the dominant intellectual paradigm for a generation of scholars.

Fama (1970) reviewed the empirical evidence on the Efficient Market Theory using a taxonomy for levels of efficiency proposed by Roberts (1967). Weak form efficiency implies that past returns cannot predict future excess returns. Semi-strong form implies that public information cannot be used to predict future excess returns. Strong form implies that no information (even direct personal knowledge of a merger, for example) can be used to predict future excess returns. Fama concluded that the empirical evidence up to 1970 supported weak-form and semi-strong form market efficiency.

1.2 Market Realism

More recent theory about the EMH has focused on making the theory more realistic. As the above quote of Samuelson points out, information is an essential feature of the theory. In effect the market price "impounds" all available value-relevant information about the future. This feature is common to all of the early theories. However, none of them explore either how the information is generated or the mechanism that causes the information to be reflected in prices. Nor do they provide a motive for information to be generated by the market. Why should a speculator do any research to evaluate the prospects for a company if trading on information is unprofitable? And, if no speculators actually collect information how can it be that prices nonetheless reflect all available information? Wouldn't this lead to a complete market failure and disequilibrium?

In the real economy, research is costly but potentially valuable if a speculator knows something no-one else knows. Indeed, empirical evidence on the gains to insider trading make it clear that illegally obtained private information can generate excess profits — which Fama (1970) would have classified as a violation of strong-form efficiency. This has led to regulations preventing such activity in most U.S. markets. However, this argument extends to publicly available information since if publicly information is already impounded into prices, who would spend time and effort to collect and process this information allowing prices to be efficient? Grossman and Stiglitz (1976) address this paradox through a model of a market with costly information acquisition. In their model traders who invest in research are rewarded through speculative profits so that they at least recoup the cost of their investment. Their trading activity, in turn, pushes prices toward fair economic value. In effect, they become the first mover of the "invisible hand." The Grossman–Stiglitz model portrays a "near efficient" economy in a constant state of controlled disequilibrium, but always moving toward equilibrium, driven by informed, active research and speculation. In the Grossman–Stigliz world, markets are by-and-large efficient but there are small pockets of inefficiency which are exploited by active managers with superior skills and resources.

This realistic picture of the investment market was mirrored by the contemporaneous development of the Arbitrage Pricing Theory [APT] by Ross (1976), who argued that the activity of arbitrageurs would naturally drive the expected return of assets toward a value consistent with an equilibrium trade-off between risk and return. The EMH was preserved by these developments, but it no longer narrowly hinged upon costless provision of information by the market, and no longer ignored the role of arbitrageurs or speculators. Although the Grossman, Stiglitz, and Ross theories about asset prices portrayed a more realistic view of the asset markets, allowing for potential deviations from equilibrium prices and active arbitrage to correct these deviations, they also relied upon some basic assumptions about arbitrageurs. In particular, the arbitrageurs in Ross's APT need to finance their purchases of undervalued stocks by borrowing cash. In order to exploit over-priced stocks, they need to borrow shares they do not have. What if these operations became difficult?

In 1997, Shleifer and Vishny explored the implications of these assumptions in a paper entitled "Limits of Arbitrage." Their paper was based on the old adage that the market can stay irrational longer than you can stay solvent. They constructed a model in which financing risk forced arbitrageurs to be cautious about exploiting mispricing. The implication of their model is that security prices might diverge from economic value for a long time if financing risk is high. The paper was particularly prescient: Long-Term Capital Management [LTCM], a very large, highly levered hedge fund collapsed in 1998. Among their major speculative positions was a bet on the convergence of U.S. vs. European and Japanese bond yields following the Asian currency crisis. This convergence eventually occurred, but in the short run the divergence between the bond yields increased and LTCM was forced to liquidate. The key implication of the Shleifer–Vishny paper for the EMH is that certain agents do not value assets according to rational asset pricing models and are instead driven by sentiment. This sentiment can significantly slow the diffusion of value-relevant information into security prices, and thus both the capital structure and institutional framework for arbitrage matter. Such constraints do not need to arise from behavioral sources; financing constraints or leverage constraints in economies

with rational agents can give rise to the same effects, as shown by later researchers.

1.3 Theory of Active Delegated Management

Thus far, the discussion of the theory about the EMH has focused on the potential for security prices to deviate from fundamental economic value, and the potential of an active manager to profit from this deviation. An equally important question from the perspective of an investor is whether a profitable delegated investment structure is possible. In other words, even if markets were not perfectly efficient, could a non-expert investor take advantage of the inefficiency? This theoretical question is often referred to as the fundamental question of agency introduced by Ross (1973): a principal (the investor) retains an agent (the manager) and compensates the agent for generating a profit. Is there some combination of auditing and incentives that will result in the principal sharing significantly in the agent's gains, or will the price the agent charges for his/her service exactly equal the benefits generated? Put simply, suppose you hire a manager with a track record of generating positive risk-adjusted returns, can you expect to beat the market after fees?

The most influential recent theory about this problem is Berk and Green's (2004) model of delegation. In their model, investors fail to earn positive risk-adjusted returns, even though they rationally invest with past successful managers. Their model allows some managers to be better than others and have talent on average, it rewards managers for information production, managers earn their fees, but the investment technology has diminishing returns to scale: fund flows push successful managers beyond optimal scale. Hence, in the Berk and Green's model, prices may not be efficient, but the market for management services is. While there are gains for active management, these gains do not flow to principals (investors), but are captured entirely by agents (fund managers).

Another important recent theory about delegated investment management does not directly address the issue of price efficiency, but instead explains delegation as a response to changing market conditions. Mamaysky and Spiegel (2001) argue that the benefit of delegated

management rests on the degree to which it is dynamic. Indexing provides only a very limited set of potential payoffs to investors. This range is grossly inadequate for most investor needs, which can only be met by dynamic adjustment of portfolio weights, and monitoring of the macro-economy. Mamaysky and Spiegel argue that managers are compensated for this active process. By the same token, investors who use only passive indexes give up the possibility of optimizing their investments with respect to their possibly complex goals.

These two recent theories are of course not mutually exclusive. It is useful to think of them as describing two different management capabilities: security selection and dynamic portfolio management. Since both are defined relative to a benchmark, this points to an important issue inherent in how active versus passive management is defined: there may exist skill in capturing returns beyond market-weighted passive indices. Moreover, the market-weighted benchmarks themselves may poorly capture the desired risk-return trade-offs of investors.

1.4 The Swensen Approach

One additional conceptual framework for delegated investment management is worth including in this survey, despite it being a non-academic theory. David Swensen, the Chief Investment Officer for the Yale University Endowment published a highly influential book on institutional investing entitled "Pioneering Portfolio Management" in 2000. This book has since become the bible for many U.S.-based endowment funds and has been credited with the broad-based trend toward alternative investing. Swensen posits major differences in efficiency across various asset classes. In highly liquid markets such as fixed income, he argues that the potential for making positive excess returns is limited due to competition and consequently in those markets there is little scope for fundamental research. By contrast, other markets such as venture capital and private equity have large potential payoffs to superior research and management skill. The gains in such markets are not competed away because of the Shleifer–Vishny problem — most managers have limited investment horizons. Swensen argues that perpetually lived institutions such as college endowments can afford to

play in these markets because their horizons are longer than those of their "competitors" for investment management services.

As empirical support for this theory, Swensen notes that the cross-sectional dispersion in manager performance for some markets is much higher than that for others. Few fixed income managers differ from benchmarks by more than a few basis points, while hedge fund managers' track records vary widely. He thus counsels institutional investors with long horizons and sufficient resources to seek superior performance by careful selection of managers in the alternative space, and, if necessary for diversification, use indices for highly liquid asset classes. With the exception of 2008, the excellent track record of the Yale and other large University endowments over the past 15 years has provided some empirical support for his theory. Although the Swensen approach incorporates many of the subtleties of recent academic research, it leaves open a few questions. Among these are whether agency problems can be addressed through contracting and also what the role of dynamic asset management and allocation should be. Another issue is the limited tenure of endowment monitors. The horizon of the institution might be infinite but the horizon of its caretakers might not. Shorter term goals of university managers might induce risk aversion against short-term loss. Despite these caveats the Swensen perspective is a very useful foundation for considering the benefits of active management for the institutional investor.

Although our review of the theoretical development of the EMH is necessarily brief, the high points manifest an evolution from a relatively abstract model of rational expectations to a framework incorporating financing, information, agency, and active management as crucial factors. While the original intuition of the EMH remains robust, i.e., that it is extremely difficult to earn excess returns in a competitive market, current academic theories no longer deny the existence of mispricing. They elaborate instead on the institutional framework for exploiting such mispricings, and conjecture a wider role for active management beyond beating the market.

In the next section we review the key empirical studies that test various implications of the efficient market hypothesis, concentrating on the results relevant to investment management.

2

Empirical Evidence Using Asset Prices

It is important to point out at the outset that much of the academic research on the EMH and active investment management has focused on a relatively narrow spectrum of assets: the U.S. equity market and equity mutual funds. This limitation is due almost entirely to data availability. Good price data for the U.S. stock market became available in the 1970s due to the creation, at the University of Chicago, of the CRSP database of equities. Leading academic research institutions around the world now subscribe to the CRSP data and their scholars have extensively "mined" the data in search of violations of the EMH. Similar databases for mutual funds, hedge funds, private equity, venture capital, derivatives, and even conventional corporate debt are much less accessible and generally much more recent.

As a consequence of this focus on a few major asset markets, the question of the relevance of the myriad of empirical tests of the EMH over the past several decades is a natural one. Institutional investors typically diversify across many different asset classes and national markets, and rarely use retail equity mutual funds as managers. Thus, there is a mismatch between our desire for reliable empirical evidence about efficiency in many different markets and the academic evidence to date.

Given the implicit contrast between indexation and active management, we also include a discussion of the empirical evidence about returns to investing in index funds.

2.1 Price Studies vs. Manager Studies

Tests of the EMH can be divided into studies of prices and studies of investment managers. Studies of prices have generally focused on a search for trading rules that generate positive risk-adjusted investment returns when back-tested on historical data. The existence of such a rule would violate the basic tenet of the EMH, namely that current prices reflect all value-relevant information and are "fair" in the sense of an unbiased game. These studies are simulations of investment returns rather than actual performance — they show paper profits rather than actual profits.

Because of the widespread acceptance of the EMH in the latter part of the last century, any such rule reported in the academic literature was labeled an "anomaly" — a puzzle that challenged theory and could not be explained by economic theory.

2.2 Methodological Issues

It is important to keep firmly in mind the statistical difficulty in distinguishing abnormal performance that is genuine from that which is spurious. With a long history of securities prices it is almost inevitable that some trading rules will appear to be profitable. If the researcher is given carte blanche to search over a wide range of trading rules then the statistical significance that can be attributed to even the best performing rules may be quite small.[1] Data mining issues in finance have been analyzed by Kosowski et al. (2006), among others. Given the numbers of analysts and professors actively studying asset prices, the data mining problem looms large.

Next to data mining the most prevalent methodological issue in studies of market efficiency and manager skill is the fact that all tests

[1] These problems of data mining trace back to the "file drawer problem" of Rosenthal (1979) that the only articles journals publish are those that are "significant" while those that are "insignificant" are relegated to researchers' file drawers (or now hard drives).

are in fact joint tests of a model of expected returns and of efficiency. In order to test for deviations from economic value, the researcher must specify economic value. For tests on stock returns, for example, this usually takes the form of an asset pricing model that relates expected returns to risk factors.

