The Index Investor

Invest Wisely…Get an Impartial Second Opinion.

Contents

This Month's Issue: Key Points

This month we begin with a review of an important, but too little discussed subject: the sources and effects of the irreducible level of uncertainty we confront when trying to predict the future performance of an investment, an asset class, or an overall financial market. We start with the roots of uncertainty in the way we perceive and process information to develop and use knowledge about the world. We then look at the sources of uncertainty that confront a CEO trying to deliver superior performance for his or her shareholders. We then look at the sources of uncertainty inherent in the operation of financial markets themselves, and in particular the complex, non-linear results produced by the interaction of fundamental/value and momentum/trend following strategies. We conclude that most investors would be better off if they focused their active management efforts not on their financial investments, but rather on those economic assets where it can produce the highest returns: the productivity of their human capital (i.e., their education and careers) and their investments in residential property.

Our second article presents the asset class risk and return estimates we will use in this year's model portfolio update. They are derived from a mix of historical data and a forward looking asset pricing model. We review the limitations of both approaches, and why combining them should produce a more accurate estimate of future risks and returns. At the end of this article we put a large number of asset allocation considerations into words, rather

ISSN 1554-5075

than numbers. To make a long story short, the challenge in asset allocation is balancing the pursuit of high returns under normal economic conditions (relatively low inflation and healthy real growth), with the need to maintain positions in defensive asset classes to limit downside risk under adverse conditions (which we term inflation and deflation).

This Month's Letters to the Editor

What are your thoughts on the new Fed Chairman? -- Subscriber, USA

Frankly, given our view of the possible future scenarios we are facing, we couldn't be happier with the appointment of Ben Bernanke to replace Alan Greenspan. If you look at the research papers Bernanke has co-authored in recent years, you see a growing focus on the dangers of deflation and the prolonged slump in real economic growth it can cause. More than any other member of the Fed's Board of Governors, Bernanke seems to have focused on how the United States, and indeed, the OECD as a whole, can avoid a repeat of the Japanese experience when the current imbalances in the world economy are inevitably reversed. Some of the recent papers he has written (which we'd recommend reading if you don't mind some heavy economics at times), include "Financial Fragility and Economic Performance", "The Macroeconomics of the Great Depression", "Monetary Policy and Asset Price Volatility", and "Monetary Policy Alternatives at the Zero [interest rate] Bound". In sum, if we're going to be sailing into a storm, he seems like the right captain to have on the bridge.

How can I tell if my financial adviser is generating alpha? -- Subscriber, UK

With the increasing focus on separating alpha and beta investing, this is a question that seems likely to come up more often in the years ahead. To quickly review the terminology, the return on traditional actively managed mutual funds is composed of two parts: the beta return on a given asset class (which could have been replicated with an index fund), and the "alpha" return, which is the difference between the active fund's return and the return on a comparable index fund. In theory, you pay higher fees to an active manager because of his or her ability to consistently generate alpha.

ISSN 1554-5075

You can analyze alpha in many different ways, including at the level of an individual fund, at the level of an asset class, or for your portfolio as a whole. Let's start with the first situation. The first question you should ask your adviser is, "what was the beta return that was used to estimate the active manager's alpha?" Answering this question is not as easy as many advisers would like you to believe. For example, suppose your adviser tells you that the manager of a value fund is generating alpha. Your first question should be, "what benchmark did you use to estimate alpha?" The issue here is that too many advisers, either on purpose or by accident, use the wrong benchmark. In our example, if the adviser says, "the S&P 500", that's the wrong answer. The right answer would have been "a value index", like the Russell 3000 Value (if the manager takes no consistent size tilts), or something like the Russell 2000 Value or S&P 600 Value if the tilts toward small cap value stocks. The key point is this: it is only after you have properly measured beta that you can accurately estimate alpha.

Now let's move on to the second question to ask your adviser: "And what is the manager's tracking error?" Alpha is the average of the monthly differences between the manager's return and the return on the relevant index. The standard deviation of these alphas is a measure of the amount of active risk being taken to generate the active return. Another name for this standard deviation is "tracking error." This leads to the third question to ask your adviser: "And the manager's information ratio is?" The information ratio is the average alpha divided by the standard deviation of the monthly alphas, or tracking error. It basically relates the active return you are receiving to the active risk being taken to generate it. IRs above .5 are rare. And this brings us to the last question to ask your adviser: "Is that IR statistically significant?" This is a fancy way of asking, "is there any statistically significant difference between that IR and pure luck?" There are two ways to achieve this level of significance (technically, a T-Ratio of greater than 2.00). The first is to generate a low positive IR over a long period of time. The second is to generate a much higher IR over a shorter period of time. Low IRs over short periods are indistinguishable from luck (of course, this result leads to a fifth question: "So why did you put me in this fund?")

You can also estimate the overall alpha for your whole portfolio. The calculation approach is the same as before; the key challenge is to identify the right weights to give to different index funds when estimating the portfolio's beta return. These should reflect your long-term asset allocation strategy. You should also use the lowest cost index funds you can

ISSN 1554-5075

find in this analysis, and make sure you subtract the investment management fees charged by both active funds and your adviser from the total return earned by your portfolio. While the calculations are a bit more complicated, the questions are the same as in the single fund case.

ISSN 1554-5075

Global Asset Class Returns

YTD 31Oct05	In USD	In AUD	In CAD	In EURO	In JPY	In GBP
Asset Held						
US Bonds	0.90%	5.50%	-0.54%	12.73%	12.87%	8.70%
US Prop.	7.40%	12.00%	5.96%	19.23%	19.37%	15.20%
US Equity	1.80%	6.40%	0.36%	13.63%	13.77%	9.60%
AUS Bonds	-6.02%	-1.41%	-7.46%	5.81%	5.95%	1.79%
AUS Prop.	-2.59%	2.01%	-4.03%	9.24%	9.37%	5.21%
AUS Equity	10.84%	15.44%	9.40%	22.67%	22.81%	18.64%
CAN Bonds	6.77%	11.37%	5.33%	18.60%	18.74%	14.57%
CAN Prop.	14.15%	18.75%	12.71%	25.98%	26.12%	21.95%
CAN Equity	15.67%	20.28%	14.23%	27.50%	27.64%	23.48%
Euro Bonds	-8.04%	-3.44%	-9.48%	3.79%	3.93%	-0.24%
Euro Prop.	12.79%	17.39%	11.35%	24.62%	24.76%	20.59%
Euro Equity	1.96%	6.56%	0.52%	13.79%	13.92%	9.76%
Japan Bonds	-11.72%	-7.12%	-13.16%	0.11%	0.25%	-3.92%
Japan Prop.	21.02%	25.62%	19.58%	32.85%	32.99%	28.82%
Japan Equity	10.90%	15.50%	9.46%	22.73%	22.87%	18.70%
UK Bonds	-2.77%	1.83%	-4.21%	9.06%	9.20%	5.03%
UK Prop.	-4.56%	0.04%	-6.00%	7.27%	7.41%	3.24%
UK Equity	2.27%	6.87%	0.83%	14.10%	14.23%	10.07%
World Bonds	-3.55%	1.05%	-4.99%	8.28%	8.42%	4.25%
World Prop.	6.85%	11.45%	5.41%	18.68%	18.82%	14.65%
World Equity	4.45%	9.05%	3.01%	16.28%	16.42%	12.25%
Commodities	15.50%	20.10%	14.06%	27.33%	27.47%	23.30%
Timber	9.23%	13.83%	7.79%	21.06%	21.20%	17.03%
Hedge Funds	1.94%	6.54%	0.50%	13.77%	13.91%	9.74%
Volatility	15.27%	19.88%	13.84%	27.10%	27.24%	23.08%
A$ Currency	-4.60%	0.00%	-6.04%	7.23%	7.36%	3.20%
C$	1.44%	6.04%	0.00%	13.27%	13.41%	9.24%
Euro	-11.83%	-7.23%	-13.27%	0.00%	0.14%	-4.03%
Yen	-11.97%	-7.36%	-13.41%	-0.14%	0.00%	-4.17%
UK£	-7.80%	-3.20%	-9.24%	4.03%	4.17%	0.00%
US$	0.00%	4.60%	-1.44%	11.83%	11.97%	7.80%

ISSN 1554-5075

Equity and Bond Market Valuation Update

Our market valuation analyses are based on the assumption that markets are not perfectly efficient and always in equilibrium. This means that it is possible for the supply of future returns a market is expected to provide to be higher or lower than the returns investors logically demand. In the case of an equity market, we define the future supply of returns to be equal to the current dividend yield plus the rate at which dividends are expected to grow in the future. We define the return investors demand as the current yield on real return government bonds plus an equity market risk premium. As described in our May, 2005 issue, people can and do disagree about the "right" values for these variables. Recognizing this, we present four valuation scenarios for an equity market, based on different values for three key variables. First, we use both the current dividend yield and the dividend yield adjusted upward by .50% to reflect share repurchases. Second, we define future dividend growth to be equal to the long-term rate of total (multifactor) productivity growth, which is equal to either 1% or 2%. Third, we use two different values for the equity risk premium required by investors: 2.5% and 4.0%. Different combinations of these variables yield high and low scenarios for both the future returns the market is expected to supply, and the future returns investors will demand. We then use the dividend discount model to combine these scenarios, to produce four different views of whether an equity market is over, under, or fairly valued today. The specific formula is (Current Dividend Yield x 100) x (1+ Forecast Productivity Growth) divided by (Current Yield on Real Return Bonds + Equity Risk Premium - Forecast Productivity Growth). Our valuation estimates are shown in the following tables, where a value greater than 100% implies overvaluation, and less than 100% implies undervaluation:

