

Evidence-Based Investing

A Scientific Framework for the Art of Investing

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Science has produced many tremendous advances, from lifesaving medical treatments to instantaneous communication. Historically, though, science has had little influence on investing. Instead of keeping pace with advancements in modern portfolio theory and historical and statistical evidence, investors and money managers often rely on conventional wisdom and flawed assumptions. How can investors sort through the vast amount of available data to maximize after-tax return and minimize risk? This paper provides a framework called Evidence-Based Investing that can provide investors optimal outcomes based on compelling scientific evidence.

Savant Capital Management

Savant Capital Management, a Registered Investment Advisor (RIA), is an independent, fee-only wealth management firm headquartered in Rockford, IL. Since 1986, Savant has provided integrated investment management, financial planning, and family office services to individuals, trust funds, retirement plans, and non-profit organizations. Savant's goal is to provide insight, wisdom, and perspective to clients. We offer direction and confidence regarding your financial decisions. Savant serves you in a manner that is fully transparent. This leads to greater peace of mind, simplicity, and clarity.

As a fee-only advisor, Savant does not receive benefits from brokerage services, commissions, or finder's fees. We believe this independence allows Savant to remain impartial. Additionally, Savant does not sell products and fully discloses any conflicts of interest. We serve *only* you, our client. To assure that Savant adheres to industry best practices, we became one of the nation's first investment advisors to attain CEFEX Fiduciary Certifications from the Center for Fiduciary Excellence.

Savant has consistently received local and national recognition. For the past six years Savant has been named by *Barron's* magazine as one of the 100 Best Independent Financial Advisors in the United States. In addition, Savant has earned a place on the *Bloomberg/Wealth Manager/AdvisorOne* "Top Dog" list for the past 10 years. Our hard work and commitment to provide the best service and value to clients has also earned us recognition by publications including *InvestmentNews* (one of the 50 Largest Wealth Management Firms in the Nation), *Financial Advisor* magazine (A Top-Growing Independent RIA), *Business Week* (Most Experienced RIA List), and *Forbes* (Top 50 Registered Investment Advisor).

The Clash of Conventional Wisdom and Science

INTRODUCTION

Scientific progress is evident in virtually every aspect of our lives. From the moment we get up in the morning, the impact of modern science is everywhere. The magnitude of change over the last few decades is overwhelming in every way except one – the manner in which most people make their investment decisions.

Over the last five decades, there has been a quantum leap forward in understanding how capital markets work and what specific factors drive investment return over time. High-quality research clearly demonstrates which investment approaches are most likely to succeed as well as those involving unnecessary risk that are more likely to fail.

Even though this research exists and is virtually irrefutable, most investors do not make their investment decisions based on the evidence. On the contrary, fear and greed rather than evidence drive investor decisions. It is astonishing how few investors are even aware of the overwhelming body of evidence that exists regarding optimal investing.

There is substantial evidence about how difficult it is to pick individual stocks, trade in and out of them, and fare as well as the market. Likewise, the notion that there is a system by which one can consistently profit by timing the purchase and/or sale of securities has been proven false. The data, compiled by a consensus of Nobel laureates and other highly-acclaimed thinkers over two decades, is crystal clear.

Nevertheless, many brokers and some investment advisors ignore the evidence. They typically follow rather unscientific models based on untested and unproven hypotheses. While doing so, they claim that they alone have information or special

knowledge that can be used to produce returns in excess of the market, overcoming their already high expenses. To expose the many shortcomings of this approach and provide a road map to investing success, this paper introduces the concept of *Evidence-Based Investing* (EBI).

EBI involves the judicious use of current best evidence to make informed investment decisions. The concept is built around the evidence-based method that has produced such great success in the field of medicine. Evidence-based medicine (EBM) is defined as “the attempt to apply standards of evidence gained from the scientific method to aspects of medical practice in a uniform manner.”¹ (An overview of *evidence-based medicine* can be found in the appendix.)

In the same way, EBI applies the available evidence to each investor’s specific questions and challenges to formulate optimal investing solutions. The goal of EBI is to maximize after-tax returns for the individual investor, while minimizing risk and protecting portfolios from downturns in the market. This decreases the maximum likely loss during bear markets.

EBI involves a series of steps. First, questions are developed. Then, related evidence is located, researched, interpreted, and compared. The third step is the ongoing application of the evidence within the investor’s relationship with his or her investment advisor.

This paper introduces the methods and conclusions of EBI, and relates how an investor can best capture market gains while avoiding the failure of the conventional approach. In doing so, this paper will demonstrate the concrete benefits of a scientific approach for the individual investor.

1. Evidence Contradicts the Conventional Approach

Question: *What is the best way to capture market returns?*

Most brokers on Wall Street believe that successful investing involves *beating the market*, and that the best way to achieve this is through *actively managed* investment strategies. Evidence demonstrates, however, that this assumption is without foundation. Both the method (the continuous trading of securities for short-term gains) and the goal (beating the market) add risk and expense while delivering a lower overall return compared to investing strategies that neither actively trade nor seek returns greater than the market. This may be counter-intuitive for many people, but the evidence is simply overwhelming.

Wall Street tells conventional investors that money managers add value by providing expertise in stock selection and market timing. In fact, there is a great quantity of evidence that demonstrates how professional market timing and stock selection actually harm investors. The conventional approach of active management not only fails to deliver returns that exceed the market, it actually underperforms the market.

A study by *Dalbar* (**Figure 1a**) shows that conventional active money management techniques actually resulted in substantially lower returns for investors. The average stock fund investor earned returns of only 3.8% per year over the 20-year period ending in 2011, while a simple buy and hold strategy in the *S&P 500* returned 9.1%. The comparison is similar for bond investors. Remarkably, the average stock investor was barely able

to realize returns above the level of inflation. The average bond investor was unable to accomplish even this feat.

In contrast, equity markets have a long and illustrious history of consistent growth. This history is illustrated in the graph of “Stocks, Bonds, Bills, and Inflation” (**Figure 1b**). The graph shows that over the long term, stocks have risen significantly.

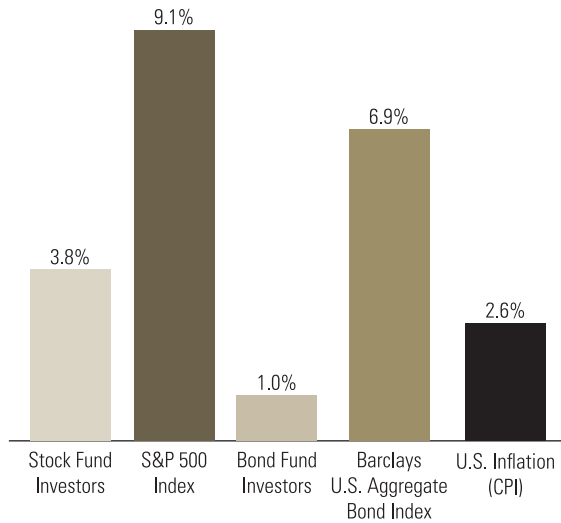
The significant long-term growth of capital markets raises the question: How can individual investors capture this growth while minimizing costs? Research conducted in 1986 and then confirmed in 1991 demonstrates that asset allocation is the key determinant in portfolio performance (**Figure 1c**).

Asset allocation is, by far, the most effective means of capturing market returns. Asset allocation is the strategic mixture of asset classes (e.g., stocks, bonds and cash) in a portfolio to reap the highest returns over the long term given an investor’s acceptable level of risk. As the figure shows, allocation decisions account for 91% of returns earned by investors. An investor’s ability to select the right stocks and time markets accounts for only 5% and 2%, respectively. Disciplined asset allocation enhances returns, whereas security selection and market timing actually detract from performance more frequently than not. Typically, conventional investors focus on stock selection and market timing while ignoring the primary determinant of future return – optimal allocation between different asset classes.

“Realized” Annualized Investor Returns

(20 Years Ending 12/31/2011)

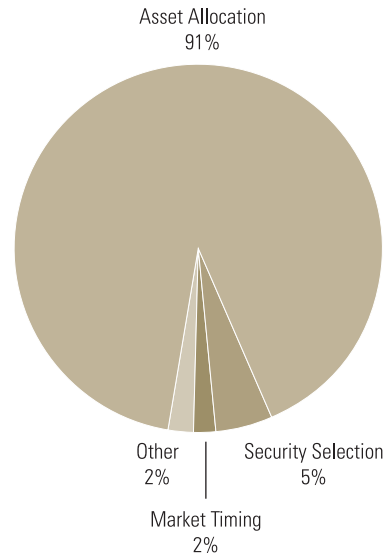
Figure 1a



Source: Dalbar, Quantitative Analysis of Investor Behavior, 2012, Morningstar Direct

Determinants of Investment Performance

Figure 1c



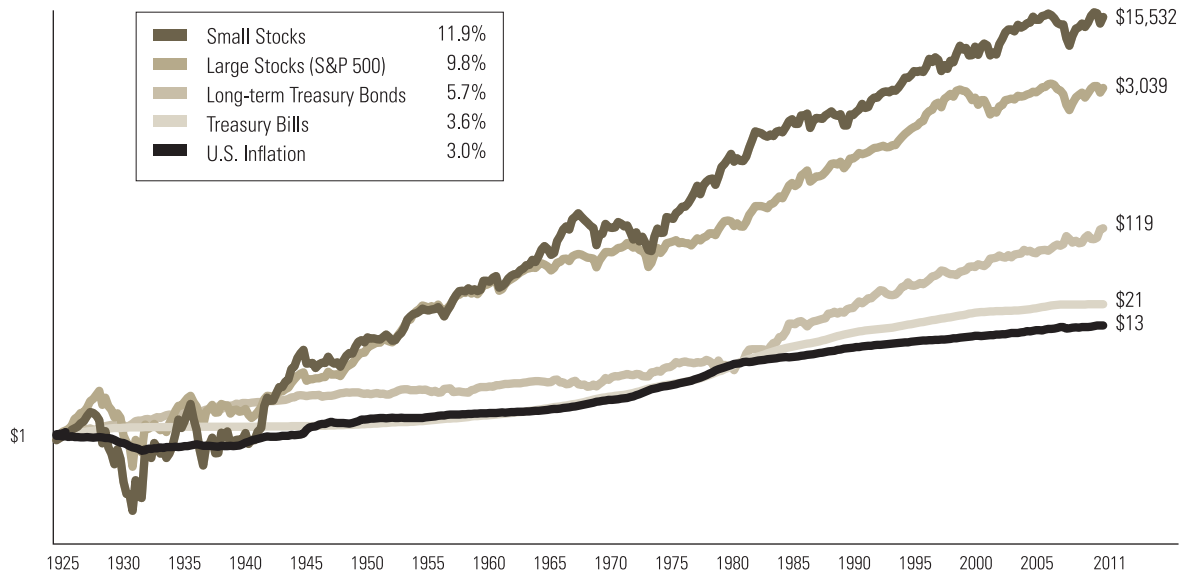
Source: Brinson, G., Singer, B., & Beebower, G. (1991, May/June). The Determinants of Portfolio Performance II, an Update. Financial Analysts Journal.

Stocks, Bonds, Bills, and Inflation

Growth of \$1 (1926-2011)

Figure 1b

Growth of \$1

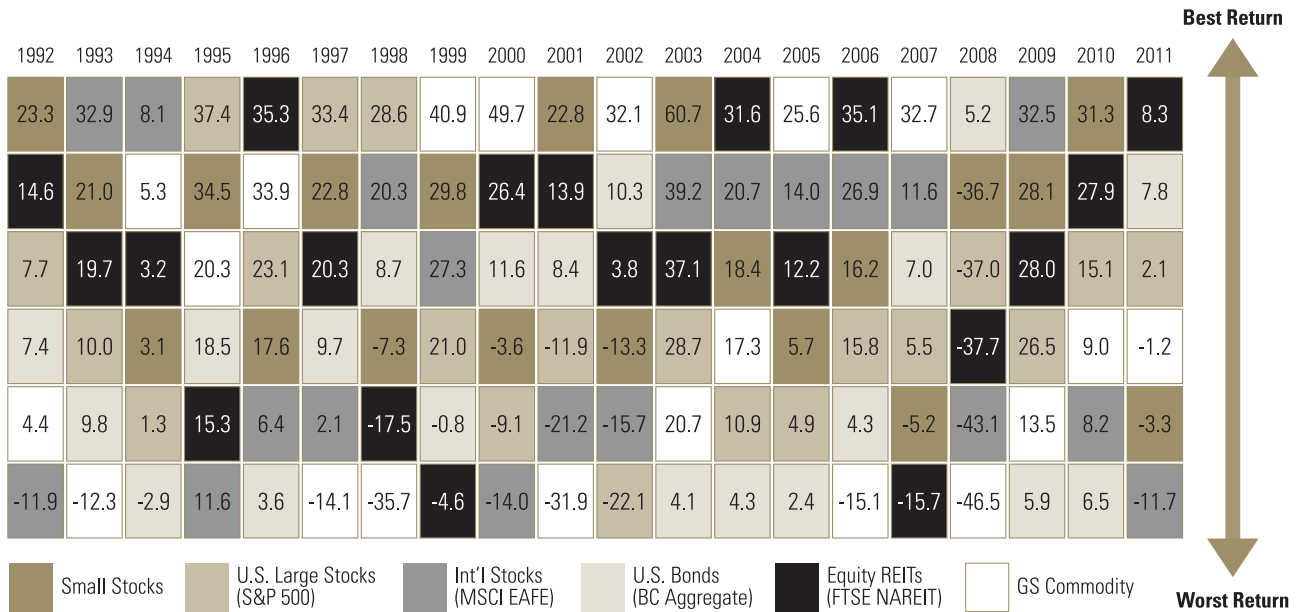


Data Source: Morningstar Direct

Can You Pick the Next Winner?