A subtle methodological issue is that most tests of efficiency are based on the Law of One Price, which posits that, in an efficient market, two economically equivalent assets will have the same value. This notion of economic equivalency in empirical studies ranges from the precise to the unmeasurable. For example, notions in the literature of the Law of One Price range from the two assets having precisely the same cash flows, to assets having only the same systematic risk exposure, to a more general notion of a present value relation that relies on a discounted stream of expected future cash flows being economically equivalent to a traded asset. While precise discrepancies in assets with cash flow equivalencies may be easily measured, deviations from the present value relation may not be, due to the impossibility of determining expectations at a moment in time.

2.3 Early Price Evidence Against Efficiency: Anomalies

The earliest reported anomalies, documented in the 1970s and 1980s, showed that fundamental accounting and payout ratios as well as company characteristics could predict future stock returns. These effects were labeled anomalies because their patterns of returns were anomalous relative to the Capital Asset Pricing Model [CAPM], which predicted that only the beta of a stock determined that stock's expected return. These studies measured stock returns relative to the market return as well as relative to other stocks and thus constituted evidence in the cross-section of stock returns against the one-factor CAPM. Later studies uncovered stock return patterns that were anomalous relative to multi-factor models including size, value, and momentum factors.

The earliest anomalies included the small firm effect (Banz, 1981) whereby small-cap companies performed better than large companies, the January Effect (Keim, 1983; Reinganum, 1983) which noted that the first few days in January provided very high returns, the earnings ratio effect (Basu, 1983) which showed that a firm's earnings

yield predicted future excess stock return, the book to market effect (Stattman, 1980) where the ratio of a stock's book value to its market value predicted relative performance, and the short-term reversal effect (Rosenberg et al., 1985). Later research uncovered long-term momentum and reversal effects: Jegadeesh and Titman (1993) showed that investing in the winning stocks over the past years and shorting the losing stocks (known as momentum investing) generated positive excess returns on the order of 8% per year. Debondt and Thaler (1985) documented an even long-term reversal pattern at the 3–5 year horizon.

In the accounting literature, Bernard and Thomas (1989) discovered that investors tended to under-react to quarterly earnings announcements. A strategy of buying on positive earnings surprises and selling on negative earnings surprises yielded positive excess returns and constituted an important contradiction to the EMH. Hand (1990) found that investors reacted to information in annual reports that had previously been disclosed in quarterly reports, consistent with prices being set by unsophisticated agents. Another famous accounting anomaly is the negative relation between accounting accruals (non-cash components of earnings) and future stock returns first documented by Sloan (1996).

2.4 Multiple Factors

Because all efficiency tests are joint tests of a model — i.e., a benchmark, the specification of the benchmark is a vital step in the analysis. Virtually all of the early anomaly studies were based on observing return deviations from a beta-adjusted market model. Because most of these studies were on stocks, and the CAPM argued that the world market portfolio was the only relevant source of risk in the economy, the standard benchmark in early price studies became the U.S. market-weighted equity portfolio. Financial economists like Roll (1977) recognized early on that this was a poor approximation to the world wealth portfolio justified by theory, however the inability to measure the world wealth portfolio presented a practical barrier to implementing theoretically justified benchmarks.[2]

[2] On the one hand, Stambaugh (1982) found that in testing the CAPM, constructing market portfolios including non-listed sources of wealth gave virtually identical results to market portfolios constructed using listed equities. On the other hand, Jagannathan and Wang

A solution to this problem was provided by the recognition that the world wealth portfolio contained within it a relatively parsimonious set of risks, or factors. The Arbitrage Pricing Theory (APT) developed by Ross (1976) generalized the single factor model to multiple systematic risk factors. His theory required that these factors have certain important characteristics. For example, they had to be widely regarded as systematic risks in the economy that, on average, people would wish to insure against. Many extensions of this framework were subsequently developed and some of the predictions of the model were foreshadowed in the intertemporal setting of Merton (1973).

A strong implication of the existence of multiple factors rather than just the single factor of the CAPM is that the market-weighted portfolio of traded assets is inefficient. That is, holding static or time-varying combinations of assets in non-market weights result in higher reward-to-risk ratios than the market portfolio. This was demonstrated by many studies like Kandel and Stambaugh (1987) who found that the market did not provide the highest possible mean return for its level of variance risk.[3] More recent studies like Hansen and Jagannathan (1997), which build on these so-called mean–variance spanning tests, also overwhelmingly reject the single market factor in favor of models with multiple factors. This evidence leaves clear scope for active management to identify benchmark factor portfolios that can price the range of security outcomes and describe the range of efficient portfolios.

Chen et al. (1986) conjectured that these risks would include inflation shocks, unanticipated shifts in the yield curve, business risk represented by GDP shocks, and changes in default premiums (this last one was clearly an important factor in the recent financial crisis) in addition to market risk. Each of these risk factors, which appear in all investments, should thus command a premium from a risk-averse investor. Only a security with a completely riskless real return would require no premium. Securities with higher exposure to these factors would,

(1996) find that it is necessary to include other non-equity market factors, in their case non-traded labor income, in a conditional CAPM.

[3] Cf. Huberman and Kandel (1987) for the basic result and Kan and Zhou (2008) for recent review and econometrics.

on the other hand, be expected by investors to have higher returns going forward, although these returns would certainly vary because of exposure to economic shocks.

The APT did not specify what the factors were, however. Researchers have been trying to develop a parsimonious set of them for many years and the question is far from settled in the literature. Recent creative work, especially in equities, has led to factor mimicking portfolios and benchmarks that include risk from higher moments and non-linearities.

In the single factor world of the CAPM, the definition of good times and bad times is equivalent to high market returns and low market returns, respectively, and also high consumption and low consumption, respectively. In the multifactor world of the APT investors care about more than just low market returns, that is, the definition of "bad times" is extended to encompass other events disliked by the average investor. Economists call these periods of "high marginal utility." For example, suppose periods of low liquidity are also bad times, which are correlated with, but not exactly the same as, periods of low market returns. This extra source of liquidity risk cannot be diversified away by investors trading with each other and liquidity risk is reflected in asset prices along with market risk.

A risk-tolerant investor prepared to bear greater losses during times of high illiquidity can earn a premium. Such an investor supplies liquidity insurance to investors unwilling to bear illiquidity risk. During normal times the liquidity-providing investor collects insurance premiums; during periods of illiquidity this investor faces losses, but overall the insurance provided in normal times outweighs the payouts during bad times and thus the investor earns a positive premium, on average, for providing liquidity. Collecting risk premiums in this multifactor world is similar to selling insurance because the risk premiums are compensation for making payouts, or enduring losses, during bad times. A similar explanation of portfolio allocation in the presence of multiple factors is given by Cochrane (2005). The key insight of the APT is that there are potentially many non-diversifiable sources of risk and that bearing these risks would give rise to earning risk premiums.

The term structure of interest rates also reflects the dynamics of risk factors. Tests of the EMH in fixed income markets have taken a distinctly different form than tests of the EMH in equity markets by testing deviations from the Expectations Hypothesis — that if markets are efficient, then, after adjustment for any risk premium, fluctuations in the forward rate for a given future period in calendar time should be unpredictable. A very large literature beginning from Fama and Bliss (1987) finds that forward rates are biased predictors of future sport rates and explains these deviations by the existence of risk premiums. These risk factors include both yield curve factors, often called level, slope and curvature [see, for example, Dai and Singleton (2003) for a summary], and also macro-factors like inflation and economic growth (see, Ang and Piazzesi, 2003).

One interesting explanation for the excess returns generated by pervasive anomalies is that they actually capture economic risk factors. As such, their higher returns are compensation for higher non-diversifiable risk. Indeed it is now common to use portfolios derived from the size, value, and momentum anomalies as systematic control factors in studies of equity asset returns, despite the fact that there is currently no broadly consistent economic theory linking these characteristics to risk. These have come to be called the "Fama-French" factors, after the researchers who, building on earlier factor models, popularized their use in a landmark paper in 1993. The logic for employing Fama-French factors as a benchmark is that these factors embody systematic risks, which are captured through size, value, momentum, and other factor returns, and a successful active manager must generate a return in excess of the exposures to these factors.

In using the Fama-French factors, academics make two important implicit assumptions. First, it is assumed that these factors can be replicated by a passive investment strategy. Although these factors are constructed from the prices of traded U.S. securities, they do not represent investable returns to a very large, global investor, a point emphasized by Cremers et al. (2008). This is because the Fama-French factors include many small or micro-cap stocks and require high turnover. The second implicit assumption is that the investor has an optimal pre-determined amount of exposure to each factor. In OLS regressions used to estimate

Fama-French factor loadings, this is reflected in the assumption that the factor loadings do not vary over time, at least for the sample used to estimate the factor loadings. The investor is not paying the manager to access these factor risk premiums — the optimal factor loadings can already be implemented by the investor through passive portfolios — and thus active managers should be rewarded only for adding average returns beyond the factor exposure of their strategies.

2.5 Multiple Factors and the Scope for Active Management

The scope for active management can be expressed in terms of the factor models described above. In a CAPM framework, the benchmark portfolio is comprised of the capital-weighted market portfolio. That is, the security weights for each asset are equal to their proportionate percentage of all of the world's risky assets. The active manager has two ways to deviate from this benchmark. The first is to change the proportion of the benchmark itself — to shift some investment from the benchmark into a riskless asset, or alternately, to borrow and buy more of the benchmark. The second is to hold securities in different proportion than the capital weights. Both of these activities (sometimes called timing and selection) have the theoretical potential to add excess returns.

The same scope for active management applies to a multifactor portfolio. The benchmark portfolio in this case is a set of pre-specified portfolios of assets, i.e., factor portfolios, each of which provides a premium to the investor. The manager's scope is now defined in terms of the variation in the relative proportions of factor proportions to hold, and deviations from the individual security weights defined for each factor portfolio. Thus, as in the single-factor case, active management in the multi-factor context has both a dynamic factor exposure component as well as a security selection component. Dynamic weighting of factors may be behind the outperformance of certain anomalies: Ang and Chen (2007) and Goetzmann et al. (2009) show that superior performance of value stocks is due to their time-varying sensitivities in different macroeconomic states.

The dynamic component may add to active management returns by opportunistically increasing the weights on a factor prior to an above-mean realization. The selection component may add value by identifying undervalued securities within a group that comprise a factor and over-weighting them prior to their increase to fair price. Together, these two dimensions comprise the scope of active management. The essential feature of both is not only the dynamic factor weights and individual security selection, but also the choice and definition of the benchmark itself. The benchmark presumably comprises low-cost, passive portfolios. In a multi-factor context, the relative proportions of factors may either reflect the composition of the market portfolio, or a composition that reflects the preferences of the investor with respect to the risks of each factor. Manager skill is therefore evaluated by subtracting the systematic factor returns.

If an active manager is benchmarked against only a single market factor when there are actually multiple factors driving returns, then active management may appear to add value (alpha) relative to the market factor by accessing these other sources of risk premiums, which are not included in the market factor benchmark. In fact, given the overwhelming evidence that the market portfolio cannot span the full range of security payoffs and there exist alternative portfolios with higher reward-to-risk ratios, it would be highly unusual for an active manager not to harvest these alternative risk premiums if the manager's task were defined narrowly to outperform the market benchmark, not a multifactor benchmark. In this case we would expect to see high correlations between the returns of the active manager relative to the market benchmark and other systematic risk factors. However, once the additional factors are brought into the active manager's benchmark then an alpha with respect to the single-factor market portfolio may disappear.

There is a final avenue for an active manager to add value in the presence of a benchmark incorporating multiple factors. Since theory and empirical work have not identified the complete set of factors, active management can also add value by identifying new factors not specified in a multifactor benchmark.

Some current candidates for widely priced risk factors include the following.