Australia	**Low Demanded Return**	**High Demanded Return**
High Supplied Return	68%	102%
Low Supplied Return	103%	141%

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ISSN 1554-5075

Canada	Low Demanded Return	High Demanded Return
High Supplied Return	92%	157%
Low Supplied Return	175%	259%

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Eurozone	Low Demanded Return	High Demanded Return
High Supplied Return	56%	100%
Low Supplied Return	102%	156%

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Japan	Low Demanded Return	High Demanded Return
High Supplied Return	93%	197%
Low Supplied Return	254%	417%

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United Kingdom	Low Demanded Return	High Demanded Return
High Supplied Return	50%	90%
Low Supplied Return	90%	136%

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United States	Low Demanded Return	High Demanded Return
High Supplied Return	108%	173%
Low Supplied Return	196%	280%

Our government bond market valuation update is based on the same supply and demand methodology we use for our equity market valuation update. In this case, the supply of future fixed income returns is equal to the current nominal yield on ten-year government bonds. The demand for future returns is equal to the current real bond yield plus the historical average inflation premium (the difference between nominal and real bond yields) between 1989 and 2003. To estimate of the degree of over or undervaluation for a bond market, we use the rate of return supplied and the rate of return demanded to calculate the present values of a ten year zero coupon government bond, and then compare them. If the rate supplied is higher than the rate demanded, the market will appear to be undervalued. This information is contained in the following table:

ISSN 1554-5075

	Current Real Rate	Average Inflation Premium (89-03)	Required Nominal Return	Nominal Return Supplied (10 year Govt)	Return Gap	Asset Class Over or (Under) Valuation, based on 10 year zero
Australia	2.58%	2.96%	5.54%	5.48%	-0.05%	0.52%
Canada	1.65%	2.40%	4.05%	4.16%	0.11%	-1.05%
Eurozone	1.35%	2.37%	3.72%	3.40%	-0.32%	3.16%
Japan	0.83%	0.77%	1.60%	1.56%	-0.04%	0.43%
UK	1.40%	3.17%	4.57%	4.33%	-0.24%	2.32%
USA	2.00%	2.93%	4.93%	4.56%	-0.37%	3.60%

It is important to note some important limitations of this analysis. First, it uses the current yield on real return government bonds. Over the past forty years or so, it has averaged around 3.00%. Were we to use this rate, bond markets would generally look even more overvalued. It also uses historical inflation as an estimate of expected future inflation. This may not produce an accurate estimate.

Second, this analysis looks only at ten-year government bonds. The relative valuation of non-government bond markets is also affected by the extent to which their respective credit spreads (that is, the difference in yield between an investment grade or high yield corporate bond and a government bond of comparable maturity) are above or below their historical averages (with below average credit spreads indicating potential overvaluation). Today, in many markets credit spreads are at the low end of their historical ranges, which would make non-government bonds appear even more overvalued.

Third, if one were to assume a very different scenario, involving a prolonged recession, accompanied by deflation, then one could argue that government bond markets are actually undervalued.

Finally, for an investor contemplating the purchase of foreign bonds or equities, the expected future annual percentage change in the exchange rate is also important. Study after study has shown that there is no reliable way to forecast this. At best, you can make an estimate that is justified in theory, knowing that in practice it will not turn out to be accurate. That is what we have chosen to do here. Specifically, we have taken the difference between the

ISSN 1554-5075

yields on ten- year government bonds as our estimate of the likely future annual change in exchange rates between two regions. This information is summarized in the following table:

Annual Exchange Rate Changes Implied by Bond Market Yields

	To A$	To C$	To EU	To YEN	To GBP	To US$
From						
A$	0.00%	-1.32%	-2.08%	-3.92%	-1.15%	-0.92%
C$	1.32%	0.00%	-0.76%	-2.60%	0.17%	0.40%
EU	2.08%	0.76%	0.00%	-1.84%	0.93%	1.16%
YEN	3.92%	2.60%	1.84%	0.00%	2.77%	3.00%
GBP	1.15%	-0.17%	-0.93%	-2.77%	0.00%	0.23%
US$	0.92%	-0.40%	-1.16%	-3.00%	-0.23%	0.00%

Sector and Style Rotation Watch

The following table shows a number of classic style and sector rotation strategies that attempt to generate above index returns by correctly forecasting turning points in the economy. This table assumes that active investors are trying to earn high returns by investing today in the styles and sectors that will perform best in the next stage of the economic cycle. The logic behind this is as follows: Theoretically, the fair price of an asset (also known as its fundamental value) is equal to the present value of the future cash flows it is expected to produce, discounted at a rate that reflects their relative riskiness. Current economic conditions affect the current cash flow an asset produces. Future economic conditions affect future cash flows and discount rates. Because they are more numerous, expected future cash flows have a much bigger impact on the fundamental value of an asset than do current cash flows. Hence, if an investor is attempting to earn a positive return by purchasing today an asset whose value (and price) will increase in the future, he or she needs to accurately forecast the future value of that asset. To do this, he or she needs to forecast future economic conditions, and their impact on future cash flows and the future discount rate. Moreover, an investor also needs to do this before the majority of other investors reach the same conclusion about the asset's fair value, and

ISSN 1554-5075

through their buying and selling cause its price to adjust to that level (and eliminate the potential excess return).

We publish this table to make an important point: there is nothing unique about the various rotation strategies we describe, which are widely known by many investors. Rather, whatever active management returns (also known as "alpha") they are able to generate is directly related to how accurately (and consistently) one can forecast the turning points in the economic cycle. Regularly getting this right is beyond the skills of most investors. In other words, most of us are better off just getting our asset allocations right, and implementing them via index funds rather than trying to earn extra returns by accurately forecasting the ups and downs of different sub-segments of the U.S. equity and debt markets. That being said, the highest year-to-date returns in the table give a rough indication of how investors employing different strategies expect the economy to perform in the near future. The highest returns in a given row indicate that most investors are anticipating the economic and interest rate conditions noted at the top of the next column. Similar returns in multiple columns (within the same strategy) indicate a relative lack of agreement between investors about the most likely future state of the economy.

ISSN 1554-5075

Year-to-Date Returns on Classic Rotation Strategies in the U.S. Markets

YTD 31Oct05

Economy	Bottoming	Strengthening	Peaking	Weakening
Interest Rates	Falling	Bottom	Rising	Peak
Style Rotation	Growth (IWZ) **0.24%**	Value (IWW) **2.54%**	Value (IWW) **2.54%**	Growth (IWZ) **0.24%**
Size Rotation	Small (IWM) **-0.54%**	Small (IWM) **-0.54%**	Large (IWB) **2.17%**	Large (IWB) **2.17%**
Style and Size Rotation	Small Growth (DSG) **2.63%**	Small Value (DSV) **1.29%**	Large Value (ELV) **1.65%**	Large Growth (ELG) **-0.54%**
Sector Rotation	Cyclicals (IYC) **-5.91%** Technology (IYW) **-1.91%**	Basic Materials (IYM) **-3.93%** Industrials (IYJ) **-2.25%**	Energy (IYE) **29.97%** Staples (IYK) **-0.25%**	Utilities (IDU) **13.47%** Financials (IYF) **0.64%**
Bond Market Rotation	High Risk (VWEHX) **0.90%**	Short Maturity (VBISX) **0.60%**	Low Risk (VIPSX) **1.30%**	Long Maturity (VBLTX) **2.20%**

ISSN 1554-5075

Uncertainty

Our second article in this issue presents the asset class risk and return assumptions we will use in the reallocation of our model portfolios' asset class weights. However, before reviewing them we first need to put them in their proper context. And the key to that is uncertainty – a critical concept that too few people like to discuss in polite company.

In this article, we will start from the ground and work up, beginning with the sources of our individual uncertainty, working our way through corporate uncertainty, and ending up with financial market uncertainty, and its implications for us as investors.

Let's start with a basic question: what is knowledge? Broadly speaking it consists of a set of theories for categorizing sensory inputs (e.g., "if it walks like a duck, and quacks like a duck, there is a high probability it is a duck"), as well as a set of causal theories to guide action (e.g., "if ___, then ____"). But this definition begs the question, where do these theories come from?