(Asset Class Returns 1992 - 2011)

Figure 2a

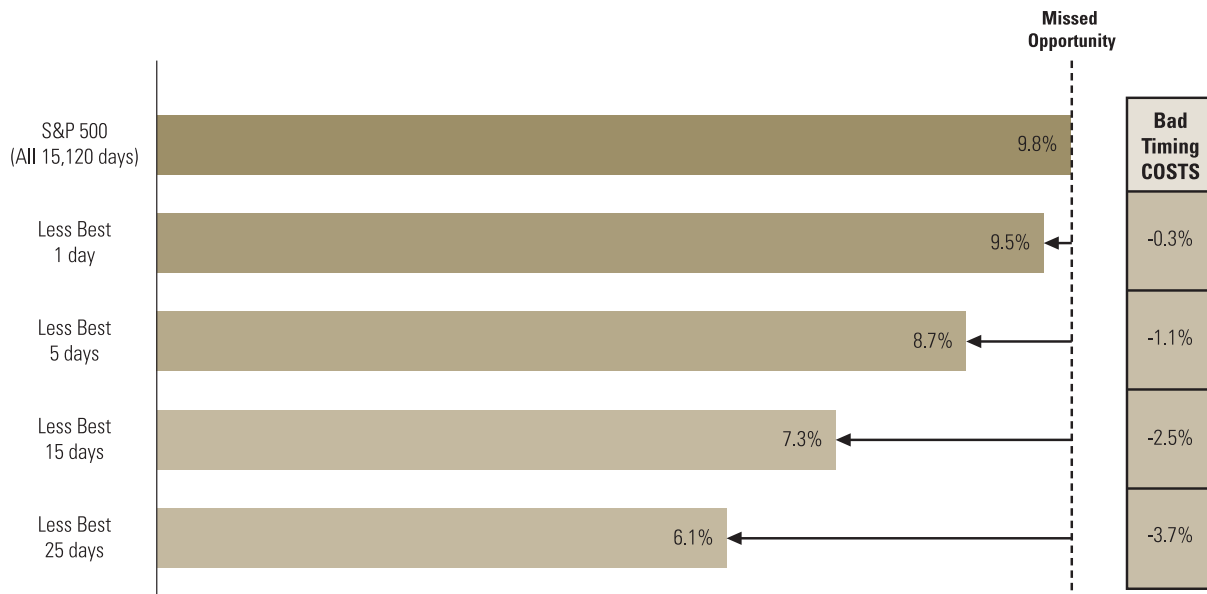


Data Source: Morningstar Direct

The Real Problem with Market Timing: Missing the Big Days

(S&P 500 1970 - 2011)

Figure 2b



Source: Dimensional Fund Advisors

2. The Allure of Market Timing – Hope Springs Eternal

Question: *Can market timing improve returns?*

Investors perennially wish to foresee the next big trend, invest accordingly, and then watch the investment shoot to the sky as the economic climate unfolds as predicted. Yet research over the last two decades strongly supports the hypothesis that markets are more or less efficient. This hypothesis states that at any given time, the market has already taken into account all available information as it sets security prices. There is consensus on this concept. Both evidence and experience suggest that those events that really *do* move the markets are notable precisely because of their unpredictability. For instance, the tragic events of 9/11 and the implosion of Lehman Brothers truly devastated markets, yet neither of these events could have been included in any list of predictable economic factors before they occurred.

The randomness of capital markets is illustrated in **Figure 2a**. This graph has *no pattern*, showing that the behavior and ranking of six basic asset classes defies prediction from year to year. In fact, even patterns that seem to appear can often reverse quickly and backfire on investors who chase returns. For example, international stocks were one of the top performing asset classes from 2003 to 2007. However, the bear market and

Global Financial Crisis in 2008 affected international stocks the most – only commodities fell more. Investors who attempted to time the market based on a few years of performance clearly were burned.

The evidence-based investor looks skeptically at any obsession over what the future holds. The fact is, substantial market growth and loss occur in relatively short periods throughout the year. As **Figure 2b** shows, stock returns come in concentrated pockets of time. The *S&P 500* Index has had an annual average return of 9.8% since 1970. However, by missing the best 25 trading days over that period, the return drops to only 6.1% – bad timing would have cost 3.7%. Even just missing the best five days cost 1.1% in average annual return.

Clearly, market timing adds risk and can be extremely costly. The evidence proves that market timing is extremely difficult to do and exposes investors to higher levels of risk, with no accompanying probability of high return. The good news is that this search for the holy grail of predictive power is as unnecessary as it is unrealistic.

3. The Poor Performance of Active Money Managers

Question: *Do professional money managers perform better than market indexes?*

Money managers can be hyperactive traders. They execute a variety of trading techniques in an effort to achieve short-term returns that are higher than the return of the stock market as a whole. With the finest information, technology, and research at their disposal, money managers no longer have to be content with simply trading in and out of the market. They can also trade from industry to industry and sector to sector simultaneously.

Their actions are best measured in terms of cost, both explicit (published in the prospectus) and implicit (hidden and not disclosed). These hidden costs are rarely discussed or disclosed. They include the cost of market impact, bid/ask spreads, and direct trading costs that only appear in the net cost of a stock position after the cost of the trade has settled. Truly visible, or admitted costs, include:

- Local broker commissions (loads).
- Expense ratios which include management fees, administrative fees, legal fees, custody costs, and 12b-1 fees.
- Wall Street brokerage commissions (inside the fund).
- Capital gains taxes from excessive trading within the fund. (Few people understand the added cost of taxes, although it may be the single most important expense to overcome.)

All of these added costs make it very difficult for active managers to outperform their passive benchmarks. **Figure 3a** shows how

the average actively managed fund compared to its relevant passive index for the 10-year period ending in July 31, 2012. Active large-cap funds underperformed the *S&P 500* by an average of 0.9% per year. The results are even more pronounced for active small and mid-cap funds which both trailed their indexes by 1.6% annually. The same holds true even for funds that invest overseas. Developed international stock funds trailed their benchmark by 1.1% per year while emerging market funds trailed by 2.6% per year.

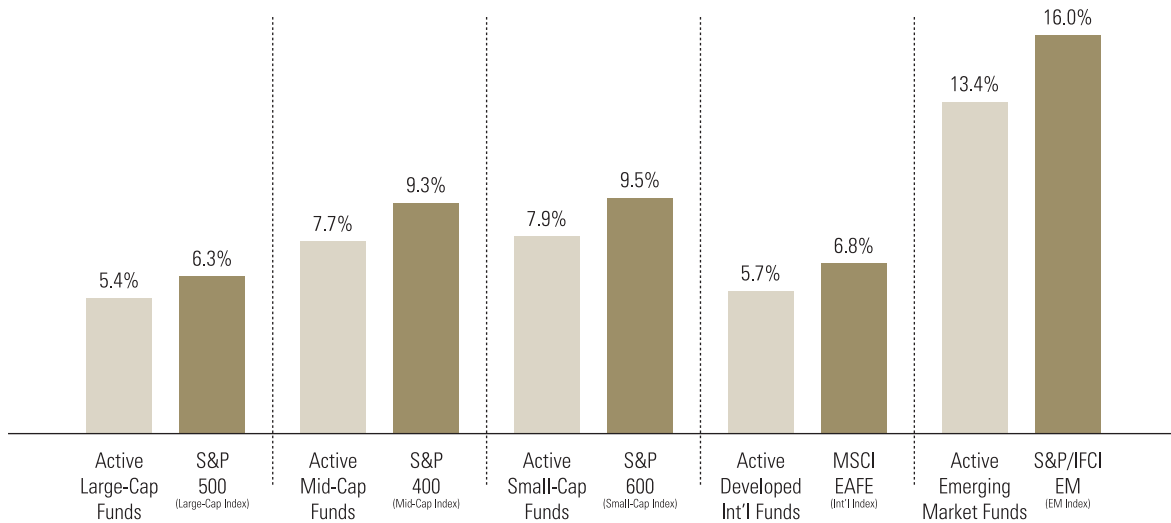
Proponents of active management often counter that fund managers are most able to add value during difficult markets. They claim that active managers can avoid bad investments and even time the market to protect investors from volatility. Maybe the best opportunity to prove this occurred in 2008 – the worst bear market since the Great Depression. Surely if active managers were able to add value by getting out of the market and avoiding losses, 2008 should have provided an excellent test case.

The evidence, however, shows that active managers using market timing were not able to add value. In fact, **Figure 3b** shows that the average actively managed mutual fund significantly trailed their passive benchmarks across almost all categories. Instead of nimbly jumping out of the market in anticipation of the events of 2008, active managers on average went down with the market and managed to lose even more money for investors.

Actively Managed Stock Funds Failed to “Beat the Market”

(Annualized Returns 10 Years Ending July 31, 2012)

Figure 3a



Data Source: Morningstar Direct. Active fund returns are category average returns.

The Typical Active Manager Failed in 2008

(U.S. Equity Funds)

Figure 3b

	Lipper Average Fund Return			Index Return			Difference*		
	VALUE	BLEND	GROWTH	VALUE	BLEND	GROWTH	VALUE	BLEND	GROWTH
LARGE	-37.40	-37.20	-40.70	-39.22	-37.00	-34.92	1.82	-0.20	-5.76
MID	-38.30	-38.50	-44.50	-34.87	-36.23	-37.61	-3.43	-2.27	-6.89
SMALL	-33.50	-36.20	-42.10	-29.51	-31.05	-32.94	-3.99	-5.12	-9.16

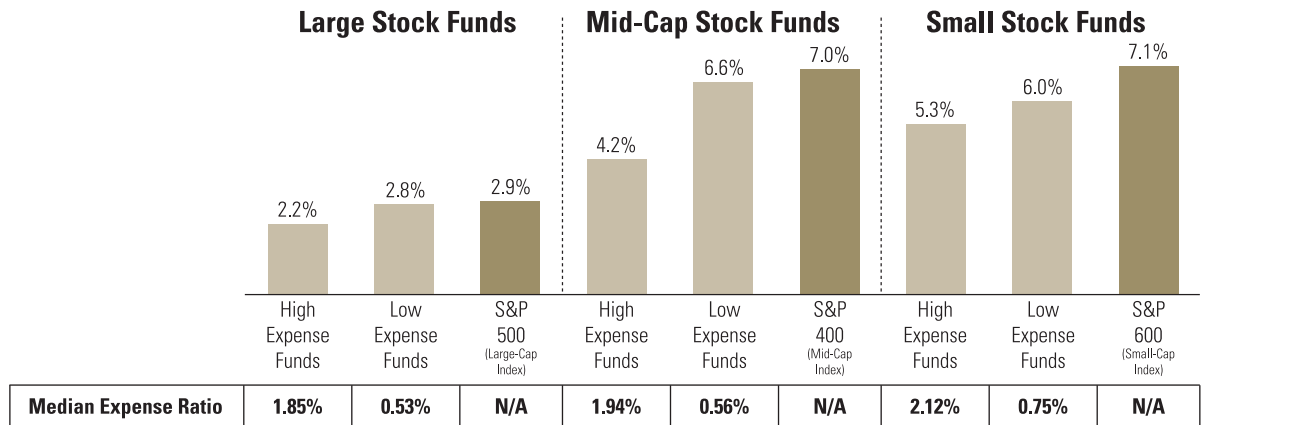
*Negative number indicates active managers underperformed indices.

Source: Lipper Average published by The Wall Street Journal, January 6, 2009 and Morningstar EnCorr

High Expense Funds Lag Market Indices

(Annualized Returns 10 Years Ending December 31, 2011)

Figure 4a



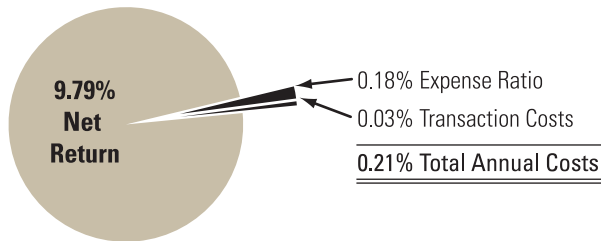
Data source: Morningstar Direct, Mutual funds in each category were sorted by expense ratio and grouped into quartiles. Funds in the top quartile are High Expense funds and those in the bottom quartile are Low Expense funds.