2.5.1 Term Structure Risk

Long-term government bonds have historically provided higher yields than short-term bonds and this difference is regarded as a compensation for the exposure to the risk in variation in the future short-term rate, although several theories of the yield curve propose additional reasons for this yield gap, including variation in demand for money at different maturities (see most recently Vayanos and Vila, 2009). Embedded in the long-term rates are also expectations about inflation and inflation risk premiums, since long-term bonds are nominal securities (cf. Ang and Piazzesi, 2003). The long-term bond rate for many countries can be traced back well more than a century through various macroeconomic regimes (see, e.g., Ibbotson and Sinquefield, 1976; Dimson et al., 2002). Thus, its range of realizations can be well understood with sufficient historical analysis. In addition, this long-term data over many political economic regimes also allows a good understanding of the co-movement of the factor with other historically documented premiums such as the equity risk premium. This factor would take long positions in long-term government bonds and short positions in short-term treasury securities.

2.5.2 Credit Risk

This captures the compensation for the risk of default on debt instruments. For risky corporate securities this is effectively a conditional equity premium and thus is likely to be correlated to the equity premium, although it is conditional upon economic events, since defaults tend to be clustered in time. Like long-term government debt, corporate and risky government or agency debt is documented over long periods of time (see, e.g., Ibbotson and Sinquefield, 1976; Dimson et al., 2002), although the cross-sectional quality is limited. At present, an academic attempt is being pursued to extend substantially the historical period over which default risk at the individual bond level can be measured. This factor would take long positions in long-term corporate debt and short positions in corresponding long-term government bonds of the same maturity or duration. Corporate bonds of various credit qualities could be used as default rates of different classes of credit risk are

imperfectly correlated, but in practice bonds in lower risk credit classes tend to be more illiquid.

2.5.3 FX Carry Risk

This factor captures the return to lending in high-interest currencies and borrowing in low-interest currencies. The most basic version of this factor takes long positions in currencies with high yields and short positions in currencies with low yields, but other yield curve measures also predict currencies (cf. Ang and Chen, 2010). This strategy has an implicit premium due to the risk of interest rate convergence, but its use has been documented only over the modern era for which currencies have traded in the capital markets, which is the post-1970s periods after the breakdown of Bretton Woods. Jurek (2007) and many other authors document large gains over multiple year horizons not only for carrying trade strategies, but also to point out that they are significantly negatively skewed, indicative of an insurance-like payoff. Given that the strategy is specific to the era of floating exchange rates, it may be difficult to assess the risk characteristics of the factor over periods of global segmentation.

2.5.4 Value-Growth Risk

This is typically constructed from a long position in stocks with an unusually high book-to-market ratio and a short position in stocks with an unusually low book-to-market ratio. In practice, many other indications of "value" would be used including prices relative to other accounting variables (such as earnings, sales, forecasted and realized earnings, etc.) A conservative view of this factor is that it represents compensation for risk, however researchers lack a good understanding of the nature of that risk. Current theories for the latent risk in the value factor abound and include the hypothesis that the value premium is compensation for low-growth options by inflexible firms with assets in place during periods of distress (cf. Zhang, 2005), or time-varying sensitivities of value stocks that manifest themselves as changing betas in macroeconomic states (cf. Ang and Chen, 2007). The behavioral explanation for the value premium is the over-extrapolation of past growth

rates into the future (cf. Lakonishok et al., 1994). Close to a century of data exists for the value-growth premium (see Davis et al., 2000) via the CRSP database of U.S. equities.

2.5.5 Small–Large Risk

This is typically constructed from a long position in small-cap stocks and a short position in large-cap stocks. There have been various risk-based explanations posed for the small firm effect, including information costs and uncertainty, investor sentiment, liquidity as well as suggestions that the anomaly is due to mis-measurement, or simply a natural consequence of generic exposure to risk.[4] The size effect as measured by the Fama–French (1993) SMB factor has had low average returns since the mid-1980s, but its international version has been more robust.

2.5.6 Momentum Risk

As with the value premium, this factor has a very strong historical premium but no clearly articulated risk. Jegadeesh and Titman (1993) documented positive returns to buying past winners and selling past losers over the post-1926 period. Rouwenhorst (1998) observed profitable momentum returns in international equity portfolios as well. Recent research by Chabot et al. (2008) demonstrate that momentum existed in the Victorian era, indicating that it is not limited to a recent window in capital market history. The scale of momentum returns adjusted for other factor exposures but before transactions costs is on the order of 90 basis points per month, although the returns from the nineteenth century are lower. These returns are not well-explained by value and size factors, nor are they related to booms and recessions in the macroeconomy. To date, the most compelling explanations for momentum are behavioral and are based on investors under-reacting to news (cf. Barberis et al., 1998). Cooper et al. (2004) and Chabot et al. (2008) note that momentum profits depend on whether the stock market itself

[4] Cf. Easley and O'Hara (2004), Barry and Brown (1984), Baker and Wurgler (2006), Amihdud (2002), Roll (1984), Berk (1995).

is in a bull or bear market. Momentum profits turn negative during an extended bear market — the implication being that bull markets attract naïve investors who slow price equilibration.

2.5.7 Volatility Risk

There is a difference between the realized volatility of the S&P500 and the implied volatility of options written on the S&P500 with implied volatility being, on average, higher than realized volatility. This premium arises, among other reasons, because agents are averse to periods of increased volatility and are willing to pay high prices to hedge against significant increases in market volatility — which typically also coincide with downward market moves (cf. Bakshi and Kapadia, 2003).[5] A volatility factor should trade the whole cross-section of options: out-of-the money options are expensive compared to at-the-money options (cf. Coval and Shumway, 2001), there are differences in prices between options on indices and individual options on index components (called correlation trades, cf. Driessen et al., 2009), and exploit this relation in all asset classes (fixed income, currencies, commodities, etc.). This factor is not restricted to just derivatives as any relation between volatility and returns should be captured by a volatility risk factor. For example, Ang et al. (2009) show that stocks with low volatility have high returns in the global cross-section of stock returns. It is also possible to include other higher moment trades like skewness and downside risk (cf. Harvey and Siddique, 2000; Ang et al., 2006a). Since derivatives are leveraged, many derivatives have relatively large transactions costs, and counterparty risk is an issue for realized vs. implied variance swaps, this factor presents more challenges than the other factors.

2.5.8 Liquidity Risk

Another challenging factor to construct is a liquidity factor. Some candidates involve taking measures of liquidity, such as bid-ask spreads, volume, turnover, and other microstructure-based statistics. Studies

[5] See also Section 2.8 for further details on option and derivative returns.

like Amihdud (2002) find that there are differential returns on stocks with high and low microstructure liquidity measures. Other authors like Pastor and Stambaugh (2003) and Korajcyzk and Sadka (2008) construct liquidity measures based on particular covariations of stock returns with certain factors. Many of these measures confound the effect of liquidity and other cross-sectional factors.

Other candidates more directly measure the differences in prices between securities that have the same credit risk. One example is the difference between on-the-run and off-the-run U.S. Treasury 10-year bonds. Most recently issued U.S. Treasury bonds ("on-the-run" or benchmark issues) are more expensive and trade at higher yields than previously issued more seasoned bonds ("off-the-run" or old issues). This phenomenon has been long known by both academics and practitioners (cf. Amihud and Mendelson, 1991; Krishnamurthy, 2002) and has been documented internationally (e.g., Boudoukh and Whitelaw, 1993). The on-the-run/off-the-run effect involves instruments with different trading volumes but identical and, effectively, zero credit risk having different prices. Thus, this measure reflects pure liquidity risk, but it is affected by how and when the Treasury brings to market new issues.

One caveat with these measures of liquidity is that although it certainly captures some dimension of the illiquidity characteristics of less-liquid assets, liquidity factors constructed from assets in liquid markets will not capture all effects or rewards to holding very illiquid assets over very long horizons, such as venture capital, real estate, and other non-listed vehicles. We consider such asset classes in Section 5.

2.5.9 Statistical Characteristics of Factors

As a guide to the risk-return premiums of some of these factors, the table below is taken from Morningstar's Ibbotson Associates, which has been documenting risk premiums with U.S. data for more than 25 years. It provides historical evidence on some of these premiums for U.S. markets from 1926 through 2008, as well as a t-value for testing whether a premium of zero can be rejected.

U.S. data series 1926–2008	Geometric mean (%)	Arithmetic mean (%)	Standard deviation (%)	T statistic
Inflation	3.01	3.10	4.23	6.68
US 30 Day TBill inflation adjusted	0.68	0.75	3.92	1.75
US bond horizon premium	1.92	2.28	8.75	2.37
US bond default Premium	0.18	0.24	3.50	0.63
US equity risk premium	5.70	7.72	20.28	3.47
SMB (small–large)	1.52	2.28	12.76	1.62
HML (value–growth)	5.56	6.87	19.00	3.27
MOM (momentum)	8.09	9.34	14.82	5.71

The second table is taken from the Dimson Marsh and Staunton [DMS] database which reports the performance of major asset classes for a wide range of global markets from 1900. DMS calculate premiums related to major factors including real interest rates, bond premiums maturity premiums and equity premiums.

	Geometric mean (%)	Arithmetic mean (%)	Standard deviation (%)	T statistic
DMS World Inflation	2.98	3.09	4.89	6.61
DMS World Real Bill TR	0.97	1.08	4.68	2.41
DMS World Real Bond TR	1.80	2.30	10.28	2.34
DMS World Maturity Premium	0.82	1.14	8.26	1.44
DMS World Equity Premium vs. Bills	4.22	5.65	17.06	3.46
DMS World Equity Premium vs. Bonds	3.37	4.64	15.64	3.10

We end this section by noting that the set of factors need not be, and empirically has not been, static. For example, only with the introduction of traded options in the late 1960s and the publication of Black and Scholes' seminal paper in 1973 could investors gain exposure to volatility risk. In the past century, foreign exchange risk only became

tradable after the removal of the gold standard and the end of fixed exchange rates in the mid-1970s. Momentum risk only became widely known after the publication of Jegadeesh and Titman's work in 1993. The high yield bond market only rose to prominence in the 1980s. Factors may also disappear. While the size effect was very prominent after the publication of Banz (1981), since the 1990s the size effect, as measured by Fama and French's size factor, has had weak returns in the U.S. As the capability of hedging risks in the economy evolves, risk premiums can be expected to change as well. For example, the weakening of the size effect in the U.S. is consistent with efficient markets where the actions of informed investors cause a CAPM anomaly to be arbitraged away.

2.6 Recent Anomalies

Since the 1970s, researchers and practitioners have uncovered, and continue to find, anomalies that appear to survive the size, value and momentum factors. From January 2006 to December 2010, there were at least 24 articles in the Journal of Finance documenting new anomalies. These include Ang et al. (2006b) who show that firms with higher idiosyncratic volatility have lower returns, Baker and Wurgler (2006) who document that investor sentiment is priced in the cross-section of stock returns, and Kumar and Lee (2006) and Kaniel et al. (2008) who find that the trading of small retail investors influences stock prices. Edmans et al. (2007) find that World Cup elimination losses result in next-day negative stock returns. Campbell et al. (2008) find that stocks with high distress risk have abnormally low average returns. Fang and Peress (2009) find that stocks with little or no media coverage out-perform stocks with large media coverage. Many of these anomalies were found not in datasets that are new to the profession but in the same datasets, except with longer samples, used by the early researchers. Naturally, this raises issues of data mining by hundreds of researchers combing the same datasets for apparent mispricing.