Assume you have just been asked to investigate a car crash. How would you proceed? After arriving on the scene, you would most likely begin to ask questions, or, more formally, collect evidence. Are there skid marks? Is the road wet? Was it raining? Were there witnesses? Was another car involved? Armed with the evidence you collected, you would then develop a number of alternative hypotheses (initial theories) that relate some or all of the evidence you collected to the result of the crash. Formally, this process of going from a result to evidence to possibly hypotheses (i.e., explanations) is known as "abduction." And right from the outset, at this most fundamental level, you can see a source of uncertainty: the limitations on your ability to identify the full range of possible hypotheses that link the evidence and the result you observe. Some of these limitations are situation specific: you may be tired or stressed. Some have to do with your own experience: if it is limited or narrow, you may not have a wide enough range of analogies to draw on when trying to think creatively about potential hypotheses. But another is more fundamental: in some cases, cause and effect are widely separated in time. To go back to our car crash, if none of the physical evidence you collect is consistent with a hypothesis to explain the crash, you may instead hypothesize it was due to "driver error." However, while that may, in some sense be the immediate cause, the more

ISSN 1554-5075

important question is the causes of that error. But in all likelihood, those causes are so far removed in time from the accident, and so complex (e.g., the genetic makeup and life history of the driver, and perhaps his family and friends as well) that you will not, if your time is limited, be able to identify them (though in the case of airline crashes, there is an entire "human factors" industry that studies just these issues).

But let's move on. How do you decide which of hypotheses you have generated makes the most sense? One way would be to check an accident database, to see how frequently different pieces of evidence were associated (correlated) with the type of accident you observed. Ideally, this will enable you to disprove some of your tentative hypotheses, or at least reject them for lack of evidence. However, in most cases you will still be left with more than one hypothesis that hasn't been disproved. If forced to choose just one (say, if the press was waiting to talk with you), you would logically weigh the weight and reliability of the evidence supporting the alternatives, and choose one hypothesis as the best possible explanation. Alternatively, you could attach differing degrees of belief to more than one hypothesis (e.g., 20%, 40% and 40%). Formally, this is process of testing hypotheses is know as "induction." And, as you can see, it is not guaranteed to reduce uncertainty. Evidence can be consistent with more than one hypothesis, and no hypothesis is ever strictly true; the best that can be said is that it has not been disproved.

It is now two weeks later, and you find yourself driving in a rainstorm. This evidence activates one of the hypotheses for which you found support: driving in rain raises the probability of an accident. You conclude that you are facing a situation of increased risk. This triggers another hypothesis: in a situation of increased risk, slowing down your speed will increase your safety. This process is formally known as "deduction." But, again, there is uncertainty: did you observe all the available evidence (e.g., did you miss that large truck in back of you traveling at high speed too close to your car?) And even if you perceived all the high value information, did your memory activate all the relevant hypotheses (e.g., if you are in a traffic jam, the probability of an accident increases if you slow down too quickly)? In most cases, the answer to both questions is "probably not." Most of the time, our perception and cognitive processing are not perfect. Formally, another way of saying this is that we are "boundedly rational", which is a further source of uncertainty.

ISSN 1554-5075

Many people have thought long and hard about the sources of our cognitive limitations. Some of the reasons seem to be physical: even at the best of time, our brain can process no more than five to seven "chunks" of information (a key difference between novices and experts is how much data is aggregated into each of these chunks). In addition, our perceptual and processing performance worsens when we are tired and stressed. Our ability to perceive and process information is also subject to some well known biases. For example, we tend to be over-optimistic, overconfident about the accuracy of our views, more likely to notice and give more weight to evidence that confirms them, and to change our mind more slowly than is warranted by the available facts.

In short, at the individual level, there are multiple sources of uncertainty that are impossible to fully eliminate from life. Perhaps the most important way people have attempted to reduce these uncertainties is to organize into groups (see, for example, the paper by Hong and Page titled "Groups of Diverse Problem Solvers Can Outperform Groups of High Ability Problem Solvers"). For the purposes of this article, let us consider a familiar group: the corporation. We are all well aware of the pressures on corporate management to deliver superior performance, relative to competitors and relative to the overall equity market index. But consider the uncertainty one confronts when trying to deliver achieve this. Broadly speaking, a corporate strategy can be though of as consisting of three parts. The first is a theory of the environment, including the evolution of customer needs priorities, competitor offerings, technological possibilities and general macroeconomic and regulatory conditions. The second is a theory of competition, involving which customer to target, what to offer them, how to deliver this offering at an acceptable return to shareholders, and how to prevent competitors from copying this business model. The third is a theory of implementation, involving the sequencing and synchronization of actions, communication and coordination requirements, and the collection of critical information that will indicate a need to adapt the original strategy. There is enormous uncertainty in all of these areas, much of which is grounded in two critical facts of life. The first is heterogeneity – customers, competitors, suppliers, and the firm's own employees all have differing source of information, and abilities to perceive and process it. The second is self-reference, or, as it is sometimes called, "reflexivity" or "recursiveness." This refers to the fact that in many cases, a person or corporation takes action on the basis of assumptions about the future actions of others, which in turn depend on the very action you are

ISSN 1554-5075

planning to take. Theoretically, there is no limit (apart from exhaustion of resources) on the extent to which one can engage in a cycle of reasoning along the lines of "I will do this, based on the assumption he will do that, because he assumes that I assume…

This means that the fundamental processes generating the returns sought by investors are themselves highly uncertain. This uncertainty is made worse by the fact that heterogeneity and recursiveness often create highly non-linear outcomes that are extremely difficult, and often impossible to accurately predict.

One consequence of this is that firms that consistently deliver superior shareholder returns are exceedingly rare. For example, in their classic paper "The Level and Persistence of Growth Rates", Chan, Karceski and Lakonishok found that there was no persistence in firm growth rates beyond chance, and that it was extremely hard to predict these growth rates in advance.

The implications of the fundamental uncertainty we have identified are critically important to investors, but too little discussed in what is written about investing.

Let's start with the efficient markets hypothesis (EMH), which is still very much the centerpiece of the investment theory that is taught in schools. In its strongest version, it assumes that all investors have equal access to full information. Moreover, they all use the same model to convert new information into an updated view of the fair price of an investment. Since these models are also assumed to perfectly reflect the underlying return generating process, prices instantly and accurately adjust to the release of new information. This means that the market for the investment in question is continuously in a state of equilibrium between buyers and sellers, in which no investor can earn anything other than the market return (i.e., this is an "all beta, no alpha" world). As we all know, none of this reflects reality. Rather, we confront a world in which information takes time to diffuse to investors who have varying perceptual and cognitive capabilities, who use differing models that all imperfectly describe the return generating process, and who, if they are active managers, earn returns that are above and below the market (i.e., have positive and negative alpha).

At this point, some will say, "Voila"; the case for passive investing is disproved, and we should all pay high fees to active managers. Not so fast. The fact that investors are not all perfectly rational and instantly endowed with perfect information does not automatically mean that index investing doesn't make sense. Fundamentally, to disprove the case for indexing, you

ISSN 1554-5075

have to show how the information and reasoning imperfections we have identified lead to a market that is "inefficient", in the sense that it creates opportunities for skilled managers to consistently earn risk and tax adjusted returns that are higher than those available on a comparable index fund.

Data on the performance of active fund managers suggest that most financial markets, despite the limitations of their participants, are, if not perfectly efficient, very close to it. The strongest evidence of this is the declining proportion of active managers who outperform index funds as the evaluation period is extended from one to five to ten years or longer. However, active managers sometimes respond with the allegation that this conclusion is specific to the time period chosen for the comparison. How do we respond to this? We return to the subject of uncertainty.

As we have written in the past, there are basically two broad hypotheses that cause a person to buy a stock. Some people buy because, having analyzed the business of the company (using some combination of information and a model), they have a theory that the stock is undervalued. Implicit in this view are two other critical assumptions. The first is that it is possible to accurately determine the fair value of a company. This is no trivial task. It requires forecasts (either explicit or implicit) of future customer needs, competitor actions, technological possibilities, the relative success of a company's offering to customers, its cost structure, and its ability to prevent imitation by competitors. It also requires belief in the accuracy of the asset pricing model being used to translate one's forecast of a company's future cash flows into the fair present value for its stock (as well as confidence in the forecasts – e.g., of interest rates and the equity risk premium – that model requires). As we have seen, the level of uncertainty involved at all levels of the system might make one question the belief that it is possible to accurately value a company. The other (and often implicit) assumption made by these "fundamental value" investors is that a sufficient number of other investors will eventually recognize the undervaluation, and their actions will cause the market price of the stock to increase. As we will soon see, this assumption is also open to question, at least about its timing.

In 1936, John Maynard Keynes began his description of the second group of stock buyers with the following observation: "Investment based on genuine long-term expectation is so difficult today as to be scarcely practicable. [An investor] who attempts it must surely lead

ISSN 1554-5075

much more laborious days and run greater risks than [an investor] who tries to guess better than the crowd how the crowd will behave; and given equal intelligence, he may make more disastrous mistakes…[However] it needs more intelligence to defeat the forces of time and our ignorance of the future than to beat the gun…[Also] human nature desires quick results, there is a popular zest in making money quickly, and remoter gains [from fundamental investing] are discounted by the average man at a very high rate."

This second group of people buy a stock because they have a theory that other people will also be buying it, and this will cause its price to rise. The focus of their information collection and modeling efforts is not on the business of the company and the fair value of the stock, but rather on the expected behavior of other investors.

However, these investors also confront uncertainty, in the form of recursiveness. For example, I decide to buy, because I forecast that other investors will act in a certain way, because I assume they assume I assume, ad infinitum. John Maynard Keynes described this problem as follows: "professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole: so that each competitor has to pick, not those faces which he himself finds prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view. It is not a case of choosing those which, to the best of one's judgment, are really the prettiest, nor even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practise the fourth, fifth and higher degrees." Given the insolubility of this forecasting problem, Keynes theorized that, in the presence of a sufficient number of these type of investors, financial markets would be driven by irrational factors, or what he termed "animal spirits."