Internal Fund Expenses Reduce Net Returns

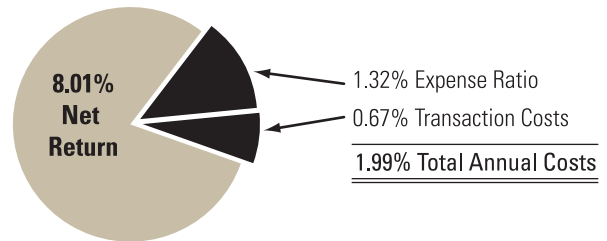
(Assumes 10.0% Gross Annual Return)

Figure 4b

Indexed Mutual Funds



Conventional Mutual Funds

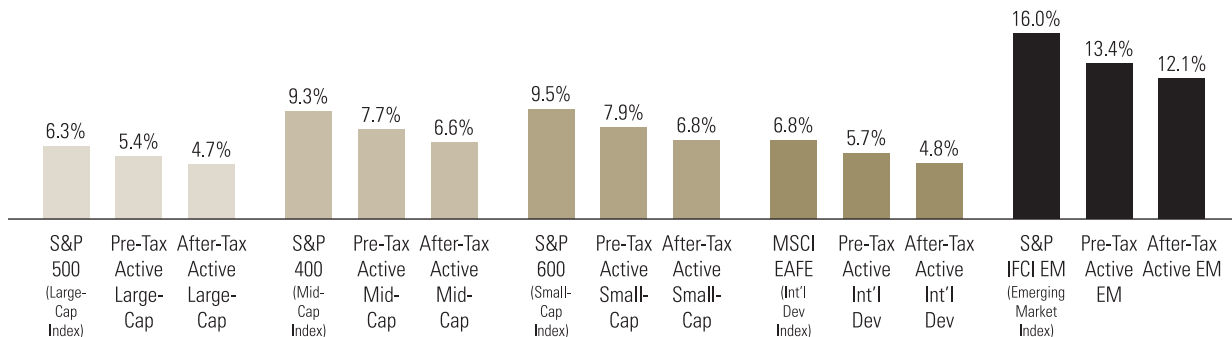


Data source: Morningstar Direct. See Endnote 2.

Pre-Tax and After-Tax Active Management Performance Trails Market Indices

(Annualized Returns 10 Years Ending July 31, 2012)

Figure 4c



Data source: Morningstar Direct, Pre-Tax and After Tax returns are those of the mutual fund category averages.

4. The Costs of Trying to Beat the Market

Question: *Can money managers overcome their high costs?*

There is an inverse relationship between fund expenses and returns. In short, costs matter. Nobel Laureate Dr. William Sharpe points to this in his landmark article, “The Arithmetic of Active Management.”³ He asserts:

“If active and passive management styles are defined in sensible ways, it *must* be the case that (1) before costs, the return on the average actively managed dollar will equal the return on the average passively managed dollar, and (2) after costs, the return on the average actively managed dollar will be less than the return on the average passively managed dollar. These assertions will hold for *any* time period. Moreover, they depend *only* on the laws of addition, subtraction, multiplication and division. Nothing else is required.”

Even though it is hard to overcome the high costs of active management, many managers try. The scientific expression for trying to beat the market is “pursuing alpha” and refers to the measure of returns above the market. A large alpha is required in order for an active manager to match the performance of a similar indexed or passive strategy. This is due to the many additional costs that active managers must overcome. High turnover also results in higher transaction costs. Thus, actively managed funds require a very high alpha in order to simply break even. In fact, a fund’s expenses can be a good indicator of its performance. **Figure 4a** shows that funds with the highest expense ratios trailed their passive benchmarks much more than funds with lower costs.

To put this in perspective, **Figure 4b** illustrates that the average money manager, with a typical turnover of 133% per year, needs to beat the market by 2.0% annually just to equal the return of the index – a nearly impossible long-term feat. Assuming 10.0% gross annual return, the difference in net return between conventional active mutual funds and a low cost index fund is 9.8% vs. 8.0%

annually. While attempting to outperform the market, active managers actually underperform by a significant margin.

The cost of active management is considerable, and there are many different layers of costs to consider. For most investors, mutual funds with up front loads are more or less a thing of the past. Yet, the fund industry has turned to more sophisticated ways of extracting commissions. Wrap accounts, for example, typically charge between 1.5 and 2.5% of assets under management – plus other hidden trading costs. Variable annuities, some with surrender charges up to 9%, have become popular. The 12b-1 fee, introduced in the 1970s as a fee for marketing costs, remains in most actively managed funds, scraping off an additional fee each year.

Transaction costs can also be a significant expense. A recent study, “The Role of Trading Costs”, found that trading costs pulled more capital from portfolios than commissions or expense ratios. The study also found that the bigger the mutual fund, the higher the trading costs. “Trading costs,” say the authors, “have an increasingly detrimental impact on performance as the fund’s relative trade size increases.”⁴

In addition to the higher expense of trying to beat the market, the high turnover generated by active management also results in higher taxes. **Figure 4c** shows how taxes can be a significant additional drag on performance. The average fund trailed its passive benchmark across multiple categories even before taxes, and after taxes are considered the picture is even worse.

Once all of the hidden costs (transaction costs and taxes) are added to the disclosed sales expenses and commissions, total costs not only cancel out any gains made by achieving alpha, but they usually result in returns that lag the market.

5. The Allure of Hunting for the Great Money Manager

Question: *Can you beat the market by identifying great money managers?*

The section of this paper entitled *The Poor Performance of Active Money Managers* established that the average actively managed fund lags behind its benchmark index. Many advisors acknowledge this is true. However, they do not see it as a reason to abandon the quest to beat the market by picking the right mutual funds. After all, they argue, they plan to select only the *best* money managers — the average money manager need not apply.

The idea is that the advisor recommends only managers with top track records – those with stellar five-year return histories. Find only the top performing money managers and leave the less successful managers to other, less attentive advisors. The Securities and Exchange Commission (SEC) has highlighted the first problem with this convention: They mandate that every mutual fund prospectus disclose that “past performance is not indicative of future returns.”

Ironically, good track records attract an influx of new capital that, in turn, often consigns the fund to lower future returns.

Figure 5a shows how few top 100 growth fund managers were

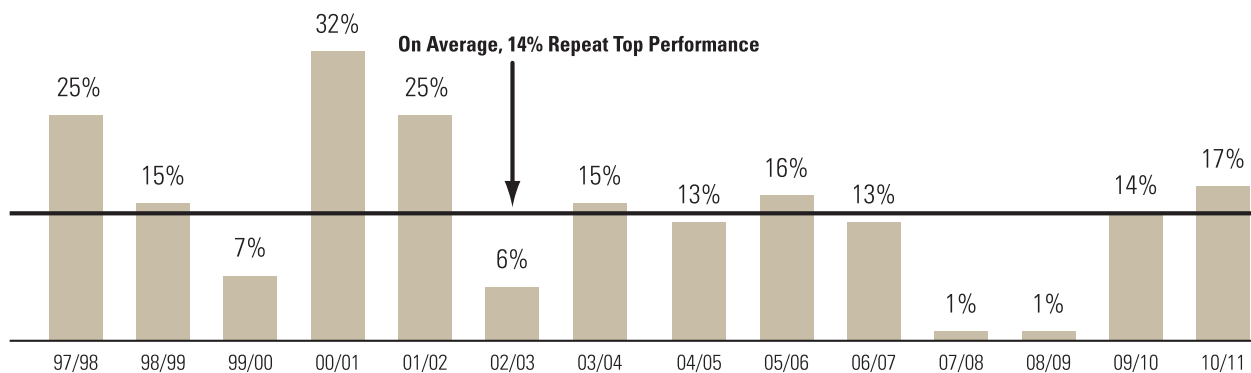
able to maintain a top 100 ranking in the following year. On average, only 14% of the managers were able to remain in the Top 100 from year to year. Notice the range of money managers’ annual repeat successes – from 1% to 32%. Such a broad range points to the random nature of a money manager’s success and to the difficulty of consistently beating the market.

Figure 5b shows that the very top funds actually perform well below average in subsequent periods. Of the 377 funds that ranked in the top quartile of performance from 2002-2006, only 32 funds, or a mere 8%, were able to stay on top in the following period from 2007-2011. An amazing 175 funds actually fell to the bottom quartile in the subsequent five years – close to half of all of the top funds. Finally, 55 of the top funds (15%) did not even survive to the end of the subsequent five year period. No evidence supports the notion of a positive correlation between superior past performance and future returns. If anything, evidence suggests that the correlation is negative. To summarize, chasing performance is like driving a car while only looking in the rear-view mirror.

Very Few Top 100 Growth Fund Managers Stayed in the Top 100 the Next Year

(Percentage of funds that repeat Top Performance)

Figure 5a

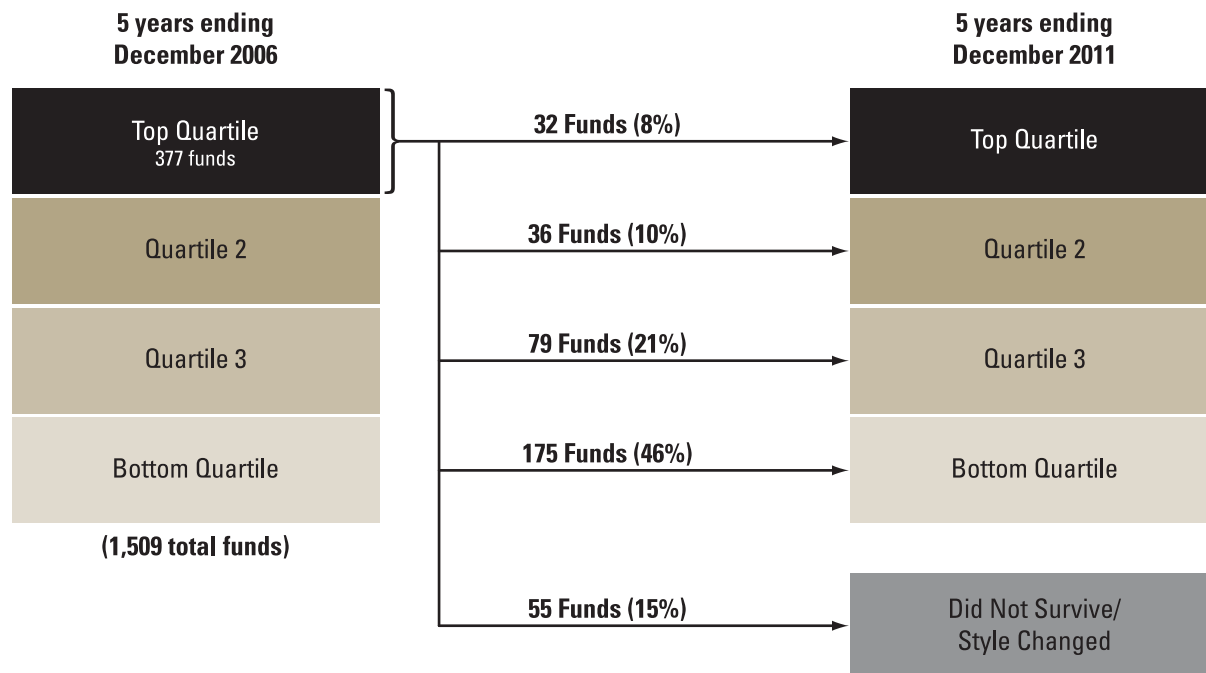


Data source: Morningstar Direct, Domestic Large Growth Funds (distinct portfolios) ranked by calendar year performance.

Subsequent Performance of Top 25% of U.S. Large-Cap Funds

(As of December 31, 2011)

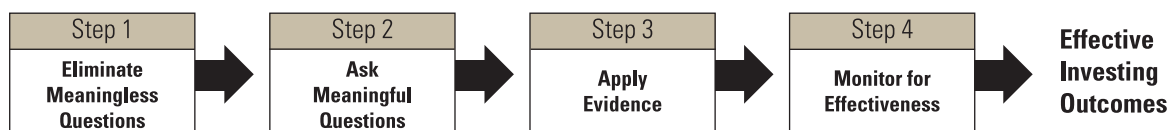
Figure 5b



Source: Dimensional Fund Advisors

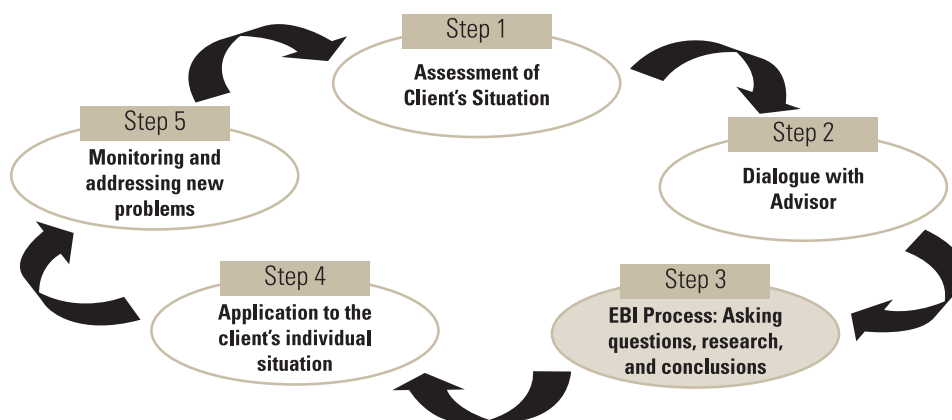
The Stepwise Application of Evidence-Based Investing

Figure 6a



The Integration of Evidence-Based Investing Into the Advisor-Client Relationship

Figure 6b



A Comparison of Conventional Investment Strategies vs. Portfolios Developed Using an Evidence-Based Method

Figure 6c

Strategies	Conventional Methods	EBI Conclusions
Management Style	Active Management - Security Selection	Index / Passive / Structured
Allocation Style	Active Management - Market Timing	Disciplined Rebalancing
Stock Size	Primarily Large	Add Additional Small
Fixed Income	All Bonds	Exclude Long-term, Junk, Exotics
Style	Tilt to Growth	Tilt to Value
Geographic	10 - 15% Foreign	25-35% Foreign
Alternatives	Often focused on hedge funds	Commodities and REITs
Diversification	Limited Diversification - Concentrated	Broad Global Diversification
Tax Management	Tax-Indifferent	Tax-Efficient

6. The Evidence-Based Method: From Medicine to Investment Management

This paper has exposed the three tenets of the conventional approach as resting on spurious assumptions and false hopes. Whether one seeks investing success by picking stocks, timing the market, or by picking skilled money managers, the costs of these speculative techniques are greater than any gains derived by their practice. These conclusions have been reached through an informal application of an evidence-based method – a process developed by examining evidence-based approaches in other fields, particularly the medical field. Evidence-based medicine has a long history, and it has been refined extensively over the past 20 years.

