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Founded 1966 - - Over 40 years of Research
and Seminars Devoted to the State-of-the-Art
in Investment Technology

Summary of Proceedings

Volume 6

2001 - 2005
PREFACE TO VOLUME 6

Volume 6 in the series completes 40 years of seminar presentations that have been designed to bridge the gap between the theory and the practice of finance. These excellent programs is the preeminent reason that the Institute has grown from its small beginnings to one of international recognition. It is noteworthy that many of the original 29 members continue to remain as Sponsors, although there have been many mergers and name changes that have taken place in the intervening years.

This issue will likely be the last of our printed 5-year summaries. With the advent of the Internet and the instant electronic communication among parties, the next logical step is for the Institute to “publish” the chronicles of our activities in this medium. The current volume is valuable because it presents summaries of the presentations from the Seminars held in the Spring of 2001 through the Autumn of 2005 and coalesces the presentations under the right topic heading.

As has been our custom in the past, the index at the back of the book contains detailed references to all six volumes. In addition, the Roger F. Murray Prize winners are also shown along with the details of each of the Spring and Autumn programs during the five years covered by the book. Finally, Volumes 1 through 5 have already been placed on our website (www.q-group.org) and Volume 6 will follow shortly.

In our previous publication (Volume V of our Summary of Proceedings), covering the period 1995-2000, we have included some heretofore unpublished information concerning the research and papers presented at Q® seminars in the period 1966 through the early 1970s. Let me refer the reader to Volume 5 for these early Seminar presentations. Please note that these papers, as well as all other Q® papers, continue to reside in the archives of the Thomas J. Watson Business School Library at Columbia University Graduate School of Business. Sponsors of the Institute wishing to have access to the Q® papers should contact the library at Columbia for the correct procedure to follow.

I personally feel that our seminar summaries have been most useful in that they capture some very difficult technical material in a direct and most comprehensible manner. We owe this unique writing style to Professor J. Peter Williamson, our long-time Summarizer, who has the unique talent enabling him to capture and present the essence of the speakers’ presentation. All six Volumes of our Summaries reflect his gift of capturing the essence of the presentation. We again take this opportunity to thank him for his endeavors and we will continue to rely upon him for his excellent contribution to the Institute.

Dale Berman
Secretary-Treasurer
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Active Equity Management
Capturing Alpha

1. Stock Market Diversity
   (Spring 2005)

E. Robert Fernholz, Chief Investment Officer, INTECH had made available a paper entitled “Stock Market Diversity.” Stock market diversity, first considered in Fernholz (1999), is a measure of the distribution of capital in an equity market. Diversity is higher when capital is more evenly distributed among the stocks in the market. Market diversity, as measured by any of the measures of diversity, appears to be mean-reverting over the long term with intermediate-term trends.

Certain measures of diversity generate portfolios, generically called diversity-weighted portfolios, and these portfolios have a more even distribution of capital than the market. The relative return of a diversity-weighted portfolio is perfectly correlated with the change in market diversity as determined by the measure that generates it. Certain diversity-weighted portfolios can be shown to have a higher return than the market portfolio, with about the same level of risk, at least over the long term.

It appears that active equity managers as a group hold portfolios with a distribution of capital that is closer to a diversity-weighted portfolio than to the market. This may enhance the manager’s returns over the long term, but it also causes short-term relative returns to be correlated to changes in market diversity.

Fernholtz began with the classical representation of rate of return on a stock. Suppose that \( X(t) \) represents the price of a stock at time \( t \). If we assume that stocks pay no dividends, etc., then the return on this stock over time interval \( dt \) is

\[
\frac{dX(t)}{X(t)} = \alpha(t)dt + \sigma(t)dW(t),
\]

where \( \alpha(t) \) represents the rate of return, \( \sigma^2(t) \) represents the variance (rate), and \( W \) is Brownian motion, the continuous-time version of a random walk.

It turns out that it is advantageous to use the logarithmic return (log-return), sometimes called the continuous return, rather than the classical return. In this case

\[
d\log X(t) = \gamma(t)dt + \sigma(t)dW(t),
\]

where \( \gamma(t) \) is the growth rate of \( X \) at time \( t \). The growth rate is also sometimes called the geometric rate of return, the logarithmic rate of return, or the continuous rate of return. The relation between the rate of return and the growth rate is

\[
\alpha(t) = \gamma(t) + \frac{1}{2}\sigma^2(t).
\]

We go now to the measure of market diversity \( D_p(\mu(t)) = \left( \sum_{i=1}^{n} \mu_i^p(t) \right)^{1/p} \), where \( 0 < p < 1 \). We see that

\[
1 \leq D_p(\mu(t)) \leq n^{(1-p)/p}.
\]

Since early in the last century, US stock market diversity, measured by \( D_p \) has been mean-reverting with intermediate-term trends.

It can be shown that the measure of diversity \( D_p \) generates the diversity-weighted portfolio \( \pi \) with weights

\[
\pi_i(t) = \frac{\mu_i^p(t)}{\sum_{j=1}^{n} \mu_j^p(t)},
\]

and the relative log-return

\[
d\log \left( \frac{Z_\pi(t)}{Z_\mu(t)} \right) = d\log D_p(\mu(t)) + (1-p)\gamma_\pi(t)dt.
\]

- Compared to the market portfolio, \( \pi \) underweights the larger stocks and overweights the smaller stocks.
- The diversity-weighted portfolio is...
likely to outperform the market, because diversity is mean-reverting and the drift process is increasing.

For an all-long portfolio with more than one stock, \( \gamma_a(t) > 0 \), and measures the amount by which the portfolio growth rate exceeds the weighted average of the stock growth rates.

From all of the foregoing the conclusions are these:

• Lowering the concentration of capital in the largest stocks allows the diversity-weighted portfolio to outperform the market, without increasing the intermediate-term risk

• Active managers may take advantage of this phenomenon, perhaps unintentionally.

• If so, the average holdings of active managers would be closer to diversity weighting than to cap weighting.

• In that case, active managers’ relative returns would be positively correlated with changes in market diversity.

• If trends in market diversity can be predicted, this could be helpful in the allocation of assets between active and passive managers.

2. The Economics of Short-Term Performance Obsession (Fall 2004)

Alfred Rappaport, Leonard Spacek Professor Emeritus, Kellogg Graduate School of Management, Northwestern University, had made available a paper entitled: “The Economics of Short-Term Performance Obsession.” He began with the basic theory that the value of a share of stock, as of any investable asset, is the discounted present value of the expected cash flows. And he observed that in practice short-term earnings and tracking error dominate investment decisions. He posed five basic questions:

1. Why do investment managers focus on quarterly earnings?

2. Can stock prices be allocatively efficient when short-term earnings and tracking error dominate investment decisions?

3. Can investment managers earn excess returns if they buy and sell stocks they believe the market has mispriced on a discounted cash-flow basis?

4. Is corporate management’s focus on short-term earnings self-serving or also in the best interest of its shareholders?

5. What can be done to alleviate the obsession with short-term performance and improve allocative efficiency?

He went on to discuss the limitations of reported earnings. The portion of earnings we can regard as “facts” are the realized cash flows. The accrual portion of earnings, however, rests on assumptions about the future. Accruals arise from existing incomplete contracts, both explicit and implicit. Some accruals, most accounts receivable for example, involve low uncertainty. Others, like pension fund expense, may involve a high uncertainty. The conventional practice is to treat accruals as though they were as certain as cash receipts, and to regard the total of cash and accruals as driving the stock price. In fact, the present value of the accruals in a DCF model accounts for no more than 5% of the present value of a share of stock.

Why is the use of earnings so appealing? For investment managers, it
is convenient to trust the earnings rather than to try estimating future cash flows. Short-horizon investors (and the holding period is less than 1 year for professional managers) are likely to see long-term cash flows as unnecessary in their valuation decisions, and in addition we know that stock prices respond to “earnings surprises.” Chief executives seem to believe that earnings drive the company’s stock price. They are concerned with their reputation for producing earnings, and their incentive compensation may depend on short-term earnings.

Rappaport turned to three measures of efficiency: informational efficiency, fundamental efficiency, and the most important allocative efficiency. In an informationally efficient market, stock prices fully reflect all relevant information and investors are unable to earn excess returns using available information. But stock prices reflect information relevant to the models investors employ, and if the models are not the right ones, then an informationally efficient market is not necessarily allocatively efficient. In a fundamentally efficient market, the prices are “correct.” The concept is perhaps not very helpful, since the “correct” price for a stock is not only unknowable today, but we cannot determine it at a later date because future prices will not be based on today’s information but on revised information. Finally, it is allocative efficiency that allocates scarce resources to firms that can make the best use of them. That is the function the capital markets are supposed to perform. Rappaport concluded that given the dominance of non-DCF traders it is doubtful that this objective is being achieved. In theory, superior ability to anticipate long-term valuation implications of currently available information combined with the DCF model should lead to identification of mispriced stocks and therefore superior returns. Rappaport discussed a number of characteristics of the market than inhibit this exploitation. These may in part explain resort to earnings obsession.

He referred briefly to the survey of financial executives by Graham, Harvey and Rajgopal that was to be discussed by Campbell Harvey at the next session (No. 15, below). Executives were actually willing to jeopardize long-term cash flows in order to meet quarterly earnings targets. In doing so they were failing to create value for continuing shareholders in order to serve short-term oriented market participants.

The balance of his presentation consisted of a series of suggestions for improved corporate performance reporting that would help facilitate fundamental analysis by way of the DCF model. His ideal performance statement would:

- Separate cash flows and accruals
- Classify accruals by level of uncertainty
- Provide a range as well as the most likely estimate for each accrual
- Exclude arbitrary, value-irrelevant accruals
- Detail assumptions and risks for each line item

For example, medium uncertainty accruals would include uncollectible receivables, warranty obligations, and restructuring charges, while high uncertainty accruals would include defined benefit pension expense and employee stock options. Such a statement would not only help investors make valuation decisions but would also make it easier for boards of directors to champion executive compensation plans that reward long-term value creation. Rappaport pointed
out benefits for managers of closed-end funds and, to a lesser extent, for open-end managers.

In terms of incentives for corporate executives, he described indexed-options plans where the executive’s performance is compared with peer group indexes, something that has been proposed for some time but adopted by almost no companies, and a somewhat more complex incentive that takes the form of discounted equity-risk options (DEROs) for companies unable to construct a peer index.

In closing, he made no claim that he has a clear and precise prescription for correcting what he identified as the unsatisfactory obsession with short-term performance, but believed that the direction in which his proposals pointed was correct.

3. Market Frictions, Price Delay, and the Cross-Section of Expected Returns (Fall 2004)

Kewei Hou, Professor, Fisher College of Business, The Ohio State University, had made available a paper by himself and Tobias J. Moskowitz entitled: “Market Frictions, Price Delay, and the Cross-Section of Expected Returns.” The research received financial support from the Q-Group®.

The motivation for his research concerned the market efficiency debate. Is predictability of returns due to risk, or is it an inefficiency? The argument for efficiency generally assumes markets are frictionless and investors are well diversified, yet there is ample evidence that these assumptions are not justified. His work assessed the impact of market frictions using a parsimonious measure of the severity of the frictions affecting a stock. This measure is the average delay with which the share price responds to market information. He hypothesized that delay would capture the potential impact of all of the sources of friction that have been identified in previous research. His data source was the CRSP-COMPUSTAT universe for July 1963-December 2001. He used weekly returns to estimate the delay measure and monthly returns to form portfolios and measure performance. At the end of June of each calendar year he ran a regression of each stock’s weekly returns on contemporaneous returns on the market portfolio, and 4 weeks of lagged returns, over the prior year. The regression took the form:

\[
    r_{j,t} = \alpha_j + \beta_j R_{m,t} + \sum_{n=1}^{4} \delta_j^{(-n)} R_{m,t-n} + \epsilon_{j,t} \tag{1}
\]

In the case where the return on a stock is affected by the market return with little or no delay, the beta should be significant and the values for \( \delta_j \) should be essentially zero.

Three delay measures were used. The first was:

\[
    D_1 = 1 - \frac{R^2_{\delta^{(-n)}}}{R^2}, \quad \forall \ n \in [1, 4]
\]

\( D_1 \) is the fraction of variation of contemporaneous individual stock returns explained by lagged market returns. The larger this number, the more return variation is captured by lagged returns, and hence the stronger is the delay in response to return innovation. \( D_1 \) does not distinguish between shorter and longer lags, or the precision of the estimates, so we move to:

\[
    D_2 = \frac{\sum_{n=1}^{4} n \delta^{(-n)}}{\beta + \sum_{n=1}^{4} \delta^{(-n)}}.
\]

\( D_2 \), through its weighting, distinguishes between shorter and longer lags.
Finally,

$$D_3 = \frac{\sum_{n=1}^{4} n \delta^{(-n)} \frac{se}{\sum_{n=1}^{4} \delta^{(-n)}}}{\beta + \frac{se}{\sum_{n=1}^{4} \delta^{(-n)}}}.$$

$se$ is the standard error of the coefficient estimate. $D_3$ distinguishes between shorter and longer lags and also allows for the relative precision of the estimates.

All three delay measures are estimated for each individual stock. The firms are then sorted into ten portfolios based on their market capitalization and within each size decile the stocks are sorted into deciles based on their $D_1$ measure. The equal-weighted weekly returns of the 100 size-delay portfolios are computed over the following year from July to June. Then equation (1) is re-estimated using the entire past sample of weekly returns for each of the 100 portfolios. The computed delay measures for each portfolio are then assigned to each stock within the portfolio. This procedure essentially shrinks each stock’s individual delay measure to the average for stocks of similar size and individual first-stage delay. We use these results to rank stocks and form portfolios to examine subsequent returns.

Hou’s Table 1 showed the characteristics of delay sorted portfolios (using delay measure $D_1$). Of particular interest are firms in decile 10, the portfolio of highest delay. For this decile the increase in delay from decile 9 is the most striking. The firms are small value, volatile firms, with poor recent performance. These firms have a high book-to-market ratio, low institutional ownership, a small number of shareholders, are followed by few analysts, and have low advertising expenditures. Volume of trading is low, illiquidity is high, and the average share price is under $5. There was some discussion of trading costs for such stocks, and Hou concluded that these costs would be relatively high compared to the excess returns. The suggestion from these results is that the delay measure has captured a number of characteristics that we might expect to associate with high trading costs.

Hou’s Table 2 showed the delay variables and the cross-section of expected stock returns. The returns were adjusted to account for return premia associated with size, BE/ME, and momentum (past one year returns). The average raw spread between the highest and lowest portfolio of delay firms was 134 basis points per month when equal weighted and 99 basis points when value weighted. The characteristic-adjusted returns are more informative about the relation of delay to average returns, but the average spread between deciles 10 and 1 remained largely the same. Commenting again on the availability of high returns, Hou noted that decile 10 comprises on average less than 0.02% of the total market capitalization of publicly traded equity on US exchanges.

Table 2 also reported results for delay measures $D_2$ and $D_3$, and the returns generated from these measures were similar in magnitude and significance to the main $D_1$ measure.

Hou went on to examine the relationship between delay and the size effect. He concluded that although there is some overlap between size and delay, each has significant independent explanatory power. He continued on the interaction between delay and BE/ME, long-term reversals, momentum, share turnover, trading volume, and residual volatility. He also examined the price response of the firms studied to earnings announcements, finding a monotonic relation between delay and post-earnings announcement
drift, particularly for positive earnings surprises. He concluded that delay is in fact a parsimonious measure of severity of market frictions. It is a strong predictor of average returns; it captures the size effect; and it interacts with other known return predictors.

4. Capturing Alpha — Different Tactics for Different Styles and Markets (Spring 2004)

Joanne M. Hill, Managing Director, Goldman Sachs & Company, began the presentation with a review of the different alpha-seeking tactics, and Stephen H. Strongin, Director of Global Portfolio Analysis, Goldman Sachs & Company, followed up with a series of explanations for the results Hill had described. She began with the proposition that variation in both alpha and tracking error may not be solely related to manager skill. Consistent alpha-generation has been a challenge especially for large-cap managers. The alpha of these managers appears inversely related to equity market strength and this was evident from a plot from 1990-2003 of the Russell 1000 return and the median manager alpha. It is not surprising that a low correlation across stocks (cross-stock dispersion) leads to more effective discrimination and a better alpha.

Three other factors helping to explain excess returns were a small-cap tilt, style dominance, and momentum. Cash drag, of course, had a negative impact. A table of correlations of alphas of large-cap managers with market-wide factors showed the impact of each factor on core, value, and growth managers, with the relative impacts for the time period 1990-1996 differing somewhat from those for 1997-2003. Not surprisingly a multiple regression indicated that cross-stock dispersion was particularly important. It also turned out that small-cap alphas are less subject to these systematic factors.

Turning to hedge funds and enhanced index fund alphas, she showed they were less influenced by market factors. For enhanced index alphas, momentum has been the most important performance driver. There appeared to be no sensitivity to market direction. Again, cross-stock dispersion was important to hedge funds. She concluded with the implications of time-varying alpha factors. Diversification across sources of alphas will reduce active risk. This means combining different styles and capitalizations. Expected alpha can be incorporated into manager performance assessment, given the factor returns present over the evaluation period. One should consider altering the tracking error of strategies or portfolios of strategies to adapt to market conditions. It may even be appropriate to allow stock variability to rise if the result will favor high values for alpha. Fees for manager skill might be linked to the shifting alpha opportunity set and the skill of delivering within it. Overlay products may facilitate benefit from shifts in factors driving alpha. One should consider hedging dynamic alpha with broad index volatility exposure or other products that profit from falling dispersion.

Strongin continued the presentation with a review of the effect of controlling for macro risk in the large-cap sample. Judging success on the basis of the Sharpe ratio, controlling for sector and size was not helpful for both the value and growth styles.

In the small-cap sample, controlling for macro risk was not very effective, but greater dispersion led to more return and better Sharpe ratios. Concentrations of stock-specific risk in Russell 1000 and Russell 2000 samples suggested that it may be important to restructure the benchmark.
Strongin presented a theoretical model of the returns to stock picking skill. The four factors that drive stock picking returns are the mean return, the cross-sectional variance of the return distribution, the correlation between fundamentals and returns, and the fraction of stocks selected as measured by the inverse Mills ratio. The product of the cross-sectional variance and the correlation account for 90% of the alpha. It turns out that sector controls enhance the results for a value strategy but not for growth. Size controls do not benefit either strategy.

5. Designing an Alpha Engine (Spring 2004)

Lee R. Thomas III, Managing Director, PIMCO, began by defining the beta portfolio (the policy portfolio) and the alpha portfolio. We begin by imagining the efficient frontier and we proceed up the curve from the minimum risk portfolio to the portfolio that suits the investor’s risk. This is the beta portfolio. To bring in alpha we imagine the new efficient frontier above the first one, a frontier made possible by the active manager. The alpha portfolio lies on this frontier. Thomas suggested at this point that the new frontier represented the ability of the manager to take advantage of investors whose choices of investment vehicles are for some reason restricted.

Next we establish the alpha and beta portfolios. The manager employs a variety of investment styles, identifying benchmarks for each, and achieving alpha for some of them. All of the alpha bets are collected and make up the alpha portfolio. The collection of benchmarks constitute the beta portfolio. The composition of the optimal alpha portfolio is independent of the underlying benchmarks. Although there is a tendency to first establish the optimal beta portfolio and then to move to the alpha portfolios, the alpha and beta portfolios can be determined separately.

If the manager implements a single strategy to establish an alpha portfolio, even with a probability greater than fifty percent of a successful choice, the end result is not likely to be impressive. It is necessary to use several strategies at the same time, with the same probability of success, to achieve a truly significant result. It is critical that the strategies be independent. This may be difficult for a single manager to achieve. Thomas discussed the need for a single firm to house a variety of successful style managers. A firm that operates on the basis of a “consensus approach” is unlikely to be able to achieve a large number of independent bets. Diversification across conventional styles, across geographical regions, and across skills will be useful. All of this diversification is likely to present a serious challenge and there was some discussion about who would coordinate all of these efforts to assure independence. Thomas stressed that we do need one organization to do it all.

A variety of proposals for the kind of manager who might have overall supervision of the independent bets was considered. Thomas identified the sorts of people who might be eligible but the difficulty in finding such a person was evident.

His strategy suggested growing opportunities for firms that are able under one roof to combine a variety of truly independent active managers. He predicted declining opportunities for boutique managers.
Richard O. Michaud, of New Frontier Advisors, introduced the topic “return predictability” represented by the presentations of Halbert White, Michael Cooper, Wayne Ferson, Jennifer Conrad and Andrew Ang (Nos. 6 through 10). He gave a brief history of modern empirical finance to provide a setting for these papers.

In the 1950s and 60s Roberts and Fama noticed that equity and index returns strongly resembled a random walk. They applied these ideas to show that many technical analysis strategies did not provide excess returns.

Next came the Capital Asset Pricing Model which provides a risk measure to adjust performance. Event studies such as Fama, Fisher, Jensen and Roll and mutual fund performance studies such as Jensen’s and many others showed that neither publicly available information nor professional management provided risk-adjusted excess returns. Fama formulated these results into the Efficient Market Hypothesis. Markets were efficient at all relevant information levels.

In the mid 70s and 80s Basu, Banz, Reinganum, Keim, and others noticed Efficient Market Hypothesis anomalies such as size, book-to-market, and turn-of-the-year not explained by the CAPM. While APT provided a competing theory of risk, the relevant risk factors were unidentified. Three anomaly rationales emerged in the 90s: behavioral finance, three-factor risk models, and return predictability.

Behavioral finance as proposed by Lakonishok, Vishny, Schleifer, Thaler and others argued that anomalies were the result of “irrational” or self-defeating investor behavior such as fashionableness, over-reaction, and window-dressing. The anomalies were profitable strategies useful by sophisticated investors.

Fama and French noted that the long-term character of market anomalies argued against the existence of profit opportunities. The more likely anomaly rationale is unmeasured risk. Their three-factor risk model is widely used by the academic community.

Lo and MacKinlay and others argue that market anomalies may be statistical artifacts resulting from excessive data-snooping. Since there is only one capital market history, if snooped enough some factor however irrelevant will always be found related to return. Such factors are unlikely to have much reliability in explaining future return. Return predictability studies are characterized by skepticism of historical anomalies, improved out-of-sample testing frameworks, and statistical tools from the forefront of modern statistics.

Members of Q® should have strong interest in predictability studies since factor-return reliability is the basis of active management in practice. The five following presentations are outstanding examples of better statistical tools and frameworks for evaluating predictability.

Halbert White, Professor of Economics, University of California at San Diego, had made available four papers: “A Reality Check for Data Snooping,” “Data-Snooping, Technical Trading Rule Performance, and the Bootstrap,” “Dangers of Data-Driven Inference: The Case of Calendar Effects in Stock Return,” and “Can Mutual Fund ‘Stars’ Really Pick Stocks? New Evidence from a Bootstrap Analysis.” He introduced his presentation by the question: Is it possible to tell whether
the results of data-snooping are real, in the sense that they have genuine ability to tell us something with respect to future returns? He observed that modern computing has created enormous opportunity to design and evaluate portfolios and trading systems. This ability can over-mine the data and the result may be one or more systems that look great on paper but that fail dismally in practice. His data mining reality check (DMRC) is a new statistical method that can be used to separate “fool’s gold” from the real thing.

He defined data-snooping as the practice of using a data set more than once for purposes of selecting and testing a model. Results obtained through data-snooping may be due to chance, but perhaps to real regularities in the data, and it is hard to tell which. A number of common stock market indexes are among the most heavily investigated data sets in the social sciences. As these data sets are used over and over again the degree of data-snooping increases with the number of studies. But do the apparent regularities in asset returns really imply a rejection of simple notions of market efficiency, or are they just the result of a large collective data-snooping exercise? He discussed a few previous methods for dealing with data-snooping, and explained why he believes DMRC is superior.

Briefly, his procedure is to compare the performance of the best strategy for which claims are made to the distribution one would expect the results to follow if they were generated purely by chance. White’s methodology permits calculation of the “pure chance” distribution. From this distribution we can calculate the probability that pure chance could generate a best performance as good as or better than the best actually observed. The probability is analogous to but not equivalent to the t-ratio. White refers to the “p-value”, which tests the null hypothesis that the observed best result is consistent with chance. A p-value near zero indicates that the observed best result is not consistent with chance and that the performance could be real. He showed graphically where an observed best relative performance might be placed on the DMRC probability curve to show the p-value.

He turned next to some applications of DMRC. First, he tested a variety of calendar effects. These included the Monday Effect, the October Effect, the January Effect, and many others that have been discovered by famous economists. So the question was whether calendar effects are simply the effect of data-snooping and are not real. A total of something like 10,000 calendar effect rules were tested on the Dow Jones Industrial Average and S&P 500 futures over a 100-year period (even though markets for the two indexes were not available for investment over this period). For the Dow Jones Industrial, it turned out that the benchmark from simply buying and holding the index was a 4.80% rate of return. The best performing rule, which was to be neutral on Mondays and otherwise long, produced a return of 8.55%. The DMRC p-value was 0.29. White suggested this number was too large to give him confidence that the best rule coming out of the analysis was a real moneymaker. There was some discussion as to how low the p-value had to be before one would be confident investing money in the rule. This is a somewhat subjective matter and White conceded that with a value of 0.29 he was not sure whether he would actually invest money.

His presentation continued with the application of technical trading rules, in place of calendar rules. These included filter rules, moving averages, support and resistance, channel break-out, for a total of almost 8,000 rules. For the Dow
Jones Industrial average, once again the benchmark return was 4.80%. The best rule turned out to be a 2-day on-balance volume rule, and the performance of this rule was a spectacular 17.07%. The p-value was 0.0, suggesting that the success of the rule was not due to chance.

To see how the best model and the corresponding p-value develops as the testing of rules proceeds, White displayed in graphical form the returns and the p-values for the models as one model after another was added to the analysis. As we add models we can expect to discover from time to time one that performs better than any of the preceding. But at the same time, as we add to the number of models the p-value will rise. That is, the likelihood that the best model performed by pure chance increases.

Using more recent data, from 1984-1996, and 1987-1996, the best calendar rule showed a p-value of .99 and .98, or a strong confirmation of the null hypothesis that there was no real value to the model.

Finally, the methodology was applied to U.S. mutual fund returns. The question was whether active management can be expected to produce superior (or inferior) returns. Working with over 4200 U.S. equity mutual funds, White found results for aggressive growth funds somewhat different from those for balanced/income funds. But in both cases, the null hypothesis was rejected at the high and low returns. That is, the performances of the top one to ten percent of funds and of the bottom one to ten percent were shown not to be the results of chance. At the same time, the most extreme performances may be due to chance.

In summary he said:

- Data snooping is a widespread practice in quantitative finance.
- To ignore the issue is to take a large and ill-defined risk.
- Previous methods for addressing the issue are ineffective.
- Data Mining Reality Check (DMRC) and related methods are convenient and effective ways to accommodate data snooping and learn whether attractive results are real or not.
- Application of DMRC to calendar rules, technical trading rules and mutual fund performance yields interesting insights.
- In the last two decades, calendar and technical strategies are no better than chance for DJIA, S&P 500.
- Under- and over-performances among mutual funds appear real.

7. **On the Predictability of Stock Returns in Real Time (Spring 2004)**

Michael J. Cooper, Associate Professor of Finance, Krannert Graduate School of Management, Purdue University had made available a paper by himself, Roberto C. Gutierrez Jr., and William Marcum entitled “On the Predictability of Stock Returns in Real Time.”

Cooper’s undertaking was in many respects similar to that of Halbert White, who had made the preceding presentation (No. 6, above). Their methodologies, however, differed somewhat. As White had done with time series data, Cooper examined whether cross-sectional patterns in stock returns are evident in “real time” without the benefit of hindsight. His methodology was to develop a recursive out-of-sample method to assess the ex ante predictability of stock returns using four premier variables: book-to-market
equity, size, beta, and momentum. The proxy for a stock’s momentum is its one-year lagged return. White had pointed out the importance of the researcher knowing ahead of time that over the full data sample a particular model had proved ex post highly successful. This makes the testing of “out-of-sample” periods vulnerable. White explicitly dealt with this problem, while Cooper pointed out that in not dealing with it he had “stacked the deck” in favor of predictability. This then biased his results towards supporting genuine predictability but strengthened his findings of an absence of that predictability.

He worked with rolling 10-year periods beginning with the period ending in 1974 and continuing through 1997. The analysis used all NYSE, AMEX, and NASDAQ nonfinancial firms listed on the CRSP monthly stock return files and the COMPUSTAT annual industrial files from 1963-1997. For each 10-year period stocks were sorted into quintiles based on each of the four variables using all possible one-way and two-way independent sorts. There are a total of 20 quintiles of the four variables and 150 two-way combinations of the quintiles. So the investor considers 170 rules in each decision period. The monthly equally-weighted returns for each of the 170 rules were calculated from July of each year to June of the succeeding year. In addition to mean monthly returns, terminal wealth and Sharpe ratio criteria were met by selecting the rules that generated the highest and lowest ten percent of terminal wealths and Sharpe ratios over the in-sample period. The same three performance measures were determined for the long and short portfolios over the out-of-sample period. The returns of the active long and short portfolios were compared to a passive benchmark: the equally weighted portfolio composed of all stocks in the data set.

The interesting conclusions came from testing the out-of-sample results. For the LONG portfolio under the mean-return criterion, performance was good from 1974-1997, but only before adjusting for trading costs. For 1974-1978 the performance was good, but not from 1983-1991. The performance of the SHORT portfolio was poor and volatile. The combined portfolios generated reasonable returns over the 1974-1982 period, based primarily on the strength of the LONG portfolio. Applying the terminal wealth criterion gave better results. Applying the Sharpe-ratio criterion produced still better results. Moreover, the evidence of predictability was not completely eroded by adjusting for trading costs.

Overall, there was a dramatic difference between the in-sample and the out-of-sample returns. The suggestion was that the predictability of stock returns has been vastly overstated in the current literature. Only the Sharpe-ratio criterion resulted in abnormal profits after trading costs were considered. Summarizing the out-of-sample results Cooper said that across the three model selection criteria there exists a narrow band of predictability:

- Max. Long monthly excess returns: 20 bp
- Min. Long monthly excess returns: 13 bp

With transaction costs:
- Max. Long monthly excess returns: 10 bp
- Min. Long monthly excess returns: 0 bp

Finally, his conclusions were:

- We conduct a simple real time simulation using methods similar to the literature, using four variables, three of which have been shown to work over the entire sample.
In-sample: high levels of predictability.

When we “get real,” we find much lower levels of profits.

Results are consistent with B/M, Cap and Momentum being spurious effects.

Results are consistent with Bossaerts and Hilton (1999) and Pesaran and Timmermann (1995).

B/M, Cap and Momentum could be real, but they are too weak to be detected in real-time.

The current notion of predictability in the literature is exaggerated.

Perhaps a real-time performance benchmark should be developed?

8. Is Stock Return Predictability Spurious? (Spring 2004)

Wayne E. Ferson, John L. Collins S. J. Chair in Finance, Carroll School of Management, Boston College, distributed an article from the Journal of Investment Management by himself, Sergei Sarkissian and Timothy Simin entitled “Is Stock Return Predictability Spurious?”

He referred in opening his presentation to Halbert White’s discussion (No. 6, above) of ways in which to deal with data mining in assessing the reliability of models of returns through time, and he observed that his paper added the problem of “spurious regression.” He identified data mining as sifting through the data to find predictive models and effectively using the same data to evaluate the models. Naïve data mining results from not accounting for the number of searches, while sophisticated data mining does account for that number. Spurious regression has to do with the fact that levels of slowly trending series are likely to appear related even when they are not. In illustrating the phenomenon has set out the regression model as follows:

Suppose Returns are Generated this Way:

\[ R_{t+1} = a_1 + b_1Z_t^* + v_{t+1} \]

where \( Z_t^* \) has autocorrelation \( \rho^* \)

But instead we observe \( Z_t \) and estimate:

\[ R_{t+1} = a_2 + b_2Z_t + u_{t+1} \]

where \( Z_t \) has autocorrelation, \( \rho \).

The main features of the simulation are

“True Persistence” = \( \rho^* \)

“True R-squared” = \( \text{Var}(a_1 + b_1Z_t^*) / \text{Var}(R_{t+1}) \)

“Measured Persistence” = \( \rho \)

The problem in spurious regression is that a t-ratio determined as \( t = b_2 / \sigma(b_2) \) will be “too big” in a spurious regression, either because the \( \hat{(b_2)} \) estimate is “too big,” or the \( \sigma(b_2) \) estimate is “too small.” Setting up a pure spurious regression he showed that the \( \hat{(b_2)} \) estimates look reasonable. This means that if the true persistence is low there should be no spurious regression bias even if the measured persistence is high. (Persistent variables are those that have large autocorrelations.) But if the true persistence is high there will be spurious regression bias unless the true R-squared is nearly zero. If two variables are highly “persistent” over time, a regression of one on the other will likely produce an apparently “significant” slope coefficient, evaluated by the usual t-statistics, even if the variables are in fact unrelated. Stock returns are not highly autocorrelated, so one might think that spurious
regression would not be an issue for stock returns. But if we think of a stock return as equal to the \textit{ex ante} expected return plus the unexpected return, we can see that if the \textit{expected} return is persistent there is a risk of spurious regression.

The main point of the study was that spurious regression and data mining interact in a most pernicious way. If analysts search for data that produce “significant” predictive regressions, they are more likely to find the spurious, persistent regressors. Data mining makes spurious regression more of a problem, and the possibility of spurious regression makes data mining seem more effective in finding predictive variables.

Ferson showed a table of thirteen common predictor variables used in the literature to predict stock returns. The table reported the autocorrelation and standard deviation of each lagged variable. The autocorrelations were almost all very high, some quite close to 1.0. At the same time the mean autocorrelation of the return series was 15% with a median of 2%.

Unreliable \textit{t}-ratios can be compared to critical \textit{t}-statistic hurdles derived from simulated trials. For the spurious regression, the critical \textit{t}-statistics are quite high, and we find that the greater the number of variables mined in a “spurious mining process” the higher the critical \textit{t}-statistic, and at the same time the greater the auto regression, the greater the critical \textit{t}-statistic. It turns out that the interaction between the data mining and spurious regression effects mean that almost none of the regressions testing the thirteen variables were significant when allowing for the possibility of a spurious data mining process.

The results do not imply, however, that stock returns are unpredictable. Stock returns should be unpredictable when expected returns are constant over time. In this case the autocorrelation for returns is zero and the simulations show that the regressions are not spurious. It is difficult, however, to build predictive models without biases. To deal with data mining the important point is to correctly account for the amount of data that is mined. The more predictive models we examine, the higher should be the statistical hurdle. The statistics literature contains a number of useful tools for doing this. However, when spurious regression enters the picture the problem is more difficult. Even when the statistics correctly account for the amount of data that is mined, we still have the problem of spurious regression bias. To deal with the spurious regression bias we must get the correct standard errors. This means getting the correct denominator of the \textit{t}-ratio.

Ferson discussed a number of suggested solutions to this spurious regression problem, concluding that most are not helpful. The best approach seems to be a simple form of stochastic detrending of the lagged variable. The lagged variable is transformed by subtracting off a trailing moving average of its own past values.

In conclusion, Ferson observed first that the academic evidence supporting the usefulness of a number of predictive models is consistent with a “spurious data mining process with an underlying persistent \textit{ex ante} return.” In this case we would expect instruments to be discovered, then fail to work with fresh data. For predictive model selection, his advice is to be wary of spurious regression, and especially wary of spurious regression and data mining.
9. Value Versus Glamour  
(Spring 2004)

Jennifer Conrad, McMichael Professor of Finance, Kenan-Flagler Business School, University of North Carolina, made available a paper by herself, Michael Cooper, and Gautam Kaul entitled “Value Versus Glamour.”

Conrad introduced her presentation by noting the amount of research that has taken place over the past two decades aimed at discovering variables that might explain the behavior of returns. The result is that a number of variables are now well known as likely predictors of returns, and the characteristics of the data sets from which they were derived are also rather widely known. Among those data sets is the one used by Conrad and her co-authors. They constructed a sample of non-financial firms which have returns listed in the 1995 CRSP monthly files as well as data in the COMPUSTAT annual industrial files from 1955-1995. The purpose of the research was to assess the impact of “data snooping” on the collective findings of the studies reported in the literature on “value versus glamour” stocks over the past two decades.

They chose twenty firm characteristics that have been used in studies over the years to uncover cross-sectional differences in returns that cannot be captured by the betas of securities. They began by ranking securities based on a particular firm characteristic, benefiting from ex post knowledge, to form several portfolios whose returns were calculated in the subsequent period. The trading strategy was specified as the zero-cost portfolio that buys the decile with the highest mean return and sells the one with the lowest. The exercise was continued for portfolios sorted on each of the twenty firm characteristics and for a 10- and 50-portfolio sort. They also conducted 3x3 and 7x7 two-way sorts. They then implemented the same strategies based on both one-way and two-way sorts on cross-sectionally randomized data.

To generate the random data, they stacked all observations for each of the twenty firm characteristics for all firms, and then created a new data set of observations by randomly drawing (with replacement) from observations of that variable in the real data set. They repeated this procedure independently for all twenty firm characteristics. The comparison of in-sample real versus randomized trading profits was interesting. For the 10-portfolio one-way sort, the average profit to the trading strategies over the period was 0.643% per month or 8% annually. A corresponding average in the randomized data was 0.189% per month or 2.3% annually. What is surprising is the extent to which the profits of trading strategies based on real data can be reproduced by strategies implemented on randomized data. The researchers also conducted out-of-sample tests. The profitability declined but the profits remained statistically significant. But then the twenty firm characteristics in the sample had themselves been snooped out of a potentially much larger pool of characteristics.

The next test allowed the investor to choose only from among the best variable combinations from a prior period rather than choosing from among the variables that are known to “work” over the entire sample period. The investor forms a distribution of out-of-sample returns from the best five variables from a 5-year in-sample period and uses only those variables to form portfolios in an adjacent out-of-sample 5-year period. The average profits to the trading strategies declined dramatically and were only marginally statistically significant. To further demonstrate the potential effects of snooping in choosing firm
characteristics, they used the randomized data to show that statistically significant out-of-sample profits could be obtained by choosing the best variables among the twenty firm characteristics.

Conrad discussed these analyses in some detail, describing the results of each. She showed that using one-way sorts, approximately 50% of the in-sample relationship profits could be biased. And with two-way sorts up to 80-100% of the in-sample relationship profits could be biased. Further sources of bias are the choice of well-known variables for testing relationships, the choice of the number of portfolios into which to partition the results, as well as the choice of using extremes (that is comparing the first with the tenth decile).

The results of the random data sorts are also subject to bias. Increasing the number of simulations will tend to increase the maximum profit, although the profits seem to stabilize around 1200 searches. It seems that some of the results from use of the real data are statistically significant.

Conrad pointed out that so long as we are using a data set that has been thoroughly mined by others for useful variables, there is a bias that is difficult to avoid. In an earlier presentation, by Halbert White (No. 6, above), a procedure had been proposed to remove this difficulty.

10. CAPM Over the Long Run: 1926-2001 (Spring 2004)

Andrew Ang, Roger F. Murray Professor of Finance, Columbia Business School, Columbia University, made available a paper by himself and Joseph Chen entitled “CAPM Over the Long-Run: 1926-2001.” Ang explained the motivation for the research as an investigation of the significance of the reported equity return premium for stocks with high book-to-market ratios. Stocks with high ratios we generally characterize as value stocks. Over the period 1963-2001, stocks in the highest book-to-market decile out-performed the lowest by 60 basis points per month or 7.2% per annum. The result appeared to discredit the validity of the CAPM over that time period. However, over the full time period for which he had data, 1926-2001, Ang did not find a significant premium. He observed that betas vary significantly over time, and proposed that a conditional CAPM with time-varying betas could account for the apparent value premium post 1963. A display of time-varying betas based on rolling OLS estimates showed that for the growth decile of stocks the beta had been reasonably stable at around 1.0 for 1927-2001, while the beta for the value decile had risen steeply in the 1930s and 1940s, had remained high in the 1950s-1960s, had been fairly close to 1.0 through 1980, but had declined significantly in the 1990s. One might be inclined to test the CAPM with OLS betas, but OLS cannot estimate conditional betas at one particular point in time.

When conditional betas are time-varying, estimating these betas by OLS produces inconsistent estimates. Ang showed that the magnitude of the inconsistency depends on the dynamics of the beta process, and so cannot be corrected unless the conditional betas are directly estimated. Using data of different frequencies, or different windows does not remove the inconsistency. Furthermore, even if the inconsistency can be corrected, the OLS beta or alpha estimates are extremely imprecise. However, Ang provided a framework for producing consistent estimates for conditional betas.
Ang described his model for a conditional CAPM with time-varying betas. The model is one of time varying latent betas, following a persistent AR(1) process:

\[
    r_{i,t} = \alpha + \beta_{i,m,t} + \sigma_i \varepsilon_{i,t} \tag{1}
\]

where \( \beta_i = \text{cov}_{i-1}(r_{i,t}, r_{m,t}) / \text{var}_{t-1}(r_{m,t}) \) is the conditional beta of the portfolio, \( r_{m,t} \) is the return on the market, and \( \varepsilon_{i,t} \) and \( \varepsilon_{m,t} \) are standard independent normals. The betas follow a persistent AR(1) process:

\[
    \beta_{i,t} = \beta_{bi} + \phi \beta_{i,t-1} + \sigma_{\beta_i} \varepsilon_{\beta_i} \tag{2}
\]

where \( \varepsilon_{\beta_i} \) is a standard normal.