It is also the case that momentum investors are, either explicitly or implicitly making two critical assumptions. The first is that they are sufficiently smarter than other investors that they will be able to "get out ahead of the crowd", or, as Keynes said, "beat the gun." For

ISSN 1554-5075

example, researchers have found that found that the average person reasons between one and two steps ahead in recursive type situations (see, for example, "A Cognitive Hierarchy of One Shot Games" by Camerer, Ho and Chong). However, the widespread finding that human beings are also habitually overconfident suggests that many people's self-assessment on this point will be wrong (and expensive). The second assumption is that when an investor decides to get out, there will be sufficient liquidity available in the market. Events such as the October, 1987 crash, and the meltdown of Long Term Capital Management in 1998 make it clear that this is not always the case (suggesting another potentially expensive lesson for trend investors).

Having described the two basic investor types, the next step is to define a stock market as being composed of a heterogenous group of boundedly rational investors, whose strategies, at any point in time, reflect a mix of widely differing approaches to fundamental/value and trend/momentum (e.g., based on the use of different information and models). So what happens over time as these investors interact with each other?

The short answer is, "lots of stuff you couldn't predict in advance." An early paper on this subject was "Heterogenous Beliefs and Routes to Chaos in a Simple Asset Pricing Model" by Brock and Hommes. Their artificial (simulation based) stock market contains investors who face an incentive of varying intensity to evaluate and possibly change their strategy based on its performance. They find that when that incentive is sufficiently strong (e.g., when many investors face high pressure to deliver good short-term performance versus a benchmark), the pattern of returns becomes non-linear and chaotic, and impossible to predict in advance. This market exhibits "irregular switching between phases [i.e., regimes] during which prices are close to their efficient market fundamental value, phases of optimism with upward trends and phases of pessimism with declining asset prices." In "Asset Prices and Wealth Dynamics Under Heterogenous Expectations", Chiarella and He find that introducing just two probabilistic processes (i.e., in which the value for a variable is drawn from a distribution of possible outcomes), one governing the generation of company dividends, which fundamental investors try to forecast, and the other governing the length of time over which other investors try to forecast the future behavior of their peers, is sufficient to produce the familiar non-linear chaotic pattern in prices and returns.

ISSN 1554-5075

An interesting question raised by these analyses is whether irrational trend chasing investors can survive in the face of trading by fundamental/value investors. Keynes thought they could. In 1986, another paper, "Noise Trader Risk in Financial Markets" by DeLong, Shleifer, Summers, and Waldmann reached the same conclusion. They found that "the unpredictability of noise traders' beliefs creates a risk in the price of the asset that deters rational arbitrageurs [fundamental investors] from aggressively betting against them. As a result, prices can diverge significantly from fundamental values even in the absence of fundamental risk. Moreover, bearing a disproportionate amount of risk that they themselves create [others have suggested this is because of their relatively greater overconfidence] enables noise traders to earn a higher expected return than do rational investors." Later papers that have used more analytically intensive approaches (e.g. more complicated simulation models, with a larger population of agents and strategies) have repeatedly confirmed the finding that irrational trend chasers will survive over time in financial markets, and some will realize exceptionally high returns.

One of these later papers is "The Price Dynamics of Common Trading Strategies" by Farmer and Joshi. This paper is interesting for many reasons. First, it includes a market maker mechanism, with which all investors place their orders. Theoretically, the existence of a market maker, who will widen spreads as buy/sell imbalances increase, should dampen the price fluctuations in the market. Second, it employs a wide range of fundamental value and trend chasing strategies, to create a reasonably realistic "market ecology." Third, the authors attempt to adjust the parameters of their model so that key features of the resulting return patterns match those found in real financial markets. These include volatility that varies over time and return distributions that have "fatter tails" (i.e., a greater proportion of extreme returns) than the normal "bell curve." They are able to do this by balancing the initial numbers of value and trend following investors, as well as tuning some of the parameters of the specific trading strategies they use (e.g., that affect when these strategies become active in the market). The resulting model shows that prices rarely match their fundamental values, with a wide range deviations from them, and lengths of time over which those deviations persist. On the other hand, the authors also find that the market is attracted towards equilibrium, though the specific conditions giving rise to it seem impossible to forecast in practice.

ISSN 1554-5075

In a more recent paper, "Behavioral Heterogeneity in Stock Prices", Boswijk, Hommes, and Manzan fit a similar model to annual U.S. stock price data from 1871 to 2003. They find that the market switches the existence of two regimes, one mean reverting, and dominated by fundamental/value investors, and the other mean averting, and dominated by trend followers. As in previous models, the proportion of investors utilizing these different strategies varies over time, in rough alignment with their relative profitability (as some investors are dogmatically committed to one approach or the other, while others have a greater willingness to switch based on their relative performance over some past interval). For example, the authors note that their model "suggests that in the mid 1990s, optimistic, boundedly rational investors, motivated by short-run profitability, reinforced the rise in stock prices triggered by the higher expected cash flows of the internet sector."

In "Market Mood, Adaptive Beliefs, and Asset Price Dynamics", Dieci, Farani, Gardini and He find that the market becomes increasingly difficult to predict as the proportion of investors who switch strategies based on recent performance increases. In "Heterogenous Expectations and Speculative Behavior in a Dynamic Multi-Asset Framework", Chiarella, Dieci and He find that the introduction of diversification across different asset classes does not moderate the finding of chaotic market dynamics in previous analyses. Rather, it adds another source of complexity, to make predictability even more difficult. In another paper, "A Dynamic Analysis of Moving Average Rules", Chiarella, He and Homees find that even something as simple as a change in the length of the moving average used by trend following investors can destabilize a market, and set off chaotic dynamics, as can a decrease in average investor risk aversion. And in "Lock-in of Extrapolative Expectations in an Asset Pricing Model", Kevin Lansing from the Federal Reserve Bank of San Francisco shows how a concern with minimizing forecast errors (as might characterize a fund manager who worries about underperforming a benchmark) may inadvertently lead to "lock-in" to a trend chasing strategy.

Another recent paper, "Feedback and the Success of Irrational Investors" by Hirshleifer, Subrahmanyam, and Titman, makes an important point. The authors find that the impact of irrational investors on stock prices and returns feeds back into the real investment decisions of companies, via the inferences they make about their relative cost of capital. In turn, this affects the valuations placed on these companies' stocks by fundamental investors. In short, there is a linkage between the complex adaptive systems that exist in the financial markets and the real

ISSN 1554-5075

economy that makes the behavior of the integrated system even more complex and impossible to predict.

Taken together, all of these studies, and more like them (two good surveys are "Agent-Based Computational Finance" by Blake LeBaron, and "Heterogenous Agent Models in Economics and Finance" by Cars Hommes), lead to the conclusion that the failure of active managers to outperform index funds (particularly over longer periods of time) is not a function of the time period used to compare their respective results. Rather, it reflects the fact that the financial markets are a complex adaptive system, in which predictability will only exist over short periods, and even then will be based on the use of very different types of superior information and models, depending on the proportion of investors using fundamental/value or momentum/trend strategies. Moreover, even within a regime, these information sources and models will tend to be self-destructive, as their increasing economic success causes asset prices to increase (as buying demand increases relative to supply) and induces other investors to copy them. In sum, while the financial markets may be made up of less-than-perfectly rational investors, who cause prices to deviate from their fundamental values, their fundamental uncertainty causes them to still be highly efficient, in the sense that it remains extremely difficult for an active manager to deliver (particularly over long periods of time) higher risk adjusted after tax returns than those produced by comparable index funds.

Why then, do so many actively managed funds continue to exist? We think there are at least three reasons. The simplest, and least likely explanation in our view is that active managers spend much, much more on advertising than index managers. In addition, given the value of active managers' advertising spending, many mainstream publications have a clear incentive not to publicize the advantages of indexing, whatever their claims of separation between their business and editorial operations.

However, we suspect that two other explanations are more important. The first is the interaction of three well-known biases in human thinking: our tendencies toward excessive optimism, overconfidence, and underweighting evidence that conflicts with our most important beliefs (and beliefs backed by one's savings must surely be important!). Too many of us believe that we (or our fund manager) will be the one who beats the market. And indeed, most of us do, from time to time. At some point, many people develop a superior insight that results in a significant investment return, which strengthens their belief in their own (or their

ISSN 1554-5075

manager's) skill. What we forget is the difference between doing this once, and doing it consistently year after year.

However, at a deeper level, it may be that a second explanation is the most important one: our deep emotional reluctance to confront the true degree of uncertainty we face. Perhaps it is our need to maintain some illusion of control that leads such a high proportion of investors to prefer active management.

On the bright side, we also note that the obstacles to indexing seem to be eroding, as evidenced by the increasing popularity of exchange traded funds, the growing percentage of institutional money that is passive managed, and the rising interest in separating alpha from beta investing, as more investors realize the inherent difficulty of active management, and allocate more of their risk budgets to a portfolio of index products that is diversified across asset classes. All of these trends make us hopeful that more and more investors are focusing their active management efforts not on their financial investments, but rather on those economic assets where it can produce the highest returns: the productivity of their human capital (i.e., their education and careers) and their investments in residential property.