The implications of Evidence-Based Investing or *EBI* are simply enormous. The first purpose of EBI is to provide a clarifying template that, laid across the spectrum of topics confronting today's investor, provides a fixed set of empirical and logical principles that make it possible to better judge the wisdom of investment advice (**Figure 6a**).

The second purpose of EBI is to enhance the investor/advisor relationship by revisiting the individual's goals and personal situation, thus increasing the likelihood of optimal gains in the future. To this end, EBI offers a way to answer investment questions in a systematic, analytical, and scientific manner (**Figure 6b**).

Step One: Eliminate Meaningless Questions

In Evidence-Based Investing, the only good question is one that can be verified. For example, consider the following question:

“Did the market decline today out of concern over Iranian oil production?”

There would be no way to irrefutably verify either a positive or a negative answer to this question. There are countless unverifiable

questions and statements that permeate investment news on a daily basis. This brings to light the importance of the next step in EBI – the need to develop the right questions.

Step Two: Ask Meaningful Questions

Meaningful questions need to be formulated. That means asking questions that can be proven or disproven with reference to evidence. The questions must also have significance for the individual investor. This requires the experience and knowledge of an objective financial advisory team.

Step Three: Apply the Evidence

Just as important as the rejection of non-verifiable questions and the development of questions that can be verified, is the *application* of the evidence through integration of both advisor expertise and the individual investor's values and goals.

Step Four: Monitor for Effectiveness

The final step in EBI is evaluating the effectiveness and efficiency of the process. This involves closely analyzing portfolio performance (after all costs) and revisiting the investor's goals and values. Effective monitoring presumes that the advisor is compensated by pre-determined fees rather than commissions. If commissions influence investment decisions, it is very difficult for an advisor to maintain objectivity.

Data obtained must be applied in the context of an individual's goals, needs, and circumstances. In this way, empirical research becomes more relevant to practical investing, and practical investing is backed by solid theory and economic knowledge. The end result is a client-centered wealth management approach that fights against misinformation and implements asset allocation strategies using highly structured, passively managed index funds across a wide range of broadly diversified global asset classes (**Figure 6c**).

7. Buy-and-Hold Indexed Strategies: Better Building Blocks

Question: *How does one avoid the failed methods of active managers?*

The conventional approach to investing is anchored in the basic belief that active managers can effectively outperform the market. However, the evidence clearly shows that active management is inefficient, costly, and counter-productive. It is very difficult if not impossible to consistently beat the market over time. There is an abundance of logical, mathematical, and empirical evidence to support this fact.

Indexed strategies recognize that financial markets discover and distribute financial information so quickly that it is difficult or impossible for active managers to consistently outperform the market over the long run. The goal of a basic index fund is to provide a return which matches the performance of a given market index, minus very modest expenses. The strategies are called “indexed” because the intention is to buy and hold all or most of the stocks in a target index.

Index strategies are often referred to as “passive” to denote the rejection of active trading. For instance, one might invest in an *S&P 500* index fund to gain exposure to the 500 U.S. large stocks that make up the *S&P 500* (See **Figure 7a**). The index fund keeps costs low by typically trading only when a stock moves in or out of the index.

Of course, index funds are now available for nearly all asset classes. In addition to the *S&P 500*, index funds now track small stocks, foreign stocks, bonds, and various alternative asset classes. To gain perspective on the index cost savings, **Figure 7a** further illustrates the cost difference between the average U.S. active fund and the largest U.S. total market index fund.

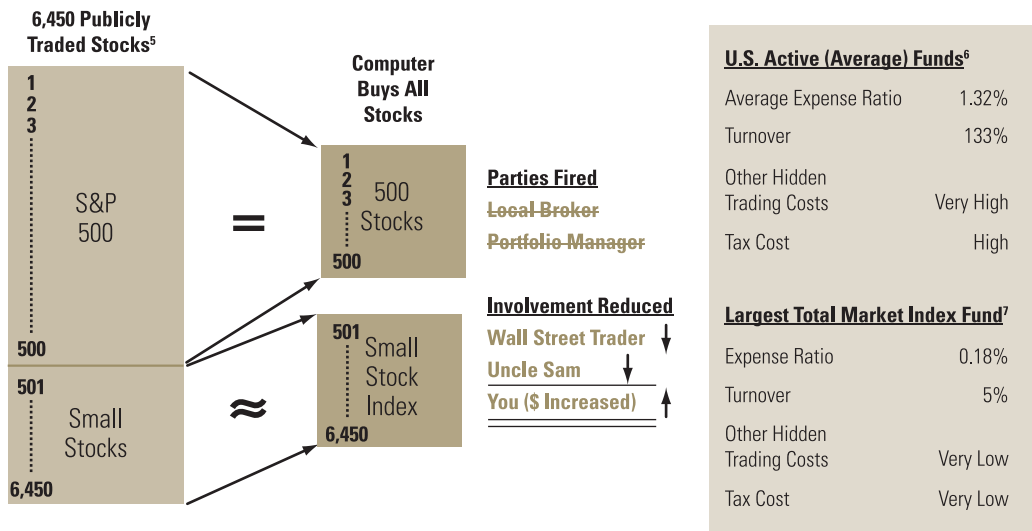
Whereas index funds seek to replicate an index as closely as possible, other index-like investment vehicles are more flexible and do not perfectly emulate a particular index. Whether it is a passive fund, asset class fund, or exchange-traded fund, the essential characteristics of all buy-and-hold index-like investment vehicles are low cost, long-term investments that are tax-efficient and transparent. A comparison of indexed investment options with conventional, actively managed funds can be seen in **Figure 7b**.

It is nearly impossible for active managers to exploit market inefficiencies in such a way as to justify their higher management costs and taxes over time. As previously discussed, there is an overwhelming body of academic and industry evidence that documents the routine failure of active management. Index and other similar funds offer the ideal path to broadly diversified and tax-efficient global portfolios of stocks, bonds, and alternative investments.

“Indexing” Approach to Investing

(As of December 31, 2011)

Figure 7a



Various Index-like Strategies Compared to Active Management Strategies

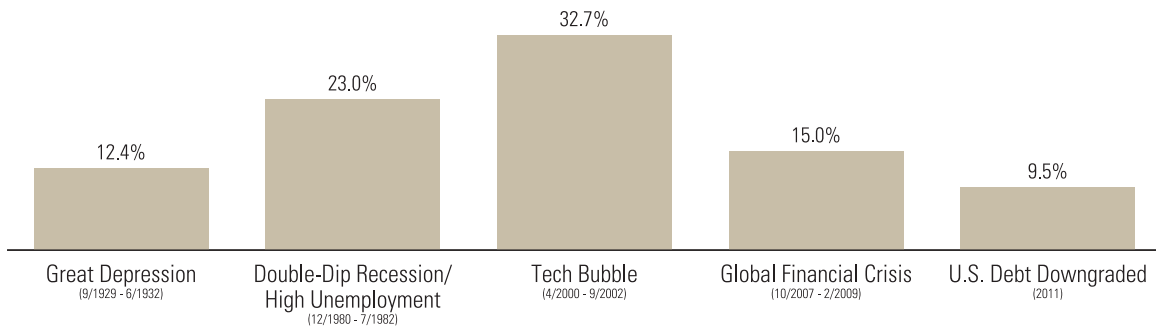
Figure 7b

	Fund or Account Type	Tracks An Index?	Can Hold Illiquid Assets?	Tax Efficient?	Fully Transparent?	Overall Expense
Index-Like Strategies	Institutional Index Fund	Yes	No	Typically	Yes	Very Low
	Retail Index Fund	Yes	No	Typically	Yes	Low
	Exchange Traded Fund	Yes	No	Yes	Yes	Low
	Passive Funds	Approx.	Yes	Typically	Yes	Low
	Tax-Managed Funds	Approx.	Sometimes	Yes	Yes	Low
	Structured Funds	Approx.	Sometimes	Typically	Yes	Medium
	Asset Class Funds	Approx.	Sometimes	Sometimes	Yes	Depends
Active Strategies	Separate Account Index	Approx.	No	Yes	Yes	Low
	Actively Managed Funds	No	Typically No	No	Depends	High
	Hedge Funds	No	Yes	No	No/Unregulated	Very High

Source: Savant Capital Management

High-Quality Bond Performance During Equity Bear Markets

Figure 8a

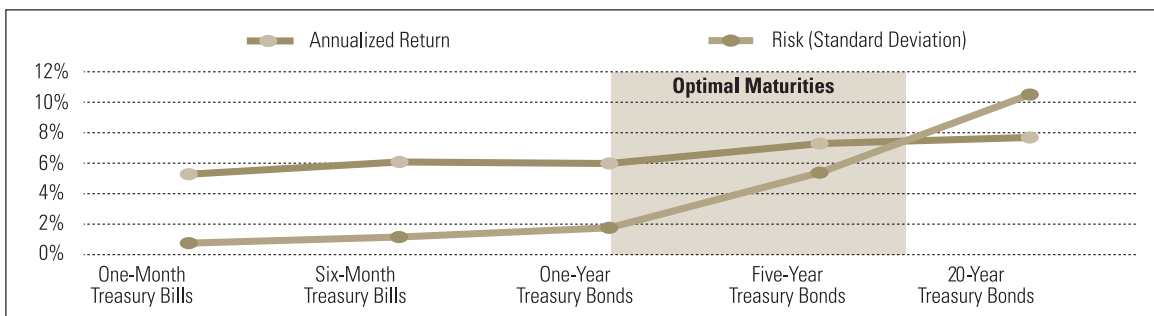


Data Source: Morningstar Direct, Reflects Ibbotson Intermediate-Term Government Bond Index.

Short and Intermediate-Term Bonds Offer the Optimal Risk/Return Tradeoff

(1964 - 2011)

Figure 8b

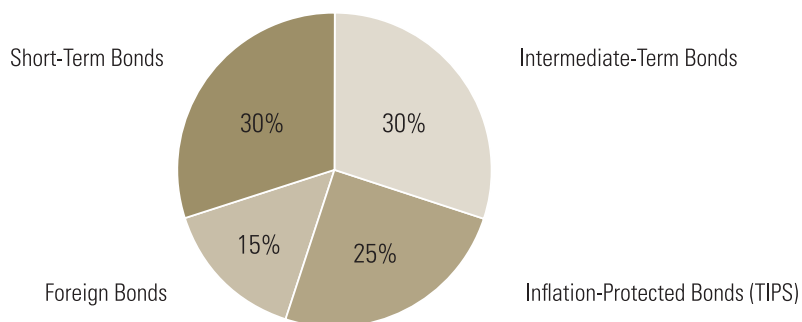


Maturity	1 Month	6 Month	1 Year	5 Year	20 Year
Annual Return (%)	5.3%	6.1%	6.0%	7.3%	7.7%
Risk (Standard Deviation)	0.8%	1.2%	1.8%	5.4%	10.5%

Data Source: Morningstar Direct, Dimensional Fund Advisors. See Endnote 8.

Savant Bond Strategy

Figure 8c



8. Bonds Reduce Risk and Protect Income

Question: *Can bonds reduce the risk of bear markets?*

Bonds have always been a preferred means of protecting principal and providing income. Recent innovations have brought a wide array of new bond investment vehicles to market; consequently, the current function of bonds is far less straightforward than it was in the past.

In order to protect capital against discouraging markets, it is not enough simply to invest in bonds. It is imperative to understand exactly what types of bonds are involved. For instance, junk bonds, preferred stock, convertible stock, and long-term bonds fail to offer investors sufficient return for their higher levels of risk. Since the purpose of holding fixed income is to protect the portfolio, it does not make sense to enter these risky areas of the market.

Figure 8a shows how high-quality bonds can be an effective hedge against equity bear markets. High-quality bonds have historically enjoyed positive returns during volatile markets and helped to ease the pain felt in the equity portfolio.

Similarly, long-term bonds should be avoided. While long-term bonds are riskier than intermediate (i.e. five-year) bonds, they have historically earned a similar return (**Figure 8b**). In short, long-term bonds do not compensate investors for extending maturities and taking more risk. Holding cash will not solve the problem; one-month bonds (cash) earned far less than one-year bonds, even though they incurred similar risk. Historically, short and intermediate-term bonds are optimal because they maximize return for their level of risk.

Treasury Inflation-Protected Securities (TIPS) offer additional diversification. They have a low correlation (described below) to other asset classes (including bonds), particularly during periods of high inflation. TIPS have a fixed interest rate at the time they are issued; however, the bond's underlying principal rises and falls with changes in inflation. TIPS actually increase in value during periods of inflation. In the event of a deflationary environment, these bonds still add safety. Even if total payments are lower than anticipated, the investor still receives the full face value at maturity.