The market return is modeled with a slowly mean-reverting conditional market risk premium, and stochastic market volatility:

\[
    r_{m,t} = \mu_t + \sqrt{\nu_t} \varepsilon_{m,t} \tag{3}
\]

where \( \mu_t = E_{t-1}(r_{m,t}) \) is the conditional mean of the market premium, and \( \nu_t = \text{var}_{t-1}(r_{m,t}) \) is the conditional variance of the excess market return, which vary over time:

\[
    \mu_t = \mu_0 + \phi \mu_{t-1} + \sigma_\mu \varepsilon_{\mu,t} \tag{4}
\]

and

\[
    \ln \nu_t = \nu_0 + \delta \ln \nu_{t-1} + \sigma_\nu \varepsilon_{\nu,t}
\]

We allow the normally distributed zero mean, unit standard deviation shocks \( \varepsilon_{\mu,t} \) and \( \varepsilon_{\nu,t} \) to be correlated with correlation parameter \( \rho_\varepsilon \). This captures a leverage effect and allows conditional expected returns and stochastic volatility to be negatively correlated. Furthermore, shocks to the conditional betas \( \varepsilon_{\beta_i} \) and market risk premium \( \varepsilon_{\mu,t} \) are correlated with correlation parameter \( \rho_\beta \).

The standard unconditional CAPM that satisfies OLS assumptions, is a special case of this model. In this setting there is no time-variation in the beta (\( \phi_i = \sigma_{\beta_i} = 0 \)), and the market return is normally distributed (\( \mu_t = \mu_0 \) and \( \nu_t = \nu \)). Ang refers to this standard case as the “OLS CAPM.”

Ang displayed a number of graphs flowing from his model, showing the market risk premium, the market volatility, and the value and growth betas for 1930-2001. One result was that over the long-run period the CAPM holds. He listed the parameter estimates for the time-varying beta CAPM described by equations (1) through (4) estimated by Bayesian Markov Chain Monte Carlo methods. He estimated the models using the value stock portfolio, the growth stock portfolio (book-to-market deciles 10 and 1 portfolios, respectively) and the book-to-market strategy which goes long value stocks and short growth stocks.

Ang found that the unconditional CAPM explained the returns on book-to-market portfolios over both the full sample 1927-2001 and prior to 1963. Using conventional asymptotic standard errors, the CAPM only fails to explain the value premium after 1963. Allowing for the time-varying betas, and applying a methodology of robust small sample inference, the model fails to reject the hypothesis that the CAPM holds over the post-1963 period.

Ang’s results demonstrated the importance of taking into account small sample bias and parameter uncertainty in the study of various cross-sectional patterns relative to the CAPM. Ang found that the effects from the time-varying betas are most important in causing size distortions of asymptotic OLS estimators in small samples. In contrast, taking into account the changing conditional mean of the
market and stochastic systematic volatility had a minor effect.

The work was extended to test the book-to-market effect by size quintiles. It turns out that over the full sample as well as over the post-1963 sample, there was evidence to reject the null of a zero book-to-market premium for small stocks within the first three size quintiles. When Ang examined the reversal and momentum effects, he found that the reversal effect is not robust to a conditional CAPM, but the momentum effect survives strongly in the post-1963 sample.

In conclusion, Ang reported that since the disappearance of the size effect since the 1980’s, the book-to-market effect is the remaining CAPM anomaly that many researchers consider to be a significant risk factor (see for example, Fama and French, 1993). However, the CAPM performs remarkably well over the long run-from 1927 to 2001. With asymptotic statistical inference, the book-to-market effect is significant in the post-1963 sample, the sample on which most studies have focused, but the book-to-market premium is insignificant in both the pre-1963 sample and over the full sample. The difference in these results is due to the fact that the correct small sample distribution of the alphas is very different from the asymptotic distribution, and the statistical inference in small samples must take into account the time-variation of betas.

He had written: “We find that once we account for small sample effects, we fail to reject the hypothesis that there is no overall book-to-market premium in the post-1963 sample. Hence, our results suggest that there is no need for additional risk factors to explain the book-to-market effect. However, a more detailed analysis of the book-to-market effect subdivided both by size and book-to-market ratios suggests that deviations from the CAPM may exist, but only among the smallest-sized stocks. We also find robust significant deviations from the CAPM using momentum portfolios but fail to find evidence of a reversal effect.”

11. Prophets and Losses: Reassessing the Returns to Analysts’ Stock Recommendations (Spring 2003)

Brett Trueman, Donald & Ruth Seiler Professor of Public Accounting, Haas School of Business, University of California at Berkeley, provided a paper coauthored by Brad Barber, Professor of Finance, Graduate School of Management, University of California at Davis, Reuven Lehavy, Assistant Professor of Accounting, School of Business, University of Michigan, and Maureen McNichols, Professor of Accounting, Graduate School of Business, Stanford University, entitled: “Prophets and Losses: Reassessing the Returns to Analysts’ Stock Recommendations.”

The question the authors set out to answer is essentially whether individual investors can profit from following analysts’ recommendations. The approach is new in that studies of analyst accuracy have generally not extended to the measurement of investor returns, following publication of recommendations. It is timely because of recent and current allegations of analyst conflicts of interest. It also extends prior studies through the year 2001, a matter of some significance because of the general failure of analysts to make successful predictions in 2000 and 2001.

The recommendations data were taken from Zacks and from First Call covering the total period 1986-2001. There were more than half a million recommendations from hundreds of brokerage houses. The
recommendations ranged from “Strong Buy” (coded as a 1) to “Strong Sell” (coded as a 5). Trueman provided some descriptive statistics for the year 1996, drawn from the Zacks database. On average there were five analysts per firm and the average rating was 2.11, very close to a “Buy”. Over the total period the average analyst’s enthusiasm rating rose from a little over 2.6 to a little over 2.0 in 2000 and fell to a little over 2.2 in 2001. The percentage of “Sell” or “Strong Sell” recommendations fell from about 15% in 1986 to less than 2% in 2000 and rose to a little under 4% in 2001.

For each day of the total time period, the average recommendation of analysts for a firm’s stock was calculated. On the following day, the firms were allocated to five portfolios based on the average recommendation. The highly recommended stocks were those with an average rating of 1.0 to 1.5; the least favorable had an average below 3.0. The portfolio composition therefore changed on a daily basis, and portfolios were value weighted. Daily returns were compounded to yield monthly returns for each portfolio.

Trueman showed a chart of averaged annualized returns over the 1986-1996 period. The average for the most highly recommended portfolio was 18.9%, versus a market return of 14.5%. The second and third portfolios produced 17.9% and 15.2%. The fourth came in below the market at 13.5% and the fifth well below the market at 6.7%. The variation across the five portfolios was greatest for small firms, and least for large firms.

The importance of acting quickly on recommendations was shown in a graph demonstrating average monthly returns following delays before acting on recommendations of 1 day, 1 week, 2 weeks, and 1 month. Delays beyond 1 day produced significantly lower returns. Transaction costs in constantly rebalancing portfolios were obviously high, with annual turnover over 400% for the high and low recommendation portfolios. And indeed transactions costs would have wiped out any gains. This did not mean that the recommendations were valueless. Trueman pointed out that if an individual were going to invest it would make sense to purchase a highly recommended stock rather than a “Sell”.

Updating through 2001 produced rather different results. In both 2000 and 2001 the comparison reversed, with the “Sells” proving more profitable than the “Buys”. An analysis by month through 2000 and 2001 indicated the return spread between the two extreme portfolios, moving back and forth between positive and negative, mostly negative, but without any clear time trend over the two years.

Comparing technology stocks with others, Trueman showed that the perverse results in the two years were stronger for the technology stocks but extended to the other stocks. Over the entire period, the most highly rated portfolio demonstrated above average market risk, a tilt towards small stocks, and a tilt towards growth. The least favorably rated portfolio was below average market risk, with a tilt toward small stocks and a tilt towards value.

The most interesting conclusion seemed to be that the analysts’ poor performance during 2000 and 2001 was the result of their continued tendency to recommend small growth stocks and despise small value stocks. While analysts’ buy recommendations slightly outperformed the average small growth stock and their “Sells” under performed the average small value stock, the fact that value dramatically beat growth during this period resulted in the most highly rated stocks trailing those regarded least favorably. A question
remains whether analysts can be relied on to make appropriate future choices between growth and value.

12. Speed of Convergence to Market Efficiency (Fall 2002)

Tarun Chordia, Associate Professor of Finance, Emory University, distributed a paper by himself, Richard Roll and Avanidhar Subrahmanyam entitled: “Evidence on the Speed of Convergence to Market Efficiency.”

There is something of a puzzle in the fact that despite substantial evidence that small investors have a perverse ability to forecast future returns, some individuals behaving foolishly all the time with respect to investments, and all individuals behaving foolishly some of the time, yet the end result is a market that is at least efficient enough that professors and money managers have a very difficult time beating a passive strategy. How long does this process take place and how does it happen? Fama in 1970 described weak, semi-strong, and strong form efficiency. A more precise definition of market efficiency might be: neither the marginal active nor the marginal passive investor will gain from changing. But, infra-marginal active investors become better informed and can earn an extra return. Passive investors will earn only the return of the marginal active investor.

Something of a paradox appears in the fact that daily returns for large and mid-cap stocks listed on the New York Stock Exchange (NYSE) are not serially dependent, yet order imbalances on the same stocks are highly persistent from day to day. In fact market-wide order imbalance (OIB) on the NYSE is remarkably persistent. OIB here is total daily market purchase orders less sell orders for stocks in the S&P 500 index. Serial dependence is positive for up to 20 days! And more than 50% of tomorrow’s OIB can be explained by past returns and past OIB.

So why do some investors persist in their orders for days on end when it does them no good (because there is no inter-day return dependence)? How long within the day does pressure from order imbalances continue to move prices? Some finite time period, perhaps quite short, simply must be required to counteract a preponderance of orders on the same side of the market. For medium and large NYSE stocks, it takes longer than five minutes for astute investors to begin such efficiency trading activity. By thirty minutes, they are well along on their unintended quest. The pattern of intra-day serial dependence, over intervals ranging from five minutes to one hour, reveals the actions of naïve and sophisticated traders and market makers.

The data covered twenty large and twenty mid-cap NYSE stocks, for 1996 and 1998. Small stocks were not included because they are subject to infrequent trading. Transactions data were obtained from the TAQ (Trade and Automated Quotations) database, providing trade prices, volume, and bid and ask quotes associated with each transaction.

An algorithm was used to estimate whether a particular trade was buyer- or seller-initiated. Three order imbalance measures were determined: the number of buyer- less the number of seller-initiated trades was the first. The number of buyer-initiated shares purchased less the number of seller-initiated shares sold was the second. The dollars paid by buyer-initiators less dollars received by seller-initiators was the third.

The researchers first set out to ascertain whether the sample of stocks conformed to semi-strong form efficiency over a daily horizon. The
average first-order daily autocorrelation coefficient for returns was positive but insignificant during 1996. Returns were also computed from “mid-points” and the daily autocorrelations in the mid-point returns were small and insignificant for both the large and the mid-cap stocks in both years. There were very strong positive contemporaneous correlations between both measures of return (trade and mid-point) and any of the OIB measures. Correlations between daily returns and lagged (by one day) order imbalances were completely insignificant for the share and dollar imbalances, but the lagged trade imbalance was significantly correlated with return during 1996 though not during 1998. The correlation was small enough that the economic value of the implied prediction would be quite small. The order imbalance measures themselves were strongly and positively autocorrelated from day to day, particularly for the trade number OIB.

Short horizon returns were computed from prices close to the ends of various time intervals within the trading day. The contemporaneous correlation between trade-based returns and midpoint-based returns was quite large, positive, and significant. The correlations grew as the time intervals lengthened, from 5 minutes to 10, to 15, to 30 and to 60 minutes. OIB autocorrelations were high and positive over a 5-minute interval, declining as the interval lengthened, and negative at 60 minutes.

The results provided strong evidence in support of the notion that traders counteract imbalances and that this activity occurs at horizons longer than 10 minutes and for up to 30 minutes. Countervailing trades in large-cap stocks peak at about 30 minutes. Mid-cap stocks appear to have exhibited stronger evidence of countervailing activity in 1998, as opposed to 1996. This is consistent with enhanced market efficiency after the reduction in tick size in June 1997.

The pattern of autocorrelation led to these conclusions: Specialists temporarily change price quotes away from fundamentals in order to manage inventory; arbitrageurs engage in countervailing trades after they have witnessed short-term price moves. Both actions could take place simultaneously.

OIB dollars were particularly interesting. Lagged OIB dollars were significantly positive for 5, 10 and 15 minutes, but insignificant at 30 minutes. Traders appear to respond to large orders by jumping on the bandwagon. The response is rapid, as can be seen from lagged coefficients.

In conclusion, the authors found that weak-form efficiency does appear to prevail over intervals of a day or longer. There was evidence, however, that some traders cause serial dependence in prices over short intervals of a few minutes. But there is also strong evidence that other traders become aware of price-moving order imbalances and undertake countervailing trades. What happens is consistent with NYSE specialists altering quotes away from fundamentals for the purpose of inventory control, while awaiting countervailing trades. By thirty to sixty minutes, depending on firm size, there is no remaining serial dependence in returns. Order imbalances measured in dollars, which reflect larger orders, have a longer lasting influence but they are still attenuated to some extent with time. Finally, there was evidence that the arbitrage activity became more effective between 1996 and 1998, perhaps as a result of the reduction in the minimum tick size from $1/8 to $1/16 during 1997.
13. Single Period Mean Variance Analysis In A Changing World (Fall 2001)

Harry Markowitz, Nobel Laureate, Fellow of the Institute and President, Harry Markowitz Company, distributed a paper by himself and Erik L. van Dijk, Palladyne Asset Management, entitled: “Single-Period Mean-Variance Analysis in a Changing World.” Markowitz posed as the problem we would like to solve: a mean-variance optimization for a large universe of investments, through many time periods, including illiquid assets, allowing for transactions costs and changing probability distributions. It is simply not feasible to handle such a problem. There are too many state variables for dynamic programming and too many time periods for stochastic programming. This raises the question how close could we come to an optimal solution using a manageable heuristic? The answer is that for the large-scale problem we don’t know and cannot find out because we cannot compute the optimum solution. But if we work with a small-scale problem that can be solved for an optimum solution and can also be approached with our heuristic, we can see how good our heuristic solution is. Markowitz reported an experiment with a simple heuristic model, in which he compared the heuristic solution with the optimum solution. For our simple model we assume that the investor portfolio can be in one of eleven states: 0%, 10%, 20%, … 100% stock. Transaction costs are incurred when the investor changes portfolio state. The investor has a stock return forecasting model which will forecast any one of five states: very optimistic, optimistic, neutral, pessimistic, and very pessimistic. Hence the system can be in any one of fifty-five states. The game is unending, so the optimum strategy does not depend on $t$.

A strategy can be written as an 11x5 action matrix which specifies the choice of next portfolio as a function of the current portfolio and predicted state. That is, given the fraction invested in stock at time $t-1$, and the predicted state (one of five) the matrix tells us to what stock fraction we should move to during the next time period.

Continuing with the description of the heuristic model, the assumed risk free rate per month was .004, values of monthly mean stock returns, $E$, and variances, $V$, were assumed for each of the expected values of a sequence of single period utility functions:

$$u(D_t) + dw(S_t)$$

where $W(S_t)$ is the expected value of

$$\sum_{t=1}^{\infty} d^{-1} u(D_{t+1})$$

We replace $W$ by a simple linear surrogate function:

$$W = E_{wt} \cdot E_p + V_{wt} \cdot V_p$$

where $E_p$ and $V_p$ are the mean and variance of the portfolio, and $E_{wt}$ and $V_{wt}$ are their respective weights in the linear surrogate function. We will have to determine the weights that work best, and we will have to determine for what portfolio we are estimating $E_p$ and $V_p$.

For our simple model we assume that the investor portfolio can be in one of eleven states: 0%, 10%, 20%, … 100% stock. Transaction costs are incurred when the investor changes portfolio state. The investor has a stock return forecasting model which will forecast any one of five states: very optimistic, optimistic, neutral, pessimistic, and very pessimistic. Hence the system can be in any one of fifty-five states. The game is unending, so the optimum strategy does not depend on $t$.

A strategy can be written as an 11x5 action matrix which specifies the choice of next portfolio as a function of the current portfolio and predicted state. That is, given the fraction invested in stock at time $t-1$, and the predicted state (one of five) the matrix tells us to what stock fraction we should move to during the next time period.

Continuing with the description of the heuristic model, the assumed risk free rate per month was .004, values of monthly mean stock returns, $E$, and variances, $V$, were assumed for each of

$$U = \sum_{t=1}^{\infty} d^{-1} u(D_t)$$

where $D_t$ is a "dividend" paid during time interval $t$, and $d <1$.

In effect what we are doing is maximizing the expected value of $U$ for the game as a whole by maximizing the
the five states and for a steady state. And a set of transition probabilities between predictive states was assumed. For example, if we are in state 1 the probability of remaining in state 1 is 0.702 and the probability of moving to state 2 is 0.298, with the probabilities of moving to states 3, 4 or 5 assumed 0. The discount factor in the first equation above was set at 0.99.

Since we may have one fraction of the portfolio invested in stocks at the beginning of a period and a different fraction at the end, we must decide on the basis of what fraction to compute utility for the period. The assumption was to take the mean of the beginning- and end-of-period fractions. Transaction costs were included, and results determined for costs of 0.005 and 0.020. The risk tolerance was assumed at 0.5. That is, $k$ took the value 0.5 in the equation:

$$Eu(D_t) = E(D_t) - kV(D_t)$$

An important assumption is that the entire return on the portfolio for any month is paid out as a dividend. This means that dividends can be negative. The assumption is hardly realistic, but it greatly simplifies the evaluation of the heuristic models and the optimization is done using the same assumption. Finally, the return on equities is bounded by a very large number on the upside and the portfolio value is not allowed to drop below zero.

Markowitz showed the optimum action matrices at a transaction cost of 0.005 and 0.02. These matrices then indicate the optimum stock fraction to which the portfolio should be moved for every starting fraction and every prediction state. For example, at a transaction cost of 0.005, and a starting fraction in stocks of 0.3, if the state predicted is 1 (most optimistic) the optimal move is to invest the entire portfolio in stock. If the predicted state is most pessimistic, the optimal move is entirely to cash. And if the predicted state is either neutral or pessimistic, the optimal move is to make no move.

He then displayed the action matrix for the heuristic model, for costs of 0.005 and 0.02. The matrices were almost identical to the optimum matrices in both cases.

Finally, Markowitz displayed graphs of expected discounted utility for the optimum strategy, for the mean/variance heuristic, for a strategy of remaining entirely in stock and one remaining entirely in cash, for no action at all, and for a 60-40 mix, as well as for a “very active” strategy, which is the one the model would indicate at zero transaction cost. It turns out that the expected utility for the optimum and for the heuristic models were virtually identical and superior to all the other strategies at a cost of 0.005, and better than or equal to the results for an inactive strategy at a cost of 0.02.

The final conclusion was that for the cases considered, the expected utility supplied by the mean/variance heuristic was essentially indistinguishable from that supplied by the optimal strategy.

14. Equilibrium Asset Pricing With Heterogeneous Information (Spring 2002)

Chester Spatt, Mellon Bank Professor of Finance, Carnegie Mellon University, distributed a paper entitled: “Equilibrium Asset Pricing Under Heterogeneous Information” by himself, Bruno Biais and Peter Bossaerts. This work was supported by the Q-Group®.

The theory of financial markets under homogeneous information has generated such things as the optimality of indexing, the nature of arbitrage, and
equilibrium-based pricing relations, as illustrated by the CAPM. Yet the investment decisions of professionals are made based upon their views about the market, and this information is heterogeneous. Investors operate on the basis of information that is not reflected in prices (in the form of private signals derived from their private information or analysis) yet they also have a respect for the information content of prices because they provide information about the private signals received by other investors.

At a theoretical level, the authors had identified a setting in which these characteristics were compatible with a form of the CAPM. And they contrasted the empirical implications of the model with those of the traditional (complete information and fully revealing prices) framework. Investors are assumed to bear constant absolute risk and the underlying random variables (asset payoffs, aggregate endowments and investor signals) are all assumed to be normally distributed. Portfolio selection is a mean/variance exercise.

Noise is crucial to heterogeneous information models because otherwise prices would fully reveal the exact structure of the total market. It is necessary to assume that all investors have the same precision of their signals (that is, that all of the signals are of equal quality) where the signals across investors are independently generated. Portfolio selection is a mean/variance exercise.

The model was described as:

A two-date model in which portfolio allocation takes place at time $t=0$, while asset returns are earned and consumption takes place at time $t=1$.

$N$ risky assets with payoffs at time $1$: $f_{i,t} = 1, \ldots, N$, and one riskless asset which also serves the role of numeraire, and earns exogenous return $r_f$ at time $1$.

(We adopt the convention for the random variables: lower case letters denote scalars, while upper case letters denote vectors.)

A continuum of agents: $a \in [0,1]$, observing signals $y_{a,i} = f_i + \varepsilon_{a,i}$.

The precision of agent $a$’s signal is denoted $S_a$ (that is $S_a$ is the variance-covariance matrix of the $N$ noise terms $\varepsilon_{a,i} = 1, \ldots, N$).

The supply of asset $i$ is random and equal to $z_i$. It is not observed by the investors. It is this noise which will prevent full revelation of the private information in equilibrium.

All the random variables are assumed to be jointly normally distributed, and the noise terms, the aggregate endowments, and the payoffs are independent. The agents have constant absolute risk avers (CARA) utility. The absolute risk tolerance coefficient of agent $a$ is denoted $\rho_a$. The average risk tolerance $\int \rho_a da$ is denoted $\rho$.

In this context there exists a linear rational expectations equilibrium, whereby: $P = A + BF + CZ$, where $A$, $B$, and $C$ are constant vector matrices, while $P$ is the $(N,1)$ vector of prices, $F$ is the $(N,1)$ vector of cash flows, and $Z$ is the $(N,1)$ vector of aggregate endowments.

In this equilibrium, as in the standard CAPM, prices are equal to expected cash flows minus a risk premium related to the supply of the risky assets. Because there is a continuum of informed agents with signals equal to the final cash flow plus a noise term, prices, which aggregate the investors’ information, reflect the final cash flow ($F$). However, because the supply shocks and correspondingly the aggregate supply of the risky assets are not known by the agents, prices are not fully revealing. In this context, investors condition their portfolio
decisions on prices, but must also use their signals. Thus, unlike the process in a standard CAPM, investors do not follow buy-and-hold strategies, as they alter their portfolio holdings to react to their signals and the prices. Note that the random supply shocks imply that the market portfolio is not observed by the agents.

Spatt continued with the equations leading to the equilibrium price of asset \( i \) and the equilibrium return. A number of conclusions could be drawn with respect to portfolio holdings. Agents hold different portfolios, because they tilt their portfolios based upon the unique signals that they receive.

Choices are affected by the winner’s curse: given risk aversion the more optimistic agent holds more of the particular risky assets. Using information in prices as well as signals mitigates adverse selection.

A buy-and-hold strategy is not optimal. Investors adjust their portfolio structure to reflect signals and prices. Even an uninformed investor will adjust demand because of learning from prices. Under partial revelation of information, a price-contingent portfolio strategy will outperform a buy-and-hold strategy.

Finally, Spatt described empirical tests to confirm that a price-contingent strategy outperforms buy-and-hold. The tests made use of the six Fama and French benchmark portfolios, using a double sort of securities based on the ratio of book-to-market and size (three book-to-market groupings by two size groupings). Mean-variance optimization was undertaken to determine the composition of the portfolio offering the highest expected return for a volatility equal to that of the CRSP benchmark. The results were displayed graphically to show how different subperiods contribute to the performance of strategies.

In conclusion, the empirical analysis suggested that prices convey information but are not fully revealing. That is, “active” strategy can outperform purely passive benchmarks. Price contingent strategies may be a valuable complement to quantitative analysis (designing optimal strategies) and fundamental analysis (estimating cash flows). More broadly, the study helped to provide an intellectual basis for a range of asset management strategies, rather than simply pure indexation.

**Active Equity Management**

**Accounting & Financial Reporting**

15. The Economic Implications of Corporate Financial Reporting (Fall 2004)

Campbell R. Harvey, J. Paul Sticht Professor of International Business, Fuqua School of Business, Duke University, had made available a paper by himself, John R. Graham and Shiva Rajgopal entitled: “The Economic Implications of Corporate Financial Reporting.”

His presentation was based on the results of a survey of chief financial officers leading to 401 usable responses, and interviews with 21 CFOs. This was the third major survey conducted by the authors. The first, on capital structure and project evaluation, was published in 2001 and the second, on dividend and repurchase policy, in 2004. He described in some detail the methodology of the project. The specific goals were:

Gain Insight on the following issues:

- Importance of reported earnings and earnings benchmarks
• Are earnings managed? How? Why?
  - Real versus accounting earnings management
  - Does missing consensus indicate deeper problems?

• Consequence of missing earnings targets

• Importance of earnings paths

• Why make voluntary disclosures?

In a broader sense, the objective of the survey was to examine assumptions, to learn what people say they believe, and to provide a complement to the usual research methods: archival empirical work and theory. Harvey believed it was important to distinguish these objectives from the predictive goals of “positive economics.” He also described the extensive efforts that had gone into designing and testing the survey instrument.

Discussing specific findings, he began with earnings benchmarks. The four most important benchmarks (in order of importance) against which quarterly EPS would be judged in the opinion of the CFOs, were same quarter last year, analyst consensus forecast, reporting a profit (against a benchmark of 0) and previous quarter EPS. The analysts consensus was relatively more important for firms with more analysts, firms that give analysts some guidance with respect to future EPS, large firms, and more levered firms. The reasons given why meeting earnings benchmarks was important were (in order of importance) to build credibility with the capital market, to maintain or increase stock price, for the external reputation of management, to convey future growth prospects to investors, to reduce stock price volatility, to assure stakeholders the business is stable, to achieve bonuses for employees, to achieve a desired credit rating, and to avoid violating debt-covenants. Eighty-six percent of CFOs said that meeting benchmarks “builds credibility” and 80% said it maintains or increases the stock price.

Describing the consequences of missing benchmarks, respondents said (listed in order of number of respondents) this creates uncertainty about our future prospects, outsiders think there are previously unknown problems, we have to spend time explaining why we missed, it increases scrutiny of all aspects of earnings releases, outsiders might think the firm lacks flexibility, and it increases the possibility of lawsuits. Harvey continued with the consequences of missing benchmarks with some quotations from CFOs.

Turning to actions taken to meet benchmarks, (in order of popularity) these were: decrease discretionary spending (e.g. R&D, advertising, maintenance, etc.), delay starting a new project even if this entails a small sacrifice in value, book revenues now rather than next quarter (if justified in either quarter), provide incentives for customers to buy more product this quarter, draw down on reserves previously set aside, postpone taking an accounting charge, sell investments or assets to recognize gains this quarter, repurchase common shares, and alter accounting assumptions (e.g. allowances, pensions, etc.). There was much more support for actions entailing a sacrifice in the value of the corporation than for accounting actions. Explaining this choice, CFOs indicated that any hint of accounting questions could have a devastating effect on stock prices. They were more willing to admit to real actions, and auditors could not second guess real actions.

The responses to a hypothetical scenario were particularly interesting. The hypothetical was a company with a cost of capital of 12%, a new
opportunity near the end of the quarter offering a 16% rate of return and the same risk as the firm, and analyst consensus EPS estimate of $1.90. Five scenarios assuming the actual EPS if the project were (1) pursued and (2) not pursued called for an estimate of the probability that the project would be pursued. A surprising number of participants would reject the project just to beat, rather than simply meet, the consensus estimate. The explanation seemed to be a wish to preserve some “cushion” in case of an adverse development before the quarter end. In general, there was a very strong inclination to protect at least the consensus estimate.

Harvey turned next to the smoothing of earnings. Almost all of those interviewed preferred smooth earnings to more volatile earnings if cash flows remained constant. In order of popularity, the reasons for smoothing were: The company is perceived as less risky by investors, it is easier for analysts/investors to predict future earnings, it assures customers/suppliers that business is stable, reduces the return that investors demand (i.e. smaller risk premium), promotes a reputation for transparent and accurate reporting, conveys higher future growth prospects, achieves or preserves a desired credit rating, it clarifies true economic performance, and increases bonus payments. It seemed that the sacrifices that would be made to achieve smoothing were somewhat less than those that would be made to achieve meeting a benchmark.

In identifying those who had the greatest impact on the stock price, the CFOs said institutional investors first, and analysts second.

16. Accounting and Stock Selection: A Survey (Fall 2004)

Brett Trueman, Professor of Accounting, UCLA Anderson Graduate School of Management, began his presentation with the observation that there appear to be accounting anomalies that can be exploited for excess returns. Many investors do not fully appreciate these anomalies and/or do not act on them quickly enough to profit. The returns occur mostly around future earnings announcement dates, and they are not explainable by risk. If the market is inefficient with respect to reported earnings, it might well be inefficient with respect to other accounting information, and Trueman proceeded to review a variety of published research.

In general the studies were characterized by a sample period extending from the 1960s into the 1990s. The abnormal returns were measured by market-adjusted returns, size-adjusted returns, and intercepts from the Fama-French 3-factor model. The returns were robust to risk adjustments and were often clustered around future earnings announcements.

Previous speakers at the seminar had referred to the different significance of cash flow and accruals that make up earnings. Trueman observed that investors appear not to fully understand the differences. It turns out that firms with high (low) accruals earn negative (positive) abnormal returns.

In Sloan’s research, accruals were defined as: (change in current assets – change in cash) – (change in current liabilities – change in short-term debt – change in taxes payable) – depreciation and amortization expense. Firms were partitioned each year into deciles according to the magnitude of accruals, and the measured return period began four months after the fiscal year end. The hedge portfolio (lowest accrual portfolio minus highest accrual)
returned 10.4% in the first year and 4.8% in the second.

The next variable of interest was growth in net operating assets (NOA). Accruals measure growth in short-term NOA. The question now was whether the accrual anomaly extended to growth in long-term NOA. Fairfield and others found that there was no significant difference between accrual and long-term NOA asset portfolio returns.

Hirshleifer and others tested the earnings implications of current NOA to find that high (low) current NOA is associated with high (low) past earnings growth but slower (faster) future earnings growth.

Daniel and others over a sample period 1964-2002 found that the hedge portfolio (lowest NOA portfolio minus highest NOA) produced abnormal returns of 14.8% in the first year, 9.6% in the second and 6.4% in the third. Further research indicated that current NOA seems to embrace the accrual anomaly.

Thomas and Zhang explored which accrual components have the greatest ability to predict returns over a sample period 1970-1997. Size-adjusted abnormal returns were highest for change in inventories. The hedge portfolio (lowest decile minus highest decile) returned 11.39%. There appears to be no explanation for these results, other than investor ignorance.

Investors simply do not recognize that less reliable accruals have lower persistence. Richardson and others using a sample period 1962-2001 found that return on assets in year t+1 regressed on year t return on assets, working capital (medium reliability), net non-current operating assets (low/medium reliability), and net financial assets (high reliability) yielded coefficients on accruals with lower reliability that were more negative than those on accruals with higher reliability. For the hedged accrual portfolio, the one-year size-adjusted abnormal return was 13.3%.

Trueman next turned to the relation between value-glamour and accrual anomalies. The research was carried out by Desai and others and was reported in the Accounting Review in April 2004. The sample period was 1973-1997. The proxies for the value-glamour dichotomy were past sales growth, book-to-market ratio, earnings-to-price ratio, and cash flow-to-price ratio, where cash flow was measured simply as earnings plus depreciation. An additional variable was cash flow as earnings plus depreciation minus change in working capital (CFO/P). Accrual and value-glamour anomalies appeared to be distinct. The next comparison was between CFO/P and the traditional proxies. A regression again, of one-year abnormal returns, showed that the CFO/P variable was enough to identify the value-glamour anomaly. Further, regressing one-year size-adjusted abnormal returns on size, CFO/P and accruals indicated that CFO/P appears to capture the predictive power of accruals for future returns. There appears to be no explanation for any of these phenomena other than the failure of investors to appreciate the anomalies.

He next turned to accounting conservatism. Costs incurred in developing intangibles are generally expensed immediately rather than capitalized, and losses are generally recognized sooner than gains. Penman and Zhang investigated whether investors and analysts appreciate the impact of conservatism on earnings. The Q-score measured temporary effects of conservatism on earnings and a high Q-score indicated that current profitability was lower than expected future profitability. It turned out that
the size-adjusted hedge return (highest Q decile minus lowest Q) was 8.95%.

Next came a review of accounting signals. High book-to-market firms outperform low book-to-market firms. But the strategy can be improved by discriminating, ex-ante, between strong and weak companies. Nine fundamental signals were used to measure financial condition, and the F-score was the sum of the signals. Piotroski found that over the sample period 1976-1996 that the spread between the return-on-assets of high and low F-score deciles was 10.6%. The addition of six growth signals to form a G-score led to the conclusion that the difference between high and low G-score firm returns was 11.2%.

Finally, Trueman turned to pro forma earnings. Many companies report pro forma earnings which exclude certain expenses. Doyle and others investigated this question to conclude that $1 of excluded expenses predicts $3.328 less in cash flow over the next three years.

In conclusion, analysts and investors do not fully and correctly react to accounting information when disclosed.

17. The Assessment and Implications of Earnings Quality: An Investor's Perspective (Fall 2004)

Linda Vincent, Associate Professor, Kellogg School of Management, Northwestern University, made available a paper by herself and Katherine Schipper entitled: “Earnings Quality.”

She pointed out that there are two significant definitions of earnings quality. The first is the Hicksian definition: “The amount that the firm can pay out in dividends (that is the amount that can be consumed) during the period, while leaving the firm equally well off at the beginning and the end of the period.” An alternative definition based on the FASB’s Conceptual Framework is: Earnings quality is a function of the earnings decision usefulness.

She noted that as a practical matter, earnings quality however defined may depend on some or all of characteristics of the firm’s business model, economic factors and environment, characteristics of financial reporting system, goals and incentives of managers in making reporting choices, expertise and incentives of auditors, enforcement function, and activities of intermediaries (analysts, financial press, investment bankers). What is important here is that the Hicksian definition requires no context, but the decision usefulness definition depends very much on the context.

Turning to academic research on earnings quality, she identified six categories:

1. Tests of specific properties of earnings that are posited to be associated with quality.
2. Tests of relevance of earnings (and book value) for stock prices (and returns) over time.
3. Comparative association of earnings and other summary performance measures with stock prices.
4. Relation between earnings quality and other economic characteristics (e.g., cost of capital).
5. Tests of quality of financial reporting standards.
6. Tests for earnings management.

Under the first category, important time series properties of earnings are persistence, predictive ability, and
variability. Vincent noted that persistence has been shown both analytically and empirically to be associated with larger investor responses to reported earnings, and leads to a larger valuation multiple attached to earnings.

Predictability is affected by the firm’s business model and economic situation, and is often measured as the standard deviation of forecast errors. Earnings have been shown to predict future operating cash flows better than do current operating cash flows. Current cash flows however, and disaggregated accruals have been shown to predict future cash flows better than aggregated earnings do.

For variability, standard deviation or variance is the usual measure. Another measure is standard deviation of earnings divided by the standard deviation of cash from operations. Other research has shown that while variability is a negative to investors, they apparently reward firms that have a series of increasing earnings. An earlier presentation by Campbell Harvey had shown the lengths to which corporate managers go to smooth earnings.

Further tests of specific properties concerns relations among earnings, cash and accruals. Previous speakers at the seminar had discussed in some detail the importance to investors of the accrual component in earnings. Vincent referred to further academic research on this topic.

Turning to the second category, tests of relevance of earnings (and book value), she reported research indicating that the value relevance of earnings has declined over time, for which the explanation may be a decline in earnings quality. With respect to the third category, comparative association of earnings and other summary performance measures with stock prices, she reported research regressing long window return on analysts’ forecast errors versus pro forma forecast errors. The former were more highly associated with returns than the latter, suggesting that pro forma earnings show higher quality than analyst forecasts.

The fourth category was the relation between earnings quality and other economic characteristics of the firm. Research relating the association between attributes of earnings and the cost of equity capital showed a negative effect on that cost for accrual quality, persistence, smoothness, predictability, value relevance, and timeliness of earnings.

The fifth category is tests of quality of financial reporting standards. Research examining the association between share price and disclosed (in footnotes), but not recognized (on the income statement) stock option expense for S&P 500 companies 1996-1998, indicated a significant negative coefficient on the expense. The conclusion was that investors view stock-based compensation expense as an expense of the firm and the SFAS #123 measure of the expense is reflected in share price. Some of her own research had led to the conclusion that there is no consistent evidence that pension assets, pension liability, pension cost or components of pension expense are reflected in share prices or returns.

The last category was tests for earnings management. Vincent pointed out two main types of earnings management: accounting manipulation and economic decisions. Campbell Harvey had discussed these two at some length in a previous presentation. She presented research evidence of earnings management from a number of sources. Some research has indicated little evidence that the apparent earnings
management was successful in increasing management compensation. But it is not clear which of management’s possible incentives for smoothing dominates.

Vincent’s final topic was the implications of earnings quality for investors. It seems clear that for a variety of valuation models and investment decisions, the quality of earnings is important. In addition, the quality of the market itself depends in part of the quality of earnings reports. It may well be, however, that the underlying characteristics of the firm, for which earnings quality supposedly proxies, are the items of chief interest.

18. Accounting Research for Asset Management (Spring 2003)

S. P. Kothari, Gordon Y. Billard Professor of Accounting, and Jonathan Lewellen, of the Sloan School of Management MIT, and Jerold B. Warner, Simon Graduate School of Business Administration, University of Rochester, had prepared a paper entitled: “Stock Returns, Aggregate Earnings Surprises, and Behavioral Finance.”

Kothari began with an overview of research over the past thirty to forty years exploiting fundamental analysis to generate abnormal returns. In what many would conclude must be an efficient market, extensive research has shown that there are very high returns to fundamental analysis because of apparently systematic mispricing. Much of the behavioral finance literature deals with this and offers behavioral explanations. He reviewed both univariate approaches detecting market overreaction and underreaction to earnings announcements, and multivariate approaches to discover further mispricing, and noted that accounting research to date has paid limited attention to the impact of time-varying expected returns or interest rates in the abnormal return analysis. And he noted that for example, V/P anomaly performance is sensitive to using time-varying discount rates. These discount rate changes can be important in evaluating the performance of accounting-based trading strategies.

Rather than continuing analysis making use of individual stock returns and earnings, the authors studied the relation between market index returns and aggregate earnings and earnings surprises. The first discovery was that market returns are negatively related to concurrent earnings news, while in the case of the individual stocks the relationship is positive. So good aggregate earnings news can be bad news for the stock market. The relationship is robust and the numbers seem economically significant.

We have seen that quarterly earnings changes for stocks have positive serial dependence at the first three lags and the same was found to be true for the aggregate. It seems that investors underestimate this dependence, so that prices respond slowly. So we have a similar pattern for firms and for the aggregate market, and the analysis using aggregate data is in some sense an out-of-sample test of the results of analysis on the firms. Returning to the contemporaneous relation between earnings and prices, we find an explanation for the relation between returns and earnings in the relationship between changes in cash flows and changes in discount rates.

Kothari concluded that the discount rate story is not the whole story, but it goes a long way to explaining the relationship we see between returns and earnings in the aggregate. What is significant is that the finding casts serious doubt on the behavioral
explanation for the relationships between returns and earnings for firms as opposed to the aggregate. The relationships themselves have clearly been identified, but some new explanations will have to be found.

19. Diagnosing Earnings Quality (Spring 2003)

Stephen H. Penman, George O. May Professor of Accounting, Graduate School of Business, Columbia University, offered a paper entitled: “The Quality of Financial Statements: Perspectives from the Recent Stock Market Bubble.”

During the recent stock market bubble, the traditional financial reporting model was assailed as a backward looking system, out of date in the Information Age. With the bursting of the bubble, the quality of reporting is again under scrutiny. Penman undertook the development of diagnostics for evaluating the quality (sustainability) of earnings. His focus was on the P/E ratio.

As we look back, earnings (losses), sneered at by Information Age believers, were actually a good predictor of outcomes for dot-coms. The intangible assets relied on as the bubble grew proved to be nonexistent. Bad accounting involved overstatement of assets and understatement of liabilities. Penman identified three reasons for poor financial reporting. The first is subversion of good accounting principles, including excessive restructurings, front-end revenue recognition, capacity swaps, cookie jar reserving, and off-balance-sheet financing. The second is GAAP itself, with its reliance on form over substance. He contrasted the governing enforcement philosophy in the US: GAAP compliance, with that in the UK: “True and fair view.” The first relies on bright line rules, and the second on accountants’ discretion. His third reason is poor accounting principles, arising from poor thinking. And it was the need for “good thinking” that motivated his paper.

First, good accounting should adopt a shareholder point of view (the proprietorship rather than the firm entity perspective). Shareholders buy earnings, so the focus should be on the quality of earnings.

There are poor features of GAAP. One is the accounting for the statement of shareholder equity. Dirty surplus accounting is one feature. Hidden expenses in share transactions, such as the cost of employee stock options, is another. Another poor feature is its treatment of debt vs. equity, failing here to take the shareholder point of view. Another poor feature is the use of prices in financial statements. If accounting is to challenge prices, then earnings must not be based on prices.

But there are also good features of GAAP. Historical cost accounting, revenue recognition, and revenue and cost matching are examples.

There is a danger in discretionary conservative accounting. Conservative accounting facilitates the creation and release of hidden reserves (LIFO inventory is an example).

The identification of sustainable earnings led to his discussing briefly portions of a second paper by himself and Xiao-Jun Zhang, Haas School of Business, University of California, Berkeley, entitled: “Modeling Sustainable Earnings and P/E Ratios with Financial Statement Analysis.” The paper develops a model of sustainable earnings by decomposing earnings into the elements of profit margin and the elements of asset and liability changes, with a view to judging
the reliability (sustainability) of each element. A “C score” estimates the amount of hidden reserves created by the accounting for R&D and advertising, and by LIFO accounting for inventories. A “Q score” indicates temporary effects on earnings by building up or releasing reserves. Finally, an “S score” is estimated and fitted to traded P/E ratios to predict future stock returns from deviations from the fit. The paper concludes that the scoring is successful. This finding may mean that the financial statement scores capture risk in investing, although tests for risk explanations do not suggest so. Scoring earnings reduced the risk of paying too much for earnings, so an alternative interpretation suggests that investors in the past paid too much (or sold for too little) by ignoring financial statement information about sustainability.