Some recent anomalies have an economic rationale based on slow diffusion of information. For example, Cohen and Frazzini (2008) organize U.S. firms into supply networks, and find that shares of suppliers react

later to economic shocks than do the primary manufacturing firms to which they serve as a supplier. A trading rule based on this information lag generated positive profits — contrary to the implications of the EMH. Similar evidence is found by Menzly and Ozbas (2010). These studies are particularly interesting because they make clear the nature of the efficiency violation: there are limits to the capacity of the market to understand cross-company and cross-industry economic news. Behavioral explanations based on the under-reaction of agents to news shocks also motivate many recent anomalies. This under-reaction may be caused by limited attention, agents incorrectly updating beliefs, or not taking into account all available information in making decisions. Such effects underlie the different market reactions to tangible and intangible information (Daniel and Titman, 2006), the reversal and subsequent out-performance persisting up to one year of stocks with high returns over the past week (Gutierrez and Kelley, 2008), and the recent anomaly of different price responses to earnings announcements on Fridays versus other days of the week (Dellavigna and Pollet, 2009), among many others.

Many trading strategies which have been and continue to be pursued by hedge funds have been back-tested by academia and found to be profitable; among them, pairs trading (Gatev et al., 2006), merger arbitrage (Mitchell and Pulvino, 2001) and convertible bond arbitrage (Agarwal et al., 2010). Similar back-tests of trading strategies have yielded positive risk-adjusted returns to trading in other assets, including fixed income (Duarte et al., 2005). Likewise many trading strategies by active managers are inspired by academic research.[6]

Although thought-provoking, studies on historical archival data are ultimately limited in their capacity to prove that markets are inefficient. In addition to the problem of data mining, it is also the case that many researchers generally do not consider realistic expenses such as transactions costs, management costs, and financing costs. Further, all analyses of past prices are, by definition, conditional upon market

[6] Two pedagogical examples are provided in Harvard Business School cases 9-298-012 "numeric investors l.p." which considers investing in the well-known value and momentum effects and 9-209-047 "Martingale Asset Management L.P." developing a strategy based on low volatility stocks outperforming high volatility stocks.

operations that do not include an investor's own presence. Estimates of actual price impact for certain popular equity strategies such as size, value and momentum suggest that this conditioning is important (Chen et al., 2002; Korajcyzk and Sadka, 2004), but trading costs do differ widely across different types of investors. While transactions costs may be an impediment to arbitrageurs entering the market and removing a potential mispricing, they usually do not explain why prices are initially formed to give rise to an anomaly. Nevertheless, many anomalies tend to occur in less-liquid securities and these cannot be exploited in extremely large sizes.

The bottom line is that the study of "anomalies" and later price-based empirical tests of the EMH do not reflect the actions of real-time investors operating in actual markets with real price impact and expenses. While they are suggestive of market inefficiencies, they do not prove that any investor actually profited or even could have profited from such activity.

To the extent that an investor seeks to exploit these documented anomalies through direct strategies or by employing managers who rely on them, it is important to consider that the investment community has a tendency to converge on the same set of quantitative strategies to generate alpha. For example, Lø (2007) studied the several U.S. equity market moves on August 7, 2007, and found evidence that when one major hedge fund unwound large positions, it caused severe dislocations in the prices of small cap stocks and other securities used in convergence strategies. This was almost certainly due to the fact that many different active managers were using the same models — and hence holding the same securities — in their quest for alpha.

The implication for an investor is that many of the documented strategies for generating positive risk-adjusted returns through exploitation of mispricing have already attracted considerable capital. While proprietary strategies based on unpublished anomalies are less likely to suffer from such coordination, it is worth noting that many of the leading quantitative managers were trained in the same anomaly literature and methods. Some at major institutions are in fact authors of the studies cited above. Although they may be working separately, it is likely that many of these managers are operating within the same

conceptual paradigm. Lo's (2007) findings suggest that this represents an additional source of systematic risk.

Among the set of short-term pricing anomalies, those for which a long-term investor has a comparative advantage will be those that reward rather than penalize scale — for example high fixed-cost research-based strategies in very liquid markets as opposed to strategies that focus on illiquid securities with high transactions costs. The Efficient Market Theory would suggest that, at least with respect to relative value mispricing, these opportunities will be difficult to find.

By the same token, the Shleifer–Vishny theory would suggest that a patient, well-capitalized investor may be able to find price discrepancies that take a long time to converge. There are fewer of these studies in the empirical literature because they are harder to benchmark and to track through time with statistical accuracy. For those that exist — such as value investing –investors with shorter horizons or capital constraints might avoid these opportunities and leave them to "value" investors. This would imply, however, an appropriate horizon for performance evaluation needs to be explicitly chosen to align incentives to find and invest in those opportunities.

2.7 Long-Horizon Forecasts as Evidence of Inefficiency

Most studies of pricing anomalies focus on departure from relative value; in effect whether one group of close economic substitutes deviates from another. An alternative question is whether whole asset classes like the stock market itself might be over-or under-valued. In the late-1980s researchers began to document and debate the apparent predictability of the aggregate stock market at long horizons: low dividend yields and earnings-price ratios, for example, were found to predict lower market returns. The market itself appeared to have a mean-reverting component that seems to suggest time-variation in actual and perhaps expected returns. The key papers demonstrating long-horizon predictability include Fama and French (1988a,b), Poterba and Summers (1988) and Campbell and Shiller (1988). These papers show that past stock returns, dividend yields and earnings-price ratios predicted multi-year stock market returns.

Shiller (1981) took a closely related approach to testing market efficiency at long horizons that was based on the question of whether the stock market might vary considerably from its fundamental value, as represented by the present value of expected future dividends. He argued that stock prices were too volatile compared to changes in future dividends. He tested this proposition of "excess volatility" by comparing the volatility of the stock market to the volatility of the discounted present value of future dividends and found standard deviation of the former greater than the latter — even though asset prices are expectations of future discounted values. This result essentially implied that investing at long horizons was less "risky" than at short horizons, and that using fundamental indicators of market value — like the dividend yield or the earnings-price ratio might be a guide for timing the market.

These long horizon studies of market efficiency were not based on beta-adjusted equivalencies, but on a present value model. They thus relied upon a critique of the unobserved expectations of market participants, and the suggestion that the markets could be irrationally valued in aggregate. This was most succinctly expressed by Summers (1986). Many researchers, Marsh and Merton (1986), for example, questioned the ability of empirical tests to distinguish between the formation of rational expectations at a given time in the past, and irrationality defined ex post by academics.

Extensive research over the following decades has qualified the findings on long-horizon predictability of excess returns on econometric grounds. Richardson (1993) and others pointed out that the statistical tools used in long-horizon prediction studies led to problems in inference. Goetzmann and Jorion (1993, 1995) cast doubt on whether the dividend can be used to forecast the equity premium at longer horizons due to issues of statistical power. Recent studies demonstrating the weakness of the long-horizon predictability evidence are Ang and Bekaert (2007) and Welch and Goyal (2008). Welch and Goyal find no convincing evidence that fundamental ratios could have been used out-of-sample to beat the market.

It should also be noted that, apart from issues of statistical power, evidence of predictability in returns by itself does not necessarily violate

efficiency: it could simply reflect changes over time in expected returns or the risk premiums associated with priced factors. In fact this is part of a broader problem, namely that no firm conclusions about efficiency are possible without the "correct" model of expected returns. Unless two return series are perfectly correlated, a difference in their average returns could be due to a risk factor which has not been properly accounted for in the model of expected returns. This "joint hypothesis" problem affects analyses of efficiency in all asset classes and, in particular, in equities and fixed income.

Despite questions of statistical power, the insights from the efficiency studies at longer horizons have generated proposals for dynamic investment strategies for long-term investors. For example, Campbell and Viceira (2002) propose strategies for strategically varying exposure to interest rates and other macroeconomic variables over the business cycle. Recently, Wachter and Warusawitharna (2009) addressed the statistical uncertainty about long-horizon predictability of asset classes in a Bayesian framework and showed that even an investor who is relatively skeptical of predictability would vary their exposure to U.S. stocks and bonds using the dividend yield as a forecasting variable. However, despite these theoretical benefits it is not easy for many investment entities to shift large amounts of money at short horizons to capture these benefits. Moreover, Ang and Bekaert (2007) using longer data series, international markets and a robust, non-linear specification find that, "At long horizons, excess return predictability by the dividend yield is not statistically significant, not robust across countries, and not robust across different sample periods."

The academic debate over long-horizon predictability remains a lively one. The question at issue is whether deviations from the long-term policy portfolio based on macro-economic variables can add value, ex ante. In particular, should an investor seek to add value through a policy of actively adjusting its exposure to the equity premium or to other priced factors through long-horizon forecasting models? There is no satisfying answer due to the fact that tests of long-horizon forecasting skill demand much longer time-series data than exist for active managers. Consequently, although it is useful to recognize the potential value to be added by correctly predicting long-term premiums, no

convincing empirical evidence suggest that is a reliable basis for an active strategy.

There has also been considerable research into whether changes in risk premiums might be forecastable in the short term. In a widely cited article, Ferson and Harvey (1991), presented evidence that monthly stock and bond portfolio returns were predictable using variables such as the equity premium, inflation shocks, yield curve changes and changes in default spreads. In their framework, this predictability is not a source of excess, risk-adjusted return, but rather a reflection of the fact that factor risk premiums change through time. Ferson and Schadt (1996) and Ferson and Kang (2002) propose that the predictable component of the variation in factor premiums should be incorporated into the evaluation of manager skill. We cite some evidence on the application of this multi-factor conditional risk adjustment to mutual fund and pension fund management below.

2.8 Derivatives

Under the strong assumption of no arbitrage and no transactions costs, derivatives are redundant assets, implying that there should be no difference between examining the returns of derivative securities or the returns of their underlying assets. This redundancy presents researchers with excellent opportunities to test market efficiency. As options market data became available for financial research, and formal models deriving option prices from the value of underlying securities developed, empirical studies examined whether option prices conformed to theoretical predictions. The virtue of tests on option prices is that, unlike tests based on stocks and bonds which rely on risk-adjusted expected returns, tests based on redundant assets are able to test the null of the law of one price.

Tests on derivative assets have a long history. Bachelier (1900) tested his continuous-time option pricing model on French government bond options and found a relatively close fit. Stoll (1969) proposed and tested put-call parity and concluded that the results supported the random-walk hypothesis. Black and Scholes (1972) performed a joint test of their famous option pricing model and the efficiency

of the options market. They found evidence of mispricing, but no profitable strategy to exploit it after accounting for transactions costs.

Tests of the Black–Scholes model using data after 1972 presented an interesting problem for research because of its widespread adoption by traders. A number of scholars addressed this by using historical options data to determine whether the forces of arbitrage — absent the Black Scholes formula — were sufficient to drive derivative prices to their theoretical value.[7] The general finding is that pre-1972 option prices conform relatively well to modern model prices, implying both model efficacy and forces of arbitrage driving markets to efficiency.

Because option pricing models make strong predictions about prices in many dimensions they have been used to test model robustness with respect to input variables such as option maturity, strike price, interest rates, and variance. An active stream of research focusing on the cross-section of option returns has demonstrated the limitations of the basic Black–Scholes model. Rubinstein (1985) was one of the first to find that implied volatilities vary by the strike and maturity of the option, contrary to the simple model of Black–Scholes where volatility is constant. Later researchers developed models of stochastic volatility to capture the volatility smile or smirk (the pattern of option implied volatilities across strike prices) and the term structure of volatility (the pattern of option implied volatilities across maturities).

Later option pricing models were developed to fit these patterns. An important contribution was made by Steven Heston in 1993, who specified the volatility as a stochastic Cox–Ingersoll–Ross (1985) process allowing the tractable computation of option prices with time-varying volatility. Pan (2002) and Eraker et al. (2003) argue that in addition to stochastic volatility, jumps in returns or jumps in volatility, or both, are also necessary to match the implied volatility smile and term structure of implied volatilities. Bakshi and Chen (1997) sought to understand the relative contribution of different extensions of the Black–Scholes model by running a horserace among many of the proposed extensions. They found that allowing jump processes improved

[7] Cf. Moore and Juh (2006) for a review.

pricing but that allowing for stochastic volatility is generally sufficient for hedging purposes and thus absence of arbitrage.