Updated Asset Class Assumptions

In order to update our model portfolios asset allocations, we need to update our assumptions about future asset class risk and returns. As the previous article has made clear, there is an irreducible level of uncertainty that accompanies this process. In fact, the only thing we can say with confidence is that our estimates will most likely turn out to be wrong. It is for this reason that we use an equally weighted portfolio as our ultimate performance benchmark, since it assumes that neither future returns nor risks can be forecast with any accuracy beyond luck. This raises an obvious question: why do we believe this is not the case?

The most important reason is that basic differences in the return generating processes for different asset classes (e.g., bonds, commercial property, and equity) suggest that there will be stable differences in the dispersion (i.e., riskiness) of their returns. This means that the ranking of asset classes according to their standard deviations should remain relatively stable over time. This economic hypothesis is supported by the statistical fact that you can improve

ISSN 1554-5075

the accuracy of an estimate of standard deviation by increasing the frequency with which data from a given period (e.g., 1989 to 2004) are sampled (e.g., by using monthly instead of annual data). To be sure, this isn't always true, as volatility (standard deviation) varies (or "clusters") over time. But it changes much less than the ranking of asset classes by their relative returns over different periods.

Given everything written in the previous article, we are much less confident about our -- or anybody else's -- ability to accurately forecast future asset class returns. At best, we can limit the size of the inevitable estimation errors we will make. To do this we combine two unavoidably flawed approaches to the estimation problem: historical data and the outputs from a forecasting model.

The use of historical data contains a number of pitfalls. The first is uncertainty about the extent to which the sample of data you are using represents the "true" distribution of results the may be produced by the return generating process. This is a particular concern with respect to so-called "extreme events", or periods in which large gains or losses are experienced. Does your sample contain all the extreme events a return process might produce? It is for this reason that the arcane subject of "extreme value theory" is so popular with hedge fund mangers who trade in highly leveraged derivative instruments.

One way to deal with this problem is to convert your sample into a distribution of returns that can be described using just a few variables – e.g., the mean (average) and standard deviation (a measure of dispersion around the mean) for a normal distribution, or "bell curve." However, this raises another issue: what is the right distribution to use? The normal distribution has some real attractions, because it simplifies a number of calculations. Unfortunately, a look at the data shows that the distributions of returns for many financial assets aren't quite normal. Typically, they are "off center" (technically, they are "skewed") and they have "fatter tails" (technically, they have excess "kurtosis") than a normal distribution. In practice, this leads to arguments about (a) what other distribution to use (e.g., a lognormal or Student's T), and (b) whether it matters. The latter question is addressed by Cremers, Krtizman and Page in their paper "Optimal Hedge Fund Allocations: Do Higher Moments Matter?" They find that the question turns on the shape of what is known as an investor's "utility" function, which is a measure of their sensitivity toward investment gains and losses. They find that for the most

ISSN 1554-5075

common models of investor utility (technically, power utility functions), using the normal distribution in asset allocation will produce an acceptable result.

Yet another issue is whether the returns generating process underlying the historical data you use has remained constant (or "stationary") over time. If it has not, then estimates derived from historical data that includes the previous process will be poor predictors of future returns. Unfortunately, statisticians continue to argue about the best way to test for these so-called "structural breaks" or "non-stationarities." Some analyses find them, and others don't, leaving investors with more uncertainty. Our instinct is that insofar as the economy is a complex adaptive system, the return generating process for many asset classes is likely to have some structural breaks, raising questions about the wisdom of relying solely on historical data to project future returns.

One technique that has been invented to deal with the problem of estimation errors when using historical data is called "shrinkage." Its basic intuition is that the accuracy of an estimate will be improved if outlying data are "shrunk" towards a common reference point. One such point is known as the "grand mean", which in our case would be the average return on all the asset classes included in our analysis. However, this raises two other issues. The first is how much to shrink each asset class's average return. Different authors have produced many different equations that attempt to improve on the everyday "let's split the difference" heuristic (see, for example, "Bayes-Stein Estimation for Portfolio Analysis" by Philippe Jorion, and "Optimal Estimation of the Risk Premium for the Long Run" by Jacquier, Kane and Marcus). Other authors have argued that the simple approach works quite well in many situations.

The second issue is the fact that even the "grand mean" – the average of the average expected return for each asset class – is still based on the original sample data. This has led to a search for other "shrinkage targets" that would add new information, and in so doing hopefully raise the accuracy of the resulting estimate. In finance, one approach to this is to use the output from a forward-looking return forecasting model as the shrinkage target.

However, this introduces another source of uncertainty: model error. As we have seen, in a complex adaptive system that gives rise to non-linear results, is difficult if not impossible to construct an accurate model of the return generating process for most asset classes. And even if we could, changes in that process (or copying by other investors) would inevitably invalidate our model at some point in the future. And how can one be certain that the model

ISSN 1554-5075

one decides to use is the most accurate one available? The simple answer is that you can never be sure of this. So what is an investor to do?

Our solution to this problem is to use an equilibrium model to forecast future returns. We know that most of the time, financial markets will not be in equilibrium. However, we also believe that markets are at least attracted to equilibrium, even if they rarely attain it. Specifically, we ask the question, what real rate of return would an investor require, in equilibrium (where the returns supplied equaled the returns demanded), to hold this asset class? To answer it, we take a so-called "building block" approach, that begins with the current yield on real return bonds (our proxy for the risk free rate), and adds various return premia to them based on the relative riskiness of different asset classes. These premia are shown in the table below:

Asset Class	**Risk Premia to Generate Equilibrium Return**
Real Return Bonds	None. Current yield is used.
Domestic Nominal Return Bonds	1% above real return bond yield
Foreign Currency Bonds	Weighted expected returns on other countries' domestic bonds, adjusted for expected annual exchange rate changes estimated from the current difference in yields on ten year government bonds.
Domestic Commercial Property	2.5% above real return bond yield (half the difference between the expected return on domestic bonds and domestic equity)
Foreign Commercial Property	Weighted expected returns on other countries' domestic commercial property, adjusted for expected annual exchange rate changes estimated from the current difference in yields on ten year government bonds.
Commodities	Equal to expected return on domestic equity, which is roughly in line with historical data
Timber	Equal to expected return on commodities
Domestic Equity	4% above real return bond yield

ISSN 1554-5075

Asset Class	**Risk Premia to Generate Equilibrium Return**
Foreign Equity	Weighted expected returns on other countries' domestic equity, adjusted for expected annual exchange rate changes estimated from the current difference in yields on ten year government bonds.
Emerging Equity	2% above expected return on foreign equity
Equity Market Volatility	Equal to domestic equity
Equity Market Neutral	Proxy for sources of alpha whose returns have a low correlation with beta returns on core asset classes. 2% below expected return on domestic equity.

For all these asset classes, our estimates of future risk (standard deviation) were based on the combination of the historical 1989-2004 results, plus a set of results for domestic equities and bonds covering 1900 to 2004 that is found in the Global Investment Returns Yearbook by Dimson, Marsh and Staunton. These were rounded to avoid the appearance of excessive precision on our part.

This leaves us with the issue of how to combine our historically based return estimates with estimates derived from our forecasting model. A recent paper "Forecast Combinations" by Allan Timmerman (an acknowledged expert in the field) concludes that simple methods often work best. Another paper, "Structural Breaks and the Performance of Forecast Combinations" by Timmerman and Marco Aiolfi presents evidence that forecast combinations are more accurate than individual forecasts because they better incorporate the affect of structural breaks. We are also persuaded by the inherent logic of the "KISS" (keep it simple, stupid) principle. All of this leads us to the use of a simple approach (50/50 weighting) to combine our historical and model based return estimates.

The following tables show our historical and model based estimates of future real returns on different asset classes. The historical table shows returns from 1989 to 2004. This period covers a relatively wide range of financial market events (e.g., the 1998 debt market problems, and the internet bubble). However, we also note that the underlying economic conditions were relatively benign during this period, with inflation generally declining, and real growth fairly steady. As a result, estimates derived from the 1989 to 2004 data probably have

ISSN 1554-5075

some limitations with respect to their coverage of the entire return generating process for most asset classes (especially the extreme events that may be possible).

Four additional qualifications are also in order. First, the data for commercial property reflects traded property securities, and not property that is directly owned. Hence, our estimates will differ from those produced by companies that measure property returns (usually using appraisal based methods, that understate risk). Second, the data for timber is based on a U.S. index. In the past, the returns on this index have diverged from those on other national indexes. Unfortunately, we have no easy basis for combining the returns on these different indexes. However, we also note that in recent years, as investment in timberland has become more popular among institutions, these differences seem to be narrowing. Third, we used the Goldman Sachs Commodities Index for that asset class, as it has the longest available data series. Finally, for equity market volatility we used the VIX index, which measures the implied volatility on S&P 500 options. This has a longer data series than similar indexes (e.g., the VSTOXX) that measure volatility in other equity markets.