Richard G. Sloan, Victor L. Bernard PricewaterhouseCoopers Professor of Accounting and Finance, University of Michigan Business School, offered a paper by himself, Scott A. Richardson, Mark T. Soliman and Irem Tuna, all of the University of Michigan Business School, entitled: “Information in Accruals About Earnings Persistence and Future Stock Returns.”

The object of the research was a comprehensive examination of the source of information in accruals about earnings persistence and future stock returns. This information is not restricted to working capital accruals, but extends to investing accruals and certain financing accruals. The results suggest that less reliable accruals are associated with lower earnings persistence and investors do not fully anticipate the lower earnings persistence, resulting in significant security mispricing and opportunities for significant abnormal returns.

Sloan began with an example showing the impacts of conservative and aggressive accounting. The differences lay essentially in choices between capitalizing and expensing items and in the case of capitalizing determining the amortization or depreciation policy. The results were rather dramatic. Both the conservative and aggressive accounting led to substantial variation in both net income and return over the five years. The variation is perhaps an invitation to mispricing.

He suggested three sources of accounting distortions. One is unintentional errors in accounting estimates. These include estimates of bad debts, asset lives, deferred taxes, and postretirement benefits. There is not much that we can do to correct these. A second source is the restrictive nature of GAAP itself. GAAP mandates a certain amount of conservative accounting (e.g., immediate expensing of most R&D and SG&A costs), and we can anticipate the effects. A third source is intentional manipulation, using accruals to artificially boost earnings (e.g., capitalizing operating costs). Careful analysis of financial statements may reveal this manipulation.

Conservative accounting refers to methods that understate accounting book value relative to invested capital. Hidden reserves are created. They increase with investment growth and depress earnings and accounting rates of return. With slowing investment, hidden reserves can be released, increasing earnings and accounting rates of return. Conservatism can be identified and measured. Examples are LIFO reserve, R&D reserve, and advertising reserve. The previous presentation by Penman included a
paper on this subject. When Penman’s Q measure is high, earnings are temporarily increased and then depressed. When the Q is low, earnings are temporarily decreased and then rise. The interesting question is whether the market picks up on this phenomenon.

Accruals represent the difference between earnings and cash flows, so that earnings consist of an accrual component and a cash flow component. Accruals are the less reliable component of earnings, and represent the component that is typically used to manage/manipulate earnings. Artificially high accruals temporarily inflate earnings and accounting rates of return while artificially low accruals temporarily depress them. It turns out that we can learn more from examining the accrual portion of earnings than by examining earnings themselves. Growing firms should have increasing normal accruals. By orthogonalizing accruals with respect to sales growth and PP&E, we can extract the abnormal accruals that are not explained by growth. Portfolios made up of companies ranked by abnormal accruals show evidence of substantial mispricing. Research reported in 2001 showed the return on a hedge portfolio (buying the lowest abnormal and selling the highest) returned 11%. Decomposing accruals facilitates even higher hedged portfolio returns. Sloan commented that capitalizing software development, as in the case of Amazon, is an abnormal accrual that has particular significance for mispricing.

He closed with financial statements constituting three particularly interesting examples of abnormal accruals. In the case of WorldCom, the huge capitalization of expenses into capital expenditures created extraordinary abnormal accruals. While one might not have known exactly what was going on, eleven and one half billion dollars of capital expenditures in 2000 should have seemed strange to an analyst.

In conclusion, Sloan observed that the quality of earnings analysis yields significant insights into the sustainability of earnings, and these insights do not appear to be incorporated into stock prices on a timely basis. Quantitative methods, like those developed in the papers just discussed work well. Detailed fundamental analysis should yield further rewards.

Active Equity Management
Behavioral Finance

21. Investor Sentiment and the Cross-Section of Stock Returns (Fall 2005)

Jeffrey Wurgler, Associate Professor of Finance, New York University, made available a paper by himself and Malcolm Baker entitled “Investor Sentiment and the Cross-Section of Stock Returns.” The research was supported by The Q-Group®.

Classical finance theory claims that “investor sentiment” cannot affect security prices, because the demands of any sentimental (read irrational) investors are neutralized by arbitrageurs. At the same time, we know that there have been and will be many challenges to classical theory. A variety of effects have been documented that point out clear violations of a theory of market efficiency. The paper provides theory and evidence that investor sentiment is real and measurable and that it has pervasive cross-sectional effects.

Mispricings require two factors. First is an uninformed (e.g. “sentimental”) demand shock and second is a binding constraint on
arbitrage. Further, for a wave of sentiment to have cross-sectional effects—not just equal mispricings across all stocks—one or both of the factors must vary across stocks. Wurgler proposed propensity to speculate as a definition of sentiment. In this case sentiment is the relative demand for intrinsically speculative stocks, and can cause cross-sectional effects even when arbitrage is equally difficult across all stocks. An intrinsically speculative stock is one with a highly subjective/uncertain valuation. The prediction then is that stocks whose valuations are most subjective, such as a canonical young, unprofitable, extreme-growth-potential stock, or a distressed stock, will be especially sensitive to fluctuations in propensity to speculate.

Another potential definition of sentiment is the marginal investor’s excessive optimism or pessimism about stocks in general. In this case, waves of sentiment will still affect the cross-section results to the extent that arbitrage forces are weaker in certain subsets of stocks. Arbitrage limits that vary across stocks include: fundamental risks, transaction costs/liquidity, short-selling costs, predatory trading risks, noise trader risks, etc. One would expect that time-varying optimism or pessimism has the biggest effects on stocks that are hardest to arbitrage.

Fortunately, it appears that roughly speaking, the same stocks that are the hardest to arbitrage are also the most speculative/hardest to value. A key prediction then is that young, small, unprofitable, extreme-growth and distressed stocks are the most sensitive to fluctuations in investor sentiment.

Wurgler began with an anecdotal history of investor sentiment over the period 1961-2002. We think of a high sentiment period as one in which there is demand for safe, “quality” stocks. High sentiment periods were 1960-61, when we had a small-growth stock bubble, 1967-69 the time of a similar bubble, the late 1970s through the mid-1980s for small, sometimes industry-concentrated bubbles, and the late 1990s internet bubble. A low sentiment period was the early 1970s, the bubble of the “nifty-fifty”.

Mispricing is difficult to identify directly. The research focused on searching out systematic patterns of correction of mispricings, from which the mispricings themselves could be deduced. For example, if returns on young and unprofitable firms are low we may be seeing the correction of a bubble in growth stocks. What we have is ex post evidence of ex ante mispricing.

Six proxies were considered as measures of investor sentiment. These were the average discount on closed-end equity funds, NYSE share turnover, the number of and average first-day returns on IPOs, the equity share in new issues, and the dividend premium. The dividend premium measures the preference, reflected in price-to-earnings ratios, for dividend paying over non-dividend paying stocks. The proxies were used to construct a composite index annually from 1962-2001. A graph of the index through the years showed clear peaks (high sentiment) and valleys (low sentiment).

Empirical results appeared primarily in graphical form. The first showed the effect of size of market equity, conditional on sentiment. Firm-level data came from the merged CRSP-Compustat database. Stocks were broken into ten deciles by size using NYSE breakpoints. When sentiment was negative, returns averaged 2.37% per month for the bottom decile and 0.92% for the top decile. This meant that
low sentiment had depressed the small stocks and their recovery had produced high returns. There was much less variation across the size decile returns following a high sentiment period, although the large capitalization stocks showed somewhat higher returns than the small. A line tracing the difference between the low sentiment and high sentiment results over the ten size deciles rose monotonically from the smallest to the largest, verifying the predictability of high and low sentiment taken together.

Similar graphs substituted volatility and sales growth for size. The former showed clear evidence of the effect of both high sentiment and low. The latter showed somewhat weaker evidence for low sentiment and not much evidence for high sentiment. The paper included graphs for a number of other variables.

The key finding was that characteristics that have no unconditional predictive power do have power once one conditions on sentiment. Investor sentiment is a real, measurable phenomenon that has large effects on the cross-section of stocks.

22. Liquidity, Asset Pricing and Financial Fragility (Spring 2003)

Franklin Allen, Nippon Life Professor of Finance and Economics, Wharton School University of Pennsylvania, had prepared with Douglas Gale, Department of Economics, New York University, a paper entitled: “Financial Fragility, Liquidity and Asset Prices.”

He began with two examples of financial fragility, where shocks that are small in relation to the economy as a whole have a significant impact on the financial system. First was the crisis in August of 1998, when the Russian government announced a moratorium on some domestic debt payments to non-residents. Although the amount of assets involved was a tiny proportion of world financial assets, stock markets fell worldwide, there was a substantial increase in price volatility, and correlations in asset price movements were unusual. The second example was the LTCM debacle in October 1998. The problems of LTCM were not extraordinary in the context of global finance, but in explaining the intervention of the Federal Reserve Bank of New York, Alan Greenspan had commented that a forced liquidation of LTCM’s portfolio would have had a significant distorting effect on market prices, would have produced large losses and inflicted substantial damage on many market participants.

Allen argued that it is difficult to reconcile this financial fragility with standard asset pricing theories. The key to an understanding is the fact that liquidity provision is endogenous in financial markets. The model he presented is of a basic economy in which the participants are banks and consumers. At date zero, banks decide how much of their assets to invest in short-term (1 period) assets and how much in long-term (2 period) assets. The assets are financed by deposits from consumers who are promised a payout of $c_1$ for each unit of deposit withdrawn at the end of period one (date 1) and $c_2$ for each unit withdrawn at the end of period 2 (date 2). Consumers are given the option of withdrawing at date 1 or at date 2, the option to be exercised at date 1. The fraction of aggregate withdrawals that take place at date 1 is $θ$, a random variable, and the ratio of withdrawals for a particular bank at date 1 is $α$. Consumers withdraw $η(α,θ)$ at date 1 and $(1-η)(α,θ)$ at date 2. A critical assumption is that there is no market for hedging $θ$ risk.)
At date 1, both $\alpha$ and $\theta$ are publicly observed, and at this point banks trade assets among themselves to meet customer demand for liquidity. If a bank is unable to meet its commitments, then all its assets are liquidated and paid out to depositors.

Turning to a specific example, Allen showed that if there is no aggregate uncertainty (only $\alpha$ for each bank is uncertain at date zero) then banks are able to trade assets satisfactorily, the value of the long asset can be determined, and the system reaches a fundamental equilibrium. The price of the long asset, in terms of the short asset, is $p(\theta)r$, where $r$ is the promised return on the long asset.

Next, he introduced a very small measure of aggregate uncertainty. The result was to eliminate the fundamental equilibrium, no matter how small the uncertainty. The supply of liquidity at date 1 is inelastic and equal to the amount the banks invested in the short-term asset at date zero. The demand for liquidity depends upon the proportion of early consumers and this demand is random. Given this supply and demand relationship, $p(\theta)$ cannot be greater than 1, because if it were there would be an arbitrage opportunity selling the long asset and buying the short asset at date 1 for a profit, and holding the position until date 2.

If there is excess liquidity at date 1, then $p(\theta)$ must equal 1 in order for banks to be willing to hold that excess short asset between dates 1 and 2. Allen showed further that we cannot have $p(\theta)$ equal to 1 for all $\theta$ and there cannot be an equilibrium with $p(\theta)$ constant and no bankruptcy.

Next we consider $p(\theta)$ not constant. In equilibrium some banks follow a safe strategy and others follow a risky one. The safe banks invest heavily in the short asset and the risky banks heavily in the long asset. When $\theta=0$ both types of banks stay solvent but when $\theta=1$ the risky banks start to sell the long asset, $p(\theta)$ falls dramatically and the risky banks go bankrupt. A robust equilibrium is reached.

Allen’s point was that in robust equilibria an arbitrarily small degree of aggregate uncertainty can lead to significant price volatility, financial crises where some banks default, and low aggregate utility. It is important that the financial fragility described is not a “coordination failure” described in another literature.

Although the examples chosen involved banks and depositors, he would argue that similar results hold for a much wider range of financial institutions. The key to asset pricing here is liquidity. Some market participants hold liquidity because they foresee that crashes may occur and liquidity is valuable in these states. This policy must balance the opportunity cost of holding liquidity in other states.

Allen commented that his model involves no central bank. A central bank might be able to inject needed liquidity and prevent the price volatility. That would depend on the degree of participation, and he referred to the LTCM case and raised the question whether the Federal Reserve could have averted a crisis by injecting liquidity. The fragility illustrated by the model is consistent with the view put forth by the Federal Reserve to justify its intervention in the LTCM case.

23. All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors (Fall 2002)
Terrance Odean, Assistant Professor, University of California at Berkeley distributed a paper by himself and Brad M. Barber entitled: “All that Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors.” The research was supported by The Q-Group®.

Odean has made presentations to the Q-Group® in the past on the behavior of individual investors, including a presentation in the Fall of 1999 entitled “The Courage of Misguided Convictions (Volume 5, No. 10),” and one in the Fall of 2000 entitled “The Behavior of Mutual Fund Investors” (Volume 5, No. 64). As in his past presentations, his work was based upon a very large set of data on individual transactions. From a large discount brokerage firm he had trading and position records for the investments of 78,000 households from January 1991 through December 1996. From a smaller discount brokerage firm he had data on 14,667 accounts for individual investors from January 1996 through June 15, 1999. From a large retail brokerage firm he had data for 647,922 investors from January 1997 through June 1999. For comparison purposes, he had data compiled by the Plexus Group for institutional clients including daily trading records for 43 institutional money managers from January 1993 through March 1996.

Two hypotheses were to be tested. The first is that the buying behavior of individual investors is more heavily influenced by attention than is their selling behavior. The second is that the buying behavior of individual investors is more heavily influenced by attention than is the buying behavior of professional investors. More specifically, on “high-attention” days individual investors will be net buyers and institutional investors will generally be net sellers.

Why should buying behavior differ from selling behavior? Odean’s answer was that individual investors, generally holding no more than about four different securities, can easily review their portfolios and decide what to sell. The buying decision on the other hand involves a very large search problem. Institutions are equipped to search through vast numbers of securities because of their staffing and their computers and decision rules. To solve the search problem, individual investors mostly buy stocks that catch their attention. And when do stocks attract attention? Odean’s answer is on days with abnormally high trading volume, or extreme price moves, or publication of news about the stock.

Abnormal trading volume was defined as the stock’s trading volume on a particular day divided by its average trading volume over the previous one year (252 trading days). So abnormal trading volume was tabulated for each stock on each trading day. Each day stocks were sorted into deciles on the basis of that day’s abnormal trading volume. For each investor type the buys and sells in each volume partition were totaled and the order imbalance for purchases and sales was calculated as the number of buys minus the number of sells divided by the sum of the numbers of buys and sells. This order imbalance, by number of trades, appeared to best display the psychology of individual trading. The order imbalance was also determined as the dollar amount of buys less the dollar amount of sells divided by the sum of the two dollar amounts. This imbalance has more economic significance. When imbalance was calculated by number of trades, 18.15% fewer of the trades were purchases than sales for stocks in the lowest volume decile, while for stocks in the highest decile 29.5% more of the trades were purchases.
Investors are likely to notice when stocks have extreme one day returns. So all stocks for which returns are reported in the CRSP daily returns file were divided into deciles based on one-day return. For stocks with the worst performance the order imbalance at the large discount brokerage was 29.4%. The imbalance dropped to 1.8% at the 8th return decile and rose back to 24% with stocks with the best return performance on the previous day. So unusually high returns and unusually low returns are causes for individual buying.

Individual investors are more likely to be net buyers of stocks that are in the news than those that are not. So the daily order imbalance for stocks was sorted into those with and without news. “News” here simply meant a mention in the daily news feed from Dow Jones News Service. For the large discount brokerage, order imbalance was -.70% for stocks out of the news, and +9.35% for those in the news.

So by and large, investors are more likely to buy than sell attention-grabbing stocks regardless of size. This is true for all three of the attention-grabbing measures: abnormal trading volume, returns, and news. It also turned out that attention-based buying by individuals is as strong for large capitalization stocks as for small stocks.

Although the hypothesis testing did not involve performance comparisons, Odean thought it appropriate to answer the question whether the investor behavior reported led to superior returns. Needless to say, the evidence was quite the opposite. The attention-grabbing stocks bought by individual investors do not outperform the market; nor do these stocks outperform those the investors sell.

24. The Evolution of Fairness
(Spring 2001)

Martin Nowak, Professor of Theoretical Biology at the Institute For Advanced Study, Princeton University, had presented a paper at the Fall 1999 Q-Group® Seminar entitled: “The Evolution of Cooperation” (See Volume 5 of Q-Group® summaries, page 38). He reviewed that previous presentation and extended it beyond “cooperation” to reach “fairness”.

As he had done in his previous presentation, Nowak began with three elements of Darwinian evolution: reproduction, mutation, and natural selection (or competition). Although we do not have a complete theory of evolution, we can see that genes develop to genomes, single cells develop to multi-cellular organisms, and individuals form societies, all processes that require cooperation. (Cancer is an example of what happens when cooperation breaks down.)

So cooperation has evolved, and the question is how does cooperation emerge from natural selection?

Our theory says that cooperation among relatives takes place when \( r > \frac{c}{b} \), where \( r \) is the coefficient of relatedness, \( c \) is the cost of cooperation and \( b \) is the benefit.

It is relatively easy to understand cooperation among relatives, but what about cooperation among non-relatives? John Maynard Smith developed from Von Neumann and Morgenstern Game Theory an evolutionary game theory whereby successful strategies are spread by natural selection. Nowak used as an example the “prisoners’ dilemma,” something he had discussed in some detail at the previous presentation. Even though the total benefit to the two prisoners is largest if they cooperate, natural selection seems to force both to
act so as to minimize the total benefit to both. To explain how natural selection brings about cooperation, we examine three possibilities. Direct reciprocity is one. I help you because I expect you to help me in the future. One version of this is “tit-for-tat.” It turns out that such a rigid rule is too unforgiving to lead to cooperation. But tit-for-tat coupled with random forgiveness can lead to cooperation.

A second possibility is indirect reciprocity. I help you because I expect someone else to help me. In this case it is my reputation that I expect to lead to my reward. Once again, natural selection can lead to cooperation.

Spatial game dynamics is another such evolutionary path.

Finally, Nowak turned to the manner in which natural selection can lead beyond cooperation to fairness. He invited the participants to join in “the ultimatum game.” Two players receive $100,000 if they can agree how to split that sum. One of the players must propose the manner of sharing, and the other player either accepts or rejects the proposal. On acceptance, the money is divided. On rejection, neither player receives anything. Nowak posed two questions: As the first player, what division would you propose? As the second player, what proposal would you accept? It turns out that most times the game is played the first player proposes keeping 50% to 70% and the second player accepts a proposal within this range. Why does the first player ask for no more than 70%? Because of the likelihood that the second player will reject such a proposal. Some might see this result to be irrational. Why would the second player reject a free benefit, no matter how small? Once again, natural selection embraces reputation effects so that self-interest is aligned with fairness. For the second player to reject a low offer involves an immediate cost, but buys a reputation for demanding fair treatment that is likely to lead to better offers in the future.

25. The Canonical Market Bubble (Spring 2001)

Jack L. Treynor, President, Treynor Capital Management, Inc., distributed a paper entitled: “The Canonical Market Bubble.” His presentation was a sequel to the presentation he had given at the Spring 1997 Q-Group meeting, under the title “Bulls, Bears and Market Bubbles.” (The summary can found in Volume 5 of Q-Group summaries at No. 97.) In that presentation he had offered a model for market bubbles, assuming that investors held only one of two possible opinions with respect to where the market was going. In the present paper he has taken what he believes to be a more realistic assumption: that value opinions will be distributed, with most investors clustered in the middle and relatively few in the tails (that is at very high and very low expected prices). His initial question was whether a bubble can develop in a market where opinions are continuously distributed, but still rational in the sense of being unaffected by a feedback process.

The model he offered was based on the following propositions:

• Equilibrium market level depends on investors’ opinions and their wealth.
• When the market level rises, wealth shifts from pessimists to optimists. When the market level falls, wealth shifts from optimists to pessimists.
• If the wealth shifts are big enough, the new equilibrium will engender further wealth shifts.
• The size of wealth shifts depends on the size of the disagreement in
opinions. In a two-opinion market, the key to the precondition for a bubble is the difference.

We assume that in any point in time the distribution of wealth depends only on the market level, and not on the path to that level. We assume that investors do not change their opinions \( x \). We assume they make active bets proportional to their disagreement with the market price \( p \), and their wealth, and inversely proportional to their estimate of the error variance in their opinions \( \sigma^2 \). The path independent wealth function is \( f(x,p) \). The fraction of their wealth they will bet is then \( \frac{x - p}{\sigma^2} \).

Investors gain or lose when the market level changes according to:
\[
\frac{df}{dp} = \left( \frac{x - p}{\sigma^2} \right) f(x,p).
\]

This differential equation leads to
\[
\ln f = \frac{1}{\sigma^2} \left( xp - \frac{p^2}{2} \right) - \frac{K}{2\sigma^2}
\]
where \( K \) is any constant of integration.

Hence,
\[
\ln f = -\frac{1}{2\sigma^2} (p^2 - 2xp + k),
\]
and \( f(x,p) = e^{-\frac{-(p^2 - 2xp + k)}{2\sigma^2}} \).

Next, in order for active long positions to offset active short positions, the equilibrium price \( \hat{p} \) must satisfy
\[
\int \left( \frac{x - \hat{p}}{\sigma^2} \right) f(x,p) dx = 0.
\]

It follows that, at equilibrium:
\[
xf(x,p) dx = \hat{p} \int f(x,p) dx
\]
\[
\hat{p} = \int xf(x,p) dx.
\]

Now when the perceived market level \( p \) changes, the equilibrium price \( \hat{p} \) also changes, so we have:
\[
\frac{\partial \hat{p}}{\partial p} = \int x \frac{\partial f}{\partial p} dx.
\]

Using our differential equation in \( f(x,p) \) we have:
\[
\frac{\partial \hat{p}}{\partial p} = \int x \left( \frac{x - p}{\sigma^2} \right) f(x,p) dx
\]
\[
= \frac{1}{\sigma^2} \left[ (\hat{\sigma}^2 + \hat{p}^2) - \hat{p}^2 \right] = \frac{\hat{\sigma}^2}{\sigma^2},
\]
for small changes in \( p \). Here \( \hat{\sigma}^2 \) is the true error variance of investor opinions, while \( \sigma^2 \) is the error variance perceived by investors.

The relation between the two error variances is the key to whether a given change in price will elicit a still bigger price change towards equilibrium in the same direction. Treynor noted that the harder the market is to value — that is, the less concrete the sources of its prosperity — the easier it is for active investors to have systematically biased opinions about the accuracy of their appraisals, and therefore produce \( \sigma^2 < \hat{\sigma}^2 \), and \( \frac{\partial \hat{p}}{\partial p} > 1 \).

It turns out then that the ratio of the error variance is a key measure. It is a measure of investors’ hubris regarding their errors. It also governs the size of active investors’ positions and hence the size of the wealth transfers when the market level changes. It is the precondition for a bubble.

The canonical model does not require investors to change their opinions. Indeed, we have assumed they do not change them. The model does require them to make bets that are proportional to their wealth, and to disagree. Unless one were to insist that mere disagreement is necessarily irrational, this model is based on rational behavior. But in the model the equilibrium corresponding to a given set of investor expectations is not unique: the same expectations — and even the same initial wealth endowments— can ultimately result in
many different equilibrium market levels. Changes in the market level can be non-random, even if expectations are rational.

Interesting questions are who buys? and who sells? as the price changes.

If investors obey our betting rule, the position \( h \) of an active investor with opinion \( x \) is:

\[
h = f(x, p)
\]

Then, when the market level changes, the investor will trade

\[
\frac{dh}{dp} = \left( \frac{x - p}{\sigma^2} \right) \frac{df}{dp} - \frac{1}{\sigma^2} f(x, p).
\]

As before, the gain or loss incurred is

\[
\frac{df}{dp} = f(x, p) \left( \frac{x - p}{\sigma^2} \right).
\]

Substituting \( \frac{df}{dp} \) in the expression for \( \frac{dh}{dp} \), we have

\[
\frac{dh}{dp} = \left[ \left( \frac{x - p}{\sigma^2} \right)^2 - \frac{1}{\sigma^2} \right] f(x, p).
\]

At the boundary between buyer and seller, we have \( \frac{dh}{dp} = 0 \), hence

\[
(x - p)^2 = \sigma^2,
\]

\[
x - p = \pm \sigma,
\]

\[
x = p \pm \sigma.
\]

We see that the effect of a market level change on extreme investors is dominated by its impact on their wealth, whereas the effect on moderate investors is dominated by its impact on their degree of disagreement. When, for example, the market level rises, the extreme bull responds to increasing wealth by lengthening his position. The extreme bear responds to declining wealth by reducing his short position. Both respond by buying. The moderate bull responds to the reduction in disagreement with the market level by shortening his long position. The moderate bear responds to the increase in disagreement by increasing his short position. Both respond by selling.

Treynor next asked: Who wins? Who loses?

At the beginning of the bubble, we had

\[
\ln f(x, p) = -\frac{1}{2} \left( \frac{x - p_1}{\sigma} \right)^2,
\]

\[
(x - p_1)^2 = -2\sigma^2 \ln f(x, p).
\]

Skipping some derivations, and assuming that the integration constant \( K = x^2 \), we have:

\[
(x - p_2)^2 = -2\sigma^2 \ln f(x, p_2)
\]

\[
= \frac{\left( p_2 - p_1 \right) \left( p_2 + p_1 - 2x \right)}{2\sigma^2}.
\]

The distribution of people —of investors— is almost certainly bell shaped. If they do indeed tend to be steadfast in their opinions during the progress of a bubble, then, as the distribution of wealth moves upward — i.e., toward more optimistic appraisals — away from the bell of the people distribution and toward one of the tails. It is moving away from the mass of investor opinions and toward opinions that are both 1) more extreme, and 2) less populated.

In the absence of a bubble, wealth accrues to investors who have guessed right. So investors who have guessed right enjoy more economic clout than investors who have guessed wrong. But in a bubble the wealth, hence the clout, ends up with investors who merely hold
extreme opinions. Can we be comfortable with the economic signals provided by such a market?

26. Contagion as a Wealth Effect (Spring 2001)

Albert Kyle, Associate Professor of Finance, Fuqua School of Business Administration, Duke University, distributed a paper by himself and Wei Xiong entitled: “Contagion as a Wealth Effect.”

Much of the motivation for the research came from the Long Term Capital Management (LTCM) crisis of the summer of 1998. At that time LTCM, numerous hedge funds, banks, and securities firms all tried simultaneously to reduce exposure to a variety of financial instruments, including Russian bonds, Brazilian stocks, U.S. mortgages, spreads between on-the-run and off-the-run government securities and spreads between swaps and U.S. Treasuries. During this financial crisis financial intermediaries suffered losses as prices moved against their positions. Market depth and liquidity decreased simultaneously in several markets. The volatility of prices increased simultaneously in several markets. And correlation of price changes of seemingly independent positions of financial intermediaries increased. Commentators used “contagion” to describe the rapid spread from one market to another of these phenomena.

The purpose of the research was to explain contagion with a theoretical model in which increased risk aversion is based on a wealth effect of financial intermediaries. Convergence traders (hedge funds) are assumed to trade in markets for two risky assets. They are perfectly competitive traders who speculate that the transitory effect of noise trading on asset prices will induce temporary deviation of prices from their long-term mean. We assume that noise traders operate in one of the two markets. Noise trading demands liquidity from time to time, which the hedge funds can provide to their advantage. Noise traders also trade on incorrect information, providing further opportunities. A third class of traders in both markets is made up of long-term investors. They are prudent but not fully rational. They follow a robust long-term investment strategy holding risky assets in both markets proportionally to the spread between asset prices and fundamental values. Convergence traders, of course, aggressively exploit short-term opportunities. They are assumed to have logarithmic utility. This utility implies a trading strategy in which both the expected trading profits and the percentage variance of the portfolio equal the short-term (instantaneous) squared Sharpe Ratio in the market. Logarithmic utility also implies a risk management strategy which prevents wealth from dropping to zero through dynamic portfolio rebalancing.

Kyle noted that in addition to the wealth effect motivating convergence traders to reduce positions due to reduced wealth, they have an opposite incentive, a substitution effect, to add to positions because these positions become more profitable as noise trading pushes prices further out of line. Usually, the wealth effect is smaller than the substitution effect and convergence traders respond to noise trading shocks by taking the other side in a manner which reduces volatility and adds to liquidity. In some extreme cases, however, when convergence traders have unusually large positions, the wealth effect dominates the substitution effect and convergence traders respond to noise-trading shocks by liquidating positions. This is what exacerbates price volatility and consumes some of the liquidity provided by long-term investors.
The model assumes that traders in the financial markets exchange a safe asset with a constant interest rate for the two risky assets. In the context of convergence trading, each of these two risky assets can be thought of as a spread position between other assets. It is assumed that the cash flows of these two assets are observable, mean-reverting stochastic processes with constant instantaneous volatilities, constant rates of mean reversion, known long-term means, and also that the two cash flow processes are independent. The fundamental values of the two risky assets are defined as their expected payoffs to a risk neutral investor discounted at the risk free rate of interest. It can be shown that the risk neutral marked-to-market profits on the two assets follow Brownian motions with constant volatility and an equilibrium depends on the fundamental cash flow process only through the parameters of the volatilities.

The equilibrium prices for the two risky assets arise from trading by the three different types of market participants. Long-term investors always provide liquidity to the market. When prices fall below fundamental values in either market, long-term investors will buy. And when the price falls further, long-term investors will buy more. Long-term investors have no wealth effects. Implicitly, they are assumed to have deep pockets. The liquidity provided by long-term investors provides an exit strategy for convergence traders during crises.

Convergence traders are subject to large wealth fluctuations when they are leveraged. Their wealth effect is therefore an important variable in determining their asset demand. With logarithmic utility, convergence traders have decreasing absolute risk aversion. As their wealth gets close to zero, these traders become infinitely risk averse. To prevent their wealth from going negative, convergence traders will use the liquidity provided by long-term investors to liquidate their risky positions as their wealth decreases. Without these long-term investors, there can be no equilibrium with only convergence traders and noise traders.

In the model there are three sources of uncertainty: the fundamental shock in asset A, the fundamental shock in asset B, and the noise trading shock in asset A. There are two state variables: the level of noise trading and the aggregate wealth of convergence traders. Due to the logarithmic utility, the total wealth of all convergence traders can be aggregated to represent their total risk-bearing capacity.

Kyle reported his results. Stochastic volatility is highest when noise traders are big sellers and convergence traders’ capital is depleted (as in a crisis) but not too small. Stochastic correlation is highest when volatility is highest. Convergence trader positions have positively correlated returns. Expected returns are most favorable when convergence traders’ wealth is low and noise trading is far from its mean. Noise traders are inelastic demanders of liquidity and long-term investors always supply liquidity. Convergence traders usually supply market liquidity but demand liquidity in crisis scenarios.

The model has important implications for risk management. The key insight is that in equilibrium the risks are endogenously determined by the trading of all market participants, and it may be dangerous to treat risks as exogenous in risk management. First, risk managers should recognize the wealth effect of convergence traders who use a short-term trading strategy. Second, risk managers should appreciate the importance of market liquidity provided by long-term investors in periods of crisis. Third, risk
managers should realize that correlation between assets tends to deviate from historical values and rise during crises in such a way that portfolio losses occur in all positions simultaneously. Failure to recognize these factors can result in under-estimation of volatility and correlation between asset prices, especially when the wealth amplification effect is severe.

Since market-created risks, such as contagion and volatility amplification by the convergence traders’ wealth effect, are only evident in extreme scenarios, studying historical data of asset returns and volatility tends to overlook or underestimate these risks, unless extremely long series of data are used. Even if very long series of data are available, the potential changes in the structure of the market can make it hopeless to determine these extreme risks from historical data. The model suggests that risk managers calculate their optimal risky positions after considering the capitalization and positions of other traders in the market.

Active Equity Management
Correlations & Convergence in Stock Returns

27. Understanding Comovement
(Spring 2005)

Nicholas Barberis, Professor of Finance, Yale School of Management made available a paper by himself, Andrei Shleifer and Jeffrey Wurglar, entitled “Comovement.” He began by observing that there are numerous patterns of comovement of stock prices in the data available. Common factors in the returns of certain groups of assets seem to affect stocks within the same industry, small stocks, value stocks and closed-end funds. His question was what is the source of this comovement, and why do certain assets commove while others do not?

The traditional view is that comovement is essentially based on fundamentals. Assets comove because their “fundamental values” comove. Another way of expressing this traditional view is that the fundamental value of a stock depends upon a rational forecast of future cash flows discounted at a rate appropriate for risk. Comovement then is caused by correlated news about cash flows or correlated changes in discount rates which in turn depend upon changes in interest rates, changes in risk aversion, and correlated changes in rational perception of risk.

There is evidence however, on comovement not based upon fundamentals. An example can be found in the two companies Royal Dutch, traded primarily in New York, with a claim to sixty percent of the cash flow of the Royal Dutch and Shell combination, and Shell, traded primarily in London with a claim to the remaining forty percent. Under the traditional view of comovement, we would expect them to move in lock step. In fact, Royal Dutch comoves more with the US stock market and Shell more with the UK market.

Another example can be found in closed-end country funds. While the funds are traded in one location, fund assets can be found in another. The fund returns comove as much with the market where the fund is traded as with the market where the assets are traded.

Barberis presented evidence on more examples that appear to challenge the traditional view of comovement. He suggested some reasons why many investors favor asset categories for investment. If categories are adopted by noise traders (irrational investors) with correlated sentiment, and if the noise
traders affect prices, then assets will comove simply because they are classified in the same category. Barberis proposed an example. We imagine a world in which there are 2n risky assets, with some investors grouping assets 1 through n in category X and other investors grouping assets n+1 through 2n in category Y. The categories are based essentially on sentiment, not on fundamental differences. Assume a shock \( f_M \) is a market induced shock that affects all of the assets, and that \( f_X \) and \( f_Y \) are shocks to the category X assets and to the category Y assets, respectively.

The consequence is:

For an asset \( i \) in X:

\[
e_{i,t} = \psi_M f_{M,t} + \psi_X f_{X,t} + \sqrt{(1 - \psi_M^2 - \psi_X^2)} f_{i,t}
\]

For an asset \( j \) in Y:

\[
e_{j,t} = \psi_M f_{M,t} + \psi_Y f_{Y,t} + \sqrt{(1 - \psi_M^2 - \psi_Y^2)} f_{j,t}
\]

where the \( f \) shocks are all i.i.d. over time, orthogonal to one another. The asset returns are given by:

\[
\Delta P_{i,t+1} = \varepsilon_{i,t+1} + \frac{\Delta \mu_{X,t+1}}{\theta_1} + \frac{\Delta \mu_{Y,t+1}}{\theta_2}, i \in X
\]

\[
\Delta P_{j,t+1} = \varepsilon_{j,t+1} + \frac{\Delta \mu_{Y,t+1}}{\theta_2} + \frac{\Delta \mu_{Y,t+1}}{\theta_1}, j \in Y
\]

so long as arbitrage is limited in some way, two assets in the same category comove not only because of correlated cash-flows news, but because of a correlated sentiment shock.

Barberis turned next to some predictions that are testable. Suppose that risky asset, \( j \), previously a member of Y, is reclassified as belonging to X. Then assuming a fixed cash-flow covariance matrix \( \Sigma_{\Delta x} \), the estimate of \( \beta_{j,X} \) in the regression

\[
\Delta P_{i,t} = \alpha_j + \beta_{j,X} \Delta P_{X,t} + \beta_{j,Y} \Delta P_{Y,t} + \nu_{j,t}
\]

rises after reclassification, while the estimate of \( \beta_{j,Y} \) falls.

Barberis reported a testing of the prediction based on entry into and exit from the S&P 500 index of individual stocks. To perform the test we calculate the average change in the beta with respect to the index, before entry and after exit, and the average change in the R squared. We also calculate the average change in beta with respect to the non-S&P 500 stock market following entry and following exit. Regressions are run daily, weekly and monthly. The form of the bivariate regression is then:

\[
R_{j,t} = \alpha_j + \beta_{j,S&P500} R_{S&P500,t} + \beta_{j,nonS&P500} R_{nonS&P500,t} + \nu_{j,t}
\]

A table reporting the changes in beta showed that S&P 500 inclusion is associated with a substantial and significant increase in beta with the S&P and a substantial and significant decrease in beta with the rest of the market. Barberis pointed out as well that the shifts in betas are economically as well as statistically significant. He turned to the possibility that there are alternative explanations for the beta coefficient results. One cause might be inclusion in the index of stocks increasingly demonstrating a particular characteristic associated with a cash flow factor. Another possible source is that a particular industry is making up more of the value of the index and that new inclusions are likely to come from that industry. Testing to explore both of these alternatives involved finding matching stocks for each event stock, matching on market cap at the time of inclusion and growth in market cap over the previous twelve months. These matching non-index stocks would come from the same industry as the stocks already examined. It was clear that the matching stocks did not show the behavior of the stocks entering and leaving the index.

A final alternative explanation might be increases in daily betas on
entering the index because the typical included stock will trade more frequently after inclusion. Checking on this simply meant seeing whether the results held for the subsample of stocks whose turnover actually decreased after inclusion. The effects were strong in the subsample, confirming the expected behavior.

28. Downside Correlation and Expected Stock Returns (Fall 2002)

Joseph Chen, Assistant Professor, University of Southern California, distributed a paper by himself, Andrew Ang, and Yuhang Xing entitled: “Downside Correlation and Expected Stock Returns.” Chen began with the motivation for the research. A fundamental tenet of finance is that investment decisions involve tradeoffs between reward and risk, and others have pointed out that investors really care about downside risk. This then suggests weighting losses greater than gains when measuring risk, and Chen and his co-author Ang had already found that the cross section of stocks in the US are more correlated with the market on the downside. The goal of the research here was to demonstrate that exposure to high downside risk commands high expected returns, and that this relation is not explained by market beta, size, book-to-market, and momentum effects, or by liquidity risk. A specific goal was to show that some of momentum profits reflect high exposure to downside risk. This work was supported by the Q-Group®.

Some have suggested that higher order moments maybe correlated with expected returns. However, sorting stocks by co-skewness or co-kurtosis produced no significant cross-sectional spreads in expected returns.

The next possibility had to do with downside and upside betas. Sorting portfolios on past downside betas (that is betas during periods when the market performance was below its average) did not produce significant differentiation in returns between highest and lowest decile past downside betas.

Betas can be decomposed into the product of a correlation coefficient and a ratio of stock volatility to market volatility. It turns out that across 48 industry portfolios the downside correlation is almost always greater than the upside correlation, but the downside volatility ratio is always smaller than the upside ratio. It seemed then that the volatility ratios, upside and downside, may mask some of the asymmetric nature of risk. So the focus turned to the correlation component, unaffected by volatility.

Sorting stocks on downside correlations, with daily data over a year, then ranking stocks into deciles and computing value weighted returns over the next month, led to an almost monotonic pattern in expected returns with a difference between the high and low deciles of 4.91% per year with a t-statistic of 2.26. There appeared to be no reward for upside correlations.

When the analysis was controlled for market betas, by sorting stocks into two groups: high-beta and low-beta, and then forming decile portfolios based on downside correlation, the decile difference increased to 6.95% per year. Controlling for the Fama/French size and book-to-market effects, increased the decile spreads to 6.55% per year.

Of particular interest was the question whether downside correlation was merely another way of defining momentum. When the data were sorted first into quintiles based on the past six months’ returns, and then sorted in quintiles by downside correlation, the spread for downside correlation was still significant. The same result was
reached when the first sort was into quintiles based on liquidity.

The researchers constructed a downside correlation factor called the CMC factor for “high Correlations Minus low Correlations.” The CMC factor goes long stocks with a high downside correlation, which have high expected returns, and short stocks with low downside correlations, which have low expected returns. More specifically, the factor is defined as the return on a zero-cost strategy of going long the downside beta balanced-high downside correlation portfolio, and shorting the downside beta balanced-low downside correlation portfolio. It turns out that the CMC not only prices the downside correlation portfolios but also forecasts economic downturns.

The analysis next moved to the momentum effect. Past winner stocks do tend to perform better than past loser stocks. The explanations for this tend to be behavioral. But what limits arbitrageurs from eliminating the profitability of momentum strategies? The answer given by the researchers is that momentum strategies have significant exposure to downside risk, and the arbitrageurs demand compensation for bearing that risk. Indeed, it turns out that the momentum strategy performs very poorly in a very bad market. Both momentum portfolios and downside correlation portfolios reflect downside risk. The CMC has some explanatory power for the momentum effect but the explanation is not complete.

In summary:

- Stocks with downside risk – measured by correlations conditional on downside moves of the market – have high returns.
- Controlling for Fama and French factors, the difference in returns between the highest and lowest downside correlation portfolios is 6.55% per annum.
- The factor structure in the cross-section rewards investors for bearing greater downside risk.
- Downside risk helps to price, but not completely explain, the momentum effect.
- The paper does not explain why assets exhibit variations in downside risk. Possibilities might be that downside risk can arise from:
  - Other preferences: Kahneman and Tversky (1979) and Gul (1991).

**Asset Allocation**

**29. Liability-Relative Asset Allocation (Fall 2004)**

M. Barton Waring, Managing Director and head of the Client Advisory Group at Barclays Global Investors, had made available two papers, “Liability-Relative Investing” and “Surplus Optimization with Beta, Alpha, and an Economic View of the Liability.”

He described his presentation as essentially putting together a number of the elements of defined benefit retirement plans that have been recognized for many years but rarely combined to produce an appropriate overall strategy. The traditional focus has been on asset allocation and estimation of liabilities, while it really
should be on the surplus or deficit (that is, the difference between the value of the assets and the value of the liabilities). And rather than attempting to optimize the asset allocation we should be optimizing the surplus. The asset efficient frontier should be replaced by the surplus efficient frontier. The minimum variance portfolio becomes the minimum surplus variance portfolio.

An important step towards establishing the surplus efficient frontier is treating the liability as simply a negative asset.