Foreign bonds make up the final piece of a truly diversified bond portfolio. By holding bonds issued by countries outside the U.S., it expands the investment opportunity set, insulates the portfolio from interest rate risk and inflation in the U.S., and adds an asset class with a low correlation to U.S. equity and fixed income.

Effective asset allocation and diversification within a bond portfolio requires a deep understanding and focus on the correlation of various bond products.

What is correlation? To fully appreciate the power of this statistical term, it is helpful to see it at work in the everyday world. Street vendors often sell seemingly unrelated products such as umbrellas and sunglasses. Initially, that may seem odd. After all, when would a person buy both items at the same time? They probably never would. Umbrellas and sunglasses have a very low correlation. By diversifying the product line, the vendor can reduce the risk of losing money on any given day. Rain or shine, the street vendor prospers. Incorporating asset classes with low correlations allows investors to minimize risk and volatility in a similar way.

In order to create a strong bond allocation, intermediate and short-term bonds should be blended with TIPS and foreign bonds – the four parts that make up a defensive bond portfolio (**Figure 8c**). This four-part bond mix protects against a variety of adverse market conditions, from a weak economy to inflation and/or deflation.

The decision to include bonds in a portfolio means investing less money in equity markets. While the implication is a lower return, there is an accompanying reduction of risk during challenging markets. Assuming that a diversified and defensive bond portfolio is partnered with a properly allocated stock portfolio, lower bond returns during periods of low inflation and high growth are more than offset by robust stock gains.

9. Small Companies Offer Higher Returns and Broader Diversification

Question: *Can small stocks be safely included in diversified portfolios?*

It is not uncommon for investors and advisors to believe that conservative investing for the long haul should exclude small company stocks. At first glance, this belief may look sound. Yet the evidence strongly suggests otherwise. While it is true that small stocks are more volatile than large stocks (i.e. *S&P 500*), they account for most U.S. stocks. As a result, there is no way to capture overall stock market returns without paying close attention to small stocks.

Small stocks offer higher expected returns. History verifies this. This additional return is often referred to as *the small stock premium*. It is depicted in **Figure 9a**. Note that the superior returns of small stocks hold true around the globe. From 1926 to 2011, U.S. micro-cap stocks (the very smallest companies) provided an average annual return of 12.1% compared with only 9.9% for large-cap stocks. Internationally, small stocks performed even better, returning an average of 15.7% compared to only 11.4% for international large stocks.

To put these returns into perspective, consider the following scenario: An investor who put \$1,000 in the largest stocks in 1926 would have \$2,300,000 today. If the same \$1,000 had been invested in the smallest stocks, the investor would have \$11,686,000. That is a truly stunning difference. The strength of small stocks is consistent over long periods. To take an analogy from nature, small stocks are the acorns in the forest. While not every one will grow into a mature tree, if no acorns matured at all, there would be no forest. Likewise, no tree grows forever. So it is sensible to see comparative limits to the future growth of mid-cap and large stocks.

Figure 9b illustrates the benefit of diversifying into small stocks. Large company stocks make up deciles 1 and 2, mid-cap stocks make up deciles 3 through 5, and small stocks make up deciles 6 through 10.

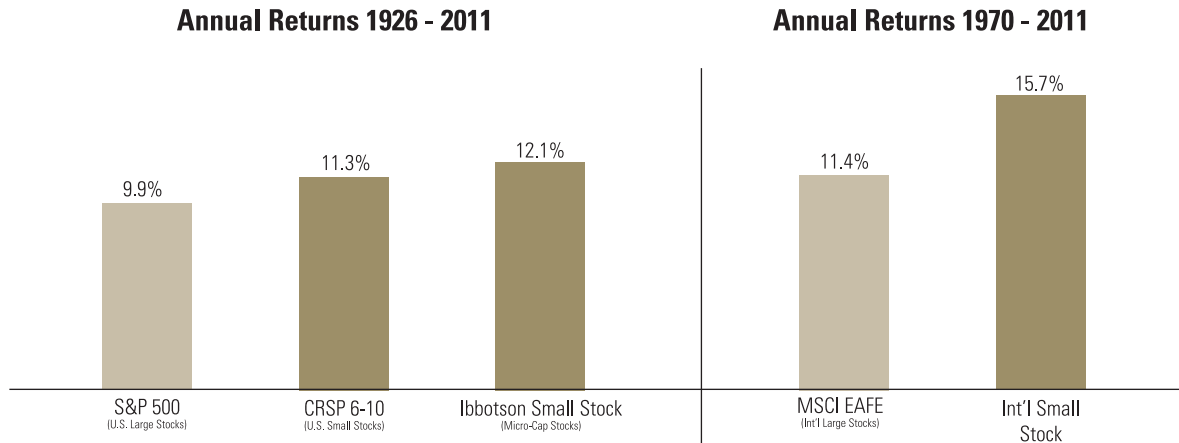
The average annual return is listed for each 3-year period from 1927 to the present for each decile. The largest and smallest stocks tend to act very differently each period. Small stocks provide a key to capturing higher returns and lower risk. The table shows that the vast majority of activity is at the two end-points of the continuum — very large and very small.

While reviewing the correlation values at the bottom of the table, keep in mind that it is on a scale from 1 to -1. A value of 1 indicates perfect correlation (no diversification benefit). A positive correlation means that the two investments tend to rise and fall together over time. A low or negative correlation indicates that the investments act differently, and when one investment is rising, the other may fall or go sideways.

It is noteworthy that mid-cap stocks act more like large stocks. This is evidenced by their high correlations ranging from 0.92 to 0.95. Thus, they provide comparatively little diversification benefit. In contrast, small stocks act quite differently, which is to say their correlation is lower. Their correlation to the *S&P 500* falls as low as 0.73. The benefit of diversification occurs at the size extremes, not in the middle.

Both in the U.S. and Internationally, Small Stocks Offer Investors Higher Long-Term Returns

Figure 9a



Data Source: Morningstar Direct and Center for Research in Security Prices (CRSP)

Blending Large & Small Stocks Enhances Diversification

(Three-year Rolling Returns - Highest and Lowest Returns Since 1927)

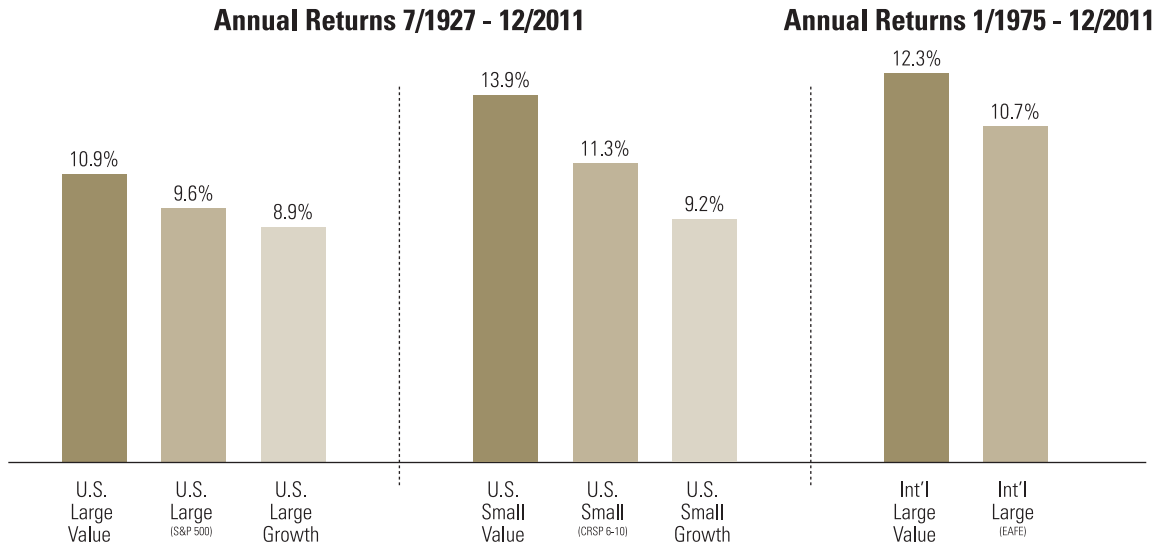
Figure 9b

Size Decile	Largest					Smallest				
	1	2	3	4	5	6	7	8	9	10
1927-29	18.6	18.2	12.3	7.1	16.0	-1.6	4.4	0.3	-4.1	0.3
1930-32	-26.7	-32.1	-30.4	-32.6	-33.5	-30.9	-34.6	-35.9	-35.2	-28.5
1933-35	28.3	42.9	44.0	51.3	52.1	54.0	58.9	80.5	74.3	98.6
1936-38	3.4	4.3	1.9	2.5	5.0	4.2	2.0	0.6	6.2	-5.2
1939-41	-4.5	-6.9	-5.7	-4.6	-3.9	-3.5	-3.4	-6.5	-7.6	-12.8
1942-44	17.9	28.0	25.4	31.0	36.3	36.4	45.5	49.0	61.7	93.8
1945-47	9.3	12.4	12.4	13.4	12.5	13.5	11.2	11.4	15.5	16.5
1948-50	16.6	17.4	17.8	15.4	16.6	16.8	17.5	15.1	16.2	22.5
1951-53	12.0	12.2	10.9	8.8	7.3	7.4	8.4	4.6	4.7	0.1
1954-56	27.2	25.1	26.4	25.2	25.9	27.5	26.4	24.6	27.9	27.7
1957-59	12.8	14.5	15.1	18.0	17.2	13.8	18.8	16.7	20.9	17.7
1960-62	5.0	6.6	6.0	4.5	1.9	1.1	0.9	2.7	1.3	1.3
1963-65	15.7	18.3	20.4	19.2	20.1	24.0	22.3	22.8	19.7	24.4
1966-68	5.6	9.9	14.4	17.3	21.5	24.1	23.6	32.5	35.0	45.9
1969-71	3.4	0.1	3.1	-1.1	-2.9	-2.2	-6.4	-9.5	-12.3	-13.2
1972-74	-8.5	-13.0	-14.0	-17.1	-16.7	-19.0	-20.7	-20.6	-24.0	-25.1
1975-77	13.2	22.3	29.0	33.0	36.6	38.3	42.3	47.2	44.6	49.7
1978-80	17.6	21.0	24.1	24.6	26.1	31.6	31.3	31.1	32.8	33.4
1981-83	9.8	11.4	16.6	18.2	20.1	20.3	17.9	21.4	21.4	24.1
1984-86	18.9	20.6	15.5	14.4	13.7	13.4	12.6	9.5	8.0	0.6
1987-89	17.1	16.1	16.8	15.3	13.2	12.3	10.1	11.7	5.9	2.8
1990-92	10.6	12.5	13.1	12.5	17.1	14.1	13.3	10.0	12.4	10.9
1993-95	15.0	14.6	14.6	15.0	15.3	14.3	15.5	14.0	15.1	16.7
1996-98	31.2	20.6	16.3	17.2	9.7	15.1	15.6	13.9	12.8	8.2
1999-01	-3.0	2.6	6.1	5.1	4.4	9.8	8.0	13.5	15.0	14.7
2002-04	1.7	10.8	10.1	12.1	10.9	12.5	11.4	15.6	16.3	29.2
2005-07	8.7	11.6	10.2	8.9	11.1	7.6	8.2	6.2	3.8	4.4
2008-10	-3.4	-0.7	2.4	3.4	6.7	2.6	6.5	8.2	6.7	7.3
Correlation w/ S&P 500	0.99	0.97	0.95	0.93	0.92	0.89	0.87	0.84	0.81	0.73

Source: Morningstar Direct, Dimensional Fund Advisors

Value Stocks Outperform Growth Around the World (Annualized Returns)

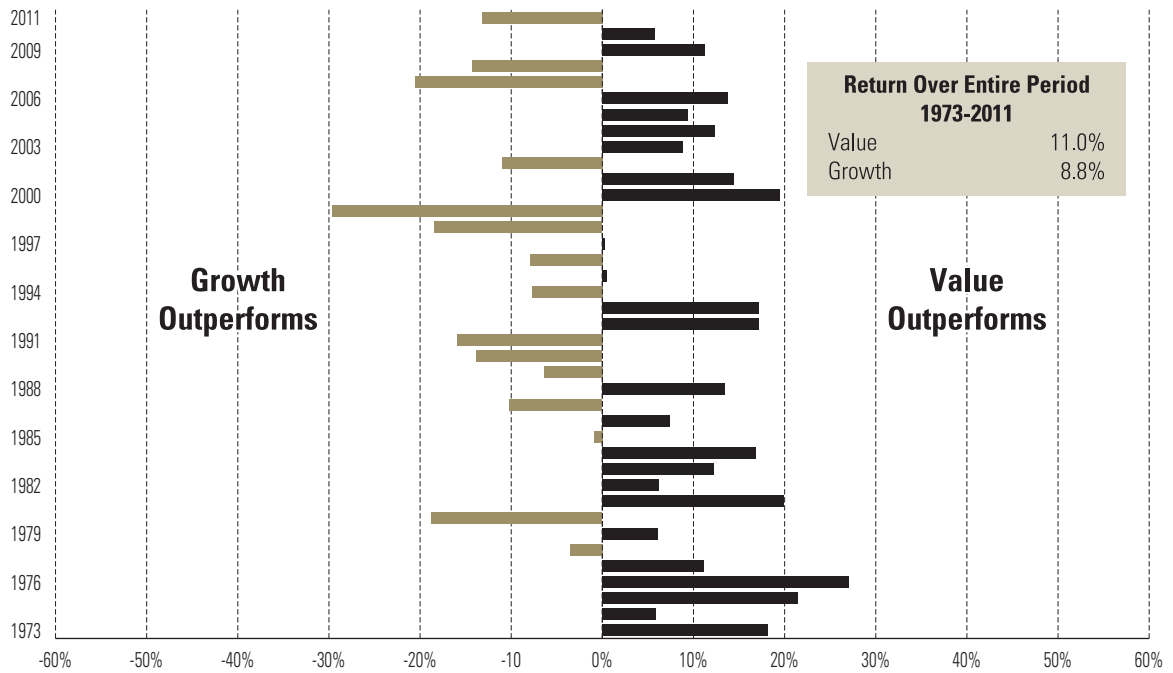
Figure 10a



Data Source: Morningstar Direct and Center for Research & Security Prices (CRSP). See Endnote 9.