Last but not least, in the following tables we present three pieces of data for each asset class. First, its average arithmetic annual return. Second, the standard deviation of those returns. We then adjust the average annual return to reflect relative risk (technically, we subtract one half the variance, which is the standard deviation squared) to derive an estimate of the compound annual (or geometric average) return that would be realized by an investor who held that asset class (an no other) over a long period of time.

ISSN 1554-5075

Historical Data
U.S. Dollar Real Returns

Asset Class	Period	Average Annual Return	Standard Deviation	Compound Return
Real Return Bonds	1997-2004	4.3%	5.3%	4.2%
Domestic Bonds	1989-2004	4.7%	4.0%	4.6%
Foreign Bonds	1989-2004	5.2%	9.1%	4.8%
Domestic Property	1989-2004	10.5%	12.9%	9.7%
Foreign Property	1989-2004	4.9%	19.4%	3.0%
Commodities	1989-2004	7.7%	18.7%	6.0%
Timber	1989-2004	10.7%	8.8%	10.3%
Domestic Equity	1989-2004	9.7%	14.8%	8.6%
Foreign Equity	1989-2004	3.1%	16.9%	1.7%
Emerging Equity	1989-2004	11.4%	23.6%	8.6%
Equity Volatility	1990-2004	9.0%	58.3%	-8.0%
Equity Mkt Neutral	1994-2004	7.6%	3.1%	7.5%

ISSN 1554-5075

Forecast Data
U.S. Dollar Real Returns

Asset Class	Average Annual Return	Standard Deviation	Compound Return
Real Return Bonds	1.8%	5.0%	1.6%
Domestic Bonds	2.8%	7.0%	2.3%
Foreign Bonds	3.9%	10.0%	3.4%
Domestic Property	4.3%	12.0%	3.6%
Foreign Property	5.0%	20.0%	3.0%
Commodities	5.8%	20.0%	3.8%
Timber	5.8%	10.0%	5.3%
Domestic Equity	5.8%	20.0%	3.8%
Foreign Equity	6.6%	20.0%	4.6%
Emerging Equity	8.6%	25.0%	5.5%
Equity Volatility	5.8%	55.0%	-9.4%
Equity Mkt Neutral	3.8%	10.0%	3.3%

As you can see, our forecasting model predicts lower real returns on most asset classes than they have delivered over the past sixteen years, along with somewhat higher volatility in some cases. This is not inconsistent with history, which has seen regimes of low returns and high volatility alternate with regimes of higher returns and lower volatility. Our simulation optimization model captures this, testing potential asset allocations against a 50/50 mix of scenarios generated from each distribution.

However, as we said in the first article in this month's issue, there is an irreducible level of uncertainty associated with these estimates, and with the results of our asset allocation analyses. At best, we can raise the probability of achieving a long-term financial goal; neither we, nor anyone else, can guarantee it.

ISSN 1554-5075

With that in mind, and before reviewing our updated model portfolios in next month's issue, we thought it would be useful to present the following tables, which put a large number of asset allocation considerations into words, rather than numbers. To make a long story short, the challenge in asset allocation is balancing the pursuit of high returns under normal economic conditions (relatively low inflation and healthy real growth), with the need to maintain positions in defensive asset classes to limit downside risk under adverse conditions (which we define as high inflation or deflation).

Asset Class Evaluations

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Real Return Bonds	· Constant real return · Low real return volatility · Generally low correlation with other asset classes	· Real returns won't decline	· Capital value is protected in some cases
Reasons Not to Invest in Real Return Bonds	· Other asset classes provide higher returns · Strong growth could lead to rising real rates and lower total returns	· Hard to think of a reason not to have these in your portfolio during high inflation	· Total real rates of return (interest payments plus change in capital value) will be higher on nominal bonds

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Domestic Investment Grade Bonds	· Relatively low return volatility · Relatively low correlation of returns with other asset classes.	· Hard to think of one. If fixed rate, negative real returns. If floating rate, potential for higher credit losses.	· Both interest payments and capital values increase in real terms
Reasons Not to Invest in Domestic Investment Grade Bonds	· Other asset classes provide higher returns	· Avoid losses.	· Credit quality may be adversely affected (non-government bonds)

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Foreign Currency Bonds	· Low to negative correlations with domestic bond and equity markets.	· If your country has higher inflation than others, your currency should depreciate, producing higher real returns on foreign bonds	· If deflation is widespread, and yours is lower than other countries, your currency should depreciate, producing higher returns on foreign bonds
Reasons Not to Invest in Foreign Currency Bonds	· High volatility compared to domestic bonds can offset benefit of low correlation	· If global inflation increases, but your country has the lowest rate, your currency should appreciate, and foreign currency bond returns will suffer	· Having higher deflation than other countries should cause home currency to appreciate, hurting the return on foreign bonds.

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Domestic Commercial Property	· If you seek higher returns than those available on bonds, but don't want to take on as much risk as equity, commercial property is attractive.	· Rents can be adjusted upward over time, which somewhat offsets the impact of inflation, though with a lag (and assuming inflation doesn't weaken demand for space) · Physical assets' value should increase with inflation	· Assuming falls in lease rates lag deflation, domestic commercial property could experience high real returns
Reasons Not to Invest in Domestic Commercial Property	· Risk of overbuilding and/or excessive valuations when interest rates are low · Theoretically, equity should produce higher returns under normal conditions	· Historical real returns data show that domestic commercial property is not as good a hedge against inflation as other asset classes.	· Deflation could force defaults on commercial leases at a time when the real burden of debt financing costs is also rising

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Foreign Commercial Property	· Low correlation of returns with foreign bonds and domestic property	· If your country has higher inflation than others, your currency should depreciate, producing higher real returns on foreign property · If inflation rises globally, but higher in your country than elsewhere, foreign property could deliver higher returns than foreign bonds	· If foreign deflation is higher than domestic, and falls in lease payments lag deflation, you could realize high foreign currency real returns, plus exchange rate gains in your home currency
Reasons Not to Invest in Foreign Commercial Property	· Correlation with foreign equity can be high · Equity should deliver higher returns under these conditions	· Given the high correlation of foreign property and foreign equity returns, a general rise in global inflation that depressed equity markets might make foreign property a less attractive inflation hedge than other asset classes	· If domestic deflation is relatively higher, home currency appreciation should depress returns on foreign commercial property

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Commodities	· Low to negative historical correlation with most other asset classes · High returns when global economic growth is high	· Price of commodities should increase with inflation · Real returns historically have low to negative correlation with inflation	· Should strengthen backwardation relationship (where forward price is lower than spot price) that favors commodity index investors
Reasons Not to Invest in Commodities	· Volatility is still high, so volatility averse investors need to limit exposure · Questions about capacity of underlying index futures strategy. Are there enough producers selling futures contracts to match demand by index funds? If not, commodity index fund returns could decline.	· To the extent that commodity index is heavily weighted toward oil, technological change could affect future commodity price dynamics · Also, capacity of strategy in the face of rising investor demand for commodity returns	· If widespread, deflation could cause a fall in economic growth, and overall demand for commodities and related hedging products

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Timber	· Unique return generating process – growth and harvesting of trees · Relatively low correlation with other sources of return	· Price of timber should increase with inflation	· Slow downward readjustment of timber sales contract prices could deliver high real returns, assuming counterparties don't default
Reasons Not to Invest in Timber	· Volatility is high, so volatility averse investors need to limit exposure · Limited capacity of investment strategy. If demand for timber investments increases, prices could rise, and lower future real returns.	· Hard to think of one, apart from potential limitations on capacity to accept new investments without reducing future real returns	· If deflation was widespread, and it caused a sharp fall in economic growth, the price of and return on timber should also fall.

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Gold	· Industrial and consumer demand for gold could rise when economic growth is strong	· Price of gold (in its role as a store of value) should increase with inflation · If there is a loss of confidence in paper currency, gold's role as a medium of exchange could be critical. However, this would make physical gold (e.g., coins) more attractive than shares in a gold ETF	· Hard to think of one, unless you believe that deflation would eventually undermine confidence in paper money.
Reasons Not to Invest in Gold	· There is no income return from holding physical gold (or an ETF based on physical gold), as would be the case if one held gold futures contracts · Strong supply response may limit price appreciation even in the face of increased demand	· Other investments may provide better protection against inflation	· There are better hedges against deflation, such as high quality government bonds.

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Domestic Equity	· Should deliver high returns in compensation for higher risk born by investors	· Since equity is a claim on residual cash flow, and since companies can eventually adjust their prices when faced with inflation, equity returns should suffer less than fixed rate bond returns.	· Some companies, e.g., consumer staples providers with strong brands/pricing power and low debt levels, could do very well during deflation. However, the returns for the asset class as a whole will suffer during deflation.
Reasons Not to Invest in Domestic Equity	· Volatility is relatively high, so volatility-sensitive investors should limit their exposure. · In many markets, current valuation levels and dividend yields imply relatively low future returns compared to recent historical returns	· Other asset classes (e.g., real return bonds, foreign currency bonds, property, commodities, and timber) provide better protection against inflation	· Other asset classes – such as domestic government bonds – provide better protection against deflation.