The return on the surplus, an important element in optimization, is easily expressed as the difference between the returns on the asset portfolio and on the liability, but Waring found it more useful to express this return scaled to the liability. So the following represents the surplus return as a fraction of the liability:

\[ R_{S(L)} = \frac{A_0}{L_0} \cdot R_A - R_L, \] where \( R_{S(L)} \) is the surplus return scaled to the liability \( L_0 \). \( A_0 \) is the asset value, \( R_A \) is the return on the assets, and \( R_L \) is the return on the liability.

The next step is to represent the asset and liability returns in terms of a risk free rate, market related return, and unsystematic return. When these are put together we have:

\[ R_{S(L)} = \frac{A_0}{L_0} \left( R_f + \beta_A \mu_Q + \alpha_A \right) - \left( R_f + \beta_L \mu_Q + \alpha_L \right) \]

where \( R_f \) is the risk free rate, \( \beta_A \) and \( \beta_L \) are the beta coefficients pertaining to the market rate of return \( \mu_Q \), and \( \alpha_A \) and \( \alpha_L \) are the unsystematic returns.

It is useful to restate the equation as:

\[
R_{S(L)} = \left( \frac{A_0}{L_0} - 1 \right) R_f + \left( \frac{A_0}{L_0} \beta_A - \beta_L \right) \mu_Q + \left( \frac{A_0}{L_0} \alpha_A - \alpha_L \right)
\]

we can now define the “surplus beta” as:

\[
\beta_S = \left( \frac{A_0}{L_0} \beta_A - \beta_L \right)
\]

The surplus beta is important because only beta risks can be hedged. Clearly if the asset and liability betas are identical, the surplus beta is zero. The asset and liability alphas, on the other hand, are likely to be uncorrelated and hence provide no hedge.

Continuing with the elements of a utility function, the surplus risk can be expressed as:

\[
\sigma_S^2 = \left( \frac{A_0}{L_0} \beta_A - \beta_L \right)^2 \sigma_Q^2
\]

\[
+ \left( \frac{A_0}{L_0} \right)^2 \omega_A^2 - \frac{A_0}{L_0} \omega_{A,L} + \omega_L^2
\]

where \( \omega_A \) and \( \omega_L \) are the standard deviations of the asset and liability alphas, and \( \omega_{A,L} \) is the covariance.

Finally, the utility maximizing statement is:

\[
\text{Max}(U_s) = R_s - \lambda \sigma_S^2.
\]

The equation can be expanded, making use of the preceding equation, to identify a beta-related surplus utility, and a surplus residual utility.
Waring turned next to modeling the economic liability. We use a market-related discount rate appropriate to the liability for valuation purposes, and Waring showed an estimation table, matching the use of long bonds, long TIPS, domestic equities and foreign equities to retired lives, active beneficiaries with accrued benefits, active future beneficiaries, and future lives. The expected returns on the asset classes and the percentage of each class used for each type of beneficiary made possible the calculation of a present value-weighted average discount rate for the overall plan.

For hedging purposes we should recognize two kinds of duration: inflation rate duration and real interest rate duration. TIPS are particularly useful here, because the inflation rate duration is zero. Long nominal bonds and equities will have both kinds of duration. Matching the dual durations of the assets to those of the liability can then be used to immunize the surplus. Waring described the liability real interest rate duration as typically long, about 12 to 25 years. The inflation duration is typically less than 10 years and will approach zero in the case of cost-of-living adjusted retirement benefits.

Waring continued with a discussion of the importance of funding ratios, and pointed out that where the liabilities are under-funded, the optimal asset beta for a minimum surplus variance portfolio is higher than the beta for the liability. A heavier reliance on equities is then indicated, although intuition might suggest that moving to the safety of bonds would be appropriate.

30. Asset Allocation Decisions and Sponsor Valuation (Fall 2004)

André F. Perold, Sylvan C. Coleman
Professor of Financial Management, Harvard Business School, began with a reminder that for a typical large defined benefit pension fund the ratio of pension assets to the market capitalization of the company is about 2:1 and a 60% equity allocation means that the equities in the pension fund are 1.2 times the market capitalization of the firm. The pension fund then is an enormous component of the financial structure of the firm itself. He next showed the funded status of plans for the S&P 500 companies for 1991-2003. In 1999, the plans had a $280 billion surplus, and in 2002 a $219 billion deficit. Perold referred to some pension initiatives coming from FASB, the rating agencies, Congress, the Treasury, and the Pension Benefit Guarantee Corporation. An interesting proposal from the PBGC was to relate the premium to the equity exposure. There are predictions that penalizing the use of equities might spell the end of defined benefit pension plans.

The General Motors pension fund presented an interesting example of what happened from 1999 to 2002. Pension assets dropped from $87.5 billion to $66.8 billion, a surplus of $4.5 billion went to a deficit of $25.4 billion, the book value of shareholder equity dropped from $20.9 billion to $6.7 billion, and the market value of the equity from $39.7 billion to $20.4 billion. The impact of the pension fund performance on the company was substantial. Perold observed that in 2003 General Motors borrowed $17 billion and invested $13 billion of it in the pension fund. The stock price actually rose, which he found puzzling. This was a matter he was to return to later in his presentation.

A number of slides illustrated the co-movement of US stocks and bonds. For the US and for a number of other countries, it appears that interest rates and inflation can be considered proxies
for business conditions. When inflation is moderate and stable, bonds go up and stocks go down when the business outlook gets worse, and vice versa when it gets better. When inflation is high and volatile, unexpected inflation is either bad for stocks as well as bonds or good for both. These conclusions suggest ways of anticipating future correlations of stocks and bonds.

To show the consequences of different correlations, Perold proposed a portfolio invested 60 percent in stocks with a standard deviation of 16%, and 40 percent in bonds with a standard deviation of 14%. As the stock-bond correlation went from 50% to 0% to -20%, the portfolio standard deviation for the investor went from 13% to 11% to 10%. But for the defined benefit plan, for which liabilities represent a short position in bonds, the standard deviation rose from 9% to 13% to 14%, as the correlations dropped.

Under-funding of pension liabilities can be thought of as a put option, and over-funding as a call option. If the plan is terminated, in bankruptcy for example, the under-funding is passed to the PBGC or simply to the beneficiaries as their loss. The firm has a call option on over-funding in that it may be able to recover the surplus even if only by reduced future contributions. Both options, of course, work in favor of the firm. The claim of a pension beneficiary can then be considered to consist of the promised benefit, less the put option, plus any Government insurance collected. An interesting question is whether shareholders in the firm place any value on the pension put. Perold suggested a number of characteristics of the firm and the pension plan that might be taken into consideration in valuing the put. He turned next to describe a pension model, one using ten different sets of assumptions, by way of simulations.

For the ten cases, Case A was the base case. Assumptions were a stock-bond correlation of 0.5, a cost of financial distress at 0%, initial funding at 100%, operating assets at $100, company debt at $50 and the equity allocation in the pension fund at 60%. Cases B through I were based on assumptions differing from those for case A.

Simulation results were shown for the deficit at termination (the put option), the surplus at termination (the call option), the benefit in the form of a contribution holiday, the penalty in the form of required funding, the probability of bankruptcy, and the end-of-period market value of the company’s equity. The initial consolidated net worth was simply the initial operating assets less the initial company debt less the initial under-funding of the pension, plus the initial over-funding. The market value of the equity was the initial consolidated net worth plus the deficit at termination, the put option.

Some conclusions that could be reached from the ten sets of simulations were:

- With the stock-bond correlation changed from 0.5 to -0.5 (case B), the put option rose significantly, as did the market value of the equity, and the bankruptcy probability.

- With the initial pension funding at only 80% (case C), the put option value rose, but the market value of the equity was relatively low.

- With only 80% funding and no equity allocation (case D), the put option was modest, but the bankruptcy probability very high.

- With 100% funding and no equities (case E), we had essentially immunization, with no put or call value, and the market value
unchanged from the initial consolidated net worth.

- Initial over-funding at 120% (case F) led to a small put option and a low probability of bankruptcy.
- Increasing initial operating assets from $100 to $300 (case G) led to a very low probability of bankruptcy and a very small put option.
- Introducing a cost of financial distress (case H) increased the probability of bankruptcy.
- Funding at 80% combined with no equity investment and a cost of financial distress (case I) produced no put option and a market value of the equity somewhat below book value.
- Finally, a simulation set up to resemble General Motors after its borrowing in 2003, to restore full pension funding (case J) led to a lower market value of equity. This was the result that had seemed logical to Perold in the actual GM case and he remained puzzled at the fact that the market capitalization had actually risen in that case.

31. Pension Risk Management: Modeling the Pension Liability (Fall 2004)

William Marshall, President, NISA Investment Advisors, LLC, began with the problems facing pension plans, following a period of poor asset performance, dramatic increases in liability present values, and surplus volatility greater than asset volatility, leading to the conversion of substantial surplus into substantial deficit in just a few years.

He discussed in some detail the differences between the positions of the plan sponsor and the fiduciary. Plan sponsors have authority to make contributions, terminate the plan, amend the benefit agreement, add participants and apply surplus funding to other plans. The fiduciary, on the other hand, is responsible for managing assets of the plan solely in the interest of participants, for the sole purpose of providing benefits, acting prudently, and avoiding conflicts of interest. If the sponsor plays any role as a fiduciary, in the investment of plan assets for example, then the sponsor takes on the fiduciary responsibilities.

Marshall’s own organization has been very sensitive to the issue of fiduciary responsibility and just how this responsibility affects the behavior of the sponsor. Some plan participants, or their representatives, may be ready to cause trouble over a sponsor’s alleged violation of fiduciary obligations, and there are many ambiguities as yet unresolved in the ERISA Rules.

At the same time, accounting and actuarial practices seem to have gotten in the way of managing the economics of the pension plan. For example, a view that the discount rate for liabilities should be stable over the long-run conflicts with a recent and current realization that a sharp decline in interest rates has a very real impact on the present economic value of the liabilities.

An interesting question posed by Marshall was whether the fiduciary, in managing the risk of the asset portfolio can take into consideration the PBGC insurance as a factor helping to reduce the risk to beneficiaries. He is doubtful that the fiduciary is free to do this.

Returning to the separate responsibilities and authorities of the plan sponsor and the fiduciary, Marshall discussed attitudes toward a funding surplus. He described the fiduciary as an investor having no incentive to produce surplus, because a
surplus does not benefit the plan participants. Some of those attending the seminar raised some questions about this view. The plan sponsor, on the other hand, will do its best to capture a funding surplus. One way is to reduce contributions. Another is to increase benefits, and Marshall referred to financial products that the sponsor may make use of.

Marshall turned to methods of hedging the duration risk in the liability. The most obvious was probably allocation of assets to long-duration bonds. The addition of interest rate swaps can substantially increase the hedge. Finally, allocation to fixed income plus interest rate swaptions can still further increase it. Marshall showed a representative pension hedge program, listing the asset allocations with their assumed volatility for a plan with $3.2 billion in assets and $3.5 billion in liabilities with a 12-year duration.

He closed with the outline of a dynamic simulation model, and identified emerging issues in the management of pension plans as:

1. Strategies for troubled plans
2. Choice of pension liability to hedge
3. Price level sensitivity of the pension obligation (CPI and wage inflation)
4. Interest rate sensitivity of equity
5. The strategies of sponsor and participant

32. Asset/Liability Management: Theory and Practice (Fall 2004)

William F. Sharpe, STANCO 25 Professor Emeritus, Stanford University and Fellow of the Institute, had taken on the assignment of reviewing and discussing the preceding three presentation on pension risk management. He emphasized that he wanted to deal with practical issues. A quick review of what has happened in recent years led to agreement among almost all of the seminar participants with Sharpe that the defined benefit system is a mess. He next referred to the shift in stock-bond correlations that had been discussed by André Perold and observed that wage inflation is also a factor in the correlation changes.

He turned to the contrast between defined benefit and defined contribution plans, and suggested that the defined benefit plan may be outdated. There has indeed been a significant shift from 1978 to 2003 from defined benefit to defined contribution plans, in both asset size and number of plans. Demographic shifts have also suggested that the defined benefit plan is not as appropriate as it once was.

Turning to asset allocation policy, he observed that the process of setting the policy and implementing it is slow and cumbersome and asked the participants whether asset allocation policy should assume efficient markets, to which the response was general agreement.

Turning to the difference between the use of present assets and ABO (accrued pension obligation) or present assets and PBO (prospective benefit obligation) as the basis for asset allocation policy, he found widespread agreement among the seminar participants that the former was preferable.

His next topic was the discount rate to be used for liabilities, and he reviewed the rates that actuaries are currently using. There seemed to be wide agreement that asset allocation policy should be based on an ABO liability discounted at the Treasury rate.
He discussed some of the explication of surplus that had been set out by Barton Waring (No. 29), including the surplus relative to liabilities, and agreed with Waring that we need dollar values and not just percentages. He proposed going beyond Waring’s CAPM model, to a multi-factor model.

He continued with a discussion of ways to present to decision makers the implication of alternative investment strategies. Waring had suggested some graphical displays that can be helpful.

He turned next to the issue of macro-consistent investment forecasts. We may think these are the forecasts we are making, but if optimization analyses without constraints are producing implausible portfolios for a wide range of risk tolerances, and require arbitrary upper and lower bonds on asset proportions, then our forecasts are not macro-consistent. And in particular they are not consistent with current market values.

Finally, he discussed an optimal procedure for revising asset allocation policy, and specifically rebalancing. The common practice is rebalancing to prior asset allocation ratios, which Sharpe characterized as essentially a contrarian strategy. He suggested rebalancing that restores not the original percentage allocation among asset classes but the original differences from market weights. An interesting observation was that over a long period, from around 1980 to the present, the average equity allocation had been just about 60% for US pension funds.

The moderator was Martin L. Leibowitz, Managing Director, Morgan Stanley, and the speakers were Keith P. Ambachtsheer, President, KPA Advisory Services, Ltd., Robert D. Arnott, Chairman, First Quadrant and Research Affiliates, LLC, William W. Jahnke, President, Comprehensive Wealth Management, and Robert B. Litterman, Managing Director, Goldman Sachs & Company.

The use of a policy portfolio, sometimes referred to as the product of strategic asset allocation, has been challenged recently, apparently as the result of the steep rise in stock prices during the 1990’s, followed by the steep decline. Leibowitz began by setting out a number of questions pertaining to the policy portfolio and asked the speakers in turn to present their views.

Jahnke quoted excerpts from his preliminary paper “Death to the Policy Portfolio.” He supported the opinion of Peter Bernstein to the effect that “policy portfolios are obsolete.” Jahnke described the theoretical foundation of the policy portfolio as the random walk model, and said that the assumptions underlying that model are incorrect. He had written: “the policy portfolio became the dominant asset allocation paradigm in the 1990s despite rejection of the random walk model in the highest academic circles. Financial planners were comfortable with the policy portfolio. The idea of setting an asset allocation in accordance with the client’s ability to sleep at night and sticking with it became dogma. It was not until the market correction that began in March of 2000 and a growing awareness in the financial planning community that historical returns can overstate what investors can expect from the stock market in the future that financial planners began to question the soundness of the policy portfolio. What financial planners should find disturbing is how easily the community
was persuaded by faulty academic arguments promoted by the commercial interests of consultants.”

In concluding, he had written: “In terms of forecasting asset class returns, it is still as difficult as it always has been, but making forecasts with fundamental variables provides more realistic inputs for asset allocation than extrapolation of historical risk premiums. This will lead to better investment solutions, more realistic financial plans, and more successful financial outcomes for many clients. In a world where stable equilibriums and central values are myths, the policy portfolio is a crutch for those who prefer to operate in a fantasy world. The policy portfolio is not just obsolete; it was never a valid proposition. The policy portfolio deserved to be buried.”

Ambachtsheer spoke next. He had made available his “Letter” of September 2003, entitled “The Fuss about Policy Portfolios: Adrift in Institutional Wonderland.” He too began with the observations of Peter Bernstein. Ambachtsheer then stated: “The reason why policy portfolios should be abandoned is because they have become a dysfunctional barrier between investment professionals, the fiduciaries accountable for setting risk policy in pension and foundation balance sheets, and the beneficiaries/stakeholders in those balance sheets.” He was particularly concerned that the use of policy portfolios generally ignores liabilities. Yet a major risk to retirement funds lies in a mismatch between the asset portfolio and the corresponding liabilities. Put very simply, a change in the level of interest rates can have an impact on the present value of the liabilities of a retirement fund very different from what it has on the value of the assets. A decline in interest rates, for example, may dramatically increase the present value of the liabilities while increasing the value of the assets to a much lesser extent. He said in his paper “Only in asset-liability space can we think constructively about risk, and how much of it the balance sheet stakeholders, can, want to, or should undertake.” He quoted from a study using the Cost-Effectiveness Measurement, Inc. database, which found that policy portfolio mismatch risk is far greater than active management risk. He summarized the findings as: “While the active investment managers were making a few billion dollars in profits for these 89 funds over the course of the last three years, the policy portfolio decisions of these 89 funds were at the same time costing their sponsors many hundreds of billions of dollars in balance sheet losses. Clearly, there is something wrong with this picture.”

The organizational problem he saw was that “with a few notable exceptions, no-one is accountable for dynamically managing balance sheet risk in pension and endowment funds. So the most important risk doesn’t get managed at all. Had the asset-mix policy risk been dynamically managed over the 1998-2002 measurement period, that risk would never have been allowed to balloon to the 20% volatility level indicated by the CEM database. Any fund managing to a 10% maximum risk budget would have been forced to reduce equity exposure as the risk needle went through 10% on its way to 20%.”

Litterman, on the other hand, defended the use of policy portfolios. Recognizing the importance of the risk of mismatch between assets and liabilities, he suggested separating the liabilities from the rest of the asset allocation decision. Derivative markets are well enough developed to allow us to hedge the interest rate risk in liabilities with swaps, and then to proceed to allocate assets. The policy portfolio considers what is offered by a
passive investment strategy, and then we can go on to look at active opportunities. In a series of three letters to investors that he had made available as “Active Alpha Investing”, he identified and discussed interest rate risk (that is, the asset/liability mismatch risk), market risk (that is, exposure to overall equity market returns), and active risk (all other sources of risk in the portfolio). He described the advantages of separating these three risks and went on to discuss the case for more active risk. He concluded by commenting that he believed Peter Bernstein’s comments on policy portfolios really indicated an endorsement of market timing. He believes there are much better ways to use investment skills.

Arnott had made available a series of commentaries from the “Editor’s Corner” in the Financial Analysts Journal. He too advocated multiple measures of risk. He also spoke of performance benchmarking as one of the most influential developments in institutional investing since the 1970s. He wrote: “Benchmarking is not without merit. What can be measured will be measured and indeed should be measured”. He continued, “But benchmarking has been used to suppress risk against a benchmark rather than to select and manage acceptable risks that are likely to deliver profits,” and “A benchmark must bear some resemblance to the obligations that a portfolio is intended to meet and should be used to gauge risk, not to suppress it.” He proposed three objectives for a benchmark:

2. Deliver positive real returns and avoid material losses. A protracted drop in asset values is unnecessary in a world where some markets are always providing positive returns. This objective implies a quest for maximum Sharpe ratios.

3. Deliver performance above peer medians. Why? A shortfall relative to peers leads to incremental funding costs, relative to peers, which weakens the competitive position of the sponsor. Designing a benchmark to meet this objective requires some sensitivity to the normal asset mix of one’s peers.

He wrote: “Among the three distinct objectives, most sponsors focus almost exclusively on the third, which is arguably the least important.” But “An investor should demand acceptable risk, measured against all three objectives.” He described two strategies that “would have soundly out-paced a passive 60/40 portfolio, with less volatility, over the past 16 years. Yet, despite implausibly large alphas, neither strategy would be likely to survive today’s benchmark-crazed investment world.” In response to argument that defeasing liabilities can be separated from asset allocation, he expressed doubts about who would buy the instruments that had to be sold. Building on some of Ambachtsheer’s statistics, he suggested identifying three sources of risk and allowing the investment committee to balance those exposures.

Leibowitz turned next to the audience of participants as well as to the speakers and proposed a series of questions, inviting responses. His first question was whether the policy portfolio is pragmatically helpful. Arnott answered that it is a necessity, but is not typically used properly. While easy to use, it has no value unless multiple risks are considered. Jahnke said it was satisfactory if the policy is dynamic and is set in terms of ranges.
Ambachtsheer answered that a balance sheet based risk budget is more useful than a policy portfolio. Litterman said the use of the policy portfolio is both easy and valuable.

Leibowitz’s next question was whether the process of establishing a policy portfolio should incorporate liability considerations. All of the speakers answered yes, but there were suggestions that the liability issue might be separated from the risk/return policy. Michaud suggested that we may not be defining liabilities satisfactorily.

Leibowitz asked whether the policy portfolio should be defined as involving “neutral” asset allocation. Arnott said yes, but what is neutral will change over time. The borderline between strategic and tactical asset allocation is blurred, since the strategic normal mix is not static in the long run. Jahnke said that the concept of “neutral” should be dynamic and expressed in terms of ranges. Ambachtsheer responded “no” to the question. We should start with liabilities, consider the mismatch risk, and end up with an allocation. Litterman said separate out the hedging of liabilities, and then go to a “neutral” allocation, deciding how much risk should come from asset allocation and how much from market risk.

Leibowitz asked whether after having considered the liabilities, we should then define policy in terms of asset class weightings. Ambachtsheer repeated his assertion that asset class weights should be outcomes of the management process, not the starting point. This new dynamic approach should be extended to performance measurement. The performance benchmark should be the liability portfolio, not the old asset mix policy portfolio. Jahnke concurred that a neutral policy portfolio is not a useful concept. Ambachtsheer said that performance will be measured against a policy portfolio, and we have to recognize this. Jahnke said we should not set a “neutral” policy. Ambachtsheer said we should begin with the set of different risks.

Leibowitz then suggested starting with inefficiencies, looking for alpha, then use swaps to deal with liabilities, and then move on to consideration of beta and asset classes. One response was to begin with risk allocations rather than asset classes, and then move on to alpha risk. There was some disagreement over the sequence for consideration of liability risk, equity risk, and active management risk. One argument was that we should start first with liabilities and stakeholder risk tolerances, set a balance sheet-based risk budget, and dynamically maximize net expected surplus return over time. Asset allocations fall out of this process. They are not predetermined.

Leibowitz suggested that we might start with the most predictable risk and go on to the less predictable. He asked why institutions have not dealt with liability risk and then gone on to asset allocation. Ambachtsheer commented that most public sector pension plans have a structural incentive to consider both assets and liabilities in establishing balance sheet risk policies. Some actually do this. Unfortunately, this incentive does not exist in corporate plans. Typically, HR worries about the benefits, and Treasury about the pension fund. With this segmentation, taking an integrative approach is very difficult. So corporate pension funds are generally managed in asset-only space. Arnott suggested that peer group comparisons have dominated. Strongin pointed out that ease of measurement is important and what is optimal for the benefit of the institution may differ from what is optimal for measurement. Performance measurement requires a benchmark.
Leibowitz asked about risk budgeting as a substitute for asset allocation, but wondered whether they are the same thing. If risk choice leads to a spot on the efficient frontier, how does that differ from asset allocation? Put another way, the risk budget combined with market assumptions leads to asset allocation.

Leibowitz next raised the question of the responsibilities of the investment committee. Ambachtsheer and Arnott both expressed dissatisfaction with the manner in which investment committees operate. Their function should be one of governance rather than implementation. Leibowitz suggested that the investment committee should “own” the policy dealing with asset allocation and risk. It was suggested that ERISA had brought about a major paradigm shift, and as a practical matter it is difficult to find a satisfactory alternative to conventional asset allocation.

Leibowitz switched from defined benefit to defined contribution plans, where the client is the individual rather than the institution. There should at least be no agency problems here, but can we say anything about policy portfolios? It was pointed out that a problem unique to institutions is that while some people work on the pension liabilities, quite different people work on asset management. And in fact dealing with that issue may have to precede much of what had been talked about so far at this seminar.

The session ended with a general affirmation that we need to think more about defining the policy portfolio to incorporate risk terms rather than relying entirely on return.

34. Segmentation, Illiquidity and Returns (Spring 2003)

Jeffrey Diermeier, Chief Investment Officer, and Renato Staub, UBS Global Asset Management presented a paper entitled: “Segmentation, Illiquidity and Returns.”

Diermeier put the liquidity issue in a historical context, as well as in the context of asset allocation models. When “alternative assets” are to be included in an asset allocation model, compensation for their illiquidity may be captured in the estimated return but not in the estimated risk. And to avoid unacceptable allocations to alternative assets the optimization must often be constrained. The problem is exacerbated today because of recently increased interest in alternatives combined with recent losses in value coupled with inability to sell these illiquid investments.

The definition of liquidity is not entirely clear and as more than one speaker suggested, different definitions are appropriate for different purposes. Transaction cost measures, such as the bid-ask spread may be appropriate in some cases but the problem with alternative assets is that they are not tradable at any cost for significant periods of time.

Staub took over the presentation with a discussion of the literature. Most of the literature is not relevant in the context of long-term investing, as it is trading-based. Within the relevant literature, three articles stand out on the subject of discounts for illiquidity. Silber (1991) found a 34% average discount for 2-year illiquidity from an examination of stocks subject to SEC Rule 144. Chaffe (1993) thinks a fair discount for illiquidity equals the value of a put option. Smith et al. (2000) think large illiquidity discounts are not justified economically. Staub offered a number of criticisms of this literature and judged that most studies overestimate illiquidity compensation.
In developing a model, he referred first to the integration/segmentation approach that they employ for modeling returns of all assets, whether liquid or illiquid. An integrated market is a world wide market, while a segmented market is one where the marginal investor is a local investor, since it is subject to barriers to free capital flow. In an integrated market the investor is compensated for market risk while in a segmented market the investor is compensated according to total risk. In reality a market is neither fully integrated nor fully segmented, and its risk premium will be estimated based on a weighted average depending on the degree of integration and segmentation.

For determining the illiquidity compensation, the authors provide a Sharpe ratio approach and an amended put option approach. The Sharpe ratio approach claims that it is useless to judge an asset by its annualized Sharpe ratio, if it is locked in for longer than one year. Rather, a multi-period Sharpe ratio, SR(T), for the asset’s lock-in time, T, should be considered. It is calculated by taking the difference between the asset’s expected wealth at the end of the lock-in and the expected wealth of the risk-free asset at the end of the same time span — i.e. the asset’s expected excess wealth — and dividing it by the distribution of the expected excess wealth. It turns out that SR(T) is a non-linear function in T. First, it increases with increasing horizon T, and then it decreases. The model claims that there is an incentive to invest in the illiquid asset only if its SR(T) is at least as large as SR(T) of the reference portfolio (the entire market).

The second approach is the amended put option approach. The authors assume a risky asset whose continuous return is fully reinvested. Its expected value after a discrete period is larger than its median value as represented by compounding its continuous rate of return. The reason for the difference is the asymmetric effect of risk through compounding. This asymmetric return effect applies to both liquid and illiquid assets, and illiquidity simply means a commitment to stay exposed to it over the length of the lock-in. The approach claims that a commitment to stay exposed justifies free insurance of the asymmetric return effect. In other words, it claims free insurance of the expected value vs. the median value, which is measured by the difference between the values of two put options, one with an exercise price equal to the expected value and the other with an exercise price equal to the median value. The difference is considered the discount for illiquidity.

Both approaches are applied to an integrated and a segmented market. They provide the total return, rather than either a risk premium or an illiquidity premium. In order to obtain the illiquidity premium we must back it out by comparing the case of a zero lock-in. Both approaches lead to fairly consistent results. Staub presented a table for a variety of alternative assets. For early-stage venture capital, for example, with a systematic risk of 25% and a total risk of 45%, the resulting illiquidity premium is 7.4%, while for late-stage venture capital with a systematic risk of 21% and a total risk of 35%, it is markedly less, at 2.9%. The reason for the significant reduction from early to late stage is both the risk reduction and the shortening of the lock-in.

His final conclusions were:

- Illiquidity premia are a compensation for locking in investments.
- Illiquidity premia are an integral part of an investment’s equilibrium return and are an essential factor in deriving asset allocation policy.
• Investors who are able to wait should expect to be rewarded for assuming illiquidity.

• The illiquidity premium is not a free lunch – the higher expected return is compensation for the cost of reduced investment flexibility.

• The premium for illiquidity is larger when:
  — The length of the lock-in period is greater (less flexibility)
  — The risk of the investment is higher (greater uncertainty)

35. The Mean-Variance-Liquidity Frontier (Spring 2003)

Andrew W. Lo, Professor of Finance, Sloan School of Management, MIT, offered a paper by himself, Constantin Petrov, and Martin Wierzbicki entitled: “It’s 11 pm – Do You Know Where Your Liquidity Is? The Mean-Variance Liquidity Frontier.”

As had the previous speakers, Lo began with the challenge of defining liquidity. Whatever it means, it has come to be an important topic in the world of portfolio management and proprietary trading. It has shown up more frequently in the academic literature of the past 4 or 5 years, and in the “practical” literature for still more years. In undertaking to integrate liquidity into portfolio management, Lo began by defining five possible measures of liquidity: trading volume, logarithm of trading volume, turnover, percentage bid/ask spread and the Loeb (FAJ 1983) price impact function. The first three variables measure the amount of trading, and the last two measure the cost. The authors began by computing each of the five measures with daily data and then aggregating the daily measures to yield monthly quantities. The five monthly measures were then renormalized. Let \( \tilde{l}_{it} \) represent one of the five liquidity variables for security \( i \) in month \( t \). Then the metric \( l_{it} \) is defined as

\[
l_{it} = \frac{\tilde{l}_{it} - \min_k \tilde{l}_{kt}}{\max_k \tilde{l}_{kt} - \min_k \tilde{l}_{kt}} \in [0, 1]
\]

The authors followed three methods of establishing mean/variance/liquidity portfolios. The first type is liquidity-filtered portfolios. Each security is passed through a filter, and only those that show a liquidity no lower than the minimum acceptable level pass into the portfolio selection process. Liquidity constrained portfolios are constructed such that only portfolios with liquidity meeting the minimum constraint are acceptable. Liquidity-optimized portfolios are constructed by adding a liquidity term to the mean/variance model. That is, the objective is to maximize expected portfolio return minus a risk aversion coefficient multiplied by the risk measure plus a liquidity preference factor multiplied by the portfolio liquidity.

A sample of fifty stocks, consisting of five stocks randomly selected from each of ten size deciles formed the basis for the portfolios in the authors’ empirical example. Daily and monthly CRSP data from January 1997 to December 2001 were used together with more recent TAQ data for computing average bid/ask spreads. In presenting a table of summary statistics, Lo pointed out that the correlations among the measures of liquidity were relatively low, indicating that each measure provided incremental information not completely contained in the others.

He presented tables showing the expected performance statistics for the liquidity-filtered portfolios as the minimum acceptable liquidity level was increased. As the filtering barrier was raised, the Sharpe ratio declined in general. Lo pointed out, however, that
in months where the market appeared to offer significant liquidity, the sacrifice in Sharpe ratio for an increase in the liquidity barrier was very small, while for a month in which market liquidity appeared low, the sacrifice in Sharpe ratio was quite high.

Greater insight could be gained from a three-dimensional representation, where the three axes represented the liquidity filter level, the expected return, and the standard deviation. For March 2000 for example, when it appeared that the market offered plenty of liquidity, as we move up the liquidity axis, we come very slowly into a region of mean/variance inefficiency. Somewhat the same effect could be seen in a three dimensional presentation of the tangency trajectories for various months. And finally a graph of the Sharpe ratio profiles for changes in the liquidity filter level showed significant differences from month to month. Lo showed the same graphs for the liquidity-constrained portfolios, and in contrast to liquidity-filtered portfolios, the liquidity-constrained portfolios were much better behaved, yielding better risk/reward trade-offs for a given level of liquidity than their filtered counterparts, and offering considerably smoother mean-variance-liquidity frontiers as the liquidity levels are varied.

Summarizing the results of the empirical analyses, he said:

- Liquidity Can Often Be Enhanced Without Much Cost
- Liquidity Varies Over Time
- Liquidity Varies With Market Conditions
- Liquidity Can And Should Be Actively Managed

36. The Equity Risk Premium Puzzle (Spring 2002)

J. Peter Williamson, the Laurence F. Whittemore Professor of Finance Emeritus at the Amos Tuck School of Business, Dartmouth College, made the first of three presentations dealing with the outlook for the equity risk premium. He reviewed and commented on the conference sponsored by AIMR and held at the offices of TIAA-CREF on November 8, 2001. Eight speakers and four moderators at that conference (most of them past speakers at Q-Group® seminars) had given their judgments. Two of the speakers — Roger Ibbotson and Clifford Asness — were to present their conclusions following Williamson’s session. Transcripts of the presentations and the discussions on November 8 will be made available on an AIMR website.

He began with the meaning of the equity risk premium. The speakers on November 8 generally agreed that it is the real, rather than the nominal, rate that interests us. There were differing opinions as to the risk-free rate on which to base the premium. TIPS (U.S. Treasury inflation protected securities) offer an appealing choice, but some would stick with traditional long-term U.S. government bonds, so long as we are thinking long-term. The speakers generally chose the S&P 500 Index and its predecessors as the appropriate representation of equities, but Williamson pointed out that for many investors there are more important sets of equities. The time horizon for an estimate of the premium can be important, depending upon whether it is tactical asset allocation (short-term) or strategic asset allocation (long-term) that the investor is concerned with. Some of the speakers on November 8 were concerned with the premium as of that date and therefore at a particular state of the market, while others were thinking of a long-term premium, not
necessarily anchored to a particular point in time. And finally, is it the expectation of experts that interests us, or the expectation of investors in general? Some may feel that investor behavior will determine where the markets go, while others will have more confidence in economic logic.

Three quantitative methods for estimating the premium are: 1) extrapolating history, 2) applying demand side analysis, and 3) applying supply side analysis. (A fourth method, behavioral and largely non-quantitative, was also to be discussed.) Williamson showed a table of historic returns confirming a historical average real rate of return on equities of roughly 7% over many past periods, long and short. His own table of past returns, based on the Ibbotson Associates’ data from 1925 to 2001, showed that over this period the arithmetic average real return on large capitalization stocks was 9.4%. The geometric average, regarded by most experts as the more significant, was 7.4%. The 2% difference, exactly one half the variance in return (the standard deviation was the familiar 20%), is what we would expect from a fairly long period of data. The trend line excess real rate of return on the stocks was 7.1%, close to the geometric average.

Williamson expressed a preference for the trend line rate over the geometric average, since the latter is calculated from only the first and last data points in the series, while the trend line makes use of all. He noted that the trend line rates of return were close to the geometric averages except in the case of real rates of return on long-term corporate and U.S. government bonds. Examining the reason, he showed graphically that for the stocks, the returns followed a trend line very closely (the R squared was .95), but for the bonds the returns followed a path far from the trend line (the R squared was only 0.2). The graph raised three questions. Of the geometric average and the trend line return rates, which was the more representative of the bond rate of return over the 76 years, or was either? Did the graphs for stocks and long-term bonds confirm that stocks were really riskier than bonds? And did the dramatic upswing in bond returns over the most recent 20 years suggest a “bond bubble” that roughly paralleled the stock bubble of the 1990s, and if so, what did it suggest for the coming decade or two?

Second was the demand method, one that examines investor expectations to forecast the premium. The focus is on the P/E, its historical average, and the likelihood and effect of a decline from the recent high levels. Williamson noted that about 1.25% of the historical arithmetic average return on stocks was accounted for by a rise in the P/E, so we might reduce the historical average by this amount for forecasting purposes.

The supply method focuses on what corporations can be expected to provide in the form of earnings, dividends and growth in the years to come. Williamson set out a variety of formulas that had been proposed on November 8, all of them variations on the dividend (or earnings) growth model proposed in 1938 by J. B. Williams in his book, The Theory of Investment Value.

A table of real premium forecasts from the November 8 meeting showed numbers ranging from 0% to 4%, all or most pertaining to the long-run, with some based on markets as of last November 8 and some representing expectations not anchored to a particular market level. Given a 20% annual standard deviation in stock market returns, there was some question how one might distinguish the reliability of forecasts at 0% from those at 4%, for planning purposes.
Turning next to behavioral finance and asset allocation, Williamson described much of the behavioral discussion last November 8 as helping to explain apparent inconsistency between investor behavior and the magnitude of the past excess return on stocks. It also produced some survey evidence of investor expectations.

The most publicized advice on the equity returns and the implications for asset allocation have been those of Robert Shiller, a speaker on November 8 and author of Irrational Exuberance, first published in March 2000, and of a number of papers, including “Bubbles, Human Judgment and Expert Opinion” commissioned by Commonfund and published in early 2001. Williamson inferred from the book and the paper, as well as from what Shiller had said on November 8, that while Shiller never uses the word “timing” and never recommends selling stocks, his message is clearly that stocks are and have been grossly overpriced and should have been (and still should be) sold, and that institutions, especially colleges and universities, have been irresponsible in not selling. This led to the question whether it is appropriate for trustees to time the market on the basis of return expectations.

Shiller’s implied advice relied on regressions of P/E ratios and subsequent ten-year average returns on stocks. Williamson showed such a regression, using the Ibbotson Associates data. The graph showed a downward sloping regression line, with an R squared of about 0.4, confirming the conclusion that P/Es and subsequent 10 year returns have been negatively correlated. He suggested that the regression serves as a useful warning but questioned whether it is reliable for timing, showing a graph of predicted and realized 10 year returns.

Shiller’s published conclusions in March 2000 were brilliantly correct. But Williamson recalled that in December 1996 Shiller and Campbell had shown the Federal Reserve Board that stock prices were then irrationally and unsustainably high, a showing that prompted Chairman Greenspan to repeat the message publicly two days later. On the day of the presentation to the Board, the Dow Jones Industrial Average closed at 6443 and the S&P500 Index at 748. Williamson’s conclusion was that market timing, even by trustees using the advice of experts based on quantitative models, is extremely dangerous.

37. The Stock Market and the Real Economy (Spring 2002)


He estimated the forward-looking long-term equity risk premium by extrapolating the way it participated in the real economy. He decomposed the 1926-2000 historical excess equity returns into supply factors including inflation, earnings, dividends, P/E ratio, dividend payout ratio, book value, return on equity, and GDP per capita. Examining each factor and its relationship with the long-run real economy led to several key findings.

First, growth in productivity as measured by earnings is in line with growth in overall productivity. Second, P/E accounts for only a small part of total return on equity. The bulk of the return is attributable to dividends, earnings growth, and inflation. Third, the increase in factor share of equity relative to the overall economy can be
fully attributed to the increase in the P/E ratio. Fourth, despite record earnings, the dividend yield and payout declined sharply in the 1990s, rendering dividend growth alone a poor measure of future growth.

Forecasts of the equity risk premium were made using this historical information in a supply side model. The long-term equity risk premium was estimated at about 6% arithmetic average and 4% geometrically, only slightly lower than the historical averages. All of the conclusions reached from the various models in Ibbotson’s paper were in the form of geometric average returns.

Four different approaches have been taken to the estimation of future expected returns on stocks over bonds. One group of studies derives the risk premium from historical returns over various markets and time periods. A second approach makes use of supply side models and relies on fundamental information such as earnings, dividends, or economic productivity. A third methodology constrains stock markets to be part of the real economy, and uses demand side models that examine the payoff demanded by investors, and especially their risk aversion. And the fourth method is to rely on opinions of investors, economists and financial professionals.

Complete reliance on historical excess equity returns will lead to forecasts that outrun earnings and GDP growth. Ibbotson’s approach was to decompose historical equity returns into different sets of components based on six different methods, to examine each of the components within the six methods, and to forecast the equity risk premium through supply side models using historical data. An important assumption was that stocks are fairly priced today, in accordance with the efficient market theory, meaning that we accept current P/E ratios as reflecting future growth prospects. He presented historical return statistics for 1926-2001 for large company stocks, government bonds, Treasury bills and inflation. The average large company stock nominal average return was almost 11% per year.

The first of the six methods he used simply decomposes the 10.7% average historical return into inflation, a risk free rate, and the equity risk premium.

\[ R = (1+CPI) \times (1+RRf) \times (1+ ERP) -1 \]

The second method — capital gain and income — decomposes the same 10.7% into inflation, capital gain, income and reinvestment.

\[ R = [(1+CPI) \times (1+Rcg) - 1] + Inc + Rinv \]

The third method, the earnings model that he preferred and most relied on, decomposes the 10.7% into inflation, growth in real earnings per share, growth in the P/E ratio and income return.

\[ R = [(1+CPI) \times (1+g_{REPS,t}) \times (1+g_{P/E,t}) -1] + Inc_t + Rinv_t \]

The fourth model — the dividends model — makes use of inflation, the growth rate of the P/E ratio, the growth rate of the dollar amount of dividend after inflation, the growth rate of the payout ratio and the dividend yield. The fifth method — return on book equity model — makes use of inflation, growth in the P/E, growth in book value, growth in ROE, as well as income and reinvestment growth. Finally, the sixth method — GDP per capita — makes use of inflation, real growth of GDP per capita (overall economic productivity), the increase of the equity market relative to the overall economy (increase of the factor share of equities in the overall economy), and dividend yields.
In addition to the assumption of efficient markets, some other important assumptions were that the equity risk premium is estimated as a constant, with inflation as a pass-through, and that dividend policy is irrelevant to total return (per Miller and Modigliani (1961)). The latter means that retained earnings do generate earnings growth. And an important part of the forecast is that the 1.25% per year contribution of P/E growth to stock returns is not expected to continue.

The forward-looking earnings model, the preferred model, indicated an expected nominal equity return of 9.37%, corresponding to an equity risk premium of 3.97%, both geometric averages. The real return corresponding to 9.37% is 6.09%.

38. Bubble Logic: The New Paradigm is Forgotten But Not Gone (Spring 2002)

Clifford Asness, Managing Principal, AQR Capital Management, LLC, distributed a paper entitled: “Bubble Logic: The New Paradigm is Forgotten But Not Gone”. He predicted quite low future equity returns, compared to those of the past. He did not see low interest rates as supporting expectations of the present high market levels, and he concluded that anecdotal and circumstantial evidence does not argue strongly for a rational investing public willing and consciously accepting a low equity risk premium.

He described a number of ways in which one might forecast equity returns and the equity risk premium.