Historical Data: Value vs. Growth Stocks (Annual Returns 1973 - 2011)

Figure 10b



Data Source: Morningstar Direct.

10. Value Stocks Outperform Growth Stocks

Question: *Are value stocks preferable to growth stocks?*

As their name suggests, value stocks are generally thought to be a bargain: The price is low relative to company assets, sales, and earning potential. Value stocks often tend to be older companies that, for one reason or another, have fallen out of favor with the financial media. They no longer generate buzz.

Value stocks can be described as *on sale* or even *beat up*. Growth stocks, sometimes called *glamour stocks*, are splashed across the headlines of magazines and newspapers. Typically, these have had very good runs and thus attract a lot of attention. Growth stocks are winning stocks. Naturally, there are plenty of investors willing to buy them. However, as the evidence suggests, there is a catch. The high expectations generated by heavy media coverage often cause growth stocks to be overpriced.

Both history and evidence vindicate the value investor over the growth investor. Since 1927, value stocks have outperformed growth stocks. This holds true in large, small, and international categories. The margins are sizeable across the board. U.S. large value stocks beat large growth stocks by 2.0%, and U.S. small value stocks beat small growth by 4.7% (**Figure 10a**).

In their breakthrough study, “Value versus Growth: The International Evidence”, Eugene Fama and Kenneth R. French demonstrated that value stocks have higher returns than growth

stocks outside the U.S.¹⁰ They demonstrated that “value stocks have higher returns than growth stocks in markets around the world.” For the 20-year period covered by their study, the difference “between the average returns on global portfolios of growth and value stocks is 7.68% per year. Furthermore, value stocks outperformed growth stocks in 12 of 13 major markets.” Value stocks only lagged in Italy, a market notorious for its poor accounting data.

Faced with the historical superiority of value over growth stocks, it can be tempting to consider investing exclusively in value. But once again the evidence warns against too much concentration in one area of the market. In fact, there are some periods of time, such as the late 1990s, when growth stocks outperformed value stocks by a wide margin (**Figure 10b**). The graph illustrates the variation in value and growth trends over an extended period of time. While value stocks are preferable, an asset mix that includes both value and growth provides the diversification necessary to reduce risk.

Of course, investing in value stocks does not require the selection of individual stocks any more than investing in small stocks. Value stocks, like small stocks, are a distinct class of securities that can be quantifiably defined, captured using a specialized index fund, and added to a portfolio to maximize return for an investor’s appropriate level of risk.

11. The Importance of International Investing

Question: *Is it advantageous to diversify overseas?*

Given the immense size of the U.S. capital markets and the unpredictability of many foreign economies, many investment professionals limit their clients' portfolios to domestic securities. In the past, it was indeed possible to invest in the domestic stock market and be quite well diversified. With changes in the global economy, following this approach today results in the loss of significant return and diversification opportunities.

As **Figure 11a** illustrates, the U.S. market now makes up less than half of the world's market capitalization. It is important to note that some countries lack stability and represent significant risk to investors. Accordingly, not all of the 117 countries with stock markets have securities available to U.S. investors.¹³ The companies listed on foreign stock exchanges number nearly 42,000¹⁴ compared to roughly 6,500 in the U.S.¹⁵

The global economy is now substantially larger than that of the U.S., with 77% of world gross domestic product presently generated outside the United States.¹⁶ Recently, China and India have experienced economic growth that has been much more rapid than in the U.S. Today, nearly 20% of U.S. consumer dollars go overseas (**Figure 11b**). Foreign companies now dominate several global industries such as energy and textiles. It should come as no surprise that foreign stocks behave differently

than U.S. stocks, making them an excellent source of broad portfolio diversification.

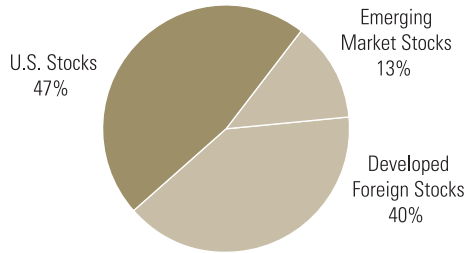
Research shows that from 1970 to 2011, the correlation between international stocks and U.S. stocks was low, with even lower correlation between international stocks and U.S. small stocks.¹⁷ In the 1980s, foreign markets provided the highest returns. In the 1990s the U.S. market dominated. Overseas markets again outperformed in the 2000s (**Figure 11c**).

There are significant advantages to a global investment strategy that includes Europe, the Pacific, the Americas, and emerging markets. International investing broadens exposure to opportunities, allowing the investor to diversify over a much larger number of stocks. It is sensible for U.S. investors to make investment choices that mirror their global consumption habits and invest in companies with whom they do business.

As illustrated in **Figure 11d**, a portfolio that includes both domestic and international equities has experienced higher returns and lower risks than a portfolio composed solely of either U.S. or international stocks. In the end, there is no more compelling evidence for the inclusion of international stocks in a diversified portfolio.

Where is the World's Wealth Located?

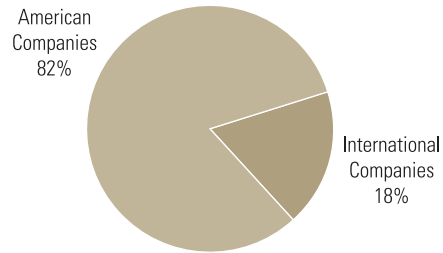
(Global Market Capitalization as of 2011) Figure 11a



Source: Dimensional Fund Advisors

Where Americans Spend their Money

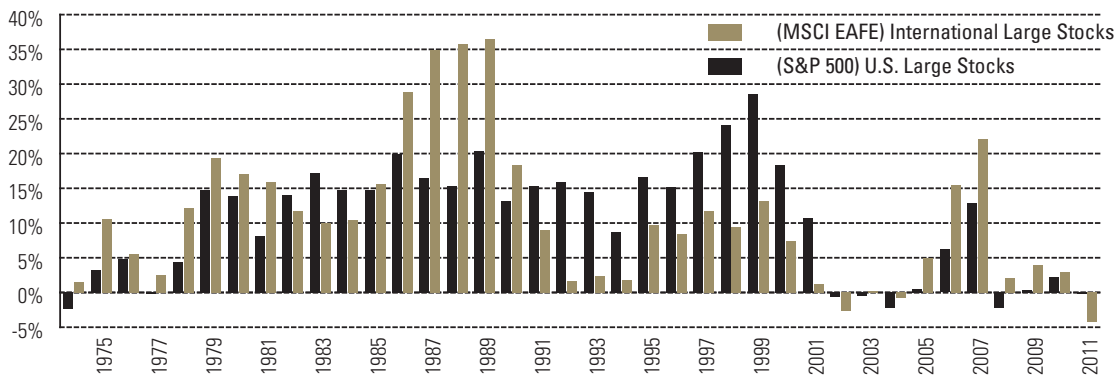
(As of December 2011) Figure 11b



Data Source: Federal Reserve, See Endnote 11.

Comparing U.S. & International Stock Performance

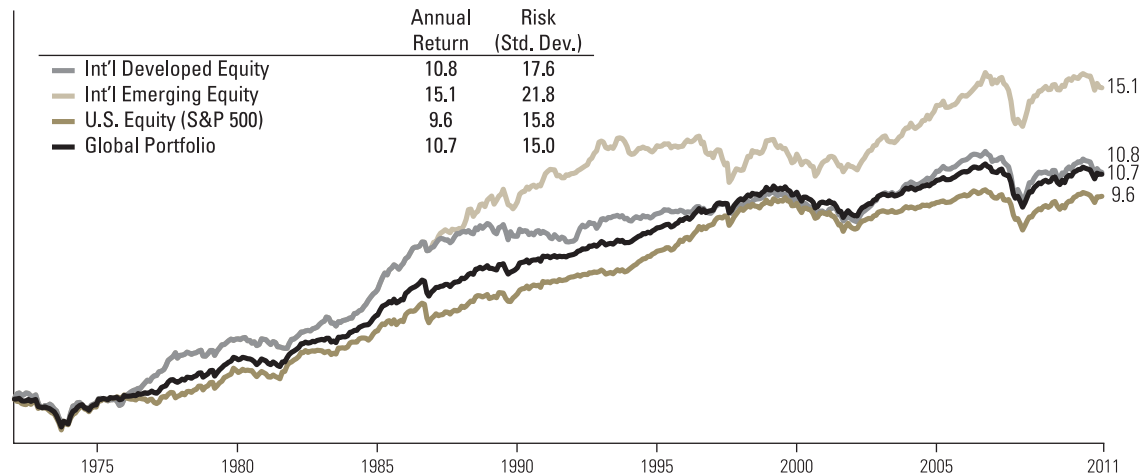
(Five-year Holding Periods Between 1970 - 2011) Figure 11c



Data Source: Morningstar Direct

Global Strategies Earned More with Less Risk

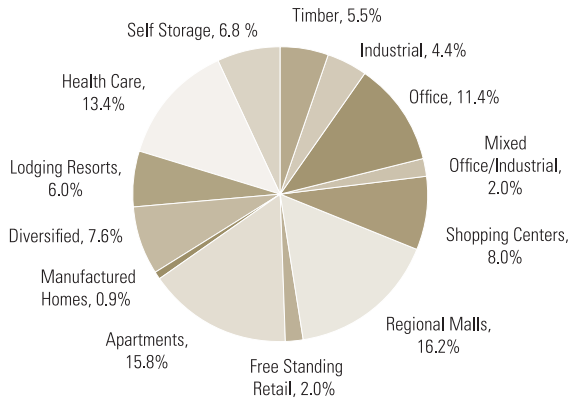
(1973 - 2011) Figure 11d



Source: Morningstar Direct, See Endnote 12.

Equity REITs Invest Across a Broad Array of Real Estate Sectors

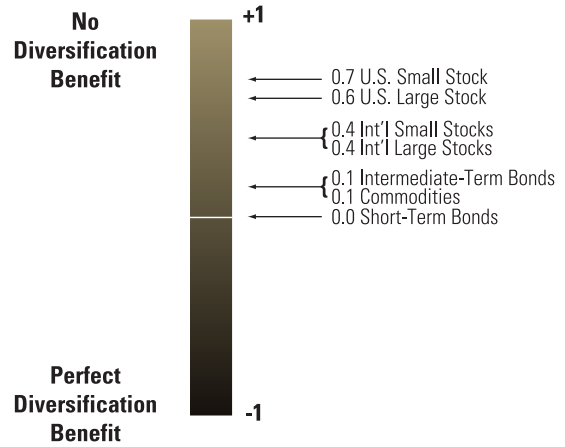
(Index Components as of December 2011) *Figure 12a*



Data Source: National Association of Real Estate Investment Trusts (NAREIT).