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Foreign Equity	· Should deliver high returns in compensation for higher risk born by investors · May deliver higher returns and/or less risk due to exposure to a wider range of opportunities	· If your country has higher inflation than others, your currency should depreciate, producing higher real returns on foreign equity	· If deflation is widespread, and yours is lower than other countries, your currency should depreciate, producing higher returns on foreign equity
Reasons Not to Invest in Foreign Equity	· Volatility is relatively high, so volatility-sensitive investors should limit their exposure. · In many markets, current valuation levels and dividend yields imply relatively low future returns compared to recent experience · Some of the diversification benefits from foreign equity often prove to be illusory during market downturns when correlations between equity markets rise	· If global inflation increases, but your country has the lowest rate, your currency should appreciate, and foreign equity returns will suffer · Other asset classes (e.g., real return bonds, property, commodities, and timber) provide better protection against inflation	· If your deflation is higher, your currency should appreciate, reducing returns on foreign equity · If deflation exists in foreign markets, it will depress equity returns there too · Other asset classes – such as government bonds – provide better protection against deflation.

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Emerging Market Equity	· May deliver higher returns due to exposure to a wider range of opportunities · Should deliver some risk reduction benefits	· If your country has higher inflation than the dollar zone (since many emerging markets currencies are closely linked to the USD, your currency should depreciate against it, producing higher real returns on emerging equity	· If deflation is widespread, and yours is lower than deflation in the dollar zone, your currency should depreciate, producing higher returns on emerging equity (assuming that these aren't offset by slowing economic activity in emerging markets)
Reasons Not to Invest in Emerging Equity	· Future returns may not be as high as historical returns, while volatility remains at close to its historical level. In short, the risk/return trade-off for the asset class as a whole may have worsened (though this may not be true for some subregions, such as developing Asian countries)	· Other asset classes (e.g., real return bonds, property, commodities, and timber) provide better protection against inflation	· Other asset classes – such as government bonds – provide better protection against deflation

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Equity Volatility	· Strong negative correlation with returns on domestic, foreign and emerging equity markets and domestic and foreign property	· If inflation leads to more uncertainty and worsening equity market performance, equity market volatility should perform well	· If deflation leads to more uncertainty and worsening equity market performance, equity market volatility should perform well
Reasons Not to Invest in Equity Volatility	· Very high volatility, so risk averse investors may not want to add much of it to a portfolio, despite its diversification benefits	· Other asset classes can be used to hedge against inflation with less volatility exposure	· Other asset classes can be used to hedge against deflation with less volatility exposure

ISSN 1554-5075

Market Condition:	**Normal**	**Inflation**	**Deflation**
Reasons to Invest in Uncorrelated Alpha (Hedge Fund) Strategies	· Equity Market Neutral seems likely to boost returns while lowering portfolio risk, because of its low correlation with returns on most asset classes · However, all hedge fund data series are short in length, and of questionable quality. Hence, this conclusion is necessarily a tentative one	· Uncorrelated returns (pure alpha) may be less infected by inflation than some broad asset classes	· Uncorrelated returns (pure alpha) may be less infected by deflation than some broad asset classes
Reasons Not to Invest in Uncorrelated Alpha (Hedge Fund) Strategies	· Liquidity is low, so not appropriate for investors who make regular withdrawls from portfolio. · With large amount of new money flowing into hedge funds, historical risk/return relationships will probably worsen in the future	· Other asset classes provide better protection against inflation · Hedge funds haven't really been tested under these conditions	· Other asset classes provide better protection against deflation

ISSN 1554-5075

Model Portfolios Update

We produce three different types of model portfolios. Each of these is based on a different portfolio construction methodology.

We use a "rule of thumb" approach (or, to use the more formal term, a "heuristic approach") to construct our benchmark portfolios. More specifically, we use three "rules of thumb" that are often cited in news stories a mix of 80% equities and 20% debt (for our high risk/high return portfolios); a mix of 60% equities and 40% debt (for our moderate risk/moderate return portfolios); and a mix of 20% equities and 80% debt (for our low risk/low return portfolios). Using different terminology, somebody else might call these three portfolios aggressive, balanced, and conservative. We implement these three rules of thumb in two different ways (to construct six different benchmark portfolios). The first uses just two asset classes: domestic investment grade bonds and domestic equity. The second uses a broader mix of asset classes: domestic and foreign investment grade bonds, and domestic and foreign (including emerging market) equity. In addition to these 80/20, 60/40, and 20/80 portfolios, we also provide our "couch potato" portfolio. This portfolio is equally allocated to all of the asset classes we use. More formally, this is known as the "1/N heuristic," which research has shown is an approach used by a significant proportion of retirement plan investors. This portfolio implicitly assumes that it is impossible to accurately forecast future asset class risk and return; consequently, the best approach is to equally divide one's exposure to different sources of return (and risk). While we disagree with this assumption, intellectual honesty compels us to include the "couch potato" portfolio as one of our benchmarks. Finally, each year we also benchmark all our portfolios against the return from holding cash. We define this return as the yield to maturity on a one-year government security purchased at the end of the previous year. For 2005, the U.S. cash benchmark return is 2.75% (nominal).

The goal of our second set of model portfolios is to either deliver more return than the domestic benchmark portfolios, while taking on no more risk, or to deliver the same level of return while taking on less risk. To develop these model portfolios, we use a methodology known as "mean/variance optimization" or MVO. This approach uses three variables for each asset class (its expected return, standard deviation of returns, and correlation of returns with other asset classes) to construct different combinations of portfolios which maximize return per

ISSN 1554-5075

unit of risk (another way of looking at this is that they minimize risk per unit of return). The MVO technique has some significant limitations. While it is a good approach to single year portfolio optimization problems, in multiyear settings it fails to adequately take into account the fact that poor portfolio performance in early years can substantially reduce the probability of achieving long term goals. It also fails to adequately account for most people's intuitive understanding of risk: what's important isn't standard deviation (the dispersion of annual returns around their mean), but rather the chance that I will fall short of my long-term goals. Given these limitations, our MVO portfolios are most appropriate for managers whose performance is evaluated on an annual basis in comparison to one of our benchmarks.

Our third set of model portfolios uses a simulation optimization methodology. It assumes that an investor understands the long-term compound real rate of return he or she needs to earn on his or her portfolio to achieve his or her long-term financial goals. We use SO to develop a multi-period asset allocation solutions that are “robust”. They are intended to maximize the probability of achieving an investor’s compound annual return target under a wide range of possible future asset class return scenarios. More information about the SO methodology is available on our website. Using this approach, we produce model portfolios for three different compound annual real return targets: 7%, 5%, and 3%. We produce two sets of these portfolios: one includes hedge funds as a possible asset class, and one does not.

The year-to-date results for all these model portfolios are shown in the tables on the following pages.

ISSN 1554-5075

Model Portfolios Year-to-Date Performance

These portfolios seek to maximize return while matching their benchmark's risk (standard deviation)			
	YTD 31Oct05	**Weight**	**Weighted Return**
	In U.S. $		In U.S. $
High Risk/Return Portfolio			
Asset Classes			
U.S. Benchmark			
U.S. Equity	1.8%	**80%**	**1.44%**
U.S.Bonds	0.9%	**20%**	**0.18%**
		100%	**1.62%**
Global Benchmark			
U.S. Equity	1.8%	**40%**	**0.72%**
Non-U.S. Equity	7.1%	**40%**	**2.84%**
U.S. Bonds	0.9%	**10%**	**0.09%**
Non-U.S. Bonds	-8.0%	**10%**	**-0.80%**
		100%	**2.85%**
Recommended			
U.S. Equity	1.8%	**55%**	**0.99%**
Foreign Equity (EAFE)	6.0%	**25%**	**1.50%**
Emerging Mkts Equity	15.2%	**7%**	**1.06%**
Commercial Property	7.4%	**3%**	**0.22%**
Commodities	15.5%	**10%**	**1.55%**
		100%	**5.33%**

ISSN 1554-5075

These portfolios seek to maximize return while matching their benchmark's risk (standard deviation)			
Medium Risk/Return Portfolio			
Asset Classes			
U.S. Benchmark			
U.S. Equity	1.8%	**60%**	**1.080%**
U.S.Bonds	0.9%	**40%**	**0.360%**
		100%	**1.440%**
Global Benchmark			
U.S. Equity	1.8%	**30%**	**0.54%**
Non-U.S. Equity	7.1%	**30%**	**2.13%**
U.S. Bonds	0.9%	**20%**	**0.18%**
Non-U.S. Bonds	-8.0%	**20%**	**-1.60%**
		100%	**1.25%**
Recommended			
U.S. Equity	1.8%	**47%**	**0.85%**
Foreign Equity (EAFE)	6.0%	**10%**	**0.60%**
U.S.Bonds	0.9%	**12%**	**0.11%**
U.S. High Yield Bonds	0.9%	**5%**	**0.05%**
Non-U.S. Bonds	-8.0%	**5%**	**-0.40%**
Commercial Property	7.4%	**6%**	**0.44%**
Emerging Mkts Equity	15.2%	**5%**	**0.76%**
Commodities	15.5%	**10%**	**1.55%**
		100%	**3.95%**