The first way was by extrapolating past returns. But if equity returns are a random walk, then extrapolating from the past is difficult as we do not have enough data. And if equity returns are mean-reverting then extrapolating the past is dangerously flawed. He displayed a history of the price-earnings ratio (price divided by 10-year prior real earnings) from 1880-2000 and a table showing the relationship between P/E and subsequent real stock market returns. It was clear that the subsequent return was negatively correlated with the P/E. He commented that at today’s P/E, for investors to obtain a 10% nominal return for 20 years the S&P must grow real earnings at about 6% per year. So no one should expect 10% nominal returns. At a 2% real earnings growth rate (about the historical average), for the long-term we can expect nominal returns of 6 to 7%. If the P/E reverts at all towards the mean, the short- or even medium-term return will be much worse, but the very long-term will be better.

Asness next considered the conditions that might preserve the level of the stock market. The first is very high and sustained real earnings growth. (A table showed that over 1927 - 2001 the average real stock return was 7% while the average earnings growth was only 2%.)

Discussing some reasons for expecting high real earnings growth, he referred to enhanced productivity, but observed that the long-run relationship between growth of real output and per share earnings growth is quite weak on both theoretical and empirical grounds. He also differed from the previous speaker, Roger Ibbotson, in rejecting market efficiency as a justification for high P/E ratios as indicating expected high earnings growth.

High cash retention (low dividend payout ratios) is sometimes cited as evidence of rising earnings growth, but it turned out that over the same 1927-2001 period, earnings growth was negatively correlated with the earnings retention rate. There seemed little reason to expect high earnings growth to save the market.
The next question was whether low interest rates could save the market. He compared the P/E ratio with the differential between the E/P ratio and bond yields. Over the 1982-2001 period, the relationship supported the argument that low interest rates can save stocks. Asness said that there are many confounding accounting and other biases that might cause P/E to vary with inflation, but the net of them is unclear. In any case, over the full 1927-2001 period, the relationship did not hold. His conclusion was that over the short-term, low interest rates explain the P/E but do not justify it and therefore have little long-term forecasting power.

Finally, there was the possibility that investors are willing to accept low stock returns in the future. Their willingness would be consistent with preservation of a relatively high P/E, and there are reasons for thinking that easier access to the stock market, increasing knowledge, and taxation changes, may have made stocks more attractive and apparently less risky. What does not make sense is to argue that acceptance of low stock returns justifies the current high P/E, and for the future we can expect “normal” stock returns of 10 to 12%. He presented a table of forecasts of the S&P 500 index for the end of 2002 from a number of investment firms suggesting that this non-sense is rather prevalent.

Turning back to investor willingness, there are two possibilities. Investors may be willing to accept historically very low expected returns on the S&P 500, and historically large chances of losing even over the “long-term.” Or they may be simply miscalculating, with the “encouragement” of Wall Street, and actually expecting high returns. It is not entirely clear whether investors understand that today’s P/E ratios can be supported only with permanently expected lower returns. If so, they may be surprised and the result may be a significant drop in the S&P Index. Asness clearly anticipates that this surprise and disappointment is likely.


He began with a discussion of some traditional approaches to spending rules for educational endowment funds and discussed their drawbacks. He was particularly concerned with reducing the risk of a decline in spending below a level consistent with minimum acceptable support for the institution. Most spending rules smooth spending from year to year, but do not avoid the possibility of a serious decline if market values decline. Dybvig focused particularly on the pattern of spending when the policy was to spend a constant percentage of the unit value, generally averaged over a historic period of perhaps three years. He showed graphically the results over time, in portfolio value and spending, of such a strategy. This policy generally preserves the allocation of the endowment to risky and risk-free assets, as the market moves up and down, and Dybvig showed graphically the result.

He proposed what he considered a better, and certainly much more conservative, approach, describing it as a ratcheting model. The first step is to establish the level of real spending that is considered to be the minimum
acceptable to the institution. Sufficient funds are invested in a risk free portfolio (riskless in real terms) to generate this minimum required real spending. The best riskless asset is likely to be inflation-protected Treasuries. For example, if the minimum real spending required is $3 million, and the real rate on the riskless portfolio is 3%, then $100 million must be invested in this riskless portfolio. The balance of the endowment assets (the “cushion”) is invested in a mix of risky and riskless assets. The proportions of the mix will depend upon the risk the institution is willing to take with the cushion. Having immunized receipt of the required minimum spending, the institution will of course face less risk with the cushion than is the ordinary case.

Dybvig’s model went further however, to solve an optimization problem that not only guarantees minimum real spending but also prohibits any year-to-year decrease in spending. In addition, spending is never to fall below a critical proportion of wealth, that is, a critical proportion of the entire endowment. Two parameters, the proportion of the cushion to be invested in risky assets and the minimal spending rate on the entire endowment, are chosen at the outset. Dybvig’s recommendation was to choose these parameters on the basis of experimentation using simulations.

If current spending is just able to equal the minimum required, then for current spending st, the total value of the endowment wt, and the risk free rate r, the portfolio is fully invested in the risk-free asset and \( \frac{st}{rt} = wt \). When \( \frac{st}{rt} \) is less than the actual income, that is, there is some income available above the minimum required, then spending is immediately raised to a new level, \( s’t \) where \( \frac{s’t}{wt} = r^* \). The \( s't \) value is now the new level of real spending that is never to be decreased. So when the portfolio value goes down, the spending level is maintained. But when the portfolio value goes up enough, the fund again increases spending.

As the portfolio value goes down, in order to maintain the minimum spending level, more funds must be shifted to the risk-free portion and a smaller and smaller proportion of the portfolio is left at risk in the cushion or discretionary part. This permits the fund to maintain enough value in the protected part of the portfolio to keep from ever having to reduce spending. Dybvig proceeded to set out the mathematics of the strategy, which may require substantial investment in risk-free assets and present the institution with spending well below the level it has been experiencing. The tradeoff is an exchange of a high spending level for a greatly decreased risk of inadequate spending.

He moved on to an even better approach. In this approach, the decrease in spending is to be avoided but not entirely prohibited. This is particularly important for accommodating clients for which an immediate switch to the ratcheting strategy would reduce current spending to an intolerable level. Another parameter is required, indicating the degree of aversion to a decrease in the spending. Adjustment of this parameter can provide a solution that varies between traditional fixed-proportion spending and asset allocation at one extreme, and the ratcheting solution at the other extreme.

In summary, he described his proposal as protecting spending while making spending and asset allocation proactive and not just reactive. The model is dynamic and not static, and flexible as well.
Jack L. Treynor, President, Treynor Capital Management, Inc., distributed a paper entitled: “Constant Absolute Risk With Longitudinal Rebalancing.” He began by explaining the difference between absolute and relative risk. The return on a risky asset can be represented by the change in value divided by the initial value. We are usually concerned with the risk in the ratio itself, and this is relative risk. Beta, for example, is relative risk. Absolute risk is risk in the numerator of the ratio. Treynor’s paper is about absolute, not relative, risk.

Consider a portfolio fully invested in the stock market. As the market rises and falls the relative risk probably remains constant, but the absolute risk rises and falls. It changes in proportion to the market level.

He offered an example. We borrow $1 and invest it at a geometric real rate of return of 10% annually for 50 years. And we assume the riskless real rate is 0. We expect the $1 to grow to $117.39. (This is the result of compounding for 50 years at 10%.) At the end of 50 years we repay the $1 loan and are left with $116.39. We made no investment with our own money, so how did we acquire the $116.39? The answer is that it was the result of taking absolute risk. It is not related to wealth.

If the gains and losses in any one year are entirely independent of gains and losses in any other year, then we may depend only on risk exposure for gain and loss.

Some calculations may demonstrate the difference between the effects of constant relative risk aversion and the effects of absolute risk aversion. For the constant relative risk aversion case,

Let $W_t = \text{wealth at time } t$

\[ W_t = W_{t-1} \beta(x_t - r) + W_{t-1}(1+r) \]

Where $x_t$ is the return on the risky asset and $r$ is the risk free rate

\[ = W_{t-1} \{ \beta(x_t - r) + (1+r) \} \]

Let $Y_t = [ \beta(x_t - r) + (1+r) ]$

Then $W_t = W_{t-1} Y_t$

terminal wealth $W_T = Y_T \times Y_{T-1} \times Y_{T-2} \ldots Y_{T-N} W_0$

Note that a 40% loss in any single year leads to a 40% loss in terminal wealth.

For constant absolute risk aversion, we set an absolute exposure to risk each year. It will be optimal to increase the absolute risk each year by $(1+r)$. This, as will be seen, causes the contribution of each year’s risk exposure to be equally weighted in contributing to terminal wealth.

Let the initial exposure be $h_0$ at beta $\beta$. The expected return to this risk exposure is $h_0 \beta(x-r)$. For year $t$ the expected return is $h_0 (1+r)^t \beta(x-r)$. If this return is invested at $r$ until the terminal year $T$, its expected contribution to terminal wealth is $h_0 (1+r)^T \beta(x-r)(1+r)^{-t}$ or 

\[ h_0 (1+r)^T \beta(x-r) \]

The expected contribution is thus the same for all $t$ and the total expected terminal wealth from risk exposure is $Nh_0 (1+r)^T \beta(x-r)$. Note that while the actual return in any year $x_t$ may not be the expected $\bar{x}$, it is assumed to be independent of all other $x_i$ and a loss of 40% in any year does not lead to a 40% reduction in terminal wealth.

The contribution to terminal wealth from wealth alone (not from risk exposure) is the result of investment at
For an initial wealth of $W_0$ and no additions this is just $W_0(1+r)^T$.

Constant relative risk foregoes the time diversification we find with constant absolute risk. And time diversification is the best kind. In effect, over 50 years we have 50 assets perfectly diversified.

In his paper, Treynor set out the example of the school teacher who sets aside $10,000 each year, borrowing another $10,000 and investing the sum in a diversified stock portfolio with a beta of 2. If at the end of the year she has a gain, she sells down to her original investment and invests both the gain and her new savings in Treasury bills. If she has a loss, she uses part of her new savings to buy back up to her original investment and puts the remainder in Treasury bills. Assuming the equity risk premium is 8%, the one-year standard deviation is 20%, and the riskless rate is 0, the annual return variance on $1 of savings is $(4 \times 0.20)^2 = 0.64$. The variance on 50 consecutive (independent) dollar investments is $50 \times 0.064 = 32$. The corresponding standard deviation is $5.66$.Scaled up by a factor of 10,000 (her annual investment) the standard deviation is $56,569$. The expected annual gain on each dollar of savings at risk is $4 \times 0.08 = 0.32$.

Multiplying by her total savings, we have for her expected lifetime gain $0.32 \times 500,000 = 160,000$.

Her expected terminal wealth is her savings $50 \times 10,000 = 500,000$ plus her expected gain $160,000$ terminal wealth $660,000$ standard deviation $56,569$

The example ignores many practical problems, hence probably exaggerates greatly the real benefits of constant absolute risk. Still, it is curious that the school teacher’s terminal wealth has almost no downside risk. (Roughly two chances in a thousand).

Now in the teacher example, Treynor was using what he considered to be an arithmetic mean risk premium of 8%. He raised the question whether he should be using an arithmetic or a geometric expected return. His conclusion was that following a path of constant relative risk one should use the geometric average, but with constant absolute risk the arithmetic mean is appropriate. He also noted that with absolute risk exposure, the relative risk exposure of the teacher is declining over time. This is something that most people feel intuitively appropriate as an investor approaches a terminal date, such as retirement.


He began by identifying the geometric mean or compound return as: Eq. (1) $G_N(\bar{r}) = \prod (1 + r_i)^{1/N} - 1$

assuming $r_i > -1$, i.i.d., no cash flows.

The geometric mean is a widely used measure of return over multiple discrete approximately equal time periods. It is also used to forecast return for given return distributions. However, it is in the forecasting process where interesting properties, errors and
fallacies arise. A single example leads to what may be surprising results. Imagine a case where two rates of return are possible: +100% and -50%, with equal probability. The average arithmetic return is 25%. The average geometric mean return is 0%. Both numbers are arrived at simply from the alternative rates of return and their equal probabilities. However, the expected geometric mean return over one period is 25%, over two periods is 12.5% per period, and over three periods is 8.26% per period. Over an infinite number of periods the expected geometric mean is 0.

Moving to the geometric mean as a possible optimality criterion, among many proposals one made by Markowitz is: For large N, find the MV efficient portfolio that maximizes \( E(G_N) = \mu - \alpha^2 / 2 \) where \( \mu \) is the expected (arithmetic average) single period return. Hakansson recommended finding the portfolio that maximizes: \( E(\log(1 + r)) \). It turns out that for a finite \( N \), the Hakansson criterion portfolio has a variance that is often very risky. Hakansson optimal portfolios may be near, at, or beyond the maximum expected return end of the efficient frontier. For many investors, and institutions, the Hakansson proposal is not always a practical and useful investment objective. More important, Merton and Samuelson insist that a general theory of portfolio choice must be based upon rationality axioms such as V-M expected utility maximization. Hakansson’s proposal violates such principles of rational modern finance.

Turning to portfolio efficiency, Michaud referred to the Levy-Markowitz conclusion that MV efficiency provides useful approximations to expected utility maximization for many utility functions and return distributions of practical interest. However, we know that V-M axioms are not consistent with gain and loss behavior and not sufficient as a rational theory of decision-making under uncertainty for modern finance. The V-M axiom inadequacy can be resolved by a deeper understanding of rational utility axioms. Luce (2000) provides an extension of rational utility axioms that encompasses gain and loss behavior. Godel (1931) showed that rational utility axiom systems are always incomplete. Bourbaki (1948) explained that rationality axioms do not define (as many in finance still think today) rationality but are ways of codifying scientific intuition.

Michaud’s position is that we need a new set of axioms. New axioms such as Luce’s will always be necessary and naturally reflect our evolving enhanced understanding of rational thought in finance.

Comparing classical and his own resampled MV efficiency he observed that MV efficiency offers these limitations in practice:

- Poor out-of-sample performance, with known large biases (Jobson-Korkie 1980, 81)
- Estimation error insensitivity
- Assumes 100% certainty in inputs
- Intuitive, marketable portfolios
- Often ignored in practice.

For resampled efficiency he commented:

- Estimation error sensitive generalization of MV efficiency
- Provably superior performance on average
- Intuitive, marketable portfolios
- Forecast certainty conditional MV optimality

The remaining issue is the role of the geometric mean. Michaud observed that the mean is not a tool for defining portfolio optimality but is a practical...
way of choosing from among efficient portfolios. It can often be the financial planning tool of choice for many cases of practical interest. He went on to some characteristics of the geometric mean. First, an alternative to the definition in equation (1) is:

\[ G_N(r) = e^{\text{ave}(\log(1+r))} - 1 \]

It is almost certain that in the limit:

\[ G_N(r) = e^{E(\log(1+r))} - 1 \]

But the limit formula is not appropriate if \( N \) is finite. Michaud suggested some useful approximations:

\[
\begin{align*}
E(G_N) & = \mu - (1 - 1/N)\sigma^2/2 \\
V(G_N) & = (1 + (1 - 1/N)\sigma^2/2)\sigma^2/N
\end{align*}
\]

Two more helpful observations are that the distribution of the geometric mean is approximately lognormal and also approximately normal. Normality implies that the mean variance geometric mean parameters (mean and standard deviation) are often convenient for describing the distribution. And normality is often convenient for estimating probabilities.

Moving on to the geometric mean and terminal wealth he offered the following equations:

- Eq. (7)
  - \( N \)-period terminal wealth in term of geo mean:
  \[ W_N(\tau) = (1 + G_N(\tau))^N = \prod(1 + r_i) \]
  - \( W_N \sim \text{Lognormal} \)
  - From central limit theorem using log of (7)
  1. Let \( G_M = \text{median} \ G_N(\tau) \)
     \[ \Rightarrow \text{Median} \ W_N = \left(1 + G_M\right)^N \]
  2. \( G_N \sim \text{Normal} \Rightarrow G_M = E(G_N) \)
     when \( N \) large
  - \( E(G_N) \) useful for approximating median \( W_N \)
  - Extremely useful result for financial planning purposes

Next he introduced the efficient frontier critical or crossover point. It turns out that when the resampled efficient frontier is plotted as geometric mean return versus portfolio risk, the curve is not necessarily monotonic increasing in return as a function of risk. At a crossover point the curve may begin to turn down. In effect the point separates the efficient frontier into a lower part indicating multi-period efficiency and an upper part indicating multi-period inefficiency. The crossover point is likely to be of interest to many asset managers. Crossover points need to be computed in order to know whether they exist and whether they are significant for investment management.

A quick summary of the characteristics of expected geometric mean return included these:

- A positive function of expected return
- A negative function of portfolio risk
- A negative function of horizon length
- Estimate of median \( N \)-period terminal wealth

Michaud turned next to CAPM and Beta. The CAPM security market line implies that high beta strategies should be attractive. Yet in practice portfolio betas are typically close to 1. The expected geometric mean is related to beta. For an expected return of 10%, a standard deviation of 20%, a risk free return of 5%, and \( N=5 \), the critical point beta is 1.85. As one goes to longer periods or higher volatility, the critical beta becomes smaller. So high betas are not necessarily attractive. Michaud used this conclusion to explain the benefit of a diversified portfolio over a single stock with a high beta and high expected return. His crossover analysis implied the diversified portfolio could be expected to outperform the single stock in three years even after taxes on the sale of the stock.
Examining the reasoning behind pension funds, and considering the tradeoff between current compensation and deferred compensation through pension funds, he concluded that the plan promises are assets rather than liabilities. It is true that when investment results are poor the pension fund assets shrink, but in an economic downturn labor expense and future retirement payments are also likely to shrink. His recommendation for the retirement plan planning process is:

♦ Study economic risks of pension liabilities for a firm
  • Business risks
  • Relationship to economy domestic, global, regional
  • Understanding relevant economic risks
  • Economic model of pension liability risk

♦ Asset allocation recommendation:
  • Liability-relative resampled efficient asset allocation study

♦ Choose among efficient allocations using geo mean analysis and
  • Monte Carlo simulation for multiperiod financial planning

♦ Defined benefit pension plans not a special case

42. Surplus Risk Management: Easy Come, Easy Go (Spring 2002)

Michael R. Granito, Managing Director, Capital Market Research, J. P. Morgan Fleming Investment Management, examined the financial status of the 200 largest pension plans in the United States. He focused specifically on the evolution of funded status, pension expense and forward-looking return assumptions used in accounting calculations. A graph of the excess return on the S&P 500 index over the Lehman Long-Term Government/Corporate index, was mostly positive from December 1976 until the last couple of years when it turned significantly negative. Correspondingly, the average funded ratio has come to its lowest level in 15 years, with only 40% of the plans over-funded. And during that time there has been little change in the asset allocation for individual plans, and little change in asset allocation across plans. This means constant relative risk through the period.

At the same time, the ratio of pension expense (the all-in-cost less the expected return on the assets) has turned from negative (that is positive income) to positive (negative income). Granito raised the question why did the funds that were doing so well not take money back during the 1990’s. One reason was a fear of being “different”. To have pulled back from a bull market in stocks might have led to unfavorable comparisons within a peer group. In addition, the pension fund was going from cost center status to being a profit center. Maximizing geometric rate of return seemed the right thing to do, and of course constant relative risk aversion was maintained.

Over the past 15 years, assumed discount rates have become more diverse among plan sponsors. They have also come down from a little under 9% to about 7% on average. But expected returns have remained high, rising from a little over 9% to about 9.5% and falling to only a little under 9% in 2001. The spread of expected return over ten-year Treasuries has risen substantially over the last 15 years from about .5% to about 2%. And the implied equity nominal return for the plans (arrived at by assuming a portfolio 60% equity and 40% bonds, with the bond
return equal to the 10-30 year Treasury yield and backing out the bond return contribution) has been between 10% and 12% throughout the 1990’s. Yet J. P. Morgan projections for the next 10 years are considerably lower.

Turning to the magnitude of pension assets as compared to the market capitalization of the sponsor corporation, Granito showed that for the median of the top quintile of the 200 pension funds, pension assets were over 200% of market capitalization of the sponsor corporations at the end of 2000 and 175% at the end of 2001. For the second quintile the ratio was 63% at the end of 2000 and 67% at the end of 2001. The picture is one of enormous pension assets compared to total market capitalization of the sponsoring companies. Next he showed the fund surplus (deficit) as percent of market capitalization. For the top quintile the surplus was 13% at the end of 2000 and 7% at the end of 2001. For the bottom quintile, it was –8% in 2000 and -20% in 2001. An interesting question raised by participants was whether the surplus or deficit had already been impounded in the market price of the company’s shares. Granito believes that plan sponsors are not examining this question.

He had also estimated the pension surplus (deficit) as a percent of market capitalization on September 21, 2001. His five quintiles were derived from a ranking by the ratio of size of assets to market capitalization of sponsor. For those in the largest quintile, the median deficit was 65% of the sponsor market capitalization. Yet at the beginning of the year it had been only 3%. Granito remarked on the extraordinary volatility of this ratio. We are looking at corporations that are now highly leveraged stock investments, in effect leveraged by their pension funds. He next showed a graph combining the volatility of the ratio of plan surplus to sponsor market capitalization, the ratio of fund assets to market capitalization, and the initial surplus to market cap ratio. For example, for a fund with plan assets at 75% of sponsor market capitalization, and a surplus to market cap ratio of 30% to 35%, the volatility of surplus to market cap is around 10% to 15%. Another graph showed the volatility of the combined sponsor and its pension plan rising significantly with the ratio of fund assets to market cap. The volatility for the company alone was estimated at about 28%, but the volatility of the combination reaches about 35% when the funds assets reach 150% of market cap. This led to a comparison of risk and return for the combination of the sponsor and its pension plan. The expected return from taking the plan assets to market cap ratio from 0% to 150%, compared to the volatility increase, led to a significant reduction in the Sharpe ratio. In other words, raising the ratio of fund assets to plan sponsor market cap is highly inefficient in terms of the Sharpe ratio. Granito’s conclusion was that the motivation for aggressive positions in pension funds is the desire to further extend contribution holidays at the cost of reaching potentially dangerous risk levels.

Finally, Granito raised the question whether it would be better for plan sponsors to “pay as you go” rather than in effect shorting the pension liability and investing in equities or even a 60:40 mix of equities and bonds.

43. Budgeting and Monitoring the Risk of Defined Benefit Pension Funds (Fall 2001)

William F. Sharpe, Nobel Laureate, Fellow of the Institute, STANCO 25 Professor of Finance, Emeritus, Stanford University and Chairman, Financial Engines, Inc., distributed a paper
entitled: “Budgeting and Monitoring the Risk of Defined Benefit Pension Funds.” The paper describes a set of mean/variance procedures for setting targets for the risk characteristics of components of a pension fund portfolio and for monitoring the portfolio over time to detect significant deviations from those targets. What Sharpe called "risk budgeting and monitoring" was initially developed for firms with multiple trading desks and was important in controlling traders day by day. The methodology is now being adopted by pension funds and Sharpe described its adaptation to meet the needs of these funds.

For pension funds, investment horizons are relatively long, and the estimation of future risk is likely to involve mean/variance analysis and/or Monte Carlo simulation. He began with the basic factor model of returns, which explains the return on a particular asset in terms of the returns on a number of factors to which the asset is exposed. In the simplest case we can imagine a portfolio in the hands of managers each of which is exposed to only one factor. In such a case the key decisions of the plan sponsor are asset allocation, selection of managers, and the allocation of funds among the managers, and the decisions will probably follow that sequence.

The methodology proposed by Sharpe is implemented in three phases. First is the policy phase in which the plan sponsor establishes a "policy portfolio" that can be represented by a set of allocations among managers (assuming in our simple case that each manager is responsible for one asset class). The key assumption here is that the policy portfolio was established as mean/variance optimal with no binding constraints. And we assume that the portfolio was established on the basis of analysis making use of a vendor factor model and risk and correlation estimates. Whether or not this was actually the basis for setting the policy it seems reasonable to assume that the policy portfolio in the mind of the plan sponsor is mean/variance efficient. But in order to proceed with Sharpe's methodology it will be necessary to have access to the set of variances and covariances.

The simplest optimization deals only with the future value of assets. A more realistic optimization deals with the future surplus values, the excess of asset over liability values. Sharpe began with the asset-only analysis. Mean/variance optimization means:

Maximize: \( EU = EER_p - V_p/rt \)
Subject to: \( \sum \chi_i = 1 \)

Where, \( EU \) is expected utility, \( EER_p \) is portfolio expected excess return, \( V_p \) is portfolio variance and \( rt \) is risk tolerance.

Next we move from expected utility to marginal expected utility. This is the change in the expected utility of the portfolio per unit change in the amount invested in an asset when the change is small:

\[
MEU_i = \frac{\partial EU}{\partial \chi_i} = \frac{\partial EER_p}{\partial \chi_i} - \frac{\partial V_p}{\partial \chi_i}/rt = EER_i - MR_i/rt
\]

where \( MR_i \) is the marginal risk of asset \( i \) which can be expressed as:

\[
MR_i = \frac{\partial V_p}{\partial \chi_i} = 2C_{ip} = 2\sum \chi_j C_{ij}
\]

where \( C_{ip} \) is the covariance of \( i \) with the portfolio, and \( C_{ij} \) is the covariance of \( i \) with \( j \).

The portfolio can be optimal if and only if \( MEU_i = MEU_j \) for every pair of assets, because if this equality does not hold portfolio utility can be increased by shifting allocations from one manager to another.
another. And so long as cash is an asset or is available as an asset, with a marginal expected utility of 0, MEU is 0 for all $i$. Returning to our optimization equations in marginal expected utility, we have:

$$MEU_i = EER_i - MR_i / rt = 0$$

$$EER_i = MR_i / rt$$

We come now to what Sharpe referred to as "reverse optimization." Just as optimization begins with covariances and expected excess returns to find an efficient portfolio, reverse optimization begins with the optimized portfolio and the set of covariances and finds the set of expected excess returns such that $EER_i = MR_i / rt$ for all $i$. If we want $EER_i$ in dollars expected to be added over and above the amount that would be obtained if the investment were in cash, we have to know $rt$. But if we want $EER_i$ only as a proportion of the total $EER$ we don't need $rt$. And the proportion of the dollar expected excess return from manager or asset $i$ is given by $PSEER_i = X_iC_{ip} / V_p$, where $C_{ip}$ is the covariance between manager $i$ and the portfolio, and $V_p$ is the variance of the portfolio. We can think of the quantity $PSEER_i$ as the risk budget for manager $i$. The risk budget for each manager, describing the way in which we have parcelled out risk among the managers, is analogous of course to the cash budget which describes how we have parcelled out funds to the different managers.

Now imagine that time has passed, the portfolio has changed, and we have a fresh set of covariances. The risk proportions are no longer the initial risk budgets and they can be represented by the following equation, where the primes represent the new asset proportions and covariances: $RP_i = X_iC_{ip}' / V_p'$. We are now in a position to compare the current risk proportions with the risk budgets. If there are differences, the implication is that either the abilities of the managers to add value have changed or that the portfolio is no longer optimal. The model does not provide a prescription for action; but it does provide a basis for deciding whether some action is called for.

The presentation so far had dealt with asset-only optimization. Sharpe next turned to surplus optimization. In this case we must add consideration of changes in liabilities and the correlations between assets and liabilities.

After discussing factor models, and the decomposition of the expected excess return for manager $i$ into the factor related expectation and the alpha for the manager, Sharpe showed for a set of managers working on a retirement portfolio the implied expected excess returns that were factor related and those that represented the manager's alpha. And he also displayed for each manager the percentages of the portfolio dollar expected excess return that were factor related and alpha related. The result is a picture of the relative importance of the managers in terms of their percentage contribution to total portfolio expected excess return as well as how much of this comes from factor related return and how much from alpha. There are some implications here for where the plan sponsor's resources can be best applied.

### Credit Analysis

44. Evidence on Corporate Default Risk Premia (Fall 2005)
Darrell Duffie, James I. Miller Professor of Finance, Graduate School of Business, Stanford University, made available a paper entitled “Measuring Default Risk Premia from Default Swap Rates and EDFs”, by himself, Antje Berndt, Rohan Douglas, Mark Ferguson and David Schranz. The paper estimates the time-series behavior of default risk premia for US corporate debt over the years 2002-2004, based on the relationship between default probabilities, as estimated by Moody’s KMV EDFs, and default swap (CDS) market rates. The research set out to answer the question: How much are investors in corporate debt paid for taking default risk, above their expected default loss? Moody’s KMV provides estimates of default probabilities, and CIBC data on default swap (CDS) prices provide default risk premia.

Moody’s KMV provides its customers with current firm-by-firm estimates of conditional probabilities of default over time horizons that include the benchmark horizons of 1 and 5 years. For a given firm and time horizon, this “EDF” estimate of default probability is fitted non-parametrically from the historical default frequency of other firms that had the same estimated “distance to default” as the target firm. The distance to default is, roughly speaking, the number of standard deviations of annual asset growth by which current assets exceed a measure of book liabilities. The liability measure is equal to the firm’s short-term, plus one half of its long-term, book liabilities. Calibration is based on the Black-Scholes option pricing model by which the price of a firm’s equity is viewed as the price of an option on its assets, struck at the level of liabilities.

A default swap is an over-the-counter derivative security designed to transfer credit risk. With minor exceptions, it is economically equivalent to a bond insurance contract. The buyer of protection pays periodic insurance premia until the expiration of the contract or until a contractually defined credit event, whichever is earlier. The stipulated credit event for purposes of this research is default by the named firm. It is the combination of the EDF data and the swap data that makes possible the measurement of default risk premia. Specifically, the data make possible the determination of risk neutral default probabilities that can be compared with actual default probabilities, to produce risk premia.

One interesting finding was that the default risk premium was bigger per dollar of expected default loss for high quality firms. The most interesting, however, was that for firms of any fixed credit quality the default risk premium was dramatically reduced from mid-2002 to the end of 2003. Duffie displayed in graphical form the difference between estimated actual and risk-neutral one-year default probabilities for specific companies, illustrating both of these findings. Among other potential explanations for the decline in risk premia, he suggested the possibility that more capital was made available to the corporate debt and credit derivatives markets during this period, per unit of default risk.

It turned out that the logarithmic relationship between credit default spreads and the EDF measure, coupled with dummy multipliers for month and industry sector, was the most useful.

An example follows:
For 33,912 paired daily median observations over 2000-2004:

\[
\log \text{CDS}_i = 1.45 + 0.76 \log \text{EDF}_i + \sum \hat{\beta}_j \text{D}_{\text{month,sector}}(i) + z_i, \\
(0.05) (0.02)
\]

- Standard errors estimated for panel correlation.
- \( R^2 = 74.4\% \)
- One-sigma confidence band for a given CDS rate places it between 59\% and 169\% of the fitted rate.

Duffie commented that until recently one would have gone to bond ratings and used default history for a rating in order to estimate probability of default. But the rating agencies did not plan on this use of their ratings, and the slowness of changes in ratings meant that they were a very inefficient source of default probabilities. The conclusions reached in this research represent a significant improvement and facilitate updating of default probabilities very rapidly.

45. Common Failings: How Corporate Defaults are Correlated (Fall 2005)

Sanjiv R. Das, Associate Professor, Leavey School of Business, Santa Clara University, made available a paper entitled “Common Failings: How Corporate Defaults are Correlated,” by himself, Darrell Duffie, Nikunj Kapadia, and Leandro Saita.

Correlated default is a matter of some concern for bond funds, credit portfolios, junk pools, basket default swaps, and collateralized default obligations. It is also a matter of concern with respect to financial institutions that offer counterparty risks. The clustering of corporate defaults could be the result of common factors — that is systematic risk. Another possibility is contagion — a domino or cascade effect. And finally, there is a feature known as frailty. There may be unobservable common variables affecting many firms, and one learns about these only from defaults in other firms. The task is to identify the significance of these possible sources of commonality.

Das described this research as based on a Cox Process framework, of which the key ingredient is the intensity of default model. Intensity of default was a key element in the preceding paper, presented by Duffie (No. 44). The framework includes a doubly stochastic process. The doubly stochastic process is two-fold, comprising a default intensity, and conditional on this intensity, a failure probability:

- Process 1: Default intensity:
  \[
  \lambda(t) = \lim_{h \to 0} \frac{s(t) - s(t + h)}{s(t)h} = -\frac{s'(t)}{s(t)}.
  \]

- Process 2: Default, conditional on intensity:
  \[
  \Pr[D_i = 1|\lambda] \forall i.
  \]

The doubly stochastic assumption is that processes in 2 are independent, implying that defaults are Poisson after conditioning on intensities. We now have plenty of data for testing Process 1,
but much less for Process 2. There is much preceding literature supporting correlation across intensities (via Process 1). This paper is aimed at Process 2, about which little research has been undertaken.

The key intensity ingredient is based on the model of Duffie, Saita and Wang (2005). In this paper, intensities for each firm are modeled in an affine manner:

$$\lambda_i(t) = e^{\beta_0 + \beta_1 X_{i1}(t) + \beta_2 X_{i2}(t) + \gamma_1 Y_1(t) + \gamma_2 Y_2(t)}$$

where

- $X_{i1}(t)$: distance to default of firm $i$.
- $X_{i2}(t)$: trailing one-year stock return of firm $i$.
- $Y_1(t)$: US 3-month Treasury bill rate.

The research reported on was based on data for 2770 firms, 1979-2004, for 392,404 firm months, and Moody’s data for 495 defaults.

The main focus of the paper was on whether the joint hypothesis of the true intensity model and the doubly stochastic process was supported in the data. Das went through an extended discussion of a series of tests, that were independent of the underlying distributions of intensities. This involved the introduction of “intensity time” measures as well as those in calendar time. Statistics in intensity time naturally condition out the information from intensities, allowing a direct test of the doubly stochastic hypothesis. Das had to conclude that the doubly stochastic property was violated. Even the addition of some macroeconomic variables did not resuscitate the model. A number of suggestions were made by participants with respect to variables that might be included, and the final conclusion seemed to be that further exploration, especially along the lines of industry effects, was likely to be promising.

46. Corporate Yield Spreads: Default Risk or Liquidity (Fall 2005)

Francis Longstaff, Allstate Professor of Insurance & Finance, Anderson School of Management, UCLA, made available a paper entitled “Corporate Yield Spreads: Default Risk or Liquidity? New Evidence from the Credit Default Swap Market” by himself, Sanjay Mithal and Eric Neis.

He began with the question how are corporate bonds priced in the market? In theory, corporate spreads should be fully explained by default risk. But in practice many studies appear to have found that default risk explains only a small (5 to 25%) fraction of corporate spreads. Now that information is available from credit default swaps to measure directly the size of the default component in corporate spreads, we can begin to study the properties of the non-default component.

Credit-default swaps had been discussed at some length in the previous two presentations, by Darrell Duffie and Sanjiv Das. Longstaff used the closed-form Duffie-Singleton model to value bonds and CDS contracts. Fitting the model simultaneously to corporate yields and CDS premia, he was able to use the fitted model to infer the size of the default component of the spreads for 76 firms. The researchers found most of the spread was due to default risk, and the non-default component was due mostly to a general bond market liquidity factor and individual corporate bond illiquidity features. The intensity of the Poisson process triggering default is expressed in the following equation:
\[ d\lambda = (\alpha - \beta \lambda )dt + \sigma \sqrt{\lambda}dZ_\lambda, \]

where \( \alpha, \beta, \) and \( \sigma \) are positive constants, and \( Z_\lambda \) is a standard Brownian motion. These dynamics allow for both mean reversion and conditional heteroskedasticity in corporate spreads, and guarantee that the intensity process is always nonnegative. For the risk-neutral dynamics of the liquidity process \( \gamma_t \), we assume that \( d\gamma_t = \eta dZ_\gamma \), where \( \eta \) is a positive constant and \( Z_\gamma \) is also a standard Brownian motion. These dynamics allow the liquidity process to take on both positive and negative values.

Turning to credit-default swaps, the value of the premium leg is given as:

\[ P = E \left[ \int_0^T \exp \left( -\int_0^t r_s + \lambda_s ds \right) dt \right]. \]

And the value of the protection leg is given as:

\[ = E \left[ w\int_0^T \lambda_s \exp \left( -\int_0^t r_s + \lambda_s ds \right) dt \right]. \]

And since the two legs must be equal, we can solve for \( s \).

Longstaff next turned to a case study of Enron. He had 31 observations of CDS premia for Enron from December 5, 2000 to October 22, 2001. Enron declared bankruptcy on December 2, 2001. To fit the model, he used credit-default swap premia and yields on eight Enron bonds with maturities bracketing five years. A graph showed the movement in the credit-default swap premium and in the yield spread over the 31 observations. Both the yield spread and the swap premium rose over the time period, with the yield spread generally greater than the swap premium. Longstaff explained the process for estimating the parameters for the intensity and liquidity processes set out above. Another graph showed the implied values of the intensity process for each of the 31 observation dates. The implied default intensities were almost the same for each of three discounting curves: a Treasury curve, a Refcorp curve and a swap curve. When the Treasury curve was used, default accounted for about 90% of the spread, although there was significant time variation in this default proportion.

Next, the approach was extended from Enron to a large sample of firms using an extensive data set provided by Citigroup. It was possible to look more closely at the non-default spreads. There was considerable cross-sectional variation in these spreads among the sample of firms, as well as variation through time.

Finally, regressing the average non-default component of the spread shed some light on the characteristics of this component. In general, the important factors were those related to liquidity.

47. Structural Models of Credit Risk Are Useful: Evidence From Hedge Ratios on Corporate Bonds (Spring 2004)

Stephen Schaefer, Professor of Finance, London Business School, made available a paper by himself and Ilya A. Stebulaev entitled “Structural Models of Credit Risk are Useful: Evidence from Hedge Ratios on Corporate Bonds.” He began with the failings of structural models of credit risk in the past. They have under-estimated the size of yield spreads on corporate bonds and over-valued the bonds. On the other hand these models appear to have provided reasonably good estimates of default probabilities. And some research has indicated that the models produce results that are well correlated with bond ratings. The work reported here
made use of a structural model to estimate the sensitivity of corporate bond prices to the value of underlying assets. This is the hedge ratio. In explaining why this is important, Schaefer pointed out that in structural models the bond value is determined as the price of the replicating portfolio and the composition of the replicating portfolio is determined by the hedge ratio. It turns out that the simple structural model of Merton (1974) provides reasonably good estimates of hedge ratios of debt to equity. However, contrary to the theory, changes in equity value and interest rates (the yield curve) explain much less than 100% of returns on corporate debt.

The data used for the analysis consisted of monthly prices for corporate bonds that are included either in the Merrill Lynch Corporate Master index or the Merrill Lynch Corporate High Yield index. These indices include most rated U.S. publicly issued corporate bonds. The data covered the period from December 1996 to September 2002. The set contains more than 323,000 bond-month observations, for about 2900 issuers and 9000 issues. Matching with CRSP and COMPUSTAT allowed the use of about fifty percent of the total number of observations and all rating categories, from AAA to CCC. As we move down the ratings the average time-to-maturity decreases and the average coupon rate increases. The median size at issuance is $200 million dollars.

The authors regressed the excess return on each bond, \( r_{j,t} \), on the excess return on the issuing firms equity, \( \bar{r}_{E,t} \), and return on riskless bonds \( \bar{r}_{10y,t} \):

\[
\bar{r}_{j,t} = \alpha_{j,0} + \alpha_{j,E} \bar{r}_{E,t} + \alpha_{j,g} \bar{r}_{10y,t}
\]

An interesting observation was that the \( R^2 \) of the regression declined substantially from the high to low bond ratings.

The Bond/Equity Hedge Ratio in the Merton Model is:

\[
\frac{\partial D}{\partial E} = \left( \frac{\partial E}{\partial V} \right) \frac{E}{D} = \left( \frac{1}{V} - 1 \right) \frac{E}{D}
\]

In the Merton (1974) model:

\[
h_E = \left( \frac{1}{\Delta_E} - 1 \right) \left( \frac{1}{L} - 1 \right)
\]

where \( \Delta_E \) is the “delta” of equity against the underlying assets of the firm and the extension to other one-factor models is straightforward.

Schaefer next described a simple simulation experiment, one that might provide a benchmark against which to compare the sensitivities given by the Merton Model.

Question: If the Merton model holds, what results would we expect to find in our simple hedging regressions?

Procedure: from the data we determine:

- The distribution of bonds by initial credit rating
- Within each credit rating class: the distribution of asset volatility, leverage, time to maturity

We simulate asset, equity and bond dynamics for individual “firms”: for each “firm”

- Draw “rating” from distribution of rating classes
- Draw asset volatility, leverage, time to maturity from distribution for firm rating
- Generate path of asset value
- Use Merton to calculate equity and bond values
- Run a regression of the simulated bond returns on simulated equity returns.

It turned out that the sensitivities from the regression were surprisingly similar to the empirical estimates.

Next Schaefer turned to a better regression. The Merton model would allow default only at maturity. The regression is changed to take account of variation in asset values and to include interest rate variation. The new model is:

\[
\tilde{r}_{j,t} = \alpha_{j,0} + \beta_{j,E} [h_{E,j} \tilde{r}_{E,j}] + \alpha_{j,rf} \tilde{r}_{10y,t}
\]

The null hypothesis: \( \beta_{j,E} = 1 \)

Volatility of assets and leverage need to be estimated.

**Quasi-market leverage:**

<table>
<thead>
<tr>
<th>Book value of Debt (COMPUSTAT items 9 and 34)</th>
<th>Book Value of Debt (9 + 34) + Market value of Equity (216 x 199)</th>
</tr>
</thead>
</table>

Asset volatility is given by:

\[
\hat{\sigma}_j^2 = \left(1 - L_j \right)^2 \sigma_{E,j}^2 + L_j^2 \sigma_{D,j}^2 + 2L_j \left(1 - L_j \right) \sigma_{ED,j}^2
\]

Some conclusions to be drawn from this model were: The mean leverage rose from high to low quality bonds, and showed a very large dispersion for low quality bonds. Asset volatilities were rather high and rose from high to low quality bonds. Hedge ratios and their volatility rose significantly from high to low quality bonds. Finally, Schaefer showed a table testing the Merton Model (the revised equation above) hedge ratio predictions. Under the null hypothesis that the Merton model correctly estimates the sensitivity of returns on firm \( j \)'s debt to firm \( j \)'s equity, the coefficient \( \beta_{j,E} \) should be unity.