REITs Offer Unique Diversification

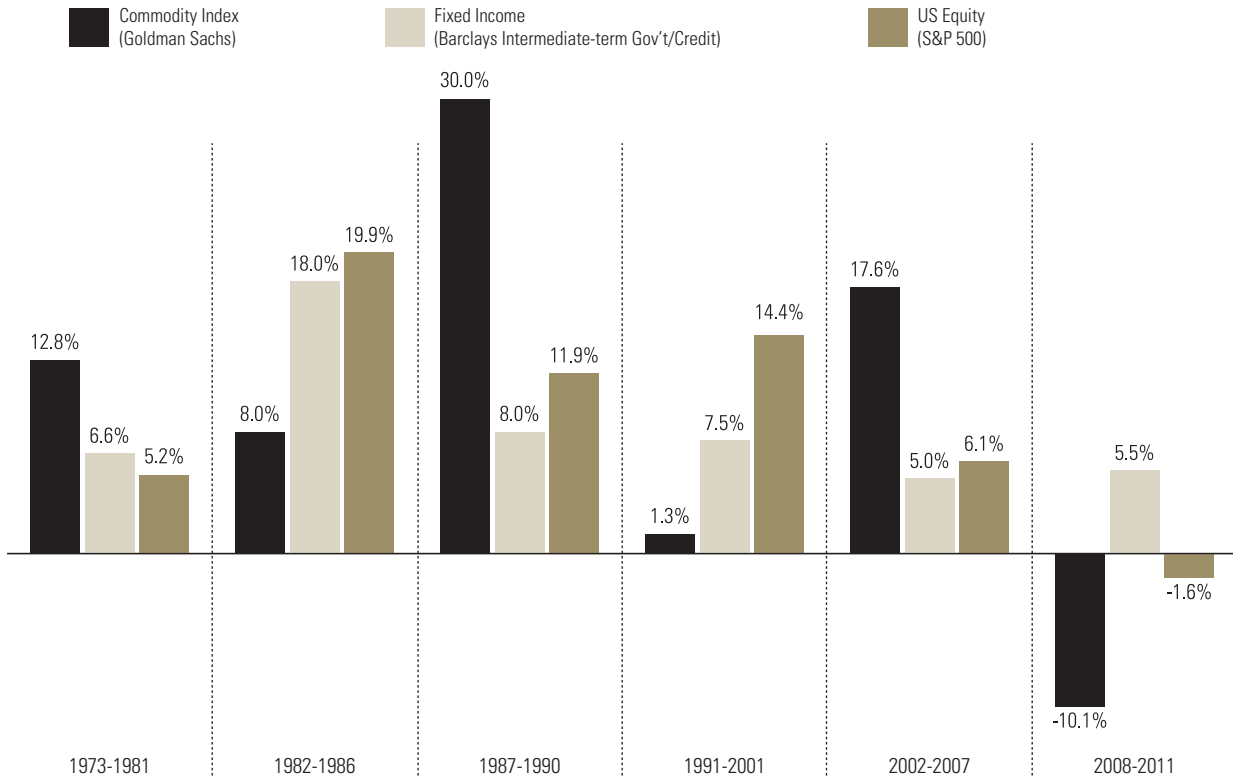
Correlation of REITs vs. Other Asset Classes (1973 - 2011) *Figure 12b*



Data Source: Morningstar Direct

Commodity Cycles Vary Significantly from Stock and Bond Asset Classes

(Annual Returns For Selected Cycles 1973 - 2011) *Figure 12c*



Data Source: Morningstar Direct

12. Reinforcing Diversified Portfolios with Alternative Investments: REITs & Commodities

Question: *Should diversified portfolios invest in assets other than stocks and bonds?*

REITs (real estate investment trusts) and commodities add a dimension of portfolio protection by virtue of their low correlation with stocks and bonds. The section about bonds illustrated the impact of diversification with an example of a vendor selling umbrellas and sunglasses. His two wares had very low correlation to one another. The vendor reduced the risk of losing money on any given day. In portfolio design, correlation describes this relationship in terms of the rise or fall of different investments or, more precisely, different asset classes.

REITs are publicly traded stocks that invest in various real estate projects. As **Figure 12a** shows, equity REITs invest across a broad array of real estate sectors. Historically, equity REITs have outperformed both traditional U.S. large stocks and bonds.¹⁸ The correlation scale in **Figure 12b** illustrates the relationship between REITs and various other asset classes since 1973. REITs have a low to moderate correlation with small stocks, large stocks, and bonds. They also have a very low correlation with commodities.

For most investors, REITs are superior to other alternative investments like private equity and hedge funds. Their availability, low costs, liquidity, and transparency make them a great addition to the portfolio. In contrast, private equity investments are illiquid and often difficult to access. Hedge funds are extremely expensive, secretive, risky, and unregulated.

Commodities – which include energy, precious and industrial metals, and agricultural assets – are another type of alternative investment offering diversification benefits. The vendor in the previous example is a shrewd businessman because his umbrellas and sunglasses have a negative correlation, which reduces risk. As depicted in **Figure 12c**, commodity returns are very different compared to stocks and bonds during a variety of market cycles. For example, the *Goldman Sachs Commodity Index* and the *S&P 500 Index* (U.S. large stocks) have exhibited a very low correlation of 0.1 since 1970.¹⁹ Commodities are also negatively correlated to bonds.

The evidence shows that adding REITs and commodities to a basic portfolio results in a clear diversification benefit. Measured allocations of REITs and commodities enhance diversification and limit risk by exposing the portfolio to asset classes that behave differently than regular stocks and bonds.

Portfolios benefit from alternative investments when they are transparent and accessible, and also have low correlations to other major asset classes. REITs and commodities demonstrate these traits, and are the logical completion of a broadly diversified portfolio designed to maximize returns and minimize risk.

13. Broadly Diversified Global Portfolios Achieve Better Returns

Question: *Can globally diversified index portfolios improve long-term returns and reduce risk?*

This paper draws on a wide array of the best available evidence to demonstrate the failure of active money management and build a case against stock selection, money manager selection, and market timing.

While repudiating the conventional approach to investing, this paper provides evidence in support of indexed investing, passive management, and broad global diversification guided by scientific methods. The findings include the following:

- Indexed investment strategies work.
- Asset allocation has a strong impact on returns.
- Owning a multitude of asset classes offers the dual benefit of increasing return while decreasing overall portfolio risk.
- Costs, which include published costs, hidden fees, and tax consequences, have a substantial impact on return.

Evidence shows that basic index funds outperform actively managed funds. This is true for the classic *S&P 500* index fund as well as simple stock/fund combinations such as the simple balanced index portfolio shown in **Figure 13a**.

An index portfolio using broad global diversification performed even better. The addition of a much wider range of asset classes increased returns and reduced risk.

While even the simple balanced index portfolio outperformed the average actively managed balanced fund by 0.3%

(**Figure 13b**), the broadly diversified balanced index portfolio outperformed the simple version by an additional 2.0%. In total, the broadly diversified global index investor earned 2.3% more annually than the active investor (10.9% vs. 8.6%). At the same time, indexing decreased risk. Notice the worst 10-year return of -0.1% for active balanced managers vs. a positive 0.1% for the simple index option and 3.4% in the case of the broadly diversified 60/40 balanced index option.

Evidence clearly shows that the added wealth generated by the broad, globally diversified index option is substantial. As **Figure 13c** illustrates, since 1973, investors who saved \$1,000 in the broadly diversified global index portfolio accumulated more than twice the wealth of investors owning actively managed funds. It paid to defy conventional wisdom and follow the evidence.

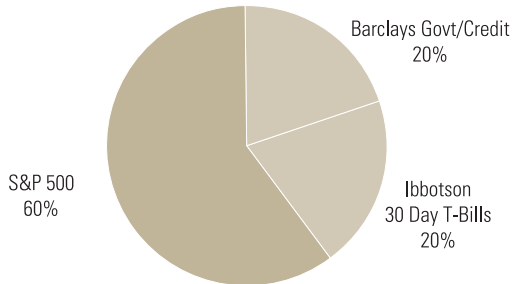
Simply put, the broadly diversified global index portfolio is a superior investment solution. This approach can be used to create broadly diversified global portfolios ranging from 100% stocks to 100% bonds, depending on the goals and risk tolerance of the individual investor. Broad global diversification reduces risk and generates better risk-adjusted returns. True diversification requires allocation among every viable asset class the market makes available to investors. Asset mixes without a broad and global reach close the door to effective diversification in today's global economy.

Broad Global Diversification Increases Return and Reduces Risk

(1973 - 2011)

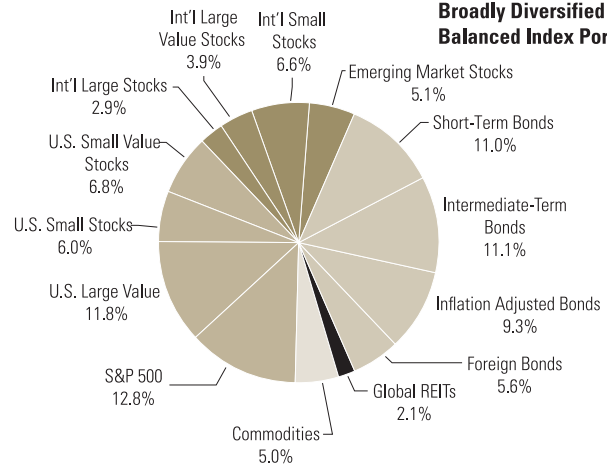
Figure 13a

Simple 60/40 Balanced Index Portfolio



Annual Return	8.9%
Standard Deviation	9.8%
Worst 10 Year Return	0.1%

Broadly Diversified 60/40 Balanced Index Portfolio



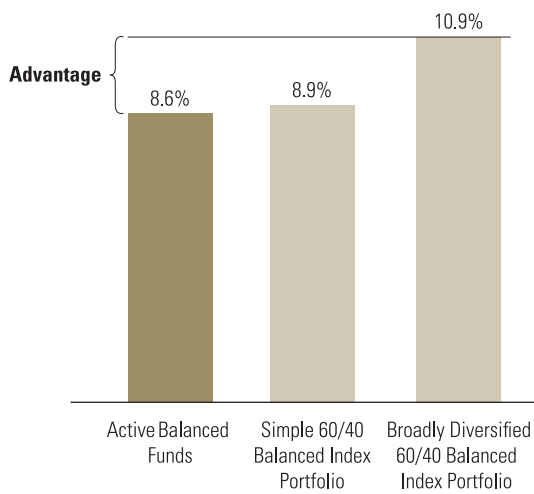
Annual Return	10.9%
Standard Deviation	9.6%
Worst 10 Year Return	3.4%

Data Source: Morningstar Direct

Broadly Diversified Portfolios Deliver Higher Returns and Less Risk

(1973 - 2011)

Figure 13b

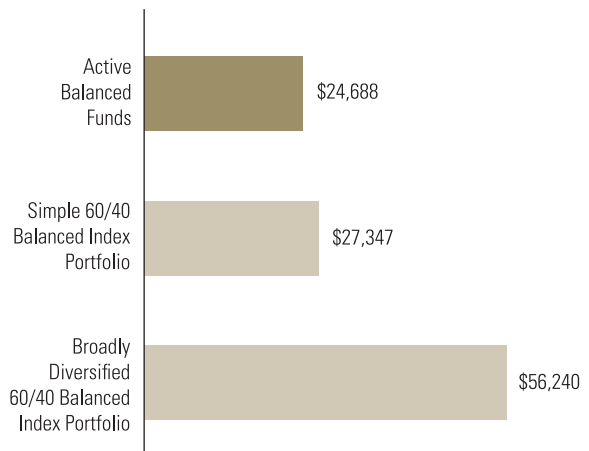


Standard Deviation	10.6%	9.8%	9.6%
Worst 10-Year Return	-0.1%	0.1%	3.4%

Higher Returns Increase Wealth Over Time

(Growth of \$1,000, 1973 - 2011)

Figure 13c



Data Source: Morningstar Direct. Active Balanced Funds reflect the Moderate Allocation Category average from Morningstar Direct.

The Evidence is Clear

SUMMARY

The purpose of this evidence-based approach to investing is to benefit the investor, whether individual or institutional. This paper demonstrates that the correct use and analysis of evidence can benefit the field of investing in much the same way as it has benefited the field of medicine. Approaching a problem or a set of questions from an evidence-based point of view has profoundly affected the field of medicine, and now investing.

Evidence-Based Investing–Negative Findings:

This paper has reviewed and analyzed the arguments supporting the conventional approach to investing. The best empirical data available has been analyzed to determine that:

- Market timing fails.
- Active money management fails.
- High costs cause money managers to fail.
- High taxes negate much of the return generated by active money management, causing even many “winners” to fail.
- Using past performance to pick money managers fails.

Evidence-Based Investing–Its Impact on the Relationship between Client and Advisor:

Investing resembles the field of medicine in another aspect – there is an art to the practice. There cannot be one “cookbook” answer for each individual investor. Rather, an advisor should work to tailor an investment approach to each investor’s individual circumstances.

EBI processes are ongoing. Analysis of pertinent data should have a direct impact on current investment options and approaches. Changes in investment recommendations should be based on the most recent empirical data with the simple goal of increasing investor return while reducing risk.

Evidence-Based Investing–The Positive Results

The broad application of Evidence-Based Investing in the preceding overview has yielded seven investment propositions:

1. Index-based investing optimally delivers market returns.
2. An effective and defensive bond strategy, reduces risk. Short, intermediate, inflation-protected, and foreign bonds protect against most adverse economic scenarios.
3. Small stocks add return and provide diversification benefits.
4. Value stocks offer a return premium globally.
5. Investing overseas enhances diversification and return.
6. Alternative investments, namely REITs and commodities, protect investors from inflation and challenging stock and bond markets.
7. Broad global diversification increases return and reduces risk.

In spite of the growing consensus and clear evidence against active management and speculation, the conventional active approach to investing is here to stay. Hopefully, armed with evidence and logic, the number of individual investors who get caught up in this unscientific approach will decrease. Why does the conventional view have such strong staying power? This question was asked by Nobel Laureate William Sharpe in his piece, “The Arithmetic of Active Management.” His answer follows:

More often, the conclusions (in support of active management) can only be justified by assuming that the laws of arithmetic have been suspended for the convenience of those who choose to pursue careers as active managers.²⁰

For us, the evidence is clear. This evidence presents a scientific framework investors can use to enhance the art of investing.

Appendix: Evidence-based Medicine: History and Methodology

The term *evidence-based medicine*, or EBM, was first used in the early 1990s. It is an attempt to apply the standards of evidence gained from the scientific method to certain aspects of medical practice in a uniform manner. EBM also seeks to judge the quality of specific evidence as it is applied to the assessment of the potential risks and benefits of a given treatment. According to the Centre for Evidence-Based Medicine at the University of Oxford, “Evidence-Based Medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.”²¹

Historically, testing the efficacy of medical interventions has existed for centuries. Alexandre Louis, a French physician, introduced an initiative called “*medecine d’observation*” in 1830. Louis stated to his colleagues that “physicians should not rely on speculation and theory about causes of disease, nor on single experiences, but they should make large series of observations and derive numerical summaries from which real truth about the actual treatment of patients will emerge.”²² Unfortunately, Louis met with strong resistance from his fellow physicians, who practiced in an era of medicine that lacked the solid basic science and experimental background of modern medicine. “*Medecine d’observation*” failed shortly after its appearance.