Backtests of certain index option return strategies have been shown to yield strikingly profitable payoffs. For example, Coval and Shumway (2001) examine the returns of zero-beta straddles. In the Black–Scholes model, the zero-beta straddle should have an expected return equal to the risk-free rate. More generally, zero-beta straddles should not be sensitive to market returns (zero beta), but are sensitive to volatility: if volatility is higher (lower) than expected, zero-beta straddles have positive (negative) returns. In data, Coval and Shumway find that selling zero-beta straddles makes, on average, 3% per week. Bakshi and Kapadia (2003) consider a strategy of delta-hedged long option positions. A portfolio of a long call and delta-hedged short stock (or a long put and delta-hedge long stock) should give a risk-free investment according to Black–Scholes. Bakshi and Kapdia show that these strategies significantly underperform zero. Constantinides et al. (2011) define leverage-adjusted option returns, which are the returns on an option and a risk-free rate where the weight on the option equals the inverse of the option price with respect to the underlying security. Contrary to Black–Scholes, leverage-adjusted option returns are decreasing in their strike prices.

The patterns of index option returns found by Coval and Shumway (2001), Bakshi and Kapadia (2003), and Constantinides et al. (2011), among others, are partially consistent with an aggregate volatility risk factor, where the risk premium on volatility is negative. Jump risk aversion, where investors fear large negative jumps in returns is likely to also play a role (cf. Bates, 2008). Economically, equity options provide a hedge to volatility spikes, which are correlated with negative market returns, and downside risk. Investors are willing to pay a premium to trade options, which pay off when volatility increases, increasing the price of options relative to the case where volatility does not carry a price of risk. In addition to risk factors, Bollen and Whaley (2004) and Garleanu et al. (2009) have also modeled option prices by demand pressure. Demand enters as a factor because option market makers are liquidity constrained and options prices reflect the demand pressure from option end-users. This is similar in spirit to Shleifer and Vishny's model of investor sentiment.

Individual options (as opposed to index options) also exhibit anomalous patterns relative to the Black–Scholes model. Certain authors have examined the relationship between index options and individual options. Driessen et al. (2009) find that correlation risk explains the differences in prices between index options and portfolios of individual options. Duan and Wei (2009) find that the level and the slope of the individual option smile curve are high when there is a large systematic component in the stock variance. Carr et al. (2009) examine variance swaps and they find that the individual stock volatility risk premium is negative and cannot be explained by traditional Fama–French factors.

Since options are empirically non-redundant securities, an interesting question is whether news is incorporate into option prices before stock prices, or vice versa. The earlier literature not reviewed here used intra-day or daily frequency data and found mixed results. A more recent literature has now uncovered compelling evidence that option prices contain predictive information about stock returns and vice versa at longer, monthly frequencies. Cao et al. (2005), for example, find that merger information hits the call option market prior to the stock market. The difference between implied and realized volatilities (cf. Bali and Hovakimian, 2009), put-call parity deviations (cf. Ofek et al., 2004; Cremers and Weinbaum, 2010), measures of risk-neutral skewness (cf. Xing et al., 2009), and simple changes in implied volatilities (cf. Ang et al., 2010) predict underlying stock returns. Ang, Bali and Cakici also find that past stock returns can predict future individual option implied volatilities.

During the financial crisis 2007–2009, the prices of several derivative securities significantly moved outside arbitrage bounds. These are failures of the law of one price: different portfolios giving (nearly) identical cashflows trade at different prices. Notable examples include the violation of covered interest rate parity (cf. Coffey et al., 2009) and the corporate bond CDS basis (cf. Garleanu and Pedersen, 2011). The 30-year swap spread (the difference between the rate on the 30-year swap and the 30-year Treasury with the former having higher credit risk than the latter) turned negative during the financial crisis and at the time of writing is still negative. A large number of recent papers can now explain why these arbitrage deviations can occur and persist: margin

requirements, leverage constraints, liquidity, collateral values, limits to arbitrage, and other frictions affect asset prices. These effects give rise to the same tendencies where mispricing can occur similar to the limits of arbitrage of Shleifer and Vishny. That these (temporary) deviations from the law of one price tend to occur during periods of turmoil has led some to suggest that recurring volatile periods and crashes themselves may violate efficiency, which we now discuss.

2.9 Crashes as Evidence

One additional popular challenge to the Efficient Market Theory is the belief that periodic crashes in asset prices are prima facie evidence against efficiency. The crash of 1987 engendered considerable discussion since the U.S. market fell by more than 20% over two days. If prices reflect fundamental values, and no relevant information about those values appeared to spark the crash, then how could the EMH be true? The answer is of course that the theory only requires that prices reflect the aggregate expectation of economic value. Prices do not have to be economically "right." They need only be consistent with rational economic reasoning at the time (cf. French, 1988).

The crash of 1987 is an interesting example. Immediately after the crash, the common wisdom was that prices had been too high due to market euphoria. The dramatic market rise in the months and years after the crash suggests that, if anything, the crash was a panic and that prices before the event were closer to the present value of the market than prices afterwards. All that market crashes tell us about the EMH is that expectations — whether optimistic or pessimistic — can deviate widely from ex-post realized economic value. The theory does not require humanity to be prescient, merely to use its knowledge in pursuit of speculative profits.

The financial and economic crisis over 2007–2009 is another case in point. The fact that prices in many asset classes simultaneously declined is not evidence against the Efficient Market Theory per se. In fact, the large negative commonality of asset price movements during this period is consistent with an underlying Ross (1976) APT model where many asset classes are exposed to the same common factors.

Systematic factors themselves can be correlated and there is no reason why factor returns should be symmetric. Furthermore, it is well known that exposures to systematic factors vary over time and increase during bad times (cf. Ang and Chen, 2002) causing many asset values to decline together. Hence, the failure of diversification of a portfolio holding many alternative assets not providing adequate downside protection can be interpreted as not correctly measuring underlying factor exposure of those alternative asset classes.

In the next section we turn to studies of active management which utilize historical data on investment manager performance. While it also suffers some of the same limitations of price studies in that scale diseconomies are potentially significant — particularly for very large investors, they are one step closer to realistic tests of the value of active management and its relation to the EMH.

3

Mutual Fund Performance as Evidence

As noted previously, mutual funds are not commonly used by large institutional investors and thus are far from ideal for determining the potential value-added by active management for one of the largest institutional portfolios in the world. While the mutual fund literature is enormous, we concentrate only on those studies focusing on aspects most directly relevant to the EMH. An important point to note is that since mutual funds are targeted primarily at the U.S. retail clientele, their relatively high costs represent a high hurdle for tests of skilled active management. The discovery of manager skill in the mutual fund industry would constitute compelling evidence to reject the EMH, however the converse is not true. Skilled managers might offer their services in venues with less regulatory burden and record-keeping expenses. We examine these other vehicles in Section 4.

3.1 Active vs. Passive Performance Tests

Researchers have been studying the average performance of U.S. equity mutual funds for several decades. Jensen (1968), for example, introduced the famous "alpha" formula as a means to adjust mutual fund

returns for differential exposures to the market portfolio. He found no evidence of systematic manager skill. The philosophy behind these tests is that active managers have to outperform the benchmark and that the amount of benchmark risk (the factor betas) can be specified by the investor. In Jensen's original article the benchmark is the market portfolio and the approach has been extended to zero-cost portfolios capturing size, value, momentum and other CAPM anomalies (cf. Carhart, 1997). A related approach is introduced by Sharpe (1992) who specifies low cost index funds as the factor benchmark. An important underlying assumption behind these tests is that the factor exposures can be replicated by the investor and most studies assume that these factor exposures are constant.

Rather than reviewing the series of studies since Jensen (1968), it is sufficient to cite some of the most recent and carefully performed studies. Fama and French (2010) use data from 1962 to 2006 to examine evidence for skilled active management. Using their Fama–French factors and a momentum factor as a benchmark, the authors find that equity mutual funds provided negative 85 basis points per year to the investor. In short, indexation would have been better than investing with an active equity manager, on average. Before fees, Fama and French find that active management added approximately 30 basis points per year but do not find this amount statistically significant. They also note that the cross-sectional variation in manager performance is inconsistent with the existence of a group of over-performers as there were fewer extreme positive performance managers than would be expected by chance.

Wermers' (2000) comprehensive study of mutual fund performance also uses stock-level characteristic controls as well as factor benchmarks. The former involves constructing control portfolios that hold stocks with the same book-to-market ratios, size, and other firm-level characteristics as the stocks held by the mutual funds. He finds that mutual funds outperform the S&P500 on a gross basis, but underperform on a net basis. Similarly, the average gross alpha is 0.79% per year, but the average alpha after risk controls is -1.16% per year. Ferson and Schadt (1996) argue that the evidence for significant underperformance by fund managers is mitigated after taking into account predictable

time-variation in factor risk premiums and find, that the average risk-adjusted post-fee mutual fund returns over the period 1968–1990 are about zero. They suggest that raw mutual fund manager performance suffers from poor timing of factor exposures.

In his presidential address to the American Financial Association, French (2008) goes further and computes the cost of active management to all investors — including individual investors, mutual funds, institutions, and hedge funds in the U.S. equity market. He concludes that the average investor would increase his average return by 67 basis points per year switching from active to passive management.

The results in Wermers (2000), Fama and French (2010), and others echo the common finding in the very large mutual fund performance literature that mutual funds beat, or equal the market, before costs but underperform their benchmarks after costs. Despite this considerable evidence, productive research on the question of whether mutual funds in aggregate indeed underperform continues. Linnainmaa (2010) for example, shows that including defunct funds in an analysis of industry performance introduces a reverse survival bias that could offset the documented negative industry alpha.

An interesting recent approach to the question of whether active management should be rejected as a strategy is to ask under what set of beliefs concerning market efficiency an investor should eschew all active management. Baks et al. (2001) address this question using a Bayesian framework and their results suggest that virtually all investors — even very skeptical ones — would use at least some active management. In a related approach, Pastor and Stambaugh (2002) find that, "Investing in active mutual funds can be optimal even for investors who believe managers cannot outperform passive indexes." These Bayesian approaches make a strong case for active investing even in mutual funds. However, the proportion of active management remains an open question.

3.2 Relative Performance Tests

Another approach to the question of active management is to see if winning managers repeat their superior performance. Tests of performance persistence have a long history beginning with Sharpe (1966),

who found that winning funds over the decade 1944–1954 were more likely to be among the winners over the period 1954-63. Since then, researchers have continued to find evidence of performance persistence consistent with the hypothesis of differential manager skill. Grinblatt and Titman (1992, 1993) found that past risk adjusted relative performance predicted future risk adjusted relative performance. Brown et al. (1992), Hendricks et al. (1993), Goetzmann and Ibbotson (1994), and Goetzmann and Brown (1995) likewise documented performance persistence using slightly varying methodologies. The last paper pointed out that persistence was driven mostly by repeat-losers as opposed to repeat-winners, which Gruber (1996) and Carhart (1997) also confirmed.

Carhart (1997) pointed out that performance persistence was explained by a momentum factor — a result consistent with the findings by Grinblatt et al. (1995) who found that mutual funds tend to chase winning stocks. The net result of these studies is that there appear to be persistent differences in manager performance. These differences may ultimately be explained by differing styles. The literature does not support the conclusion that investing with winning managers, on average, will increase a mutual fund investor's probability of beating the market on a risk-adjusted basis.

3.3 Flows, Incentives, and Mutual Fund Returns

One interesting finding germane to the issue of market efficiency is that flows into and out of mutual funds are strongly related to lagged performance measures (cf. Chevalier and Ellison, 1997; Sirri and Tufano, 1998). But once this money enters funds that have performed well in the past, these same funds tend not to outperform in the future. Such a phenomenon is explained by Berk and Green's theory where managers do have ability to add value but this ability decreases as funds increase in size. As investors learn from past returns they shift their money into funds with high past performance, but as these funds increase in size the manager's alpha disappears.