The results are given in Table IX of the paper. For the entire sample the mean estimate of \( \beta_{j,E} \) is 1.206. The t-statistic against unity, the value of \( \beta_{j,E} \) under the null is 1.156. For the six rating categories the mean value of \( \beta_{j,E} \) is different from unity in only two cases: BB where the mean value is 2.498 and CCC where the mean is 0.415. For the other four categories the mean value ranges from 0.55 (AA) to 1.54 (B) and none is significantly different from one.

These results are supportive of the structural approach, and the Merton model in particular, in a way that previous analyses of the level of prices or credit spreads have not been. They are also complementary to the results recently obtained by Leland (2002) who shows that the default frequency predictions of structural models are also broadly consistent with the data.

Schaefer continued by testing the significance of other determinants of returns on corporate bonds. It turned out that the VIX index of implied volatility of options on the S&P 500 index was important. And a preliminary conclusion was that the impact of VIX on corporate bond prices in unrelated to credit risk.
The conclusion in the paper reads:

This paper studies the ability of structural models to explain excess returns on corporate bonds and the main question we ask is whether these models provide accurate predictions of hedge ratios. Using data on monthly returns for a large sample of U.S. corporate bonds over a five-year period, we find those variables included in structural models — returns on the issuing firm’s equity and on riskless bonds — explain a large fraction of returns on investment grade bonds and a smaller but significant fraction for high yield bonds. Further, and this is the main result of this paper, we find that, for most rating categories, the hedge ratios predicted by the Merton model are not rejected by time series data.

The next step is to account for other factors. We include in our regression variables that in previous studies have been shown to influence corporate bond prices. The variable we use are: (i) changes in the 10-year minus 2-year yield spread on US Treasuries, (ii) the return on the S&P 500 index, (iii) changes in the VIX index of implied volatility of options on the S&P 500 index and (iv & v) the Fama-French SMB and HML factors. We find that none of the included variables undermines the significance of either the risk-free rate or equity. Our main result here, and the second main result of the paper, is that changes in the VIX index have an impact on corporate bond returns that is both significant and apparently unrelated to a bond exposure to credit risk. It seems clear, therefore, that returns on credit risky bonds are systematically related to at least one factor that lies outside standard measures of “credit risk”. Whether there are other factors, and the precise role of Δ(VIX) in the determination of risky bond prices, is a question for further research.

48. Correlated Default Analysis of Bonds (Fall 2001)

Gifford Fong, President, Gifford Fong Associates, and Sanjiv R. Das, Associate Professor of Finance and Dean Witter Fellow, Leavey School of Business, Santa Clara University, distributed a paper by themselves and Gary Geng of Gifford Fong Associates, entitled: “The Impact of Correlated Default Risk on Credit Portfolios” and a paper by Das, Geng and Laurence Freed of Moody’s Investors Service and Nikunj Kapadia, Department of Finance, University of Massachusetts, entitled: “Correlated Default Risk.”

Gifford Fong began the presentation by describing the research as an outgrowth of a research project that has been in progress for some time to create a valuation model for collateralized debt obligations (CDOs). The collateral for these obligations consists of bonds, loans and other debt obligations and the risk in the cash flows over the whole life of the CDO is a function of the credit risk of the collateral, including risk from correlations among the collateral instruments. Individual monthly default probabilities for five thousand securities over 1987 - 2000 were obtained from Moody’s. For convenience in the research, the total time was broken down into four subperiods: 1987-90, 1991-93, 1994-97, and 1997-2000. Moody’s bond ratings form 6 categories, with a 7th un-rated category and for purposes of the research it was convenient to group the rankings into three classes: high, medium, and low rating.

A principal components analysis proved instructive. For the high-grade issuers, there were two dominant principal components in time period 1, and for the median and low-grade issues the first two components were important, but other components, up to the tenth, were not trivial. In the fourth
subperiod, the picture was much the same for the median and low-risk issuers, but for the high-grade issuers as many as six components were not trivial, although the first two were clearly much more important. The first sub-period, of course, was one of relatively low probabilities of default for debt obligations, and the fourth was one of relatively high probabilities.

It turned out that the principal components showed very little correlation across categories of obligations. Fong observed that auto-correlations in the probabilities of default were very important.

Sanjiv Das took over the presentation, pointing out that even when the auto-correlation effects were removed, there was substantial correlation of probabilities of default among the obligations in each rating group. We find the correlations to be asymmetric with respect to periods of high and low credit conditions, with substantial tail dependence for the lower quality obligations, but much less for the higher quality. What we worry about are tightening correlations in regimes of difficult economic conditions and hence high probabilities of default.

He showed a graph demonstrating the asymmetry of the correlations. Plotted vertically for each of the six Moody’s rating categories were the conditional correlations, conditioned on the risk regime for debt. Horizontally, the graph was centered on a zero "exceedance level", representing the mean of default risk over the entire period, with high exceedance (high default risk) plotted to the right and low exceedance to the left. It was clear that the conditional correlation was highest for the highest credit rating, and lower for the lower credit ratings, although the reduction in conditional correlation was not monotonic with ratings. It was also clear that tail dependence was low for the high credit ratings and high for the low credit ratings. He observed that there are three conclusions we can draw from the graph. The first has to do with the level component of conditional correlation, the second with the asymmetry, and the third with tail dependence.

Das paused to summarize some results so far. We find there are two clearly distinct regimes for high and low probabilities of default. The probability of default volatility is level dependent, higher in the high regime and lower in the low regime. There is strong persistence in regimes, with few switches. The long-run value of a Markov chain suggests that 25% of the time were are in the high regime and 75% in the low regime.

Now, we want to perform a Monte Carlo simulation that will capture all three of the characteristics of the conditional correlation, and generate a graph like the one just described that was derived from empirical data. To do this we use an ARCH model, AR(1), mean reverting process fitted to a regime model. We use interest rates to drive the economy from a low default regime to a high default regime. Das commented that in order to use the model one needs to know in which regime one finds oneself. It turns out that for all three risk categories of obligations, the covariance matrix differs statistically between high and low default regimes. So the correlation statistics will tell us whether we are in a high or low regime.

He next presented some pictures of correlations of default probability in the two regimes. For rating group two (the second highest of six) some "hot spots" showed up, where correlations were very high, suggesting that it might be appropriate to alter the portfolio mix in order to reduce correlation risk. For the
lower rated groups four and six the existence of "hot spots" was much less evident. A plot of statistical properties of distributions of probability of default for the six rating groups showed positive skewness for the lower rating categories and negative skewness for the higher ratings. Leptokurtosis was also evident. This means that in order to simulate different scenarios we must have a model to cope with these features.

Das described the Monte Carlo loss scenarios. A random vector of probabilities of default is drawn based on the estimated parameters. Aggregation of this random vector gives the probability of a default occurrence in the portfolio. Next, we draw from an exponential distribution the time of default based on the aggregate default probability of the portfolio assuming Poisson default arrivals, so inter-arrival default times are exponential. If the time of default lies within the portfolio horizon, then a random bond is drawn from the portfolio with a probability proportional to its contribution to the total default probability of the portfolio. This bond is then defaulted, and the experiment is repeated, until the next default time exceeds the portfolio horizon.

From the scenarios we learn that for the high-quality obligations the regime is very important. We also find that simple mean-variance optimizing, ignoring skewness and kurtosis and simply minimizing variance of default subject to a fixed level of expected default (a measure of the expected return on the portfolio), is not satisfactory. We find that ignoring correlations results in taking more risk. In particular, high-grade debt has more risk in portfolios as less diversification is available. So now how do we model the joint distributions of default?

The answer is a copula. This is a mathematical function that combines marginal probability distributions into a joint distribution. In effect we take univariate distributions and combine them into a multi-variate distribution. A particular version of the copula facilitates adjustment of tail dependence. Hence it is possible to modify the simulated results to produce a graph fairly close to the graph described earlier, based on the empirical data. Das showed such a graph that for most of the rating categories matched the earlier one, although for rating class three the match was rather poor and Das confessed that he did not have a reason.

Finally, summarizing the work,

- Default risk varies in the time-series and cross-section.
- Default correlations are regime-dependent, and asymmetric.
- Correlated default affects optimal credit portfolio performance.
- Correlated default is not just a phenomenon affecting poor quality credits.
- Joint default distributions are not Gaussian, and copula functions may be used for more generic modeling.

**Commodities**

49. The Long Term Performance of Commodity Futures (Spring 2005)

K. Geert Rouwenhorst, Professor of Finance, Deputy Director International Center for Finance, Yale University, made available a paper by himself and Gary Gorton of the Wharton School, University of Pennsylvania and the
National Bureau of Economic Research, entitled “Facts and Fantasies About Commodity Futures.”

The paper began with a brief introduction to commodity futures and some explanations of terminology and basic concepts. A commodity futures contract is an agreement to buy (or sell) a specified quantity of a commodity at a future date, at a price agreed upon when the contract is entered into — the futures price. At that point, no cash changes hands, and the value of the contract is zero at its inception. The contract is essentially a bet on the future spot price. The rate of return an investor can expect to earn is the risk premium: the difference between the current futures price and the expected future spot price. As the current futures price moves towards the expected future spot price, the contract is marked to market daily, and daily cash settlement follows.

Keynes’ (1930) and Hicks’ (1939) theory of normal backwardation postulated that the risk premium would on average accrue to the buyers of futures. They envisioned a world in which producers of commodities would seek to hedge the price risk of their output and would hence sell futures to lock in a future selling price. Speculators would purchase the futures, in effect providing insurance to the sellers. The speculators would demand a futures price below the expected spot price, anticipating a risk premium for assuming the risk of price fluctuations. The assumption here was that those seeking to hedge price risk were sellers and hence the risk premium would be earned by those who purchased futures contracts. However, we know now that buyers may also wish to hedge price risk by buying futures contracts, in which case the investor or speculator providing insurance will be a seller of the contract, and will participate only if the price of the futures contract is greater than the expected spot price of the commodity.

To investigate the long-term return to commodity futures, the authors constructed an equally-weighted performance index of commodity futures. Rouwenhorst discussed the advantages of working with an index and described the data collection that had been necessary to construct their index. This was a substantial undertaking, and he considered it a significant part of their work.

He turned next to empirical evidence on spot and futures returns. Futures positions were considered to be collateralized, generally by a 100% investment in Treasury Bills. He compared the performance of the collateralized futures position with the spot return for the “average commodity future.” A first conclusion was that the historical returns to an investment in commodity futures have far exceeded the return to a holder of spot commodities. He showed that the average returns of a futures index rebalanced monthly to equal weights and of an index that does not rebalance are very similar, and somewhat lower than returns on an index that rebalances annually. The frequency of re-balancing has a larger influence on the spot index returns and lowers those returns. The geometric average buy-and-hold spot return of 3.47% per annum from 1959-2004 was lower than the average inflation of 4.15%, consistent with the common wisdom that over the long-term commodity prices have not kept pace with inflation.

Over the period 1959-2004, the average historical risk premium of commodity futures has been about 5% per year, about equal to the risk premium of stocks, and more than double the risk premium of bonds.
Turning to risk measures, he showed that the historical volatility of the equally-weighted commodity futures total return has been below the volatility of the S&P 500. Further, commodity futures returns are positively skewed while stock returns are skewed negatively. In addition, commodity futures display relatively high kurtosis and can be especially helpful in months when stocks perform particularly badly.

He next focused on unexpected inflation. The negative sensitivities of stocks and bonds to inflation stem mainly from sensitivities to unexpected inflation. Commodity futures are also more sensitive to unexpected inflation, but in the opposite direction. Once again, commodity futures offer strong diversification benefits.

It turns out that commodity futures have some power at diversifying the systematic component of risk, the part that is not supposed to be diversifiable. Futures perform well in the early stages of a recession, a time when stock returns generally do poorly. In later stages of recessions, commodity returns fall off, but this is generally a good time for equities.

The empirical evidence discussed so far is consistent with Keynes’ theory of normal backwardation. The current practice is to use the term contango to refer to cases where the futures price exceeds the current spot price, while futures priced below the current spot price are referred to as being in backwardation.

Finally, Rouwenhorst discussed the difference between investing in commodity futures and investing in the stocks of commodity producing companies. It turns out that commodity company stocks behave more like other stocks than like their counterparts in the commodity futures market. An investment in commodity company stocks has not been a close substitute for an investment in commodity futures.

50. The Tactical and Strategic Value of Commodity Futures (Spring 2005)

Campbell R. Harvey, J. Paul Sticht Professor of International Business, Fuqua School of Business, Duke University had made available a paper by himself and Claude B. Erb, Managing Director, Trust Company of the West entitled “The tactical and Strategic Value of Commodity Futures.”

The previous presentation on commodity futures by Geert Rouwenhorst (No. 49) had focused on analysis of an index of commodity futures. Harvey’s focus, on the other hand, was primarily on individual commodity futures or on particular sectors. Some of Harvey’s conclusions, particularly with respect to inflation hedging, differed from those of Rouwenhorst and much of this was a function of the different focus. In addition, Harvey was particularly interested in opportunities for tactical strategies in the futures market.

He reviewed the three most commonly used commodities futures indices, the Goldman Sachs Commodity Index (GSCI), the Dow Jones-AIG Commodity Index (DJ AIG), and the Reuters-CRB Futures Price Index (CRB). Since the GSCI open interest represents 86% of the combined open interest of the three indices, Harvey based most of his analysis on data from it. The GSCI currently invests in 24 underlying futures contracts and is heavily skewed towards energy exposure because its portfolio-weighting scheme is based on the level of worldwide production for each commodity. It turns out that there are rather low correlations among the three indices, because of their different weightings.
In the overview to his presentation he made five points:

• The term structure of commodity prices has been the driver of past returns
  - And it will most likely be the driver of future returns

• Many previous studies suffer from serious shortcomings
  - Much of the analysis in the past has confused the “diversification return” (active rebalancing) with a risk premium

• Keynes’ theory of “normal backwardation” is rejected in the data
  - Hence, it is difficult to justify a ‘long-only’ commodity futures exposure

• Commodity futures provide a dubious inflation hedge

• Commodity futures are tactical strategies that can be overlaid on portfolios
  - The most successful portfolios use information about the term structure

In exploring the sources of return in commodity futures he began with the diversification return. This is essentially the return due to rebalancing of weights in a group of futures. Quoting from Booth and Fama, 1992, he noted:

“For a portfolio with a constant percentage invested in each asset, the compound return is the sum of the contributions of the individual assets in the portfolio. The portfolio compound return is greater than the weighted average of the compound returns on the assets in the portfolio. The incremental return is due to diversification. The contributions of each asset exceeds its compound return by the amount it adds to the portfolio diversification return.

The compound return on an asset is approximately the asset’s average return minus one half the asset’s variance. A portfolio’s average return is the weighted average of each asset’s average return, but a portfolio’s variance is the weighted average of each asset’s covariance.”

Harvey’s position is that the payoff to rebalancing is not a risk premium, it is an active strategy return. He followed with some examples and the mathematics of the diversification return.

He continued with the components of commodity futures excess returns. The two components are roll return and spot return. The roll return comes from maintaining a commodity futures position, selling an expiring futures contract and buying a yet to expire contract. This is somewhat analogous to rolling down the bond yield curve. The spot return comes from the change in the price of the nearby futures contract. The key driver of the roll return is the term structure of futures prices and the key driver of the spot return might be something like inflation. He demonstrated both drivers of futures returns graphically. Two distinct term structures go with the backwardation and the contango configurations. Backwardation refers to futures prices that decline with time to maturity (crude oil futures are an example), while contango refers to futures prices that rise with time to maturity (gold is an example).

He turned next to normal backwardation. The theory says:

• Commodity futures provide “hedgers” with price insurance, risk transfer

• “Hedgers” are net long commodities and net short futures
Futures trade as a discount to expected future spot prices

A long futures position should have a positive expected excess return

This theory, of course, applies to the case where the hedger is net long commodities and net short futures, but we find that some hedgers are short commodities and long futures and in this case a short futures position should have a positive expected excess return.

Next Harvey considered commodity futures as an inflation hedge, correlated with unexpected inflation. Historically, the GSCI has been highly correlated with unexpected inflation. But he raised the question do all commodity futures have the same unexpected inflation sensitivity? It turns out that commodity futures with the highest roll returns have the highest unexpected inflation betas. It also turns out that the average commodity itself trails inflation.

Finally, he turned to four tactical approaches. First, when the price of the nearby GSCI futures contract is greater than the price of the next nearby futures contract (when the GSCI is backwardated) we expect that long-only excess returns should on average be positive. Second, making use of momentum, go long the GSCI for one month if the previous one year excess return has been positive or go short if the previous one year excess return has been negative. Third, for individual commodities go long the six most backwardated constituents and go short the six least backwardated constituents. Fourth, form individual commodity momentum portfolios, by investing in an equally-weighted portfolio of the four commodity futures with the highest prior twelve-month returns, a portfolio of the worst performing commodity futures, and a long/short position.

51. Modeling the Dynamics of the Term Structure of Commodity Futures (Spring 2005)

Pierre Collin-Dufresne, Associate Professor of Finance, Haas School of Business, U.C. at Berkeley had made available two papers, the first being “Equilibrium Commodity Prices with Irreversible Investment and Non-Linear Technologies,” by himself, Jaime Casassus, Pontificia Universidad Catolica de Chile and Carnegie Mellon University, and Bryan R. Routledge, Carnegie Mellon University. The second is “Stochastic Convenience Yield Implied From Commodity Futures and Interest Rates” by himself and Jaime Casassus.

The paper presents an equilibrium model of commodity spot and futures prices for a commodity whose primary use is as an input to production, such as oil, and captures many stylized facts of the data, which the authors review.

Empirical studies of time series of commodity prices have found evidence of mean-reversion and heteroscedasticity. Further, combining time series and cross-sectional data on futures prices provides evidence of time-variation in risk-premia as well as existence of a ‘convenience yield’ (Fama and French (1987), Bessembinder et al. (1995), Casassus and Collin-Dufresne (CC 2002)). Interestingly, the empirical evidence also suggests that there are marked differences across different types of commodities (e.g., Fama and French (1987)). It appears that ‘convenience yields’ are much larger and more volatile for commodities that serve as an input to production, such as copper and oil, as opposed to commodities that may also serve as a store of value, such as gold and silver. Gold and silver markets exhibit mostly upward sloping futures curves with little variation in slope, whereas copper
and especially oil futures curves exhibit more volatility. In particular, oil future curves are mostly downward-sloping (i.e., backwardation), which, given the non-negligible storage costs indicates the presence of a sizable ‘convenience yield.’

Collin-Dufresne was particularly interested in the significance of the convenience yield and its role in the valuation of futures contracts. The convenience yield is defined as an implicit dividend that accrues to the holder of the commodity (but not to the holder of the futures contract). This definition builds loosely on the insights of the original ‘theory of storage’ (Kaldor (1939), Working (1948, 1949), Telser (1958), Brennan (1958)) which argues that there are benefits for producers associated with holding inventories due to the flexibility in meeting unexpected demand and supply shocks without having to modify the production schedule.

The authors’ model has regime switching between the near-investment and the far-from-investment regions. There is an infrequent state that is characterized by high prices and negative return and a more frequent one that has lower average prices and exhibits mean-reversion. To further test the model the authors estimate the smoothed inference about the state of the economy (Kim (1993)), i.e., they back out the inferred probability of being in one state or the other. They find that, as predicted by the theoretical model, futures curves are mostly convex in the near-to-investment region but concave in the far-from-investment region, reflecting the high degree of mean-reversion when investment and a drop in prices is imminent.

Crude oil futures prices were obtained from the New York Mercantile Exchange (NYMEX). They used daily prices from 1/2/97 - 8/29/03 and contracts with maturities of 1, 6, 12, 18, 24, 36, 48, 60, and 72 months. They consider this period of time in order to include contracts with longer maturities. The contracts with the higher number of observations are the 1-, 6-, and 12-months maturity contracts with 1653 observations, while the one with the lowest number of observations is the 72-months contract with 1457 observations. For the period considered, the means and volatilities of futures prices decrease with the maturity of the contract. This implies a high degree of backwardation in crude oil prices (in their dataset 66% of the time the 6-months maturity contract is below the 1-month maturity contract).

He described the conclusions as follows:

We develop an equilibrium model for spot and futures oil prices. Our model considers the commodity as an input for a production technology in an explicit way. This feature endogenizes one of the main assumptions in standard competitive models of storage, i.e. the demand function. Our model generates positive convenience yields and long periods of backwardation in futures curves without the necessity of running out of oil, like the standard “stock-out” literature. Convenience yields arise endogenously due to the productive value of the oil, which is consistent with the predictions of the “Theory of Storage”. This convenience yield is high when the stocks of commodity are low, and vice versa. By modeling explicitly risk-averse agents, we can investigate risk-premia associated with holding stocks of commodities versus futures contracts.

Equilibrium spot price behavior is endogenously determined as the shadow value of oil. Our model makes predictions about the dynamics of oil spot prices and futures curves. The equilibrium price follows an
heteroscedastic mean-reverting process. The spot price is non-Markov, because there are two regimes in our economy that depend on the distance to the investment region. For reasonable parameters, the futures curves are most of the time backwardated. Also, the two regimes imply that two futures curves with similar spot prices can have very different degrees of backwardation.

We calibrate the model using futures price and economic aggregates data. We find that the model captures many of the stylized facts of our data set. In particular, our model can reproduce the means and volatilities of futures prices for maturities up to 72 months and also the average consumption of oil-output and output-consumption of capital ratios. We estimate a linear approximation version of our model with crude oil prices from 1982 to 2003. Our empirical specification successfully captures spot and futures data. Finally, the specific empirical implementation we use is designed to easily facilitate commodity derivative pricing that is common in two-factor reduced form pricing models.

52. Running Out Of and Into Oil: Analyzing Global Oil Depletion Through 2050 (Spring 2005)

David L. Greene, Oak Ridge National Laboratory made available a paper entitled “Running Out Of and Into Oil: Analyzing Global Oil Depletion and Transition Through 2050”, prepared for the US Department of Energy, October 2003, by himself and Janet L. Hopson and Jai Li of the University of Tennessee.

He began by tracing some of the recent history of oil production end use and the special importance of OPEC. He noted that the modern debate over oil production and consumption has made a useful shift from concern over “running out” to the “peaking” of oil production, the date beyond which oil production can no longer be increased. With reference to OPEC, he noted that the US Energy Information Administration appears to be counting on significant increases in production from OPEC although it seems clear that OPEC can profit more by holding back production in anticipation of rising prices.

For the most part, geologists are pessimistic about oil production and expect it to peak by 2010. Economists, on the other hand are generally optimistic. They count on technological progress to exceed the rate of depletion and believe that the market system will provide sufficient incentives to expand and redefine resources. Greene takes the optimistic view, but seeks to quantify it.

It is important to distinguish at least two kinds of oil. Conventional oil is in the form of liquid hydrocarbons of light and medium gravity and viscosity, in porous and permeable reservoirs, plus enhanced recovery and natural gas liquids. Unconventional oil consists of deposits of a density greater than that of water (heavy oil), of viscosity greater than 10,000 cP (oil sands) and of tight formations (shale oil). Although some production has begun on unconventional oil sources, the expectation is that conventional oil, being cheaper to produce, will take care of demand until a shortage leads to reliance on unconventional.

There is considerable uncertainty about how much oil there is. The year 2000 study of the US Geological Service indicates about 3 trillion barrels of conventional oil, plus another 300 billion if natural gas liquids are included. These estimates include cumulative production to the year 2000 of 540 billion barrels.
In his study, Greene relied on three sets of estimates: USGS 2000 conventional oil estimates plus the unconventional oil estimates synthesized from USGS/WEC/IEA; Rogner’s 1997 estimates; and estimates based on Campbell’s (2003) year-end 2002 global assessment. Campbell’s estimates are at the pessimistic end of the scale while those of the USGS are optimistic.

For modeling purposes, six depletion/transition scenarios were constructed. They were based for the most part on existing projections of production and energy use. It is convenient to distinguish Middle East oil production from non-Middle East (NME) oil production. The latter is carried on essentially under competitive conditions, while the former is at least at present under monopoly conditions.

The six scenarios test three alternative sets of conventional and unconventional oil resource estimates against a reference world energy scenario, then test somewhat higher and radically lower energy scenarios against the resource estimates based on the USGS assessment and finally examine the implications of a pessimistic assessment of world oil resources in the low energy use scenario.

Changing Middle East production forces demand and supply from other regions to adjust, but they will adjust from the scenario values to which they have been calibrated. As a result, changing Middle East production does not produce a new long-run equilibrium energy supply and demand scenario consistent with the new Middle East path. Rather it produces an adjustment of demand in NME supply to an unexpected change in Middle East supply.

The risk analysis simulations based on the USGS assessment indicated an expected peak year for conventional oil production from NME of about 2023, with a roughly 10% probability that the date would be later than 2028. The results suggest only a 5% probability that the peak year will occur before 2016 and essentially no chance of non-Middle East conventional oil production peaking before 2010. In sharp contrast, simulations based on Campbell’s data indicate little chance of the peaking date occurring after 2010 and an expected peak production date of 2006.

Simulations using USGS resource estimates indicate that the peak year for world conventional oil production will be sometime after 2015 but is more likely to occur after 2040 than before. Rogner’s estimates produce greater certainty of a conventional oil peak occurring before 2050. And Campbell’s estimates point to 2015 as the expected date of peak world conventional oil production.

Greene went on to discuss the sensitivities of peaking dates to key parameters. The most important factor overall is the rate of increase in production from the Middle East and Northern Africa. The target reserve/production ratio for NME producers is the second most important factor. The higher the target ratio, the sooner NME production peaks but the flatter the peak is. Since the world peak is largely determined by Middle East output, a long flat NME production curve postpones the overall world peak. The world peaking date depends strongly on only one factor: the rate of increase in Middle East production. Greene concluded that using the estimates based on Rogner or the USGS, peaking of NME conventional oil production is likely sometime between 2010 and 2030. Under a wide range of assumptions the rate of growth in world conventional oil production will slow substantially after 2020 if it does not decline. The transition to
unconventional oil will be rapid if the growth of oil consumption continues at current rates or rates projected through 2020 by the Energy Information Administration. At first, unconventional oil supplies are likely to come from the oil sands resources of Canada, followed by increased development of Venezuelan and Russian resources. If growth and demand continue, US shale oil (or some other source of liquid hydrocarbons) will begin to be developed at a rapid pace following the peaking of conventional oil production from NME regions.

It appears that OPEC market dominance is robust to a wide range of alternative demand and resource availability scenarios. This is evidenced by OPEC’s ability to maintain market share in the vicinity of 30 percent to 50 percent over the entire 50-year period in all scenarios and variants. Moreover, the Middle East will remain the lowest cost supplier of oil. While the emergence of large-scale unconventional oil production could put a cap on long-run oil prices, with the majority of the world’s proved conventional reserves, Middle East producers will have the ability to temporarily raise or lower world oil prices throughout the period.

**Corporate Governance**

53. **Should Investors Remain Passive On Corporate Governance?**  
*(Spring 2003)*

The opening speaker at the Spring 2003 Q-Group® Seminar was John Biggs, former Chairman and CEO at TIAA-CREF, who was introduced by Martin Leibowitz, Chief Investment Officer of CREF.

Biggs began by describing three elements of our system of corporate governance: strong management, weak boards of directors, and passive investors. He saw advantages to the strong CEO, but found it perhaps strange that a CEO hired for competence in the business of the corporation and its strategy is being given complete control over activities in which he may have no experience or particular expertise. Examples are responsibility for the management of pension funds, and relations with the external community, including policies with respect to disclosure. Other industrialized nations, the UK for example, place significant responsibility in the Chairman of the Board, including responsibility for corporate strategy and external relations. The CEO essentially carries out the program established by the Chairman. Comparing the British with the US system, he equated the British Chairman to the US Chairman and CEO, and the British CEO to the President and Chief Operating Officer in the US. Comparing advantages and disadvantages of the CEO authority in US corporations, he concluded that it would not be wise to attempt to weaken that authority as a general principle.

With respect to the Board of Directors, he referred back to the writing in the 1930s of Berle and Means, who saw as a fundamental problem in US corporate governance the lack of anyone in a position of authority looking out for the shareholders. He saw reason to be optimistic about strengthening the role of the Board. Independent directors have become more common on boards. Audit committees and compensation committees are taking more significant roles. At the same time, he questioned whether we can expect boards of directors to perform better when they do not feel any aggressive push from shareholders.
The serious problem rests with passive shareholders. In some countries, notably Japan and Germany, large equity holders, and in Japan the government, tend to keep a close eye on corporate managements and can exert considerable influence. In the United States, the major institutional investors — life insurance companies in the past, but more recently banks and mutual funds — have generally avoided attempts to influence corporate governance. Part of this has to do with a short-term mentality with respect to equity investing. Long-term investors are the most likely to be willing and able to play a strong ownership role. He does see some progress in the voting of proxies.

In commenting on the attractiveness of greater institutional influence on corporations he cautioned against a degree of intrusion that might lead to political repercussions. This may be especially true of insurance company investors.

In closing, he raised the question whether problems with corporate governance are so serious as to call for structural changes, and hoped not. He was not, however, optimistic that corporate governance would improve significantly before shareholder attitudes change.

Demographics, Social Security, Saving & Lifestyle Finance

54. The Long-Term Budget Outlook and Social Security Reform: Implications for Financial Markets (Fall 2005)

Kent Smetters, Associate Professor of Insurance & NBER Research Associate, The Wharton School, University of Pennsylvania, made available a paper by himself and Jagadeesh Gokhale entitled “Fiscal and Generational Imbalances: An Update.”

The paper provides an update of the US fiscal and generational imbalances that were originally calculated by the same authors in 2003. Much has changed in just a few years. In particular, the nation’s fiscal imbalance has grown from $44 trillion as of fiscal year end 2002 to about $63 trillion, mostly due to the recent adoption of the prescription drug bill (Medicare, Part D). The imbalance also grows by more than $1.5 trillion (in inflation adjusted terms) each year that action is not taken to reduce it. In contrast, US debt held by the public is only $4.4 trillion.

Traditional federal budget measures substantially underestimate existing liabilities. They fail to take account of approximately $60 trillion in long-term liabilities. The true federal fiscal imbalance is calculated as the debt held by the public plus the present value of all future outlays (for Social Security, Medicare etc.) minus the present value of all future revenue. The long-term liabilities have been incurred only during the past 50 years or so, and the federal budget has not yet caught up. The fiscal imbalance must be brought to zero for sustainability. Smetters pointed out why reforms to correct the fiscal imbalance are difficult, in some cases because of misperceptions, and in others for political reasons.

In addition to fiscal imbalance we have a generational imbalance. The latter arises because younger generations subsidize older generations. To correct or at least ameliorate generational imbalance, we must choose among a set of sustainable policies.

Smetters set out a series of economic and demographic assumptions underlying his calculations of both imbalances:
• Real annual discount rate, \( r = 3.6\% \)
• Real annual per-capita productivity, \( g = 1.7\% \)
• Excess real growth of health care over productivity until 2080, \( h = 1.0\% \)
• 2080-2100: excess growth reduced linearly to 0
• After 2100: excess growth fixed at 0

A particularly interesting assumption is the excess real growth in health care costs over productivity of 1%. This “wedge” is the same as that used by the Trustees of Social Security and Medicare. By historic standards it is quite conservative. The actual wedge for 1980-2001 was 2.3%.

A table of fiscal and generational imbalances was particularly interesting. The fiscal imbalance in Social Security as of 2004 was $8 billion. It is forecasted to rise in 2005 to $8.4 billion and in 2010 to $10.2 billion. The forecast fiscal imbalance in Medicare (Parts A, B & D) is far greater, at $61 billion in 2004, $63 billion in 2005 and $76 billion in 2010. The total forecast fiscal imbalance of $63 billion in 2004, $66 billion in 2005 and $79 billion in 2010 arises because the forecast fiscal imbalance for the federal government apart from Social Security and Medicare is actually negative at $-6 billion.

The magnitude of the fiscal imbalance can be brought into perspective by looking at three options for paying the $63 trillion. Confiscating all of the physical capital assets in the United States would not quite do the job. Increasing federal income taxes by 68% immediately and forever, assuming no reduction in labor supply or savings would do the job. Increasing the combined employer-employee payroll tax from 15.3% to over 32% and also removing the payroll tax ceiling would do the job. Finally, slashing Social Security and Medicare by over half would do the job. As a practical matter, it is easier to fix Social Security than to fix Medicare. The Social Security imbalance is smaller, and easier to deal with because it is a cash payment. The Medicare problem is seven times as large, and harder to fix because the payment is in-kind (medical products and services) and driven by technical change.

Smetters raised the question why have fixed income markets not reacted with higher interest rates to the problems he has described. One possibility is that the capital markets do not understand the problem. Another is that capital markets believe that most of the obligations will be reduced by reducing benefits.

He concluded with some comments on the President’s Social Security Plan. The proposal is for an actuarially-fair carve out. For every dollar now paid in Social Security tax that would be diverted to a personal account, the individual’s Social Security benefits would be reduced by a $1 present value. The end result would leave the fiscal imbalance unchanged. But about 50% of US households do not hold any equities directly or indirectly, so there is some question as to how many would take the option for personal accounts invested in equities.

55. The Impact of Global Aging on Saving, Investment, Asset Prices and Returns (Fall 2005)

Smetters’ preceding presentation (No. 54) had been exclusively concerned with the United States. Burtless extended the discussion to consider the problems globally. Populations in both rich and poor countries are growing older. The impact of aging on financial markets and the economy may be important. There may be relative declines in rates of saving and investment. Will aged societies be net lenders or net borrowers? The answer has implications for asset prices and returns. For an open economy, the demographic change may have implications for current account balances.

Burtless turned to life-cycle consumption theory. Consumption is essentially level over a lifetime, while earnings rise with age, peak at something like 50 years of age, decline to about age 65, and then drop to about zero. Over the lifetime, earnings approximately equal consumption. The pattern of wealth accumulation that follows the earnings and consumption pattern shows dissaving up to approximately age 45, then savings rising and peaking at about 65, and then declining to about zero around age 90. Burtless raised the question whether household saving is actually consistent with what the life-cycle hypothesis implies. Microeconomic analysis seems to indicate weak life-cycle influences. Many people have no significant retirement savings. And highly disparate patterns of wealth accumulation make it difficult to estimate aggregate savings patterns.

Evidence on the proportions of income from capital and from labor across ages supports the life-cycle theory. Evidence on savings rates is less supportive. The high savings rates for those 65 and older are not consistent with the theory. This is when savings are measured as after-tax income minus consumption expenditures. When saving is measured as change in wealth minus estimated capital gains, savings for those 65 and older appear much lower, and there is a better fit with the life-cycle theory.

When we turn from microeconomic to macroeconomic analysis, we find stronger evidence of demographic effects on saving. Even then, within-country demographic changes are small compared to changes in saving, and the significant decline in US saving overall since the mid-1980s contradicts the prediction of the theory.

Burtless turned next to whether changes in the age structure have the impact on investment demand implied by the life-cycle hypothesis. The theory would say that a slower labor force growth should reduce growth of required capital stock. There are only a few studies of the impact of aging on investment demand, and Burtless commented on two major studies that reached contradictory forecasts of the future relationship of savings and investment. So we just don’t know whether the theory is consistent with the evidence.

Next was the question whether changes in the age structure have a significant impact on asset prices. The difficulty in making forecasts here is illustrated by the Mankiw-Weil prediction in 1989 with respect to housing prices. Demographic changes led them to forecast from 1990-2005 a significant decline in housing demand and in prices, when the opposite actually occurred.

Continuing with the asset price issue, we find that risky asset holdings as a percent of net financial assets, in the US, rise from the age bracket 20-24 up to the bracket 40-44 and then decline steadily for those 75 and older. However, risky assets as a percent of household net worth (including homes)
in the USA show a rise from the 20-24 age bracket to the 50-59 age bracket and then very little change through age 75 and older. A tabulation from the US Survey of Consumer Finances (1983-1995) showed a somewhat similar pattern, with the peaking at the age bracket 65-69 but a larger decline to 75 or older.

Under the title Research Agenda, Burtless commented on savings, investment and asset price effects. With respect to saving there is a large disconnect between the micro and macroeconomic research on saving. A general increase or decrease in saving across generations appears much more important than savings related to demographics. And savings patterns differ greatly from country to country. With respect to investment, we need to know more about the linkage between labor force growth and technological change. And we need panel data for a large sample of countries in order to refine our estimates of demographic effects.

With respect to asset prices, we need to improve the microeconomic data to incorporate pension funds and likely patterns of investment and disinvestment.

56. Saving, Portfolio Choice and Individual Investors: What Are We Learning from Behavioral Studies? (Fall 2005)

John Ameriks, Senior Investment Analyst, The Vanguard Group, made available a paper by himself and Stephen P. Zeldes entitled “How Do Household Portfolio Shares Vary With Age?”

Using pooled cross-sectional data from the Surveys of Consumer Finance, and new panel data from TIAA-CREF, the authors examined the empirical relationship between age and portfolio choice, focusing on the observed relationship between age and the fraction of wealth held in the stock market. Their paper illustrates and discusses the importance of the well-known identification problem that prevents unrestricted estimation of age, time and cohort effects in longitudinal data. They also document three important features of household portfolio behavior: significant non-stock ownership, wide-ranging heterogeneity in allocation choices, and the infrequency of active portfolio allocation changes (almost half of the sample members made no active changes to their portfolio allocations over a nine-year sample period). In estimating portfolio share equations, they considered three separate exclusion restrictions: excluding time effects, cohort effects, and finally age effects. They found no evidence supporting a gradual reduction in portfolio shares with age. However, for older individuals to shift completely out of the stock market around the time of annuitizations and withdrawals.

The economic theory proposed by Mossin, Samuelson and Merton says that the fraction of wealth optimally held in stocks is constant and independent of both age and wealth. The assumptions underlying the theory are no labor income or non-tradable assets, stock returns are i.i.d., constant relative risk aversion utility is time invariant, and there are no transactions costs or other market frictions. To break free of the constant fraction of wealth held in stocks the authors must break free of some of the assumptions. A key issue is the correlation of labor income with the stock market. They could also consider other utility functions, including risk aversion.

Turning to practice as distinct from theory, Ameriks observed that the usual
professional advice is that the longer the investment horizon, the greater the equity share should be, and a typical rule of thumb is that the fraction of financial assets invested in stocks should equal 100 minus the investor’s age. Consistent with this advice are “life-cycle” mutual funds. The solution to the optimal portfolio choice problem will be of the form:

$$\omega_{it} = f(a_{it}, b_i, t, W_{it}, Z_{it}),$$

where

- $$\omega_{it}$$ = share of financial wealth in equities
- $$a_{it}$$ = age of person $$i$$ at time $$t$$
- $$b_i$$ = birth year of person $$i$$
- $$t$$ = calendar time
- $$W_{it}$$ = financial wealth of person $$i$$ at time $$t$$
- $$Z_{it}$$ = other state variables and person-specific characteristics

There is, however, a well-known identification problem that arises because $$a_{it} = t - b_i$$; what this means is that one can test pairs of the three effects, but not all three together. And Ameriks demonstrated that depending upon which pair is chosen, one can arrive at quite different explanations for variations in asset allocation across ages.

One source of data was the Surveys of Consumer Finances conducted in 1962, 1983, 1989, 1992, 1995, and 1998. A second source was a large sample (~16,000) of TIAA-CREF participants, for up to 13 years (52 quarters) of data on contributions, accumulated balances, and transfers. In addition, the research made use of a smaller sample (~2000 individuals) with a one-time survey of demographics and assets outside of TIAA-CREF, linked to ten years of quarterly administrative data. New data recently incorporated in the research covered a population of Vanguard clients with assets in tax-deferred individual accounts, excluding employer plans, as of 12/31/2004. Two million records were available, showing historical balance data back to 1998 reconstructed from transactional records.

An important feature of household portfolio behavior is that while about half of all US households do not own any stock, the fraction of households owning stock has risen substantially over the period 1962 (23.9%) to 2001 (52.2%). With respect to TIAA-CREF participants, 20% owned no stock in 1987 and less than 15% owned no stock in 1999. Looking at flows (rather than balances) of contributions into TIAA-CREF, we can see clustering particularly at 0%, 25%, 50%, 75%, and 100% stock purchases.

A second feature is the infrequency of changes in asset allocation of balances and the allocation of flows.

Turning to patterns based on age, Ameriks presented a number of graphs showing both cohort and age influences on equity shares. Similar patterns appeared in both assets and flows. It was important to examine separately ownership probability and equity share conditional on ownership. There was little evidence supporting a systematically declining age pattern over the entire period, with the possible exception of decreasing probability of being a stockowner at later ages. Through time, cohorts generally showed an increasing emphasis on stocks. Ownership actually rose in older cohorts, and more than 70% of those in their seventies still owned some equities as of 2004.

It does turn out that across all individuals in the 55-70 age bracket, the equity share is declining. But all of the decline appears to be in the probability of stock ownership, and none in the equity share conditional on ownership.
The final conclusions were:

- No evidence supporting gradual, systematic decline in equity shares with age.

- At best, based on TAA-CREF data, there is some evidence of people shifting completely out of equities around retirement as they begin to withdraw or annuitize their money.

- Most recent Vanguard data shows that equity exposure among the old is still not uniformly decreasing.

57. What Does the World Look Like When 70 Becomes the New 40: Effects on Spending, Savings and Asset Prices (Fall 2005)


He began by observing that in revisiting quantitative thought processes, he often finds that the original insights have been greatly simplified and often narrowly interpreted or worse, misinterpreted, by practitioners. He described his paper as concerned with an unusually pervasive compression in global financial risk premia at present.

Turning to demographics, he commented on the argument that retirement costs of aging countries will be financed in the future by younger workers in developing nations. He expressed skepticism that the economies of developing nations would be able to perform such a service. In addition he noted that while funded pension schemes allow for economic transfer of wealth across borders through debt or equity ownership, pay-as-you-go systems will not accrue the same wealth transference. These systems rely on a closed set of workers to finance a country’s retirement costs.

He continued, observing that political intransigence regarding Bush’s funded Social Security pension proposal and the current power base that the AARP controls through lobbyists means that the US is likely headed in a direction similar to that of France for at least a portion of the US population.