ISSN 1554-5075

These portfolios seek to maximize return while matching their benchmark's risk (standard deviation)			
Low Risk/Return Portfolio			
Asset Classes			
U.S. Benchmark			
U.S. Equity	1.8%	**20%**	**0.36%**
U.S.Bonds	0.9%	**80%**	**0.72%**
		100%	**1.08%**
Global Benchmark			
U.S. Equity	1.8%	**10%**	**0.18%**
Non-U.S. Equity	7.1%	**10%**	**0.71%**
U.S. Bonds	0.9%	**40%**	**0.36%**
Non-U.S. Bonds	-8.0%	**40%**	**-3.20%**
		100%	**-1.95%**
Recommended			
U.S. Equity	1.8%	**16%**	**0.29%**
U.S. Bonds	0.9%	**55%**	**0.50%**
U.S. High Yield Bonds	0.9%	**3%**	**0.03%**
Real Return Bonds	1.3%	**10%**	**0.13%**
Commercial Property	7.4%	**5%**	**0.37%**
Foreign Equity (EAFE)	6.0%	**6%**	**0.36%**
Commodities	15.5%	**5%**	**0.78%**
		100%	**2.45%**

ISSN 1554-5075

These portfolios seek to minimize risk while matching their benchmark's returns.			
	YTD 31Oct05	**Weight**	**Weighted Return**
	In U.S. $		In U.S. $
High Risk/Return Portfolio			
Asset Classes			
U.S. Benchmark			
U.S. Equity	1.8%	**80%**	**1.44%**
U.S.Bonds	0.9%	**20%**	**0.18%**
		100%	**1.62%**
Global Benchmark			
U.S. Equity	1.8%	**40%**	**0.72%**
Non-U.S. Equity	7.1%	**40%**	**2.84%**
U.S. Bonds	0.9%	**10%**	**0.09%**
Non-U.S. Bonds	-8.0%	**10%**	**-0.80%**
		100%	**2.85%**
Recommended			
U.S. Bonds	0.9%	**5%**	**0.05%**
Commercial Property	7.4%	**10%**	**0.74%**
U.S. Equity	1.8%	**58%**	**1.04%**
Foreign Equity (EAFE)	6.0%	**17%**	**1.02%**
Commodities	15.5%	**10%**	**1.55%**
		100%	**4.40%**

ISSN 1554-5075

These portfolios seek to minimize risk while matching their benchmark's returns.			
Medium Risk/Return Portfolio			
Asset Classes			
U.S. Benchmark			
U.S. Equity	1.8%	**60%**	**1.08%**
U.S.Bonds	0.9%	**40%**	**0.36%**
		100%	**1.44%**
Global Benchmark			
U.S. Equity	1.8%	**30%**	**0.54%**
Non-U.S. Equity	7.1%	**30%**	**2.13%**
U.S. Bonds	0.9%	**20%**	**0.18%**
Non-U.S. Bonds	-8.0%	**20%**	**-1.60%**
		100%	**1.25%**
Recommended			
U.S. Equity	1.8%	**45%**	**0.81%**
Foreign Equity (EAFE)	6.0%	**10%**	**0.60%**
U.S. Bonds	0.9%	**29%**	**0.26%**
U.S. High Yield Bonds	0.9%	**5%**	**0.05%**
Commercial Property	7.4%	**6%**	**0.44%**
Commodities	15.5%	**5%**	**0.78%**
		100%	**2.94%**

ISSN 1554-5075

Low Risk/Return Portfolio			
Asset Classes			
U.S. Benchmark			
U.S. Equity	1.8%	**20%**	**0.36%**
U.S.Bonds	0.9%	**80%**	**0.72%**
		100%	**1.08%**
Global Benchmark			
U.S. Equity	1.8%	**10%**	**0.18%**
Non-U.S. Equity	7.1%	**10%**	**0.71%**
U.S. Bonds	0.9%	**40%**	**0.36%**
Non-U.S. Bonds	-8.0%	**40%**	**-3.20%**
		100%	**-1.95%**
Recommended			
U.S. Equity	1.8%	**10%**	**0.18%**
Foreign Equity (EAFE)	6.0%	**8%**	**0.48%**
Commercial Property	7.4%	**4%**	**0.30%**
U.S.Bonds	0.9%	**40%**	**0.36%**
Real Return Bonds	1.3%	**25%**	**0.33%**
U.S. High Yield Bonds	0.9%	**8%**	**0.07%**
Commodities	15.5%	**5%**	**0.78%**
		100%	**2.49%**

ISSN 1554-5075

These portfolios seek to maximize the probability of achieving at least the target real return over twenty years, at the lowest possible risk.			
	YTD 31Oct05	**Weight**	**Weighted Return**
	In US$		In US$
7% Target Real Return	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	3%	**0.04%**
U.S. Bonds	0.9%	3%	**0.03%**
Non-U.S. Bonds	-8.0%	29%	**-2.32%**
Commercial Property	7.4%	10%	**0.74%**
Commodities	15.5%	13%	**2.02%**
U.S. Equity	1.8%	25%	**0.45%**
Foreign Equity (EAFE)	6.0%	0%	**0.00%**
Emerging Mkt. Equity	15.2%	17%	**2.58%**
Hedge Funds	1.9%	0%	**0.00%**
		100%	**3.54%**
	YTD 31Oct05	**Weight**	**Weighted Return**
	In US$		In US$
5% Target Real Return	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	2%	**0.03%**
U.S. Bonds	0.9%	15%	**0.14%**
Non-U.S. Bonds	-8.0%	22%	**-1.76%**
Commercial Property	7.4%	13%	**0.96%**
Commodities	15.5%	6%	**0.93%**
U.S. Equity	1.8%	27%	**0.49%**
Foreign Equity (EAFE)	6.0%	5%	**0.30%**
Emerging Mkt. Equity	15.2%	10%	**1.52%**
Hedge Funds	1.9%	0%	**0.00%**
		100%	**2.60%**

ISSN 1554-5075

	YTD 31Oct05	Weight	Weighted Return
	In US$		In US$
3% Target Real Return	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	40%	**0.52%**
U.S. Bonds	0.9%	25%	**0.23%**
Non-U.S. Bonds	-8.0%	8%	**-0.64%**
Commercial Property	7.4%	8%	**0.59%**
Commodities	15.5%	7%	**1.09%**
U.S. Equity	1.8%	7%	**0.13%**
Foreign Equity (EAFE)	6.0%	3%	**0.18%**
Emerging Mkt. Equity	15.2%	2%	**0.30%**
Hedge Funds	1.9%	0%	**0.00%**
		100%	**2.39%**

ISSN 1554-5075

These portfolios seek to maximize the probability of achieving at least the target real return over twenty years, at the lowest possible risk.		***These portfolios are the same as our other target real return portfolios, except that they can also invest in hedge fund index products.***	
	YTD 31Oct05	**Weight**	**Weighted Return**
	In US$		In US$
7% Target Real Return	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	3%	**0.04%**
U.S. Bonds	0.9%	0%	**0.00%**
Non-U.S. Bonds	-8.0%	27%	**-2.16%**
Commercial Property	7.4%	13%	**0.96%**
Commodities	15.5%	10%	**1.55%**
U.S. Equity	1.8%	20%	**0.36%**
Foreign Equity (EAFE)	6.0%	0%	**0.00%**
Emerging Mkt. Equity	15.2%	12%	**1.82%**
Hedge Funds	1.9%	15%	**0.29%**
		100%	**2.87%**

	YTD 31Oct05	**Weight**	**Weighted Return**
	In US$		In US$
5% Target Real Return	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	5%	**0.07%**
U.S. Bonds	0.9%	20%	**0.18%**
Non-U.S. Bonds	-8.0%	22%	**-1.76%**
Commercial Property	7.4%	7%	**0.52%**
Commodities	15.5%	10%	**1.55%**
U.S. Equity	1.8%	20%	**0.36%**
Foreign Equity (EAFE)	6.0%	0%	**0.00%**
Emerging Mkt. Equity	15.2%	6%	**0.91%**
Hedge Funds	1.9%	10%	**0.19%**
		100%	**2.02%**

ISSN 1554-5075

	YTD 31Oct05	Weight	Weighted Return
	In US$		In US$
3% Target Real Return	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	42%	**0.55%**
U.S. Bonds	0.9%	16%	**0.14%**
Non-U.S. Bonds	-8.0%	11%	**-0.88%**
Commercial Property	7.4%	10%	**0.74%**
Commodities	15.5%	7%	**1.09%**
U.S. Equity	1.8%	7%	**0.13%**
Foreign Equity (EAFE)	6.0%	2%	**0.12%**
Emerging Mkt. Equity	15.2%	2%	**0.30%**
Hedge Funds	1.9%	3%	**0.06%**
		100%	**2.24%**

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	YTD 31Oct05	Weight	Weighted Return
	In US$		In US$
Equally Weighted Portfolio	*YTD Returns are Nominal*		
Asset Classes			
Real Return Bonds	1.3%	12.5%	**0.16%**
U.S. Bonds	0.9%	12.5%	**0.11%**
Non-U.S. Bonds	-8.0%	12.5%	**-1.00%**
Commercial Property	7.4%	12.5%	**0.93%**
Commodities	15.5%	12.5%	**1.94%**
U.S. Equity	1.8%	12.5%	**0.23%**
Foreign Equity (EAFE)	6.0%	12.5%	**0.75%**
Emerging Mkt. Equity	15.2%	12.5%	**1.90%**
		100.0%	**5.01%**

ISSN 1554-5075