Another area of the mutual fund literature relevant to tests of market efficiency is the finding, both theoretically and empirically, that

incentives matter for performance. Chevalier and Ellison (1997) show that the strong response of investor flows to past performance tends to reward risk taking by mutual fund managers since mutual fund managers are compensated for assets under management. Elton et al. (2003) look explicitly at incentive fees in the mutual fund industry and find that funds that have compensation tied to performance exhibit stock selection ability. Khorana et al. (2007) study funds in which the manager owns shares and thus has an economic alignment with customers. They find a slight but significant positive relationship.

3.4 Conditioning Factors to Identify Skill

The current mutual fund literature is not entirely negative on the existence of managerial skill, however. A number of recent studies have found evidence that some active managers are able to deliver positive risk adjusted returns. The degree to which managers actively rebalance their portfolio appears to be an indicator of potential skill. For example, Mamaysky et al. (2008) evaluate managers by allowing dynamic exposure to systematic factors. They use a technique called a Kalman filter to control for changing portfolio weights. This adjustment results in strong evidence of positive risk-adjusted manager performance, which they interpret as skill. Taking a different tack, Cremers and Petajisto (2009) separate active vs. passive managers using a method called "active share." Managers with higher active share exhibit much stronger positive performance persistence. A third paper focusing on the relative quality of active managers is Kacperczyk et al. (2006). They sort managers based on their unobserved — or unmeasured — portfolio re-balancing activity within the calendar quarter and find significant persistence in positive risk adjusted performance for the most active mutual fund managers. In another paper by one of these authors Kacperczyk and Seru (2007) show that managers who rely less on public information perform better.

Other recent research investigates the possible sources of mutual fund manager alpha. Baker et al. (2010) study mutual fund manager trades around earnings announcements and discover evidence of skilled trading around earnings announcements. This finding suggests that, at

the very least, managers can forecast earnings announcements better than the public. In a similar vein, Da et al. (2010) look at timely trading by fund managers, reasoning that these trades are more likely to be informed by value-relevant information that will shortly diffuse broadly in the market and affect stock prices. Managers who profit from timely trading of this nature exhibit performance persistence. This finding is consistent with a Grossman–Stiglitz world of rewards to fundamental research.

Wermers (2000) looks at the stocks held in mutual fund portfolios in the decade from 1975 to 1994 and shows that they outperform as a group — suggesting that mutual fund managers are skilled stock pickers. Consistent with the other evidence on active managers providing better returns, he found that high-turnover funds generated positive excess returns.

Cohen et al. (2010) look at the largest holdings of active managers to identify stocks for which the managers have the greatest conviction. These "best ideas" in the manager portfolio tend to strongly outperform the other stocks they hold. The authors interpret this as strong evidence against the EMH. Even if the total portfolio does not outperform, the "best ideas" of the manager do. They interpret their evidence as supportive of the Berk and Green theory of diminishing returns to scale, where scale in this sense is measured by number of stocks held rather than by the dollar value of the portfolio.

In contrast to the aggregate studies of mutual fund manager skill discussed in the previous section, the above papers strongly suggest that some managers in the mutual fund population are able to identify underpriced securities and trade profitably. Since many of the recent studies focus on after-fee returns, the further implication is that the fund investors also profit from this differential skill. How does one reconcile the earlier negative evidence about mutual fund performance with the recent results? It is clear that skill, if it is present, is realized through dynamic strategies. It has long been known that when active managers shift their exposures to systematic risk, the standard linear model used to calculate alpha or risk adjusted return break down. Skilled timers might have negative alphas and yet still deliver value to a client, as Dybvig and Ross (1985) point out. Thus, dynamic strategies

are, by their very nature, difficult to measure with standard, static factor models.

There are other ways that active mutual fund managers can potentially deliver positive risk-adjusted returns. Some funds change exposures to different systematic factors (cf. Jagannathan and Wang, 1996). In the standard factor control regressions the exposures to the factors are estimated to be constant. However, Mamaysky et al. (2008) find strong evidence that active management adds value by allowing dynamic exposure to systematic factors. Like the conditional performance metrics of Ferson and Harvey (1991), however, the beneficial predictability in their analysis is mostly short term in nature. Timing skill, if it exists at all, is likely to be only measureable at short horizons. Thus, dynamic strategies are, by their very nature, difficult to measure with standard, static factor models. Indeed, recently Goetzmann et al. (2008) show that many dynamic strategies, or the use of derivatives by active managers, cause the standard linear model used to calculate alpha or risk-adjusted return to misrepresent performance. Nevertheless, changing factor exposures, relative to a market-weighted portfolio or a set of factors with fixed weights, is a potential source of alpha.

4

Other Managed Portfolios as Evidence

In this section we summarize the performance of other managed funds. Given the large number of constraints under which mutual funds operate and that superior talent may be attracted by the larger fees levied by other alternative asset vehicles, non-mutual fund portfolios constitute an interesting area to investigate active management. These managed portfolios are also far more relevant to institutional investors who have a large choice of investment vehicles beyond mutual funds.

4.1 Institutional Funds

In this category, we place institutional funds such as pension funds and endowments as well as large-scale private capital pools, although the latter differ in that they are taxable. Institutional funds are distinct from mutual funds because they have much lower servicing and marketing expenses, and the decisions are made by professionals rather than retail investors. These lower costs should, in turn, represent less drag on performance.

There have been few studies on institutional funds and managers. Tonks (2005) uses UK pension fund data from 1983 through 1997

and finds positive risk-adjusted manager performance, accounting for survivorship and for momentum. Christopherson et al. (1998) use a potentially survival-biased sample, however they find strong evidence of persistence in the performance of pension fund managers from 1979 to 1990, although the persistence is concentrated among poor performers. Goyal and Wahal (2008) show that in terminating managers, pension plan sponsors would have done just as well keeping the old managers as hiring new ones. Busse et al. (2010) look at persistence in manager performance using more than 6000 institutional accounts over 1991–2008. They find evidence of significant performance persistence, however it is attributable to the momentum factor — i.e., chasing returns with positive previous year performance.[1]

Stewart et al. (2009) use institutional manager data provided by Informa Investment Solutions from 1984 through 2006 and ask whether institutional pension plan sponsors add value through the manager selection process. In short, they ask if plan sponsor money is "smart." The answer is no. Consistent with Goyal and Wahal (2008) they found that products with the largest outflows outperformed those with the largest inflows.

In contrast, Bauer et al. (2008) analyze the domestic equity portfolios of 955 pension plans compared to their specified benchmarks. They are able to examine gross and net returns and their focus is on understanding agency costs in the financial services industry. Their main finding is that pension funds out-perform style and size-matched mutual funds by 200 basis points per year. They attribute this differential to hidden agency costs in the mutual fund industry that are not captured by reported fees.

University endowments are of particular interest given the role that the top university endowment managers have played in changing the fundamental asset allocation approaches to institutional management. A systematic survey of college endowments is conducted regularly by NACUBO. The data from 1992 to 2005 were studied by Lerner et al. (2008) who looked for correlates to good performance. They found

[1] Interestingly, in an earlier version of the paper with data extending to 2004, they find significant positive performance, accounting for factor exposures.

that the largest endowments and endowments for academically elite institutions out-performed the best. These institutions were also the group that relied most on alternative investments.

Brown and Tiu (2009) and Brown et al. (2009) use the NACUBO data to study whether the asset allocation decisions of endowments were profitable, and whether they could add value through active management. The latter study specifically asks whether endowments took sufficient active decisions away from their benchmarks over the period 1989–2005. The approach essentially chooses a mix between active and benchmark strategies to maximize the risk return tradeoff ex post. They found that most endowments were too cautious in deviations from benchmark, and could have added value by being more active. They tested this proposition out of sample by using first half of the sample period to select an active allocation weight for each endowment then applied this to the second half of the sample period and found a significant increase in the Sharpe [reward to risk] ratio. Their conclusion is that the alpha-generating capabilities of endowment managers are typically underused.

One limitation of these recent studies of university endowments is that they all use data that end before the crash. This omission has advantages and disadvantages. The advantage is that a single, adverse event does not color analysis. A common human bias in data interpretation is to overweight the salience of recent events. To the extent that one believes that the basic economic system is in a long-term equilibrium state, one way to mitigate this bias is to omit recent data. Thus, a case can be made for placing considerable weight on these pre-crash institutional studies.

On the other hand, the disadvantage of these studies is that the crash of 2007–2008 revealed a lot about the long-run equilibrium state of the economy. In particular, it showed the dramatic effect of severe market distress on asset allocation strategies. In particular, the diversification expected by multi-asset managers based on low recent historical correlations did not protect against a truly major shock. By the same token, excess-return investment strategies that had performed regularly in the previous decade ceased to do so in this same interval, suggesting they were likewise vulnerable to market contractions.

The recent crash highlights a major limitation of the modern alternatives-focused endowment strategy. There is simply no long-term empirical data for most of the popular alternative investment classes. This makes estimates of risk and return imprecise at best, but more importantly, the lack of such data means that it is difficult to model performance during periods of macro-economic stress. The sudden shift toward investing in alternatives is thus truly remarkable, given the long-term perspective of endowments. Over the very long-term, endowments should expect major ruptures in markets similar to those that occurred in the twentieth century. These include wars, recessionary shocks, demographic changes, market emergences and disappearances. None of the popular alternative asset classes — save real property — have been in existence in the current scale and institutional structure for more than 40 years. The allocation away from well-understood asset classes like equities, fixed income and real properties should be regarded as a recent experiment, and well-documented successes such as the Ivy League endowments should be examined in the context of first-mover advantage, top manager special access and a rare, quiescent period in financial history in which markets for normally illiquid assets flourished.

4.2 Sovereign Wealth Funds

The data on many of the largest Sovereign Wealth Funds (SWFs), with one striking exception being Norway, is difficult to obtain and contains potential bias because the data, when available, is voluntarily reported.

Bortolotti et al. (2008) studied a voluntarily reported sample of 1216 transactions by 35 SWFs over the period 1986–2008. A subset of these transactions were purchases of shares in public companies, which allowed the researchers to calculate an abnormal return. They find short-term positive performance and long-term underperformance when the purchases are benchmarked against an appropriate set of comparisons. Kotter and Lel (2009) and Dewenter et al. (2009) find similar positive announcement effects (1–2%) but essentially zero long-run risk-adjusted performance. The announcement effect is consistent with a positive market response to an SWF taking a major stake in a

firm; the long-run flat to negative performance is consistent with the difficulty in identifying investment opportunities for out-performance over long horizons. Fernandes (2009), focusing on price not return, documents an apparently large premium (15%) due to sovereign fund ownership, also consistent with expected positive governance effects of a large external shareholder. On the other hand, Knill et al. (2009) note that Sharpe ratios decrease due to sovereign fund ownership, which they interpret as potentially "destabilizing."

Although the academic literature on SWFs is very recent, the empirical evidence suggests that the potential gains by funds are related to issues surrounding expectations about governance and corporate control. To the extent that funds are able to acquire shares at market prices prior to announcement of a major stake, they may benefit from a modest announcement effect. The positive price adjustment appears to fully encompass the anticipated positive governance effects — in other words, the market free-rides on the SWFs' monitoring of company management.

4.3 Price Impact and Indexation

One area of active research in institutional funds management is the price impact of fund flows. This line of study began in the 1980s with Shleifer's (1986) discovery that prices of stocks that moved onto the S&P index jumped on the day of inclusion — as index funds all bought on the same day. This led Shleifer to hypothesize that the demand for stocks sloped down and that as money chased particular investments, this would drive prices up and expected returns down. Extensions of these early studies pushed in several directions. Some looked for evidence that the shock was temporary — consistent with the Shleifer-Vishny limits-to-arbitrage model (cf. Wurgler and Zhuravskaya, 2002).