In a March 2005 speech, Ben Bernanke discussed the notion of a “savings glut” in Asia as the source of liquidity pouring into US financial markets, depressing real and nominal interest rates. China’s circumstances shed a new light on the body of economic research on demographics. There tends to be very little crossover work from sociologists to economists considering the demographic issue in a broader context.

According to CitiStreet, large balance IRA Rollover and 401 (k) accounts are not being drawn down as fast as actuarial tables would predict. CitiStreet confirmed that this holds even for the subgroup of accounts that have established regular distributions. The drawdown rate either assumes negative asset growth in the future or a life expectancy well beyond current actuarial tables. It is likely that Prospect Theory, by Kahneman and Tversky may describe the behavior of these retirement account holders. They make up a subset of the population displaying a propensity to save rather than consume current income.

The under consumptive nature of this savers group shows how societies may already be responding to the aging demographic issue. The implication is that a dynamic response mechanism is already at work screening out
consumptive behavior in the old age savers group and explicitly reducing the young consumptive group in relationship to the savers group in the middle. All of this implies that the rate at which savings will be drawn down may be persistently overestimated. It is possible the pressures on securities markets will either be delayed or less significant than might be suspected by analysis based on a Bernoullian view of the wealth drawdown. Further, the amount of wealth that will be inherited is greater than the currently estimated amount based on the fact that significant mortality will only begin to hit larger defined contribution balances between 2010 and 2030.

In a defined benefit plan, early death subsidizes those who live longer within the tax shielded asset pool. In the case of defined contributions, plan assets will be extracted upon death, or upon the second to die in the case of a spouse, creating a wealth transfer (due to estate taxes) to the government. Those who live too long and consume at a rate consistent with mortality tables increase old age poverty and become reliant on government transfers. This implies that through current income taxes and inheritance taxes today’s savers may, in their death, potentially become responsible for those who did not save and are solely reliant on the pay-as-you-go system or live too long.

Speculation in the near term will tend to center on the future of the defined pension plan as delinquencies similar to that of Delphi Automotive become more commonplace. In the final period just prior to the end of the current risk premium compression there will be a large number of defined benefit plans that are closed to new entrants and/or frozen to existing participants. These corporations will shift to a defined contribution pension plan. Asset allocations made either in response, or in fear of this phenomenon are likely to be misguided as to current compression and risk premiums being directly linked to the savings habits of an aging demographic.

The aggregate present value of the pension liability in the US is now the largest it has ever been as a percentage of GDP. There is an important difference between the future ratio of retirees to laborers in the system overall and the rapid escalation in value of a final pay pension liability as any single worker nears retirement. With baby boomers nearing retirement en masse, the value of their cumulative liability is accelerating while the financial asset markets are offering some of the lowest risk premiums in history. The victim of these confluences is the funded status of any defined benefit plan. Corporations will increasingly immunize liabilities in a classic risk aversion response to economic pressures on surplus. Pension plans closed or frozen are obligated to pay all benefits earned to that point, so the assets are not so much liquidated as they are reallocated. This will result in periodic wholesale liquidation of equity portfolios and purchase of medium to long duration bond portfolios.

58. The Realities of Social Security Reform (Spring 2002)

Robert Charles Pozen, Lecturer at Harvard University, and former Vice Chairman of Fidelity Investments, who recently served on President Bush’s Commission to Strengthen Social Security, delivered the opening after-dinner speech at the Spring 2002 Q-Group® Seminar.

He began with a succinct description of the chief problem now facing Social Security: demographics. In 1962 in the United States there were six working people for each retiree, while by 2032 we forecast two workers for each retiree. In addition, the Social Security surplus is a fiction, and the
unfunded liability is enormous. The year 2011 is an important year, because it will be the first year the baby boomers retire, and it is impractical to change the rules for people who have actually retired. In 2017 the system will move to yearly deficits, and in 2040 it will be bankrupt. Further, life expectancies underlying the planning for Social Security are very conservative. Just adding two years to the actuarial estimate has a huge effect on Social Security liabilities.

One proposed solution is to raise the Social Security tax from 12.4% to 18% to fill the gap. Another is raising the amount subject to the Social Security tax, to $100,000. This would cover 15% of unfunded liabilities, and an increase to $150,000 would cover 30%. But it would be difficult to do this without offering something to those whose taxes would go up, and this avenue is not politically popular.

Slowing the growth in benefits would help. The cost of living adjustment has already been reduced somewhat and it could be reduced further, but this would not gain much ground.

Indeed, the Commission has proposed increasing the minimum Social Security benefit to 120% of the poverty level, to bring better protection to very low-income wage earners. Similarly, there is a proposal to raise the benefit for the family of a single earner who dies, by raising the benefit to 75%. There is a further proposal to provide for 50/50 sharing for divorced couples.

We are seeing a substantial move on the part of workers towards early retirement, at the same time that life expectancies are rising. Penalizing early retirement and providing a greater incentive to continue working would be helpful.

Pozen turned to the proposal for personal retirement accounts (PRA). Social Security is predicting a 4.6% real return on equities over the rate of inflation. If this forecast is correct, then the PRA plus reduced benefits would do a lot to solve the problem. Pozen continued with a further discussion of how the PRA might work. He was opposed to any direct government interference in the investment of the equity funds. He suggested that a number of substantially diversified funds be authorized for the participation of workers. His conclusion was that the Commission had come up with a workable solution to the problems of Social Security. He said there is a fairly short time window in which action must be taken. Unless something is done before the baby boomers start retiring, then nothing will happen before the year 2030. As a practical matter, the best opportunity might be during Presidents Bush’s second term. That gives until the year 2008.

59. Bridging the Gap Between the Theory and Practice of Lifestyle Finance (Spring 2002)

Zvi Bodie, Professor, School of Management at Boston University, distributed a paper entitled: “Life-Cycle Finance in Theory and in Practice”. His presentation was a continuation, with specific examples, of the presentation made by Robert C. Merton at the Autumn 2001 Q-Group® Seminar (No. 60) dealing with ways in which financial institutions might better serve the lifetime finance needs of clients in coming years.

Bodie began with the observation that the trend from defined benefit retirement plans to defined contribution plans was indeed empowering but also
dangerous. The objective of his paper was to use financial science to design and produce a new generation of user-friendly life-cycle products for consumers. One of the important insights of modern financial science is that a person’s welfare depends not only on end-of-period wealth, but on the consumption of goods and leisure over the entire lifetime.

He saw investment management as a process of intermediation. An important example of an intermediate product is Treasury Inflation Protected Securities (TIPS) for retirement plans. Stripped TIPS become a powerful new investment tool. It turns out however that only one firm is offering stripped TIPS. Mutual funds do not offer them, and the Bureau of Debt Management complains that there is insufficient demand for TIPS. Bodie suggested that zero-coupon TIPS should be an important component of 401K plans or IRAs. Series I savings bonds with a real rate fixed for 30 years and deferral of income tax, could be valuable components of a retirement plan, although the rate offered is currently only 2%. There is a downside protection not available for TIPS in that the Series I bonds are always redeemable.

Turning to risk management, Bodie observed that diversification is the usual answer. But diversification across asset classes does not reduce intertemporal risk. Multi period hedging is the way to manage this risk, yet one finds that retirement planning models generally do not have term structure elements. Portfolio managers should make greater use of the interest rate and implied volatility information embedded in the prices of derivatives such as swaps and options. For optimizing models, for example, it would be much better to derive measures of volatility from the current marketplace rather than from history.

The value, riskiness and flexibility of a person’s labor earnings are of first order importance in optimal portfolio selection at each stage of the life cycle. But once again, we find these elements are not generally taken into account in retirement planning models. Habit formation can give rise to a demand for guarantees against a decline in standard of living and therefore in investment income. This suggests the need for products that will guarantee minimum income while offering some opportunity for higher although risky extra income.

Dynamic asset allocation should be part of lifetime investment strategy, yet individuals are poorly equipped to deal with this. Because of transaction costs, agency problems, and limited knowledge on the part of individuals, dynamic asset allocation should be an activity performed by financial intermediaries. In particular, the investment product industry should be offering vehicles for downside protection. An example is the real life annuity offered by Lincoln National Life. He pointed out that precautionary savings is the standard device recommended for risk protection, and commented that there are much better ways to hedge risk.

Summarizing what is being done (the old paradigm) and what should be done (the new paradigm), he presented the following table:
<table>
<thead>
<tr>
<th>Feature</th>
<th>Old Paradigm</th>
<th>New Paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure of Wealth</td>
<td>Wealth</td>
<td>Lifetime consumption of goods and leisure</td>
</tr>
<tr>
<td>Time frame</td>
<td>Single period (Stocks seem safe in long run)</td>
<td>Many periods (Stocks are risky in short and long run)</td>
</tr>
<tr>
<td>Risk Management techniques</td>
<td>• Precautionary saving</td>
<td>• Precautionary saving</td>
</tr>
<tr>
<td></td>
<td>• Diversification</td>
<td>• Diversification</td>
</tr>
<tr>
<td></td>
<td>• Mutual finds</td>
<td>• Hedging</td>
</tr>
<tr>
<td>Retail investment products</td>
<td>Mean-variance efficiency and Monte Carlo simulation</td>
<td>• Insuring</td>
</tr>
<tr>
<td></td>
<td>• Estimated from historical statistics</td>
<td>• Structured standard of living contracts</td>
</tr>
<tr>
<td>Quantitative model</td>
<td></td>
<td>• Targeted accounts (e.g., tuition-linked CDs)</td>
</tr>
<tr>
<td>Capital Market expectations</td>
<td></td>
<td>Dynamic Programming and Contingent Claims Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inferred from current prices of financial instruments (swap curves and implied volatilities)</td>
</tr>
</tbody>
</table>

### 60. Observations on Time Horizons and Investment Decisions (Fall 2001)

Robert C. Merton, Nobel Laureate, Fellow of the Institute and John and Natty McArthur University Professor, Harvard Business School, offered a variety of suggestions for ways in which financial institutions might better serve the needs of clients in the coming years. He focused on three classes of clients: households, corporations and endowments. Households, he said, face far too many complex financial decisions. An important one is how to convert a defined contribution retirement plan into satisfactory consumption throughout retirement years. Another is simply the choice of an appropriate mutual fund for savings. Another is how to finance college education for children. Financial institutions offer a number of discrete products from which the household must pick and choose to best meet its needs. Overall, the household is attempting to satisfy consumption needs and to minimize risks. It is likely that there are financial institutions that can take care of both much more efficiently than the household can. He offered as an example the pricing of long-term care insurance and the pricing of life annuities. It seemed there was at least a possibility that a package of both might reduce the risk to an insurer of adverse selection, and that the two products as a package could be considerably cheaper to a household than the products purchased separately.
A major household asset is human capital. And surely it ought to be included in the household portfolio if we are to attempt an optimal asset allocation. For example, someone whose earned income is linked to a particular industry might be expected to hold fewer financial assets linked to the same industry than a household with no earning dependence on that industry. Incorporation of human capital in household portfolio selection must also take account of the flexibility in human capital. To some extent the age of retirement may be within the control of the household, but this flexibility will not be the same for every household. And for a household an optimizing model should recognize that level and stability of consumption over a lifetime is probably the chief objective of the household, at least over substantial periods of time. He suggested that a real life annuity unit maybe an appropriate numeraire for measuring the wealth of a client.

Financing the expected college education of a young child presents a household with considerable difficulty. One might think that there are financial institutions better able to cope with the uncertainty of tuition increases and investment returns than is the household, and therefore in a position to offer tuition futures contracts. In summary, his proposal was that individuals should not be bearing basis risk that can be handled much more efficiently by institutions.

Turning to the corporation as client, Merton argued that a pension fund, both in its assets and its liabilities, should be considered as part of the total assets and liabilities of the firm. In recent months corporations with substantial pension funds have seen dramatic declines in the pension surplus (or dramatic increases in the pension deficits) suggesting that these companies may be much more highly leveraged than the corporate capital structure would indicate. And as in the case of the individual whose human capital should be considered in setting an overall portfolio strategy, to the extent that the corporation depends upon particular industries for its revenue it is important to take that into account in allocating the pension fund assets.

Turning to endowment funds, Merton pointed out that the efficient asset allocation of the funds ought to reflect covariances with other sources of revenue. For some institutions, gift income is extremely important and one can imagine a sort of “shadow endowment” that is the capitalized value of the stream of gifts. And the liabilities of a university may also be important in the portfolio allocation. For example, a major liability of a university is faculty salaries. An increase in the cost of local housing may put serious pressure on salaries and a useful hedge might be an investment in such housing.

Overall, Merton suggested that there maybe substantial efficiencies to be gained by shifting risks to financial institutions, much as mortality risks have been shifted to insurance companies for centuries, through contractual arrangements that are at present non-existent or at least not widespread.

**Equity Lending**

61. **Stocks Are Special Too: An Analysis of the Equity Lending Market (Fall 2001)**

Christopher C. Geczy, Assistant Professor of Finance, University of Pennsylvania, David K. Musto, Assistant Professor of Finance, University of Pennsylvania and Adam
V. Reed, Assistant Professor of Finance, Kenan-Flagler Business School, University of North Carolina, distributed a paper entitled “Stocks Are Special Too: An Analysis of the Equity Lending Market.” The research was supported by The Q-Group®.

Geczy began the presentation with the motivation for the research. Short-sellers must borrow stock. The availability, expense and feasibility of short positions depends on availability and cost of loans. We would like to know the feasibility of strategies that involve short-selling in four important cases:

- Formation of factor-mimicking “spread” portfolios
- DotComs
- IPOs – Initially, later on and lock up expiration
- Merger Arbitrage

The methodology was essentially to recreate the situation of an investor who wants to short a stock on trading day $t$. We look ahead to $t+3$ to answer the question can he get shares and at what cost. And we ask the further question can he get shares at $t+4$ to continue. The source of data covers one year of stock loans by a major lender, including over 200,000 loans, with over 7,000 stocks loaned at least once, over 3,000 loaned out on a given day, covering the time span November 1998 to October 1999. The activities of this lender might be considered as characterizing the wholesale stock lending market.

A borrower of stock provides 102% cash collateral. If the stock is characterized as “general collateral”, or GC, it is not scarce and can be borrowed at low cost because the lender rebates some of the interest it earns on the collateral, at the GC rate. If the stock is scarce then it is “special” and the rebate is less. The amount by which it is less than the GC rate is the “specialness.”

It turns out that it is easy and inexpensive to borrow stock for factor-mimicking portfolios (for example, buying high book-to-market stocks and shorting low book-to-market stocks). Similarly, stock borrowing frictions were a minor impediment to shorting DotCom stocks. IPOs were a little different. Shorting was generally available only to well-placed investors from the first day, and the stocks only gradually became GC stocks. At 6-12 months they were cheap to short. For merger arbitrage (buying the target and shorting the acquirer), for those (especially hedge funds) able to borrow GC or special stock, the benefit of the arbitrage is not greatly reduced, but for those without access to specials the strategy is a good deal less valuable. An important observation here is that while loan scarcity can have a significant impact on an attempt to arbitrage a particular merger, it does not have a significant impact on a strategy of arbitraging mergers as a class.

Geczy next turned to three trading strategies that are considered profitable, to explore the impact of borrowing costs. The first strategy is suggested by the Fama/French work: buy small-cap and short large-cap stocks. The second, from the same source, is buy high book-to-market stocks and short low book-to-market stocks. A third strategy is buy winners and short losers. Stocks were sorted into the six portfolios every Wednesday. Returns to the long positions on day $t$ are the equally weighted returns of all stocks assigned to that position for $t$. Returns to the shorted stocks for day $t$ (the unconstrained short sides) are likewise the equally weighted returns of all stocks assigned to the short side for $t$. Returns to the short positions for day $t$ (the GC and special short sides) are the
equally weighted returns of only the GC and special stocks (as of \( t+2 \)) assigned to the unconstrained portfolio for \( t \), specialness cost is calculated separately. Returns to the shorted positions for day \( t \) (the GC only short sides) are the equally weighted returns of only the GC stocks (as of \( t+2 \)) assigned to the unconstrained portfolio for \( t \). Given these calculations it is possible to see the cost of GC and special portfolios relative to unconstrained profitability.

David Musto took over the presentation at this point, to show that even the specialness cost did not seriously detract from the profitability of the strategy.

For the DotComs the results were similar. The IPO situation is more interesting. It turns out that despite complaints from many sources about the extraordinary difficulty of shorting IPOs, about \( 3/4 \) of the stocks are borrowable for trading on special on the first day, although nothing is GC on the first day. After about the third day, GC borrowing becomes available on a small scale and for the next three weeks GC borrowing increases while special borrowing decreases. And at the end of that time about \( 1/4 \) of the stocks have become GC. Musto continued with a discussion of the particular characteristics of IPOs and differences among IPOs that may have to do with the difficulty of shorting them.

The presentation was completed by Adam Reed, who discussed merger arbitrage. It is said that acquirers tend to be special stocks so that an important question was the extent to which specialness costs cut into merger arbitrage profits. Reed also explored the question what profits can be made with just GC stocks, and what makes some acquirers harder to short than others. The research covered 226 mergers, all of those announced in the first 11 months of the sample. A regression related the specialness at time \( t+3 \) to the log of the market cap of the acquirer plus the log of the market cap of the target. At 0, 5, 10, 15 and 20 days after the merger announcement, the coefficient of the first variable was consistently negative and significant in the early days after the announcement, while the coefficient on the second was consistently positive and not nearly as significant. This is consistent with the intuition that a small acquirer will be harder to short. Three indices were constructed, one for all mergers, one for mergers where the acquirer is GC or special that day, and mergers where the acquirer is GC that day. With a limitation to GC stocks only, the return from the arbitrage was substantial, but only about the half the return in the unconstrained case. For GC and specials, the specialness cost was small.

The overall conclusions were:

- Factor portfolio expected returns are attainable, even with just GC stocks.
  - Specialness costs of specials is tiny.

- Substantial negative exposure to DotCom returns was available, even with just GC stocks.
  - Specialness cost of specials was around 115bp.

- IPOs are
  - Available but scarce at first.
  - Profiting from under-performance is feasible, especially for those who can short scarce stocks.
    - Specialness is 44bp/year.

- Merger arbitrage
  - Big effect of constraining shorts.

- Big picture
  - Short sale constraints are first-order considerations in the context of stock-specific events, but not in context of categories of stocks.
Financial Structure of Companies

62. Financial Architecture
(Spring 2001)

Stewart C. Myers, Gordon Y. Billard
Professor of Finance, Sloan School of
Management, Massachusetts Institute of
Technology, distributed a paper

Financial architecture, a term
proposed by Myers, is something
broader than corporate control or
corporate governance. It means the
entire financial design of a business,
including ownership, the legal form of
organization, incentives, financing and
allocation of risk.

Most of the theory and standard
practice of corporate finance has
developed with a particular financial
architecture in mind. Generally it is that
of a public corporation in a country such
as the U.S.A. or U.K. with well
developed securities markets. But even
in those countries there are other
distinct and successful architectures.

He introduced his talk by discussing
two questions. The first is why some
kinds of business firms go public while
others do not. The second is why some
types of conglomerates are successful
while others are not.

What are the reasons for going
public? One is access to financing.
Another is liquidity for early private
investors. Another is the determination
of an objective value of a company.
Myers pointed out that a related
objective may be receiving applause or
derision from investors with respect to
company activities. Finally, stock can be
used to compensate management. The
company can pay employees for
services that will confer a future benefit.

On the other side, objections to
going public include the hassle, the
paperwork, and the imposition of
regulation. Investors may be poorly
informed and perhaps shortsighted.
And effective control over management
by dispersed outsiders can be difficult.

In considering why high-tech firms
go public, it is useful to consider the
sequence of events in a business plan for
such a company. At stage 1, proving the
concept and manufacturing process, the
entrepreneur or scientist is essential.
The same is true of stage 2 comprising
pilot production and sales. In stage 3,
where product improvement and
manufacturing take place, the
entrepreneur is valuable but perhaps
not essential. At the full production
stage, the entrepreneur is probably
helpful but replaceable. At the final
stage of follow-on activities the
entrepreneur is simply not needed.
From the point of view of the
entrepreneur or scientist, the incentive
to work hard and bear great risks is
likely to be the prospect of ultimately
going public. The question then is at
what point should the firm go public.
The answer is somewhere around stages
2, 3, and 4, that is while the
entrepreneur is still important but not
essential. This strategy is appropriate
for both the entrepreneur and the
private investor who carries the firm’s
financial needs during the early years.

Myers took a further example:
biotech start-ups. For these companies,
assets are intangible, and there is high
uncertainty at the early stages of
development. It is difficult for outside
investors to evaluate performance or
prevent waste or capture of resources.
Investment requirements are
substantial, nevertheless, biotechs go
public “early.” Why is this so?
Investors in the IPO are patient and can diversify. The payoff to insiders depends on the price of shares. There is a very large upside potential if the R&D succeeds. And if it succeeds, the value of the product is reachable by outside investors, the interests of insiders and investors are aligned, and dispersed ownership limits investor power. Especially if the product is a patented FDA approved drug, investors are protected from theft, transfer or expropriation.

A management consulting company, on the other hand, has assets that are almost entirely human capital. Assets are not reachable by outside investors. Outside investors could not evaluate performance or prevent waste or capture of resources. Investment requirements are small, and management consulting companies are almost privately held. Myers commented that those that have gone public have generally not been successful. The key idea here is that a combination of human capital and financial capital needs set the stage for public financing.

Turning to the matter of conglomerates in the United States, Myers suggested that the advantages claimed for this form of business are internal diversification and reduction in risk, superior management, and increased shareholder value from growth in earnings per share. Why then have most conglomerates not been successful? Top management may have added value in some cases, but continuing synergies were rare. Diversification for risk reduction does not add value. U.S. conglomerates already had relatively easy access to capital markets, so there was little need for internal capital markets. Furthermore, internal capital markets often misallocate capital. It is impossible to observe the market values of divisions within a conglomerate, and therefore difficult to set incentives for division managers.

At the same time, there have been some successful U.S. conglomerates. These include private investment companies and partnerships, for example those engaged in venture capital, merchant banking, and LBO firms. But these are temporary conglomerates, their strategy is to buy, fix and improve, and sell. They do not “buy and manage.”

Outside the United States, however, conglomerates are quite common. Myers suggested among the reasons: size may give access to financial markets in foreign countries, and especially to international markets. Size and political power may be particularly important in “managed” economies. Family enterprises are important in some countries, and conglomerates may be essentially family owned. Companies in smaller countries may need scale to attract professional management and scale may require diversification. In some countries conglomerates may provide the clout to protect entrepreneurs from political interference.

The key ideas here are that there are many different financial architectures that are adapted to the nature of the business and local conditions. The particular financial architecture should depend on scale and nature of assets. On whether the assets are tangible or intangible. On the significance of assets in place versus growth opportunities. On whether the assets are reachable by financial investors. On the nature of business risk. And on human capital investment versus capital financed by outside investors. Once again, the choice has to do with the relative roles of human and financial capital.
Hedge Funds

63. Irrationality and Hedge Funds
(Fall 2003)

Richard Lindsey, President, Bear Stearns Securities Corporation, delivered the opening address at the Autumn 2003 Seminar. He began by observing that investment performance is path dependent. The same strategy that produced an impressive performance for one fund may produce very different results for another, because of a series of events quite out of the manager’s control. The result may give a false impression of randomness in quality of performance.

He observed next that managers who feel they have met a performance target before year-end frequently cease taking risks for the balance of the year, content to preserve what they have accomplished. Managers who have performed poorly to date, on the other hand, tend to take increased risk in the hopes of achieving a target by year end. He said we have still not solved this agency problem.

Investors reward hedge fund managers with a basic fee plus incentives. But how do they know whether the manager has really been successful? We don’t have good hedge fund performance measurements. He described performance comparisons he had made on 322 hedge funds, using monthly data, showing that 62 of the funds were statistically significant losers, and 30 were statistically significant winners.

Commenting that sophisticated investors chase returns, and thereby create performance ups and downs, he described the popularity of convertible arbitrage in 2002 and 2003. Convertibles were bid up, producing high returns for existing managers, and by the summer of 2003 the strategy had ceased to be profitable.

He noted too that custody data at Bear Stearns suggested $20 billion of excess cash in hedge funds, on which investors were paying 2% fees. Was this an example of “smart money”?

He closed with some comments on proposals for extending regulation to hedge funds. He observed that about 30% of hedge fund managers are already registered under the Investment Advisors Act. A major difficulty facing extension of regulation lies in the definition of a hedge fund.

64. Hedge Fund Industry Structure and Regulatory Alternatives
(Fall 2003)

Harvey Westbrook, Jr. financial economist in the Office of Economic Analysis at the Securities and Exchange Commission, had made available a paper entitled: “Hedge Fund Industry Structure and Regulatory Alternatives.”

In his introduction, he set out three questions:

- Why are hedge funds suddenly so interesting to investors, to financial regulators, and to other market participants?
- What has changed for the hedge fund industry?
- Why should we care?

Investors have become enthusiastic about the hedge fund search for absolute returns. Financial regulators don’t know nearly enough about what is going on in the hedge fund industry. Other market participants see in hedge funds both competition and opportunities. The hedge fund industry has changed with the introduction of
new types of funds and the participation of small investors through Funds of Hedge Funds (FOHFs). As participation in hedge funds moves beyond affluent and sophisticated investors, and particularly as the funds take in retirement money, there is increased concern for investor protection.

The hedge fund industry structure has some implications for possible regulation. We may think of hedge funds as a distinct asset class, or as asset management firms similar to investment companies, or as financial services firms. There is a further complication in that a number of foreign jurisdictions have mature hedge fund industries of their own. There are close relationships between some US and off-shore hedge funds, and it is relatively easy for a hedge fund to move to a foreign jurisdiction to escape US regulation.

The most significant current reach of US regulation to a domestic hedge fund includes FOHF registration with the SEC, and the application of the Employee Retirement Income Security Act of 1974 (ERISA) if employee benefit plans hold a large enough percentage of the fund.

Westbrook reviewed a number of regulatory alternatives. Tightening restrictions on the number or type of investors in a hedge fund would probably not be troublesome to the funds themselves, but it would deprive many investors of the opportunity to participate in hedge fund investment. Restrictions on portfolio holdings would be likely to divide hedge funds into those that are similar to investment companies and those that simply migrate off-shore. Restrictions on investment strategies would probably have the same effect, and would put regulators in the position of establishing the business model.

Disclosure requirements are a further alternative. But dynamic strategies are hard to disclose adequately, hedge fund portfolio information is extremely valuable and not always helpful to investors, and the end result might be simply to drive hedge funds off-shore. Attempts to control risk or require disclosure of risk measures are not likely to be any more successful. Risk measures are noisy. Operations risk, a particularly significant one, is not appropriately measured by standard metrics. It was on operational risk that Westbrook focused, and suggested the value of hedge fund certification. Finding and measuring operational risk we generally regard as “due diligence.” His proposal was that institutional investors as a group establish operational standards and issue certification. He saw these investors as having incentives to perform stringent due diligence. They could distribute due diligence costs by certification standards and creating a body to enforce them. The results would be beneficial for hedge funds and for all hedge fund investors.

65. Short Volatility Strategies: Identification, Measurement and Risk Management (Fall 2003)


A desire on the part of investors for full position transparency from hedge funds may be quite misguided. The risk exposures of certain hedge fund strategies are not revealed in balance sheet positions. Two strategies—merger arbitrage and event-driven—result in a “short volatility” exposure
not obvious from balance sheet positions. Merger arbitrage managers make a calculated bet that a merger will be completed, and they can be viewed as merger insurance agents. By shorting the acquirer and buying the target, the manager locks in a spread corresponding to a known insurance premium. If the merger fails, the manager takes the risk of loss away from the shareholders of the companies. The strategy is equivalent to selling a put option to those shareholders. Various other event-driven arbitrage strategies bear the risk of a short put option. The goal of Anson was to find a way to manage this risk exposure.

It turns out that the short volatility risk is very much related to the stock market’s return. A comparison of event arbitrage excess returns and merger arbitrage excess returns with excess returns on the S&P 100 index, shows a kinked regression line. To the right of the kink, the excess returns on the S&P 100 are positive and the excess returns to merger and event-driven arbitrage are almost constant. To the left of the kink, where excess returns on the S&P 100 are negative, there is a linear relation between the excess returns to the stock market and those to the hedge fund strategies. In essence, Anson plots two regressions with the different coefficients around the kink, following this model:

\[ r = \alpha + \sum \beta_i F_i + e + D\left[\alpha_{\text{high}} + \beta_{\text{high}}(R_{\text{OEX}} - R_f)\right] \]

Where

- \( R_{HF} \) is the return to the hedge fund strategy
- \( R_f \) is the risk free rate
- \( R_{OEX} \) is the return to the S&P 100

\( \alpha_{\text{low}} \) and \( \beta_{\text{low}} \) are the regression coefficients to the left hand side of the kink

\( \alpha_{\text{high}} \) and \( \beta_{\text{high}} \) are the regression coefficients to the right of the kink

\[ D = 1 \text{ if } R_{OEX} - R_f > 0; \text{ and } D = 0 \text{ if } R_{OEX} - R_f \leq 0 \]

Maintaining continuity of the regression line at the kink calls for the following condition:

\[ \alpha_{\text{low}} + \beta_{\text{low}} \text{(threshold)} = \alpha_{\text{high}} + \beta_{\text{high}} \text{(threshold)} \]

The regression statistics are shown in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Event Arbitrage</th>
<th>Merger Arbitrage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>t-Statistic</td>
</tr>
<tr>
<td>Threshold</td>
<td>0.007</td>
<td>#N/A</td>
</tr>
<tr>
<td>Alpha low</td>
<td>0.014</td>
<td>7.566</td>
</tr>
<tr>
<td>Beta low</td>
<td>0.460</td>
<td>9.494</td>
</tr>
<tr>
<td>Alpha high</td>
<td>0.017</td>
<td>#N/A</td>
</tr>
<tr>
<td>Beta high</td>
<td>-0.003</td>
<td>-0.051</td>
</tr>
<tr>
<td>S.E. Regression</td>
<td>0.015</td>
<td></td>
</tr>
<tr>
<td>R square</td>
<td>0.444</td>
<td></td>
</tr>
<tr>
<td>Adj R Square</td>
<td>0.436</td>
<td></td>
</tr>
</tbody>
</table>
For the event arbitrage, it is clear that the kink occurs at zero excess return on the market, the average premium earned from the strategy when the market excess return positive is 1.7% per month, and the slope of the line is essentially zero. To the left of the kink, the arbitrage excess return falls as the market falls. For the merger arbitrage the premium is only about half as large, and there is some market risk to the right of the kink, although to the left of the kink the loss in a falling market is about the same as for the event arbitrage.

Having identified the short volatility risk as the risk in a short put option, Anson next turned to build mimicking portfolios. The mimicking portfolios can be used to simulate the performance of arbitrage strategies under different market conditions.

The mimicking portfolio is constructed as follows:

- **Short OEX Put Option**
  - Strike = OEX Index x (1+threshold + R_f)
  - Volatility = VIX index
  - Number of options sold = (β_{low} - β_{high})

- **Long S&P 100**
  - Number to buy is equal to β_{high}

- **Long Risk Free security**
  - The number of risk free securities to buy = 1-β_{low}

It turns out that the mimicking portfolios for the event and merger arbitrage strategies show relationships to the S&P 100 excess returns very similar to those shown by the arbitrage strategies themselves. So the mimicking portfolios capture the premium collection attributes of an event-driven and a merger arbitrage hedge fund strategy, as well as the downside short put option exposures.

The next step was to run Monte Carlo simulations with the mimicking portfolios to develop Value at Risk (VaR) statistics. From these we can estimate the probability of the risk of loss associated with short volatility strategies. The results appeared as follows:

<table>
<thead>
<tr>
<th></th>
<th>Event Driven</th>
<th>Merger Arbitrage</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Month VaR @ 1% Conf</td>
<td>-2.51%</td>
<td>-6.04%</td>
</tr>
<tr>
<td>One Month VaR @ 5% Conf</td>
<td>-1.59%</td>
<td>-3.14%</td>
</tr>
<tr>
<td>Maximum Loss</td>
<td>-4.00%</td>
<td>-10.74%</td>
</tr>
<tr>
<td>Number of Simulations</td>
<td>10000</td>
<td>10000</td>
</tr>
</tbody>
</table>

It can be seen that the merger arbitrage strategy is considerably more risky than the event-driven strategy.

The next question was whether the risk exposure could be hedged. One possibility was to invest in a hedge fund strategy that tends to be long volatility.
The Barclay’s Diversified Commodity Trading Advisor (CTA) Index is an equal weighted composite of managed futures programs that trade a diversified portfolio. A scatter plot of managed futures versus the S&P 100, and the fitted regression line, suggested a long put position, the mirror image of the event-driven and merger arbitrage strategies. The conclusion was that managed futures are an excellent diversifying agent for a hedge fund program that includes event-driven and merger arbitrage strategies.

66. Do Hedge Funds Have Enough Capital? (Fall 2003)

Bing Liang, Associate Professor, University of Massachusetts, Amherst had made available a paper by himself and Anurag Gupta entitled: “Do Hedge Funds Have Enough Capital? A Value-at-Risk Approach”.

Liang’s presentation began with the question of hedge fund risk, continuing the theme of the previous speaker, Mark Anson (No. 65). And to the issue of risk and its measurement, he added the question of capital adequacy. Extreme value theory (EVT) gives us a measure of Value at Risk (VaR). VaR is a probability statement about the potential loss from changes in market factors over a specified time interval. VaR is designed to cover most, but not all, losses faced by a risky activity. Intuitively VaR can be interpreted as the equity required to support the risky activity. The Basel Committee recommended the use of VaR to determine capital requirements for financial institutions, and concluded that three times the VaR is an appropriate required equity capital.

Use Extreme Value Theory (EVT) to estimate the 99% 1-month VaR:

\[
VaR = \left[ \left( 0 - R_{99\%} \right) \times NAV \right]
\]

\( VaR = 99\% \) 1-month VaR,

\( R_{99\%} \) = Cut off return at 99% confidence level from the EVT estimation on the left tail,

\( NAV \) = The total net asset value (equity) of a fund,

Calculate a capitalization ratio (cap ratio) as

\[
Cap = \frac{E_{\text{actual}} - E_{\text{required}}}{E_{\text{required}}}
\]

where required equity is 3 times the 99% VaR while the actual equity is taken from the data.

The multiplier three takes care of estimate errors and model misspecification, as recommended by the Basel Committee.

Liang worked with monthly data from the TASS data source for hedge funds. A total of 1,436 hedge funds (942 live and 494 dead), met the criteria of a minimum 5-year return history (for live funds ending March 2003 and for dead funds ending at the date of death), with equity information for capital adequacy and style information for classification. He noted that the data covered volatile periods including the Asian crisis of 1997, the Russian debt crisis of 1998, and the 2000 stock market crash. The funds were grouped under ten classifications plus “other”. The largest grouping was long/short equity hedge funds, and the second largest was funds of funds. All of the funds were characterized by high values for kurtosis (fat tails), and many by negative skewness. It was clear, therefore, that standard deviation in returns was not an appropriate measure of risk. A table of relative VaR — the ratio of absolute VaR to fund net assets — averaged 11.3% for the live funds and 17.9% for the dead funds. Of the 942 total live funds, 35 were
undercapitalized. Of the 494 dead funds, 54 were undercapitalized. The undercapitalized funds were generally smaller, with equity capital about one-third the size of the capital of the healthy funds. They were more volatile than healthy funds, highly leveraged, and their returns had fatter tails and were more negatively skewed. The large funds (over $1 billion in capital) were better capitalized, used less leverage, were less volatile, and were older funds.

Liang went on to consider tail conditional losses (TCL). This measure estimates the potential size of the expected loss if it exceeds the VaR. On average for both the live and dead funds, the TCL was twice the VaR. This provided some assurance that three times the VaR, as the capital adequacy standard, erred if anything on the safe side.

Reference had previously been made to the inadequacy of VaRs derived from standard deviation, and Liang showed that they produced a less strict test of capital adequacy.

Finally, Liang showed that undercapitalized funds have shown an increase, especially after the LTCM episode. And lack of sufficient equity capital (or using high leverage like LTCM) could be a chief reason for a fund to die.

67. A Hedge Fund Risk-Factor Model (Fall 2003)

David A. Hsieh, Professor of Finance, Fuqua School of Business, Duke University, made available a paper by himself and Willliam Fung entitled: “Hedge Fund Benchmarks: A Risk Based Approach”.

Hedge funds promise a lot but disclose very little. The promises include absolute returns uncorrelated to conventional asset classes, an alternative source of alpha, and equity-like returns with bond-like risk. But information is derived from limited history and suffers from a lack of transparency in explaining how these good things come about. The source of alpha is alternative to what? And we see both equity-like and bond-like disasters. Investors need to know how the alternative returns are generated, and how to develop strategies for hedging tail risks. A first step is to create transparent, rule-based investable alternative portfolios. It will help to estimate expected return and risk that relate to conventional economic factors. The hedge fund risk factor model is the following:

\[ r = \alpha + \sum \beta_i F_i + e \]

where \( \alpha \) is the alternative alpha, the \( F_i \) are the risk factors, and the \( \beta_i \) are the beta coefficients for the factors. The next question is what are the factors and are they investable? From the rate of return data we can arrive at return-based style factors. But we need asset-based style factors. Prior research had suggested seven such factors.

The trend-following strategy produces high returns when the stock market makes extraordinarily high or low returns, the same phenomena that result from option straddles. Five portfolios of long straddles were useful for extracting common returns for trend followers. A short put on an S&P index worked well for merger arbitrage hedge funds. For fixed income strategies, a common risk factor was the credit spread between Baa bonds and 10-year Treasuries. The change in the 10-year Treasury yield was also helpful. For long/short hedge funds, two risk factors were the S&P index and the difference between small and large cap returns.

A regression of the HFR Fund of Funds Index over two time periods (it
turned out there was a sample break in March 2000) produced the following results:

<table>
<thead>
<tr>
<th></th>
<th>Jan 99 — Feb 00</th>
<th>Apr 00 — Dec 02</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff</td>
<td>t-stat</td>
</tr>
<tr>
<td>Constant</td>
<td>0.0045</td>
<td>2.75</td>
</tr>
<tr>
<td>S&amp;P</td>
<td>0.28</td>
<td>6.86</td>
</tr>
<tr>
<td>SC-LC</td>
<td>0.30</td>
<td>6.76</td>
</tr>
<tr>
<td>Change in 10 yr Treasury</td>
<td>-2.10</td>
<td>-2.38</td>
</tr>
<tr>
<td>Change in credit Spread</td>
<td>-8.14</td>
<td>-4.53</td>
</tr>
<tr>
<td>Option on bonds</td>
<td>-0.0069</td>
<td>-0.70</td>
</tr>
<tr>
<td>Option on Currencies</td>
<td>0.0043</td>
<td>0.58</td>
</tr>
<tr>
<td>Option on Commodities</td>
<td>0.0181</td>
<td>1.57</td>
</tr>
<tr>
<td>R²</td>
<td>0.66</td>
<td></td>
</tr>
</tbody>
</table>

A graph showed a close fit between the actual and fitted values of the Index. Similar tests with indices for particular hedge fund strategies and appropriate factors chosen from the seven above showed high correlations. Hsieh observed that analysis of more hedge fund styles and the discovery of additional risk factors will add to the explanatory power of this hedge fund risk-factor model. The hedge fund betas can then be useful in risk management. They reveal how the funds of varying types are likely to perform under different conditions described by the factors.

68. Hedge Funds and Skewness (Fall 2003)

Harry M. Kat, Professor of Risk Management and Director of the Alternative Investment Research Centre, Sir John Cass Business School, City University, London made available a number of working papers of the Cass Business School on the subject of hedge funds.

He began with a series of reasons to view with suspicion the data that are available for the analysis of hedge funds, and went on to deal with the risks in hedge funds that go beyond the standard deviation measure familiar to so many investors. Specifically, he was concerned with skewness and kurtosis in the return distributions of hedge funds, and with correlations of those returns. Many, but not all, hedge fund strategies involve negative skewness, extending the likelihood of negative returns beyond what they would be in a symmetrical distribution. While diversifying a portfolio across hedge funds of any particular investment strategy can reduce standard deviation significantly and raise Sharpe ratios, for many categories it increases negative skewness. It also increases the degree of correlation with the equity markets.

Kat pointed out that at the same time some of the apparent alpha for hedge funds is due to illiquidity and not simply to manager superiority.
In a similar vein, he showed that adding hedge funds to a stock portfolio can reduce standard deviation but effectively only if the portfolio is invested 40-50% in hedge funds. And at that point the increased negative skewness is likely to be significant. Turning to yield enhancement with hedge funds, increasing return while holding standard deviation constant, the result is again substantial increase in negative skewness. In conclusion he said that aiming for diversification will give up more profit than loss potential, and aiming for yield enhancement means accepting extra loss potential.

To sum up, mean-variance analysis is too simplistic when hedge funds are involved.

But there are ways to hedge the negative skewness caused by hedge fund investment. One is to buy out-of-the-money put options on an equity index. Another is to invest in managed futures. He showed the result of combining the S&P 500 stocks, bonds, hedge funds and S&P 500 puts. The negative skewness is reduced but kurtosis is increased. An unfortunate effect is a reduction in return. Both return and standard deviation are reduced. The next step then is to introduce leverage to increase the mean return and standard deviation. The specific improvement will depend of course on the cost of the debt and the return on the stock market itself.

Turning from puts to the use of managed futures, he showed that combining managed futures with stocks and bonds is actually more satisfactory than adding hedge funds to the stocks and bonds. The skewness can be turned positive and the kurtosis brought down with a modest sacrifice in return.

A series of three dimensional graphs showed the interrelationship among mean returns, standard deviation, skewness and kurtosis for portfolios of stocks, bonds, hedge funds, and managed futures. In general, improving one risk measure led to worsening another or paying a price in reduced rate of return. It did appear that for an investor in hedge funds, adding managed futures improves the standard deviation, skewness and kurtosis risk factors.