A Scottish epidemiologist, Archie Cochrane, set forth much of the groundwork for EBM in his 1972 book *Effectiveness and Efficiency: Random Reflections on Health Services*. His work has been honored through the naming of centers of evidence-based medical research – Cochrane Centers. Cochrane’s efforts also led to the establishment of the *Cochrane Collaboration*, an international organization dedicated to tracking down, evaluating, and synthesizing randomized controlled trials in all areas of medicine.²³ The concept and terminology of EBM originated with David Sackett and his

colleagues at McMaster University, with the term first appearing in the medical literature in 1992. An article in the 1992 *Journal of the American Medical Association* first used the term “evidence-based medicine”.²⁴

In the 1980s there were several studies examining the utilization of various operations in the healthcare system in the northeastern United States. There were large variations noted in the amount and type of care provided to similar populations. Nearby counties with similar populations were found to have variations in the rates of prostate surgeries and hysterectomies of up to 300%. Variation in the rate of cataract surgeries was noted to be up to 2000%. Researchers concluded that physicians must use very different standards to determine the need for surgery in a given patient. With the same body of information and medical research available to all practitioners, wouldn’t one expect more uniformity in medical practice? On a daily basis, clinicians are asked questions regarding the interpretation of a diagnostic test, the potential harm of a given medicine, the effectiveness of a preventive measure, the prognosis for a specific patient, and the cost effectiveness and consequences of a course of action. EBM gives physicians the ability to find a proven therapy for a patient.²⁵

The Methodology of EBM

EBM is an evolving methodology. There are a series of steps by which the method is used:

1. Formulation of a question that is to be answered.
2. Finding the best evidence of outcomes available.
3. Critical appraisal of the evidence.
4. Application of the evidence, including integration with clinical expertise and patient values.
5. Evaluation of the effectiveness and efficiency of the process.²⁶

Appendix: Continued

Once evidence has been gathered, it is stratified according to the quality of the evidence. A commonly used system is the one developed by the U.S. Preventive Services Task Force:

- **Level I:** Evidence obtained from at least one properly designed randomized controlled trial.
- **Level II-1:** Evidence obtained from well-designed controlled trials without randomization.
- **Level II-2:** Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group.
- **Level II-3:** Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.
- **Level III:** Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.²⁷

There are other alternative systems to categorize levels of evidence, such as the Oxford CEBM system:

- **Level A:** Consistent Randomized Controlled Clinical Trial, Cohort Study, All or None, Clinical Decision Rule validated in different populations.
- **Level B:** Consistent Retrospective Cohort, Exploratory Cohort, Ecological Study, Outcomes Research, Case-Control Study; or extrapolations from level A studies.
- **Level C:** Case-series Study or extrapolations from level B studies.
- **Level D:** Expert opinion without explicit critical appraisal, or based on physiology, bench research, or first principles.²⁸

After evidence has been obtained, analyzed, and categorized, a recommendation can be given. A taxonomy has been developed to rate a recommendation, based on both the balance of the risk vs. benefit as well as the level of evidence upon which this evidence is

based. The U.S. Preventive Services Task Force uses the following system:

- **Level A:** Good scientific evidence suggests that the benefits of the clinical service substantially outweigh the potential risks. Clinicians should discuss the service with eligible patients.
- **Level B:** At least fair scientific evidence suggests that the benefits of the clinical service outweigh the potential risks. Clinicians should discuss the service with eligible patients.
- **Level C:** At least fair scientific evidence suggests that there are benefits provided by the clinical service, but the balance between benefits and risks are too close for making general recommendations. Clinicians need not offer it unless there are individual considerations.
- **Level D:** At least fair scientific evidence suggests that the risks of the clinical service outweigh potential benefits. Clinicians should not routinely offer the service to asymptomatic patients.
- **Level I:** Scientific evidence is lacking, of poor quality, or conflicting, such that the risk versus benefit balance cannot be assessed. Clinicians should help patients understand the uncertainty surrounding the clinical service.²⁹

Example 1: Corticosteroids for Preterm Birth³⁰

The need for EBM, including the dissemination and use of the latest medical information, is illustrated by the case of corticosteroid use in the treatment of preterm birth. In 1972, a randomized controlled trial (RCT) was reported showing the improved outcomes for preterm infants whose mothers received corticosteroid treatment just prior to birth. From 1972 to 1989, six more RCTs were done on this subject, and all confirmed the findings of the 1972 study. During this time, most obstetricians were unaware of these studies, and corticosteroid treatment for mothers about to give birth to preterm infants did not become the accepted practice or standard-of-

References, Notes, Sources of Data and Methodology:

care. The first systematic review of the issue was published in 1989, and seven new studies were reported in the following two years. This treatment has been found to reduce the odds of a preterm baby dying from complications of immaturity by 30 to 50%, but thousands of babies did not benefit from this treatment because doctors did not know about the effectiveness of the treatment.

Example 2: Flecainide for the Treatment of Arrhythmias³¹

The use of the drug flecainide in the treatment of heart patients during the 1980s demonstrates another instance of the dangers of the gap between research and clinical practice. At an address to the American College of Cardiology in 1979, Bernard Lown, the inventor of the defibrillator, pointed out that one of the most common causes of death in young and middle aged men (20 to 64 years old) was heart attack. Moreover, he pointed out that arrhythmias, which often appeared as a result of a heart attack, were often the cause of death. He suggested that a safe and effective antiarrhythmic drug that protects against ventricular fibrillation could save millions of lives.

In response to this challenge, a paper was published in the New England Journal of Medicine regarding a new antiarrhythmic drug, flecainide. In a well designed randomized placebo-controlled cross-over trial, this local anesthetic was found to decrease the number of premature ventricular contractions (PVCs). The conclusions reached were quite straightforward: flecainide reduces arrhythmias, arrhythmias in heart attack patients cause death, therefore people who have had a recent heart attack should be given flecainide. Flecainide was approved shortly by the United States Food and Drug Administration, and this treatment soon became standard treatment for heart attack in the United States.

As flecainide became the standard of care, information about its use was published in medical textbooks. At the same time, researchers started gathering information on the survival of patients instead of the rate of PVCs. In other words, they started to actually measure the outcome as opposed to the mechanism. These subsequent studies showed that in the 18 months following a heart attack, more than 10% of the patients treated with flecainide died, which was about twice the number of deaths in the placebo group. Despite a useful mechanism of action – reducing cardiac arrhythmias – the drug was clearly toxic and overall did much more harm than good. Unfortunately, these subsequent studies received much less publicity than the original studies regarding the benefits of flecainide.

The widespread use of flecainide continued and actually expanded, and by 1989, about 200,000 people were being treated with the drug. Although good medical evidence to the contrary was available, the inappropriate use of flecainide continued due to the poor dissemination of the good quality outcome-based research studies.

The flecainide story demonstrates the importance of the dissemination of quality medical research. The initial information may have been more widely and readily accepted because it offered “a cure.” The follow-up studies were counterintuitive in their conclusions and negative with respect to a potential treatment. Doctors continued to prescribe flecainide because they believed it worked. They did not know that there was contrary information available. It is especially difficult to obtain information when one is unaware of its existence.

References, Notes, Sources of Data and Methodology Continued:

Indexes used except where otherwise noted.

U.S. Inflation – Consumer Price Index – Bureau of Labor Statistics

Treasury Bills – Ibbotson U.S. 30 Day T-Bill Index

Short-Term Bonds – Ibbotson U.S. 1-Year Treasury Index

Aggregate Bond – Barclays U.S. Aggregate Bond Index

Intermediate-Term Bonds – Barclays Intermediate Govt/Credit Bond Index

Long-term Treasury Bonds – Ibbotson U.S. Long-Term Govt Index

Inflation-Protected Bonds – 50% Barclays Intermediate Government/Credita Bond Index and 50% Ibbotson U.S. 1-Year Treasury Constant Maturity Appreciation Index (1/73 – 2/97), Merrill Lynch U.S. Treasury Inflation-Linked Securities Index (after 2/97)

U.S. Large Stocks – Standard & Poor's 500 Total Return Index

U.S. Large Value Stocks – Fama-French Large Value Index

U.S. Small Stocks – Ibbotson U.S. Small Stock Index

U.S. Small Value Stocks – Fama-French Small Value Index

Int'l Large Stocks – MSCI EAFE Index

Int'l Large Value Stocks – MSCI EAFE Index (1/73-12/74), MSCI EAFE Value Index (after 12/74)

Int'l Small Stocks – DFA International Small Company Index (1/73 – 9/96), S&P EPAC Small Cap Index (after 9/96)

Emerging Markets Stocks – 50% MSCI EAFE and 50% DFA International Small Company Index (1/73 – 12/84), IFC EM Composite Index (1/85 – 12/88), S&P IFCI EM Composite Index (after 12/88)

REITs – FTSE NAREIT Equity REIT Index

Commodities – S&P GSCI Commodity Index

[1] Centre for Evidence-Based Medicine. (n.d.). What is EBM? Retrieved August 4, 2008, from <http://www.cebm.net>

[2] Expense ratio of 0.18% reflects the cost of the Vanguard Total Stock Market Index (Investor Class). Transaction costs are estimated as .50% per annum per 100% portfolio turnover, with turnover of 6% for index funds (based on the Vanguard Total Stock Market Index) and 135% for conventional funds (based on the U.S. Large cap category average). Data from Morningstar Direct as of 12/31/2011.

[3] Sharpe, William F. (1991, January/February). The Arithmetic of Active Management. *Financial Analysts Journal*.

[4] Edelen, Roger M., Evans, Richard B. and Kadlec, Gregory B. (2007, March). Scale Effects in Mutual Fund Performance: The Role of Trading Costs.

[5] BigCharts.com, data as of 8/8/2012. Includes NYSE, NASDAQ, and Bulletin Board Exchanges.

[6] U.S. active funds turnover and expense ratio reflects average of all U.S. equity funds in Morningstar Direct as of 2/15/2012 (excluding index funds, exchange-traded funds, funds of funds, and balanced funds).

[7] Largest Total Market Index reflects Vanguard Total Stock Market Index (Investor Class) from Morningstar Direct as of 2/15/2012.

[8] One-Month Treasury Bills = Ibbotson U.S. 30-Day T-Bill Index; Six Month Treasury Bills = Merrill Lynch Six-Month U.S. Treasury Bill Index; One-Year Treasury Bonds = Ibbotson U.S. 1-Year Treasury Constant Maturity Appreciation Index; Five-Year Treasury Bonds = Ibbotson U.S. Intermediate-Term Government Index; 20-Year Treasury Bonds = Ibbotson U.S. Long-Term Government Index.

[9] U.S. Large Value = Fama-French Large Value Index; U.S. Large = Standard & Poor's 500 Total Return Index; U.S. Large Growth = Fama-French Large Growth Index; U.S. Small Value = Fama-French Small Value Index; U.S. Small = CRSP Deciles 6-10 Index; U.S. Small Growth = Fama-French Small Growth Index; Int'l Large Value = MSCI EAFE Value Index; Int'l Large = MSCI EAFE Index.

[10] Fama, Eugene F. & French, Kenneth R., (1998, December). Value Versus Growth: The International Evidence. *The Journal of Finance*.

[11] Federal Reserve Flow of Funds Report (2011). Table F.6 Distribution of Gross Domestic Product and Table F.7 Distribution of National Income. Data from <http://www.federalreserve.gov>. Data is as of Fourth Quarter 2011. Used the following calculations: International Consumption % = Total U.S. Imports / Total American Consumption Total American Consumption = National Income – Exports + Imports

[12] International Equity: A blend of the MSCI EAFE, and International Small (DFA International Small Company Index from 1/1973 - 9/1996, then S&P Citigroup EPAC after 9/1996). Emerging: MSCI EM after 1/1988 and MSCI EAFE prior to 1/1988. Global Portfolio: 70% U.S. Large Stocks, 4.8% Int'l Large Stocks, 6.3% Int'l Large Value Stocks, 11.2% Int'l Small Stocks, 7.6% Emerging Markets Stocks.

[13] Central Intelligence Agency. Rank Order – Market Value of Publicly Traded Shares. *The World Fact Book*. Data as of 12/31/2011.

[14] The World Federation of Exchanges. Data as of 12/31/2011.

[15] See Endnote 5.

[16] IMF World Economic Outlook, September 2011.

[17] From 1970-2011, the correlation between the MSCI EAFE Index and the S&P 500 Index was .62. The correlation between the MSCI EAFE Index and the Ibbotson Small Stock Index was .51. Source: Morningstar Direct.

[18] From 1973-2011 the annualized total return of the FTSE NAREIT Equity REIT Index was 17.5% compared to 15.8% for the S&P 500 Index and 5.8% for the Barclays Government/Credit Index. Source: Morningstar Direct.

[19] Morningstar Direct.

[20] Sharpe.

[21] Centre for Evidence-Based Medicine.

[22] Liberati, A. and Vaneis, P. (2004) Introduction to the Symposium: What Evidence-Based Medicine is and What it is Not. *Journal of Medical Ethics*.

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[30] Glasziou et al.

[31] Glasziou et al.

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Brent is the Chief Executive Officer (CEO), a Principal, and a financial advisor. He has 23 years of experience in the financial services industry. He has previously taught investment and finance courses at Rock Valley College, Rockford College, and Northern Illinois University.

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