Others tested for causality between institutional flows and security prices. Gompers and Metrick (2001), for example, studied stocks held by institutions and found an association between valuations and institutional ownership. Sias et al. (2006) showed that the price impact had both a permanent and a temporary component. Goetzmann and Massa (2003) used high frequency flows to S&P 500 funds to test the

hypothesis of flows causing price changes, documenting an immediate impact on stock prices in the S&P 500 in the afternoon following positive order imbalances for index investors.

Taken together, these results suggest that indexation comes at a cost of its own due to institutions tracking these indices trading at the same time. The main cost is a one-time differential of 2% or more due to a sloped demand curve, another cost is the continuing response to flows. The price impact of index additions and deletions has important implications for market efficiency and for investment management strategies predicated on indexation. First, clientele shocks can be considered as evidence contrary to efficiency since they violate the law of one price because a stock presumably has the same fundamental risk and return characteristics before and after inclusion in an index. However, if information effects and liquidity effects are priced risk factors these may change. Secondly, the fact that index stocks are higher priced suggests that passive strategies that avoid common indices — or even exploit index re-composition anomalies — may provide superior returns.

4.4 Hedge Funds

A natural arena to examine the question of market efficiency and the efficacy of active management is the hedge fund universe. Although there is no standard institutional definition of a hedge fund, they are generally actively managed investment pools that seek to generate positive alpha for clients. They are sometimes referred to as absolute return funds because they do not benchmark themselves against specific long-only indices, but against an absolute standard such as LIBOR. The compensation structure in the hedge fund industry is consistent with this goal. The standard manager contract is a 2% fixed fee with a 20% incentive fee and a high water mark. The manager thus gets 2% of net assets per year and 20% of gains in excess of a fixed benchmark like 0%, or LIBOR. The high water mark provision means that previous year's losses must be recouped by the investor before the 20% incentive provision is in effect. Given these extraordinary incentives, one would expect the hedge fund industry to attract the most skilled managers.

These very high fees also imply that if hedge fund performance adds value after fees and hedge fund strategies can be mimicked by a low cost manager, such strategies would lead to significant value.

One of the major challenges to studying hedge funds is that the industry is comparatively new, and has changed dramatically in its short history. Performance data, particularly for early years, is of questionable quality and still voluntary making it subject to such problems as survival and selection bias. A deeper challenge to measuring hedge fund excess performance is that, unlike long-only managers, hedge funds use a wide range of securities, contracts, leverage and trading techniques, and their positions can shift quickly. For example, a global macro-hedge fund might shift its exposure to a particular currency from highly positive to highly negative overnight and then back again within a few days. Statistical controls for this changing systematic factor exposure are imperfect at best. Because of their wide ranging strategies, hedge fund returns also may be skewed or have option-like characteristics that render standard linear techniques inadequate. This has motivated considerable research into how to capture these complexities with alternate statistical instruments.

With these qualifications, let us turn to the existing academic evidence. Empirical studies of hedge funds are comparatively recent. Fung and Hsieh (1997) studied a database of hedge funds and found that their trading strategies were extremely dynamic and not well-captured by standard index benchmarks. They introduced a number of additional systematic factors that are now commonly used as regressors in the performance measurement of hedge funds. Theirs was the first paper to show that hedge funds were a good investment. Following their pioneering study, Ackermann et al. (1999) found that hedge funds outperformed mutual funds over the period 1988–1995, but do not on average, provide positive risk-adjusted returns. In contrast, Brown et al. (1999) found evidence of positive risk-adjusted performance in a database of off-shore hedge funds over the same time period. Surprisingly, they failed to find evidence of performance persistence in funds. Later studies like Agarwal and Naik (2000) with longer time series data have since documented repeat-winners at short horizons among hedge fund managers, however, suggesting some skill

differential. Jagannathan et al. (2010) hedge fund study documents persistence in winners as opposed to losers — also strongly suggestive of skill.

Bailey et al. (2004) found evidence of the average outperformance of hedge funds under the null of no arbitrage, even when non-linear factor payoffs are considered. Kosowski et al. (2007) examined the risk adjusted performance of hedge funds over the period 1990–2002 using fairly sophisticated measures. Their results concur that hedge funds over this extended period appear to deliver positive performance, and that performance is persistent at the annual horizon. Avramov et al. (2009) develop a predictive model for individual hedge fund managers similar in spirit to the conditional models discussed above used to predict mutual fund returns. They document a dynamic strategy of hedged fund allocation that generates positive alpha and attribute it to time-varying skill.

There is some contradictory evidence on hedge fund manager skill, however. Griffin and Xu (2009) examine hedge fund trades around the tech bubble of 2000 and cannot find evidence of differential or superior trading skill. Malkiel and Saha (2005) argue that hedge funds fail to deliver significant positive performance, and that the problems of survivorship bias and backfill bias loom large in any reliance on historical hedge fund data. Gibson and Wang (2009) add a liquidity risk variable to the Avarmov, Barras and Kowsowski framework and show that a lot of the alpha may be compensation for bearing liquidity risk.

On balance, some, but not all, academic hedge fund studies have found evidence that hedge funds contribute positive excess returns. The only caveat is that, given the difficulties in performance measurement and the lesser quality and short history the hedge fund databases, the positive results about past performance need to be qualified with a concern that reported results might not truly reflect real-time investor experience.

Going forward, can these positive results be expected to continue? The changes in the industry such as the vast increase in scale, the competition for alpha within scale-constrained strategies, the re-institutionalization of proprietary trading, the orientation toward marketing, the introduction of indices and synthetics, and the shifting

regulatory landscape all suggest that the past cannot simply be extrapolated. So far, the cumulated evidence suggests that hedge fund manager skill exists and that the rewards to that skill can be passed on to fund investors, depending upon a judicious manager selection process. However, the mutual fund industry has succeeded in delivering negative active returns to investors while keeping any talent as fees. In the long run, there is no reason why the hedge fund industry would not tend to the same Berk–Green equilibrium.

Furthermore, many hedge fund strategies are simply not scalable. This is shown by Agarwal et al. (2004) who show high flows into hedge funds are followed by poor fund performance. Teoh (2009) is a comprehensive study of the size/performance relationship in the hedge fund universe. He finds strong evidence of a convex (diminishing) relationship between size and risk-adjusted returns, consistent with capacity constraints.

While hedge funds may be an attractive as investment vehicles at this time, issues such as manager access, transparency, reporting, evaluation, and due diligence remain challenging, even for large-scale institutional managers. Any sophisticated hedge fund program should take into account such issues when deciding upon an allocation to specific managers and strategies.

5

Other Market Sectors

5.1 Fixed Income

A recent study of the various fixed-income active strategies commonly taken by hedge funds was conducted by Duarte et al. (2005). They looked at profits from trading on the interest rate swap spread, the yield curve (i.e., the Expectations Hypothesis), mortgage-backed security mispricing, arbitrage in volatility (i.e., differential pricing of risk in different securities markets), and capital structure arbitrage. In effect, they tested the efficiency of the fixed income market using a variety of strategies employed in practice. The concluded that several of these strategies were profitable ex post, and that those with greater complexity paid off more — consistent with the Grossman–Stiglitz theory. In many cases, however, the excess returns computed by Duarte et al. were not statistically significant.

There are few studies of bond portfolio managers. An early study is Elton et al. (1993) who study bond mutual funds and find no evidence of manager skill. Ferson et al. (2006) also study bond mutual funds using a different methodology and different data period and also report that performance on average is negative — although not statistically significant. In these studies of bond mutual funds, the issue of before-fee

and after-fee performance is similar to equity mutual funds. Chen et al. (2010) find that bond mutual funds outperform several common bond index fund benchmarks on a before-cost basis but under-perform on an after-fee basis. They document a large average expense ratio of around 1.3%. Low-cost active management in fixed income markets could capture alpha close to those reported for gross returns. Repeat-winner tests on bond funds (cf. Huij and Derwall, 2008) find performance persistence among fixed income mutual funds, suggestive of differences in relative skill. Moneta (2009) recently studied holdings of bond mutual funds and documented some positive evidence of management skill, based upon timing ability.

As with active equity managers, one would expect to find skilled fixed income managers in the hedge fund universe because of the relative lack of strategy constraints and the attractive compensation. Following this logic, Fung and Hsieh (2002) studied the fixed income managers in the hedge fund universe up to 2001. The paper has a rich set of findings relevant to the analysis of active fixed income management. First, the authors show that the returns to various strategies within the fixed income category are related to not only standard long-only indexes but also proxies for trend-following and convergence trading. They note that these factor exposures are different than those represented in the mutual fund universe. They also point out that the shocks to these factors in the 1990s and 2000s were relatively small. Back-testing the effects of Great Depression-scale shocks to credit spreads, the authors forecast the potential for large monthly declines, in the order of 8% for at least one style. Fung and Hsieh conclude that, "there exists cyclical exposure to risk factors inherent in most Fixed-Income Arbitrage funds that may be masked by the short existence of the funds themselves." How right they were! Although the paper is silent on the average risk-adjusted return to fixed income funds, the implication of their study is that even a positive and significant historical alpha for a fixed income return may actually the be result of an exposure to rare risk events, and thus no more than fair compensation for risks — once they are all properly accounted for.

Okunev and White (2002) provide corroborating evidence by more intensive econometric work on "unsmoothed" monthly hedge fund

returns. They uncovered a non-linear, option-like strategy inherent in the fixed income hedge fund index similar to a short position in a put on high-yield debt. This strategy would explain why many active fixed-income managers performed so poorly relative to indexes during the credit crisis. Thus, performance analysis of fixed income funds is highly dependent upon both the time-period of study and upon the choice or risk factors and their empirical proxies. Most interesting is the clear prediction by two research teams in the early 2000s that fixed income hedge funds were asymmetrically exposed to serious credit shocks.

Our discussion of fixed income has been necessarily brief because research on both bond market efficiency and delegated fixed-income portfolio management is much less extensive than for the equity market. This obvious large gap in the literature is unfortunate.

5.2 Private Equity and Venture Capital

The EMH generally presumes a liquid capital market. Non-marketable alternatives such as real estate, private equity, venture capital — and even markets farther afield such as collectables — are thus considered to be less efficient. The Swensen approach to institutional investing stakes a considerable amount on these markets and thus it is worth considering the academic evidence on non-marketable alternatives such as it is.

The most widely cited paper on private equity investment is Moskowitz and Vissing-Jorgensen (2002) which treats all non-marketable entrepreneurial investment in the U.S. as private equity. Their conclusion is that private equity is no more profitable than public equity. Phalippou and Gottschalg (2009) are even less sanguine. They claim that the reported returns in historical private equity databases are overstated and that private equity fund returns are 3% lower than those of the S&P 500 and 6% lower than a risk-adjusted benchmark. Conroy and Harris (2007), using data from 1989 through 2005 and adjusting for smoothing of returns, concur, pointing out that their portfolio characteristics are not particularly attractive. Franzoni et al. (2009) suggest that private equity funds have a major exposure to liquidity risk and this factor should be considered in the allocation decision.

The fees in private equity investments are very high. Most private equity funds charge a 2% management fee and 20% on the profits (called "carry"). The 2% fee is charged on committed, not invested, capital. That is, suppose the initial investment is $10 million on a fund where investors have committed $100 million of capital, which is drawn upon as needed by the manager. The management fee charged in the first year is on $100 million, not $10 million. Not surprisingly, even though the returns to investors are below the S&P500, or the risk-adjusted benchmark, Phalippou and Gottschlag find that the gross-of-fee alpha is positive at 4%.

Kaplan and Schoar (2005) also examine private equity funds and venture capital funds. They generally agree with the conclusion of average poor performance. Net of fees, the IRR of private equity and venture capital investment differed little from that of the S&P 500 over equivalent time periods. After appropriate risk-adjustment these investments are less attractive than an index of public equity. However, Kaplan and Schoar also note considerable cross-sectional variation, suggesting there may be differential manager skill. The fund offerings of general partners of previously successful private equity funds tend to also perform well. Lerner et al. (2008) find that endowments have been able to earn higher than average returns from private equity investments. This lends some support to the Swensen approach, and suggests that market frictions such as access to top managers and economies of scale may come into play in achieving good returns in the non-marketable alternatives space.

Yale and Harvard may be able to invest in these top private equity funds along with certain other University endowments (cf. Lerner et al., 2007). But, it is not clear that other investors can or that even past performers persist. Phalippou and Gottschalg (2009) casts doubt on previous findings of persistence in performance for venture capital funds, arguing that the data support the decreasing returns to scale argument advanced by Berk and Green. On the other hand, Ljungqvist et al. (2009) argue that persistence in after-fee returns found by Kaplan and Schoar is driven by investors having some holdup power that prevents top funds from pricing their services to the margin.

Cochrane (2005) examines venture capital returns from 1987 to 2000, addressing a number of methodological problems. He finds that venture capital returned 15% in this period, roughly the same as the S&P 500, however risk adjustment for market exposure resulted in a negative alpha for the industry. These results are confirmed by Korteweg and Sorensen (2010) who also address econometric biases due to use of infrequently traded data and estimate low alphas for venture capital.

Metrick and Yasuda (2010) point out that the venture industry differs markedly from the private equity industry in that venture capitalist focus on small firms and thus the business is by definition labor-intensive and non-scalable. Buyout firms, on the other hand, can operate on billion-dollar companies. This suggests that the performance of venture capital as opposed to private equity should be viewed as strongly conditional upon scale, and that past percentage returns are not necessarily valid as a basis for projecting future performance. Venture capital returns depend critically on opportunities and capital in the industry. Thus, investing in a venture capital area that is currently "hot" may lead to poor future performance.

5.3 Real Estate

Basic theories of diversification would recommend holding a substantial portion on an investment portfolio in assets that constitute the majority of world wealth: real property. This asset class includes direct investment in housing, commercial buildings, agricultural land and mineral and extraction rights. Constraints on real property investment are significant, however. They include issues of liquidity, agency and nationalism. Securitized investment in property is, of course, possible via bonds and publicly traded property companies. Several attempts have been made to develop derivatives contracts based on real estate indices. Despite the widespread belief in demand for these derivative products, none have been successful enough to serve the needs of large-scale investors. Nor has the scale of publicly traded real estate claims matched the relative wealth share of the asset class. As a result, it would be very difficult to replicate the returns to real estate investment using

passive investment products with one exception: real estate investment trusts [REITs], which will be discussed below.

The question addressed in this section is whether there are opportunities to exploit mispricing in real estate via active management. We thus review the academic evidence on the efficiency of the real estate market and consider how an investor might or might not be able to profit from this.

5.3.1 Empirical Studies and Data Sources

Some institutional background: one set of real estate studies uses information from publicly traded firms (REITs) and other studies use pooled information from institutional investment via the National Council on Real Estate Fiduciaries [NCREIF]. The NCREIF database contains return information on U.S. properties held by insurance companies, pension funds, and endowments. These two sources of information are quite different, since REITs are priced by the market and the NCREIF data is appraisal-based. Finally, for residential real estate, the most widely observed market indexes, the Case–Shiller indexes, are based upon repeated-sales of houses. Only the REIT indices are replicable by an investor. There are similar indices for the UK and other countries, for example, Investment Property Databank provides an appraisal estimate for several countries, including the UK, broken down by property type. The same caveat applies. Tracking an index of properties you do not own is likely to be difficult.

Random walk tests on non-tradable real estate indices have generally shown high levels of predictability. Case and Shiller (1989), Goetzmann (1993) and Kuo (1996) found that U.S. housing indices have strong autocorrelation. Goetzmann and Ibbotson (1990) calculated high autocorrelation for appraisal-based commercial property indices. Publicly traded real estate companies demonstrate less predictability, and may deviate in relative value from appraisal-based measures. Whether this deviation between two measures of commercial property values is due to stock market prices being wrong, or due to appraisals being wrong is currently an open research question. Pagliari et al. (2005) find that this deviation has narrowed through time, suggesting increased integration between the public and private

real estate markets. The predictability of the non-market-based indices in any case does not suggest that the markets are inefficient in a no-arbitrage sense — frictions prevent speculators from easily exploiting trends, a point made by Gatzlaff and Titiroglu (1995). A long-short trade on public vs. private real estate can be interpreted as a financing challenge in the Shleifer-Vishny framework.

Darrat and Glascock (1993) broadly ask whether real estate investments provide returns commensurate with their macroeconomic risks and find that they do. On the other hand, well before the burst in U.S. housing prices, some researchers were finding evidence that home prices deviated from "fundamentals" due to euphoric over-reaction. Capozza and Seguin (1996) report evidence from rent-to-price ratios suggesting that homeowners extrapolated temporary trends in income growth. Robert Shiller also famously predicted the recent housing bubble and collapse, suggesting it was due to market irrationality.

5.3.2 Skill

Do real estate managers have skill? With the broader accessibility of REIT pricing in the 1990s, real estate scholars generally followed the precedent of testing for trading rules and real estate manager skill. Cooper and Downs (1999) showed that a short-term contrarian strategy on REITs made excess returns after accounting for microstructure costs and frictions. Titman and Warga (1986) did an analysis of REITs and found little evidence of differential skill across managers, and noted that a single factor model was inadequate for analyzing real estate returns. Rodriguez (2007) looked at managers of REIT mutual funds from 1999 to 2004 and, in contrast to the results obtained by Gallo et al. (2000) for an earlier time period, found no selection skill. More recently, Lin and Yung (2004) looked for evidence of performance persistence in REITs and found none, although they looked at returns on the publicly traded shares, as opposed to the performance of the underlying assets. Presumably the share prices would reflect investor expectations of manager skill as well as expectations of asset values.

Beyond REITs, there have been some studies of funds serving the institutional sector. Brueggeman et al. (1984) compared the performance of institutional real estate funds to a rational benchmark based

on the CAPM, but the data series for analysis were short. Gallo et al. (2006) collected evidence from the co-mingled real estate fund sector serving institutional managers for the period 1985–2002 and tested for performance persistence. Among other things they found that tracking error was correlated to under-performance.

Ciochetti and Fisher (2002) and Goetzmann and Fisher (2005) examine the managed real estate assets represented in the NCREIF database — presumably indicative of a core investment style, as opposed to development or opportunistic styles. Their evidence suggests that over the period 1977–2004, the internal rate of return to a well-diversified portfolio of properties was about equal to the performance of transactions-matched U.S. government bond investments over the same time period, suggesting that equilibrium expectations were not realized over the 28-year interval, additional factor exposures explained relative returns, or that this particular set of managed assets simply did not beat bonds.

Recent analysis of real estate investing by Bond et al. (2003) among others has explored the international structure of property returns. Bardhan et al. (2008) look at the relative efficiency of national real estate markets by using property stocks as a measure of the integration of global real estate markets. They find that real estate firms in less open economies have higher risk-adjusted returns; evidence in favor of local pricing and potential gains for the cross-border investor. These results might be relevant because they represent a source of factor exposure to the asset class, and also offer the potential for active management of marketable assets.

6

Conclusion

The Efficient Markets Hypothesis [EMH] has been refined over the past several decades to reflect information, transactions, financing and agency costs. Tests of the theory on prices have occasionally produced violations, suggestive of the potential for active management to add value to a multi-asset portfolio.

Much of the tests of the EMH on managers focus on retail mutual funds. It does appear that within the retail sector there is some evidence of differential skill. A Bayesian analysis of skill in the mutual fund sector argues that passive indexing is difficult to justify when there is a large population of managers. On the other hand, there is no compelling evidence that active professional management in the retail sector has added incremental return to investors net of fees.

Turning to other investment sectors, a limited number of studies report mixed results on other institutional manager performance. Studies using data prior to the mid-2000s find some performance persistence, but more recent evidence finds none. At best, the evidence for institutional manager skill is time-dependent.

There is evidence of positive returns in the hedge fund sector where highly paid managers actively trade marketable securities but the

quality and duration of these data remain open to criticism and doubt. On the other hand, there is surprisingly little convincing evidence of superior risk-adjusted returns to private equity and venture capital. Despite claims that top managers can produce consistent high returns, the current data are not conclusive on this point. In the real estate sector there is simply not enough information to evaluate whether managers have added value on a risk-adjusted basis. Interestingly, the evidence does not suggest a "pecking order" structure with respect to potential alpha ranging from highly liquid asset classes such as fixed income to equities to less liquid securities.

To summarize the relevance of the efficient market theory and evidence for active investment management:

1. The preponderance of empirical evidence from academic research suggests that liquid securities markets are generally efficient with respect to information. More specifically, prices are driven toward efficiency through active trading by market participants. Economic profits may accrue to managers with competitive advantages in the acquisition, analysis and trading on value-relevant information. As a result, the balance between passive and active management is a choice variable for which the optimum depends on many factors. These include beliefs about the existence and potential of manager skill, the pricing opportunities afforded within a given market, the time preferences and risk aversion of the investor, and the expertise and incentive contract of the manager.
2. If the benchmark is solely a market-weighted portfolio consisting of all traded securities, then active management (defined as deviations from these market-weights) may be useful in accessing factor risk premiums that are not captured by market exposure. In the context of a multifactor model this could also be interpreted as passive exposure to additional risk factors. Theory and empirical evidence suggests that investors are compensated for taking systematic risks — such as value-growth and volatility risk — over the long-term. In the presence of these multiple systematic

risk factors, empirical tests overwhelmingly reject that the market portfolio is efficient. However, often there are no standard industry benchmarks that could serve as passive benchmarks to systematic factors other than fixed income and equity risk factors. In any case, the clientele effects around popular indexes like the S&P 500 and the EAFE index suggests these products are overpriced.

3. Back-tests of trading strategies have suggested a wide array of potentially profitable investment strategies. However, for a number of reasons these provide limited investment guidance going forward. They represent simulated not actual returns and usually do not take into account transactions costs, fees, and price impact. They suffer from data-mining biases. Changing market conditions, including arbitrage activity makes it difficult to extrapolate future performance. Finally, many CAPM anomalies are not scalable.
4. Recent theory and empirical evidence suggests that some fund managers do have talent and out-perform market benchmarks before fees. However, little of that superior ability filters through to the ultimate investors in those funds with after-fee returns and alphas being, on average, zero or negative.
5. Most studies of manager persistence suggest that negative performance persists, but that it is difficult to achieve positive risk-adjusted returns solely by investing with past winning managers. Recent research into conditional strategies for identifying skilled mutual fund managers suggests the possibility of choosing good ones. In the hedge fund arena there is some evidence in favor of positive performance persistence, and hence past track records may help identify winning hedge fund managers. However, this evidence must be qualified by questions over data quality and the indications of diminishing returns to scale and the negative impact of fund inflows.
6. For many alternative asset classes, the quality and duration of the empirical data on assets and managers is not sufficient

to draw firm conclusions about the potential for profitable active management. Despite recent dramatic trends in institutional investing, little is known empirically about the performance of alternative assets over long business cycles. It seems that some alternative asset class managers did well in the relatively calm capital markets of the two decades before 2008, but many alternative asset classes performed very poorly during the financial crisis in 2007–2009.

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