Kat closed with two conclusions:

• Hedge funds come with a number of special features that require a more elaborate decision framework than that currently in use by most investors. Decision makers have to properly incorporate survivorship and backfill biases, autocorrelation, skewness and kurtosis effects, estimation error, and illiquidity.

• Hedge funds are not a free lunch. Investors pay for improved mean-variance properties by accepting an increased probability of a large loss, extra uncertainty and reduced liquidity.

69. Hedge Funds: Getting the Most out of Diversification (Fall 2003)

François-Serge Lhabitant, Professor of Finance, Université de Lausanne, Switzerland, and Thunderbird, made available a paper by himself and Michelle Learned entitled: “Hedge Fund Diversification: How Much is Enough?”

Hedge funds have achieved a reputation for higher long-term returns than can be obtained from stock and bond portfolios, better risk-adjusted performance (using standard deviation as the risk measure) and have achieved very substantial growth in number of funds and assets. Their correlation coefficients argue in favor of diversification across several hedge funds. An immediate question is how
many hedge funds make a diversified portfolio. The corresponding question — How may assets make a diversified equity portfolio? — was answered in the 1960s by a range of 8-10 but more recently by a range of 30-40. Similarly, the estimate of how many hedge funds are needed for a diversified portfolio was considered in the range 8-10 six or seven years ago but is estimated at around 20 in the last year or two.

In terms of diversification strategy, Markowitz optimization is not practical. The distributions are not normal, forecasts are very difficult, and the procedure is simply not feasible for hedge funds. Naïve diversification may in fact be quite satisfactory. This means simply choosing funds at random to combine in a fund of hedge funds. The authors created equally weighted portfolios of increasing size (N=1, 2, ..., 50) by randomly selecting hedge funds from a data base including 6,985 funds, with no replacement. For each portfolio size, the process was repeated 1,000 times to obtain 1,000 observations of each statistic. In addition, the sample was split among ten representative investment styles: long short equity, market neutral, emerging markets, dedicated short sellers, event driven, global macro, CTA/managed futures, fixed income arbitrage, merger arbitrage, and multi-strategies. From these simulations, performed over three time periods, it was possible to see the effects on returns, standard deviation, skewness, and kurtosis of diversifying across up to 50 funds, for the entire sample and for each strategy. It turned out that the level of diversification had little effect on returns. But there was a big reduction in standard deviation when 10-15 funds were included. Skewness was not altered much by the number of funds used in the diversification, except for the event-driven and fixed income styles, where negative skewness was increased as the number of funds was increased. With respect to kurtosis, the same two strategies showed significant increase in kurtosis as the number of funds was increased.

Three further risk measures — worst monthly return, VaR, and maximum drawdown — were plotted against the number of funds in the diversified portfolios and in all three cases the loss measure improved with diversification up to about 10-15 funds in the portfolio. A test for correlations with the S&P 500 index showed mixed results. For short sellers and managed futures, the correlation was reduced by adding 10-15 funds, for convertible arbitrage there was no correlation at any level of diversification and for the other strategies the correlation generally rose as the diversification was increased, up to around 15 funds.

In concluding, Lhabitant said:

- Diversification is clearly protection against ignorance.
- Diversification brings most of its benefits with very few funds (10-15) in a portfolio.
- Funds of hedge funds seem overdiversified, at least from a market risk perspective.
- There is a need to model correlation variations to effectively build more robust portfolios.

70. Sharpe Ratios, Serial Correlation and Risk Management for Alternative Investments (Fall 2001)

Andrew W. Lo, Harris & Harris Groups Professor of Finance, Sloan School of Management, Massachusetts Institute of Technology, distributed a paper entitled: “Risk Management for Hedge Funds: Introduction and Overview.” The paper focuses on
characteristics of hedge funds that call for risk management techniques that differ from the traditional techniques appropriate to traditional investment vehicles such as stocks, bonds, and mutual funds. In his presentation he focused on one of the troublesome characteristics of hedge funds: serial correlation. The absence of serial correlation is sometimes equated with market efficiency, but Lo explained why serial correlation need not be inefficient. Apart from inefficiencies, serial correlation may be the result of time-varying expected returns, nonsynchronous trading (a data problem), illiquidity, and performance smoothing. For hedge funds the last two are the most relevant.

He presented a table showing that for a set of mutual funds and for a set of hedge funds it was clear that serial correlation was far more significant for the hedge funds than for the mutual funds. Next came a model of performance smoothing and its consequences in terms of observed values. We turn to a one-factor model to explain true returns period by period where there is no serial correlation. Then we turn to the observed (or reported) returns which for each period are actually the average of the true return for that period and the true returns for a number of previous periods. The result is that the variance of the observed returns (that is, the observed variance) is lower than the true variance and the observed beta is lower than the true beta.

Lo considered three smoothing profiles: straightline smoothing, sum of the years smoothing, and geometric smoothing. Straightline smoothing, especially over as many as five periods, had a dramatic effect in lowering the observed beta and standard deviation, raising the Sharpe ratio, and showing substantial serial correlation.

Lo next reported an estimation of smoothing and illiquidity profiles (both having the effect of creating serial correlation) for eighteen categories of hedge funds. The hypothesis was:

$$R_{it}^o = \theta_0 R_{it} + \theta_1 R_{it-1} + \theta_2 R_{it-2}$$

where the thetas are the weights on the three true rates of return in the averaging process to produce the observed return. For five funds that appeared to be investing in fairly liquid securities, the mean \(\theta_0\) was very close to 100\% so there was little evidence of serial correlation. A number of other hedge fund classifications, however, showed significant values for \(\theta_1\).

Both illiquidity and performance smoothing (that is, a management inspired characteristic of reported returns) lead to serial correlation and its observed statistical consequences. Lo concluded that with current data we cannot distinguish between the two causes. And he also observed that deliberate smoothing is not necessarily an indication of bad behavior on the part of managers.

He turned next to the implications for risk management of what he had described. Sharpe ratios are widely used in financial decision making. The ratios have to be estimated, and the question is how accurate they are. Lo presented standard errors for Sharpe ratios under the assumption of independently and identically distributed returns for various values of sample size and the true Sharpe ratio. He then turned to the non-iid case. From the comparison he developed an adjustment factor for the non-iid case. Then he displayed a table of classical and adjusted Sharpe ratios for a set of mutual funds and a set of hedge fund categories. Applying the adjustment to the classical Sharpe ratios for the mutual funds in most cases made little
difference, sometimes raising and sometimes lowering the ratio. For the hedge funds, the adjustment generally made a substantial difference in most cases lowering the classical ratio.

In conclusion Lo pointed out the importance of serial correlation in asset returns:

• As a sign of illiquidity and performance smoothing
• As empirically relevant for hedge funds
• As having important implications for performance measures
• As a potential measure of liquidity risk exposure
• As a potential auditing tool for mark-to-model irregularities

71. Risk Transfer and Liquidity Risk
(Fall 2001)

Myron S. Scholes, Nobel Laureate, Fellow of the Institute and Managing Partner, Oak Hill Capital Management, began with the role of chaos in financial markets and services. An important consequence of chaotic events is our response in trying to understand a process that confronted us with surprise, and in developing the means to cope with that process. We learn far more from chaos than we learn from the smooth functioning of financial markets as we think we know them. Some great innovations have results from chaotic events. Stock volatility in the 1970s led to hedging, to the use of futures contracts and options. The Japanese market collapse in 1990 led to revisions in regulations and to growth in the United States. The Asian financial crisis of 1997 led to some new understandings and less reliance on governments, with more respect for entrepreneurship. The 1998 financial crisis and Russian default led to new forms of risk management and liquidity management.

The price of liquidity rises under chaotic conditions and we are forced to improve the processes of risk transfer and liquidity management. The evolution of risk management in fact is largely the result of chaotic events and learning from them. We are learning to devise dynamic measures of risk to replace some of the old static measures. Three tools of risk management are risk shifting, diversification and insurance. And we are learning more about the need to allow for increased risks of adjustment. Adjustment costs are significant in a chaotic environment. Recent years in particular have taught us about the changing structure of asset correlations. What we thought was diversification vanished when correlations moved from near zero to near one.

We need a dynamic theory of liquidity. Option theory is helpful and we are likely to see option theory joined to portfolio theory.

Scholes turned to the role of hedge funds as a major element in dealing with what we have learned from recent chaotic events. Hedge funds may have a role in replacing large financial institutions. Hedge funds are better suited than financial institutions to provide inventory services. They can profit by carrying inventory forward or providing inventory in the capital markets to smooth out transitory supply and demand imbalances. Talented risk managers are actually leaving financial institutions to establish hedge funds.

Large hedge funds are generally possessed of superior information which makes it possible for them to analyze quickly a chaotic environment and seize opportunities. They have the infrastructure necessary to act when it is too costly for others to build that infrastructure.
Hedge funds also have a size advantage. This leads to lower transaction costs and better market access.

Scholes described a number of investment strategies used by hedge funds based on yield curve shape, basis risk, spreads, and judgments on volatility level. At the same time risk control is particularly important. Each investment strategy should be allocated its own risk capital and risk capital must be budgeted. Optimization must take account of the risk in shifting correlations.

Hedge funds can take advantage of market dynamics. Having an infrastructure in place to understand imbalances and their duration provides a competitive advantage. Provision of inventory services can be profitable as idiosyncratic changes in the level of supply and demand lead to profits as inventories can be sold and reacquired at more favorable spreads. In effect, the hedge fund can perform the role of a re-insurer.

Scholes closed with the observation that the insurance company model for controlling risk is diversification. But if the correlations of asset classes approach 1, then diversification is of little help. Optimizing becomes very different from traditional portfolio theory. Stress testing and a stress budget is probably the avenue to follow in controlling risk.

72. Overview of the State-of-the-Art in Hedge Funds (Spring 2001)

followed by

Dangerous Attractions: Informationless Investing and Hedge Fund Performance Measurement Bias (Spring 2001)


Weisman began with a discussion of the hedge fund industry, tracing the evolution from private partnerships making heavy use of speculative tools like leverage and hedging, charging substantial incentive performance fees, aimed at wealthy and/or sophisticated investors, to the present day hedge funds with publicly offered units, and a wide variety of participation forms and investment strategies. He stressed that there is no established classification system by which investors can reasonably compare performances and judge risks.

It is difficult to obtain useful data for hedge funds. There are at least three sources of data collected from the funds, but fund reporting is optional. Some funds have never reported; some report the performance of some portfolios but not all; and it is particularly difficult to learn anything about the performance of funds that have failed and shut down. It is also true that most hedge funds have very short histories.

Turning to his paper, Weisman had undertaken to provide some insights into some of the return generating processes of hedge funds that are probably not well understood by investors. He argued there is an over-reliance on conceptual frameworks and technologies that are appropriate to the traditional investment world but highly inappropriate in the context of hedge funds. More specifically, analyzing the apparent performance records of hedge
funds using traditional tools, and applying traditional portfolio optimization models to these performance data may lead to disastrous conclusions. The paper dealt with three specific “informationless” investment strategies. Weisman believes them to be endemic to the hedge fund industry, and indicated that a careful analysis of the published performance results of a hedge fund may indicate or at least suggest the use of informationless strategies, and a potential investor should therefore understand what these strategies are likely to lead to.

The first strategy he discussed is short-volatility investing. This can be described as essentially equivalent to writing insurance policies against low probability events. An example is investing all of the fund’s capital at the risk free rate, say 5%, and then at the beginning of every month selling a series of fairly valued calls and puts that expire at the end of the month. The strike prices might be 2.5 standard deviations above and below, respectively, the current market price of some financial instrument. The manager sells a sufficient number of these “strangles” such that in the event the market remains within the 2.5 standard deviation collar, the premiums received will double the risk free rate. The manager is clearly making no use of any judgment other than an expectation that the options are unlikely to be exercised. A Monte Carlo simulation shows that the manager has approximately an 88% chance of outperforming the risk free rate in any year and almost an 86% chance of doubling it. The manager has an almost 50% chance of doubling the risk free rate over any five year period. The expected time to a monthly outcome where the underlying security trades outside the collar by month-end, resulting in a loss of capital, is almost seven years. The strategy then has a high probability of success over a limited future. But as the probability of outperforming the risk free rate increases, the size of the anticipated loss of capital increases at an increasing rate. Weisman showed this graphically. At an 88% chance of outperforming the risk free rate, the corresponding expected loss of capital is approximately 32%. This should not be surprising, since we are assuming that the options are fairly valued, and the “informationless” process of selling options should have a zero expected value, so that an equalizing event is necessitated, and that event is the loss of 32%. This return generating process is, of course, utterly unlike the process one would expect to underlie long positions in speculative stocks.

The second form of informationless investing is illiquid security investing. If a manager is unable or unwilling to value accurately the fund portfolio on a periodic basis, reported returns will be inaccurate, and the standard deviation in returns will probably be substantially underestimated. The result is that the Sharpe Ratio may appear extremely high (and Weisman pointed out that Sharpe Ratios are much touted by hedge funds).

The third informationless investment technique is St. Petersburg investing. The St. Petersburg Paradox refers to a strategy of making bets on the outcomes of a binomial process such as a coin toss. Upon winning, one bets again with the same unit size. Upon losing, the loser bets two units on the subsequent trial. Another loss leads to doubling up by betting four units. Even though the coin is assumed to be fair the strategy has an infinite expected value. The paradox is that without unlimited funds, the strategy will lead to bankruptcy with a probability of one. The investment analogy is that of a manager increasing leverage as investment losses deplete capital. Weisman showed the results of a
randomly generated sample monthly performance history for a manager operating in this way, to show a fairly prolonged period of consistent profitability ending in a complete loss of capital. More specifically a Monte Carlo simulation indicated the expected time to a month-end loss of 50% was approximately four hundred weeks. As in the previous examples, the fund is likely to enjoy a few years of very attractive performance results.

In conclusion, a very attractive apparently superior performance record over a few years for a hedge fund is quite consistent with ultimately disastrous informationless investing strategies. The investor who does not understand this, or is unable to determine just what the hedge fund is doing, is in trouble.

73. Hedge Funds With Style (Spring 2001)

Stephen Brown, David Loeb Professor of Finance, Stern School of Business, New York University, distributed a paper by himself and William N. Goetzmann entitled: “Hedge Funds With Style.”

He began by reiterating the need expressed by Andrew Weisman in the preceding presentation (No. 72), for style benchmarks. And he suggested quantitatively derived style benchmarks. He had found that differences in investment style contribute about twenty percent of the cross-sectional variability in hedge fund performance. He also explored the meaning of “hedging” to point out that while the pioneer Alfred Winslow Jones had put genuine hedges in place in order to minimize or eliminate market risk, Jones’ successors did not hedge in the usual sense. Most current hedge fund strategies are very aggressive and far from the low or zero risk that the word “hedge” suggests.

TASS, a major data service, has classified hedge funds into seventeen different types. This classification is based in large part on manager survey responses and is therefore vulnerable to the manner in which mutual funds describe themselves. It appears that when funds change their self-classification the effect is generally to increase their returns relative to a newly defined benchmark. Brown went on to describe his Generalized Style Classification (GSC) methodology, which is based on ex post returns of individual funds. Where the number of styles is set at eight, it turns out that class GSC1 corresponds to event driven international, GSC2 to property/fixed income, GSC3 to U.S. equity focus, GSC4 to non-directional/relative value, GSC5 to event driven domestic, GSC6 to international focus, GSC7 to emerging markets, and GSC8 to global macro. This classification scheme seemed to work quite well, with about twenty percent of the cross-sectional variance explained by prior returns-based classifications. This was an improvement over the use of the TASS classifications.

Turning next to the matter of predicting fund performance with style, Brown showed scatter plots of fund returns year by year from 1993 through 1999 as a function of the annual fund return in the previous three years. It turns out that there is very little evidence of persistence in annual hedge fund returns. But members of a style category tend to cluster together.

Next, Brown considered whether hedge fund styles separate managers out in terms of the risk they are willing to bear. For this purpose median value-at-risk for each of eight GSC styles was calculated for 1993-1999. Management styles grouped into three distinct risk
classes. The global equity hedge, U.S. equity hedge and global macro styles clustered together in the highest risk class. International and emerging markets were in the intermediate class, and the remainder were in the lowest class.

In conclusion, Brown said:

• There is no well defined “hedge fund” style.
• There are at least 8 distinct styles.
• Styles explain 20% of cross-sectional variation among fund returns.
• Styles also explain differences in risk.
• There is a danger in the use of self-misclassification.
• Appropriate analysis of style, independent of the manager’s preference, is crucial.

74. Analyzing Hedge Fund Risks: An Overview (Spring 2001)

Tony Kao, Managing Director, General Motors Investment Management Corporation, distributed a paper entitled: “Analyzing Hedge Fund Risks.”

Kao described the challenge in these terms: One of the emerging applications to active institutional investing is to transfer alpha from hedge funds to a specified asset class. Issues arising from such an approach include: (1) Do these alphas present different distributions from traditional long-only active alphas? and (2) Do these two types of alpha derive from different risk factors? His presentation provided empirical evidence of return sources of long-only versus long/short investing and potential explanations from the standpoint of compensation and investment constraints.

Turning to the classification of hedge funds, he identified first order of return distribution, and second order, of volatility. A third system of classification might be based upon trading strategies or styles, but for this no standards exist. Examining differences between hedge funds and institutional asset accounts helps to identify the advantages enjoyed by hedge funds and to see where risks unique or especially important to hedge funds may lie.

It is helpful to understand hedge fund return patterns. Payoffs are similar to option payoffs as in straddles, collars and calls. Hedge funds appear to have higher risk adjusted returns but this raises the question just what risks are actually being taken. Individual funds have low correlation to asset class returns. Correlations across fund categories are very low, but within categories range from .05 (non-directional) to .68 (directional). Within a specific hedge fund, diversification among yield-to-call/put, capital structure arbitrage, multi-class stock arbitrage, paired trade, and special situations is generally quite low.

The return generating process for a hedge fund is complex, so it is difficult to identify systematic risks. Hedge fund risk is a function of leverage, instruments and markets traded, market volatility, strategy diversification within the fund, and liquidity. Kao went on to discuss asymmetric return sensitivities to risk factors in different market environments. Monthly correlations, for example, in fixed income markets are very different in rising and declining interest rate environments.

He identified a number of approaches to risk analysis of hedge funds. These include conventional risk measures, asset class factor analysis, economic/market risk factors, mimicking portfolio/strategy approach,
and an integrated risk approach. Discussing each of these in turn, he gave as examples of conventional risk measures the use of standard deviation, drawdowns, and percent of negative months. The Sharpe Ratio, the information ratio, efficiency ratio, appraisal ratio and value-at-risk are further conventional measures. The mimicking portfolio/strategy approach can be especially useful, and Kao offered a number of references on the subject. Finally, he reviewed an integrated risk analytical approach.

He ended his presentation with a series of investment implications.

- Correlation measures can be misleading. One should examine relationships under various market conditions and factor exposures.

- Strategy diversification between funds as well as within funds is important to consistent performance.

- One should distinguish different types of diversification. Some are good, and some are not so good. It is best to assume no diversification benefits under a worst case scenario for value-at-risk.

- It is useful to look for common factors driving both hedge funds and long-only funds.

- How a fund manages its exposures to implied volatilities in extreme cases is the key to consistent performance.

- Optimization requires understanding risk profiles — directionality and volatility exposures.

- Understanding a manager’s style drift, changes in leverages, and in concentrated positions is important.

75. Performance Evaluation of Hedge Funds With Option-Based and Buy- and-Hold Strategies (Spring 2001)

Narayan Naik, Associate Professor of Finance, and Director of the Centre for Research and Education in Hedge Funds, Department of Finance, London Business School, distributed a paper by himself and Vikas Agarwal, entitled: “Characterizing Hedge Fund Risks with Buy-And-Hold and Option-Based Strategies.” He began by posing the question: Given only a series of rates of return for a hedge fund or a group of hedge funds, what can we learn about the characteristics of the funds and in particular the nature of their risks?

A few graphs based on the Hedge Fund Research (HFR) database comparing hedge fund returns with S&P500 Index returns and with quality spreads for bonds suggest that the strategies of a number of classes of hedge funds have produced results similar to those that could be achieved by buying and selling put and call options on stocks, and by taking stock and bond positions. Naik reviewed the reasons why one might expect to come close to replicating the performance of various classes of hedge funds using a set of “Location factors” and one of “Trading Strategy factors.” His trading strategy factors were returns on at-the-money and out-of-the-money call and put options on the Russell 3000 Index. The Location factors included returns on thirteen asset classes, including equities, size, book-to-market and momentum factors, bonds and the change in default spread, currencies, commodities, and the return on the CBOE Volatility Index.

The model involved regressing a time series of returns on a hedge fund style index against the set of Location factors and the set of Trading Strategy factors. The two hedge fund strategies were “Event Driven” and “Relative Value Arbitrage”. Both of these
strategies have been examined in the past, making it possible to compare the results of the current research with what has been found in the past. In other words, it is possible not only to compare the results of the model strategy with the results of the two classes of funds but also to compare them with prior attempts to replicate the two strategies. Naik saw two main advantages in his approach. First he believes it can be universally applied to all hedge fund strategies, and second the approach provides a simple and intuitive way of capturing the important risk exposures of hedge funds.

The returns from Location factors (Buy-and-Hold strategy) are captured by different equity, bond, currency and commodity index returns and by returns to Fama-French’s Size and Book-to-Market factors and Carhart’s Momentum factor. The returns from Trading Strategy factors are determined from returns on passive strategies that involve buying or writing put or call options on standard asset classes. Monthly net-of-fee returns on Event Driven and Relative Value Arbitrage equally weighted index data from HFR over January 1990 to December 1999 were divided into twenty four-month rolling windows starting from February 1988 and ending in July 1999.

Stepwise regressions were performed, in order to identify the significant factors in the regressions, and it turned out that there were one to four such factors.

Naik first presented a table for the Event Driven strategy. For five two-year periods he showed the alpha of the regression, the adjusted r-squared, and identified the significant factors. For example, for the period January 1990 through December 1991, generally a down stock market, the significant factors were sale of put options on the Russell 3000 index and a short position based upon default spreads. It seemed then, that these factors corresponded to what one might have expected the hedge fund managers to have been doing to profit from a falling market. In this particular example the adjusted r-squared was 0.8. For all five two-year periods the alpha was positive. Naik commented that this may be due in part and perhaps substantially to selection bias in the calculation of the equally weighted index. Naik also reported that the factors that had proved significant were very similar to the factors found by previous researchers for this hedge fund style.

Naik continued with similar tables for the capital structure arbitrage strategy, the equity hedge strategy, the short strategy, the long strategy, the HFR relative value arbitrage index, the HFR restructuring index, and the HFR hedge (long bias) index. The adjusted r-squareds were generally quite high, although they varied a good deal from time period to time period, and the significant factors seemed intuitively appropriate to the style being considered.

In his presentation, Naik described analysis using index returns. In the full paper he also discussed analysis using individual funds in the Event Driven and Relative Value Arbitrage groups. A large majority of funds showed significant factor loadings on up to five factors. Simple option-based trading strategies played a major role in explaining the variation of return on these hedge funds over time. For the Event Driven strategy a majority of funds showed significant loading on the Fama-French Size factor. For the Relative Value Arbitrage funds, again a majority showed significant loading on the same factor and also on the Value-Growth factor.

Naik also performed out-of-sample tests using the results of a twenty-four
month regression to predict fund characteristics in the twenty-fifth month. The results were encouraging.

In his concluding remarks Naik noted the importance of his “Trading Strategy” factors in mimicking the return pattern of hedge funds. The inclusion of option buying/writing strategies captures non-linear risk exposures that are peculiar to these funds. His general approach is applicable across hedge fund strategies and is potentially useful in asset allocation, the construction of an appropriate fund of hedge funds, in risk control and in the design of benchmark and managerial compensation contracts.

**Inflation**

**76. Macro Policies and Inflation**  
**An Overview (Fall 2002)**

Eric M. Leeper, Professor, Department of Economics, Indiana University, distributed a paper entitled: “Macro Policy and Inflation: An Overview.” He began with the probable consequences of President Bush’s tax reduction. Current legislation calls for reductions to take place over the next ten years with, in the eleventh year, a reversion back to the original rates. What the effect on inflation will be is a complex question, or set of questions. Whether the tax rates in 2011 will actually revert to those in 2001 is an important question. Leeper guessed that they probably will not. He observed that a permanent tax cut is impossible unless government spending is to be brought down, and this he thought unlikely.

What happens if there should be a recession? This would probably lead to even more government debt. And what about monetary policy under a successor to Alan Greenspan? The point of all of this speculation was that in order to predict the consequences of the current tax policy, one must go well beyond today’s monetary and fiscal policy, and consider what people expect in terms of policy changes in future years.

He moved next to a review of the conventional view of US macro policy and inflation consequences: higher deficits or money growth will stimulate aggregate demand, which in turn raises output, which increases inflation if the economy is operating near its potential. He then reviewed what has actually happened over the past four decades. In the 1960s we saw tax reductions, the “Great Society,” and the Vietnam War, accompanied by lengthy economic expansion, a good performance of the stock market, and a slow rise in inflation. Then in the 1970s we saw chronic budget deficits, the Federal Reserve “chasing its tail”, with terrible performance in the stock market, and very high inflation. This was a decade in which the conventional view seemed accurate. In the 1980s, Paul Volker believed in holding down the growth rate of the money supply, rather than focusing on interest rates, and Reagan’s tax reductions were accompanied by record deficits. Yet inflation came down, something that the conventional view would not have predicted. In the 1990s the economy grew well, there were budget surpluses, and then the Bush tax cut, a recent rise in government spending, rising money growth and rising deficits. The conventional wisdom would say that inflation will soar.

Leeper continued with the conventional wisdom, identifying four principles. The first is that inflation is always and everywhere an “overheating” phenomenon. But this principle seems to suggest that if the economy produces too many goods,
prices will rise rather than fall and does not seem very sensible. The second principle was that fiscal policy goes through periodic “unsustainable” episodes. But bondholders must have thought fiscal policy sustainable, or they would not have held bonds. So expectations must have played an important role. The third principle is that monetary policy is the only game in town; and that fiscal policy is inflexible. Leeper proposed that the historical experience of large swings in fiscal policy contradicts this principle. Finally, the conventional wisdom is silent on the dynamic links between current and expected future policies. This seems to be quite incomplete. The links must be there, and it is important to figure out what the expectations are with respect to the interplay of current and future policies.

Leeper’s paper had discussed three models one might use for forecasting, and in his presentation he focused on the third: an asset pricing perspective on macro policies. There are three ways to carry dollars from today into the future: as money, as bonds, and as real assets (including equities). The return on money comes in the form of transactions services, adjusted for inflation. The return on bonds comes in the form of a nominal interest rate, adjusted for expected inflation and risk. The return on real assets comes in the form of the marginal product, again adjusted for risk. The relative values of and demands for these three kinds of assets are determined through arbitrage. Expected returns are affected by expected money growth, taxes, and spending. These expectations, and the ultimate returns, determine portfolio choices and inflation.

Inflation depends generically on expected monetary and fiscal policies. Two special cases are the quantity theory, to the effect that inflation is a monetary phenomenon, and a fiscal theory, to the effect that inflation is a fiscal phenomenon. But both of these theories require strong assumptions about policy behavior. A more realistic picture involves the interrelationship of rate of return effects among transaction services, money holdings, bond holdings, real asset holdings, and both fiscal and monetary policy. Leeper demonstrated the relationship in terms of rates of return and equilibrium linkages.

One can think of the asset-pricing model as incorporating expected rates of return on money, bonds, and real assets, combining these with expectations of government tax revenues and government spending, to arrive at portfolio choices and ultimately at inflation. But all of these must be determined simultaneously. Leeper went through a series of equations determining demand for the three classes of assets, and equating supply and demand for each, to arrive at an equilibrium. Along the way, in order to form rational expectations, decision makers have to anticipate fiscal and monetary policies that are consistent with equilibrium. The government budget constraint must be satisfied in every future period and the question then is how it will be satisfied. The government can print money, borrow money, and levy taxes. It can also reduce or increase government spending. If current policies are changing any of these (as in planned tax reductions) then some future policy must change. Alternatively, if some future policy is established now (a tax change in the year 2011, for example,) then some current policy may have to change to make that future policy feasible.

We then arrive, on the basis of our expectations, at feasible fiscal and monetary policies. Leeper suggested a simple experiment. Assume a reduction in taxes financed with debt coupled
with constant government spending, and arrive at how future policy would have to adjust. He considered first a policy of pegging nominal interest rates. Future taxes would have to rise. Returns to real asset investments would therefore decline, leading to substitution from real to nominal assets. The current fiscal expansion would reduce current inflation, but future inflation would increase.

A second policy might be to fix future money growth and taxes. The real value of debt would not change, and current inflation would increase. Finally, one might fix current money growth and future taxes. This would fix return to real assets but not the nominal interest rate, so that future money supply, inflation and nominal interest rates would rise. In addition, the current fiscal expansion would raise current inflation.

In conclusion, Leeper emphasized again the shortcomings of conventional macro policy and in particular that what are intended to be counter-cyclical policies can turn out to have just the opposite effect.

77. A Theory of Inflation (Fall 2002)

Jack L. Treynor, President of Treynor Capital Management, Inc. distributed a paper entitled: “Theory of Inflation.” This paper prepared for the Q-Group® Seminar is a much-abbreviated version of a more complete paper entitled: “A Theory of Inflation.”

For a long time now the Phillips Curve has been used to show the relationship between inflation and tightness or ease in the labor market. Treynor proposed a theory relating inflation to surplus or scarcity of plant. And he argued that the basis for the historical importance of the Phillips curve was the demonstrated tendency of scarcity of plant and labor to move together.

He began by distinguishing clearly between an open and a closed economy, and a third economy that combines characteristics of the first two. The distinction rests on the importance of home goods and tradable goods. An open economy is one that consumes tradables; a closed economy is one that consumes home goods. Real economies consume both but differ in the relative importance of the two, that is in their degree of “openness.” In a closed economy the real wage equals the money wage divided by the price level.

\[ w = \frac{W}{P} \]. This is the real wage identity.

In terms of rate of change,

\[ \frac{dw}{w} = \frac{PdW - WdP}{PW} = \frac{dW}{W} - \frac{dP}{P} \]. We anticipate that the intention of employers and employees in reaching agreement on wages and salaries (in formal and informal wage negotiations) is to maintain the real wage. The wage negotiators rely on expectations so that the change in the nominal wage becomes

\[ \frac{dW}{W} = E\left[\frac{dw}{w}\right] + E\left[\frac{dP}{P}\right] \]

and from this we arrive at

\[ \frac{dP}{P} - E\left[\frac{dP}{P}\right] = -\left(\frac{dw}{w} - E\left[\frac{dw}{w}\right]\right) \]. What we see now is that surprise in the rate of change in the real wage leads to surprise in the rate of change in inflation. On average, a 1% surprise in the real wage will produce a 1% surprise in the inflation rate over any time period.

Treynor next explored why a change in the real wage is uncertain. At time \( t \) the economy has a stock of plant capacity represented by a cumulative number of jobs \( N(t) \) and a cumulative amount of output \( Y(t) \). At any given level of current demand, employers will use their newer and more efficient plant, idling older and less efficient plant.
When plant built before time $\tau$ is idled, then employment $n$ and output $y$ are, respectively, $n = N(t) - N(\tau)$ and $y = Y(t) - Y(\tau)$. The higher output and employment are, the older is the marginal plant and the lower is the resulting wage.

Now if employment, $n$, increases suddenly,

$$\Delta n = \frac{\partial n}{\partial \tau} \Delta \tau = -\frac{dN}{d\tau} \Delta \tau,$$

$$\Delta y = \frac{\partial y}{\partial \tau} \Delta \tau = -\frac{dY}{d\tau} \Delta \tau$$

so the rate of change of output $y$ with respect to labor input $n$ is

$$\frac{\Delta y}{\Delta n} = -\frac{\frac{dY}{d\tau}}{\frac{dN}{d\tau}} = \frac{dY}{dN}, \text{ and } \frac{dY}{dN} \text{ is the labor productivity at plant completed at time } \tau. \text{ So the marginal productivity of labor, and hence the real wage, at time } t \text{ depends on } \tau. \text{ And this number is the key to real wage surprise. At the same time, we cannot plausibly argue that observed changes in the real wage are entirely the result of surprise.}

Now going back to our equation for the change in the negotiated wage, and assuming that the best estimate of the inflation rate will be the inflation rate of the past period, we arrive at

$$E\left[\frac{dw}{w}\right] = \frac{dW}{W} - B\left[\frac{dP}{P}\right]$$

where both right-hand terms are observable and $B[ ]$ is the backshift operator (indicating the value for the previous year). Treynor showed a graph (Figure 1) in which he plotted the right hand side of the equation (the implied estimate of the expected real wage change) against the previous year actual change in the real wage to show a reasonably good linear fit for the United States for the years 1972-1999. His conclusion was that last year’s price inflation may be a useful proxy for this year’s expectation. This gives us the following:

$$\frac{dP}{P} - B\left[\frac{dP}{P}\right] = -\left\{\frac{dw}{w} - E\left[\frac{dw}{w}\right]\right\}$$

and if we further assume that surprise in the real wage can be proxied by the change in the rate of change, we have

$$\frac{dP}{P} - B\left[\frac{dP}{P}\right] = -\left\{\frac{dw}{w} - B\left[\frac{dw}{w}\right]\right\},$$

$$\Delta \left[\frac{dP}{P}\right] = -\Delta \left[\frac{dw}{w}\right]$$

This says that the change in the rate of inflation is equal to the negative of the change in the real wage growth rate, and indeed a graph based on data for the United States for 1959-1999 (Figure 4) showed a fairly good relationship. A plot of similar data for Japan (Figure 8) for the same time period showed a similar relationship. Turning to the topic of Phillips curves, Treynor showed (Figure 3) a good relation between the change in the inflation rate predicted and the percentage unemployment.

The conclusions above, for a closed economy, indicate that inflation momentum will continue until it is disturbed by real wage surprise. An economy that is neither wholly open nor wholly closed will exhibit inflation momentum, but the effect of a local disturbance will die out over time. And the more open the economy, the faster the disturbance will die out. Sometimes the fraction of a country’s GDP devoted to commerce with other countries is taken as a measure of openness. But Treynor expressed skepticism of the usefulness of such a measure, and suggested that a country’s inflation behavior is a better indication.
For an economy that is neither wholly open nor wholly closed, Treynor set out a series of equations to explain inflation and change in the nominal wage as follows: Where $C$ is the fraction of the value of the economy’s market basket that consists of home goods, and $(1-C)$ is the fraction that consists of tradables, and $T$ is the money price of tradables, then the change in the inflation rate in year $t$ leads to

$$\frac{\Delta W}{W} = (C - 1)\left(\frac{\Delta W}{W}\right) + (1 - C)\left(\frac{\Delta T}{T}\right),$$

$$= (1 - C)\left(\frac{\Delta T}{T}\right) - (\frac{\Delta W}{W}) + u.$$  

In the absence of any surprise since time zero, the momentum in the home goods inflation rate damps toward the tradables rate, that is, toward the global rate. In the closed economy, $C$ is approximately one, and there is one inflation rate and one source of surprise. In the open economy, $C$ is very much smaller than one, and there are two inflation rates and three sources of surprise. The two inflation rates are in home goods and in tradable goods. The three sources of surprise are home goods surprise, global surprise in tradables prices, and currency surprise. All three surprises can alter some of the money prices in the worker’s market basket, so they can all affect the worker’s future real wage, unless there is a compensating change in the money wage. Does such compensation take place?

Treynor tested the extent of compensation by a regression for twelve countries, using the change in inflation rate as the dependent variable, using the difference between money wage inflation in a country and the “global” inflation rate, which he took to be the IMF’s index for 23 industrial countries, as one explanatory variable, and using the first difference of real wage trends (serving as a proxy for surprise), for a second explanatory variable. The coefficients on the first were all positive, ranging from .072 (by far the lowest) for the United States to .636 for the U.K. The coefficients on the second were all negative, ranging from -.060 for the United States to -.476 for Korea. For the United States, then, the economy is almost closed. For the UK and Korea, the economies are closer to balanced between open and closed.

There are then two radically different inflation mechanisms. In some countries, one mechanism dominates. When policy advice is given it is important that the advice fit the mechanism. A model general enough to comprehend both may be important in making the giving of advice, and dialogue, more productive.

78. Outlook for Inflation and the TIPS Market (Fall 2002)

Henry Willmore, Chief US Economist, Barclays Capital, distributed a paper entitled: “Treasury Inflation-Indexed Securities.” He began with a description of these securities and a little history of their issuance, beginning in January 1997. A total of $130 billion worth has been issued, with $127 billion still outstanding. When the US government was enjoying surpluses there were some doubts about continued offerings of TIPS, and a number of investment firms hoped they would be abandoned. Barclays, partly because of the history of inflation-indexed bonds in the UK, has achieved a dominant position in the TIPS market. Willmore expects $30 billion of new TIPS to be offered next year.

The performance of TIPS in 1997 and 1998 was rather poor compared to that of conventional treasuries, but since then, and especially in 2001 and 2002 year-to-date, the performance has been very good.
Turning to the inflation outlook, Willmore described work at Barclays to identify the variables having the greatest statistical power in predicting inflation a year ahead. Focusing on core inflation, it turns out that by far the most significant variable is core inflation from the previous year, with a significant contribution from the change in gold prices, the change in industrial materials prices, and the change in house prices (all from the previous year). No other variables tested contributed additional predictive power. Of the four variables, gold made the smallest contribution. The forecasting model has proven quite accurate in predicting the direction of change in core inflation. In January of 2002, the model forecasted core inflation would drop to about 2.5% from last year’s 2.7%. So far this year core inflation has averaged close to 2.5% year over year. The expectation is that core inflation will rise to 3.0% in 2003.

Breakevens are of particular interest. These are defined as the differences in yields between TIPS and nominal bonds of similar maturity. The yield differential between the two bonds should provide some insight into the market’s inflation expectations over the life of the security. The existence of an inflation risk premium for nominal treasury securities leads to an expectation that the breakevens would be higher than the market forecast for inflation. However, over the past five years average breakevens have been systematically below the Blue Chip economists’ forecasts. Further, there has been much greater variation in breakevens than in the forecasts. In addition to the inflation risk premium, there are liquidity differences between TIPS and nominal bonds, so one would expect a liquidity premium. There are also differences in the duration of TIPS and nominal bonds with the duration of the TIPS tending to be longer than that of the nominals. The three factors — inflation-risk premium, interest rate risk premium, and liquidity premium — affect the breakevens differently. Which factor dominates is hard to determine, and the premiums may vary over time.

Willmore noted in closing that it also turns out that there is a seasonality of breakeven inflation. Breakevens typically rise during the first five months of the year and decline in the last seven. There appear, then, to be opportunities for trading profits.

**International Markets**

**79. Momentum and Value in International Markets (Spring 2003)**

Charles M. C. Lee, Henrietta Johnson Louis Professor of Management and Professor of Accounting and Finance, Johnson Graduate School of Management Cornell University, based his presentation on two papers. One, by himself, Dong Hong and Bhaskaran Swaminathan at the Johnson School, was entitled: “Earnings Momentum in International Markets.” The second, by himself, Sanjeev Bhojraj and David T. Ng, also of Cornell, was titled: “International Valuation using Smart Multiples.” The second of these two he identified as preliminary and incomplete.

The purpose of the research was to carry the examination of momentum strategies, that have been extensively studied for US markets, to eleven international equity markets. The research encompassed both price momentum and earnings momentum, and the dependence of the first on the second. Three questions were to be explored:
• Are earnings and price momentum related across international markets?
• Why does momentum exist in some countries but not in others?
• Are earnings and price momentum incrementally useful in predicting returns?

The key findings were that earnings and price momentum are demonstrated in six countries (the first six): Australia, Canada, France, Germany, Hong Kong, and the UK but not in five countries (the second five): Japan, Korea, Malaysia, Singapore, and Taiwan. This despite the finding that there is earnings forecast revision persistence in all eleven countries. Finally, momentum is linked to information dissemination mechanisms within a country. Low levels of investor protection exhibit little or no momentum effect, suggesting that insider trading leads to the impounding of earnings effects in stock prices before the earnings are publicly known.

The earnings momentum strategy was implemented for each country individually. From July 1987 to June 2001, the authors ranked stocks within each country on the basis of the change in their IBES consensus one-year-ahead (FY1) earnings forecast at the end of each month, scaled by price. The forecast revision over the past 6 months for firm $i$ in month $t$ is defined as:

$$REV_{i,t} = \sum_{j=0}^{s} \frac{rev_{i,t-j}}{p_{i,t-j-1}}$$

where $REV_{i,t}$ is the change in analyst earnings forecasts in month $t$ for firm $i$.

After the stocks are ranked by revisions, they are assigned to one of five quintile portfolios in each month. A trading strategy is implemented as in Jegadeesh and Titman (1993): they construct overlapping portfolios and compute equal weighted returns for each portfolio in each month. For instance, for a holding period of six months, the portfolio with the most favorable revisions in a given month (E5) consists of six overlapping portfolios from the previous six ranking months. The earnings momentum portfolio is the zero-investment portfolio that buys the most favorable revision portfolio and sells the least favorable revision portfolio (E5-E1) in each month.

A table summarizing the average monthly returns on these long-short portfolios formed from July 1987 to June 2001 showed that an earnings momentum strategy is profitable in the first six countries. But for the second five, although positive returns are generated over most holding periods, none are statistically significant.

Two conditions are necessary for mispricing to occur: (1) systematic noise trading, and (2) constrained arbitrage. Prior research suggests that persistence in analyst forecast revisions could arise from their tendency to herd, the sequential nature of individual revisions, or their general reluctance to provide negative information. But revision persistence alone would not lead to returns continuation if investors are aware of analysts’ tendencies, and can fully accommodate them in establishing prices. The fact that they are successful in doing so in some countries, and not in others, suggests that certain arbitrage forces are operating more effectively in some countries than in others.

The authors next focused on aspects of the information dissemination mechanism within a country that could either hinder or enhance the market’s ability to incorporate firm specific news. Four variables were examined. The most useful appeared to be the Corruption Perception Index (CPI) compiled by Transparency International. Corruption is a result of a
a combination of incomplete laws and poor law enforcement, and CPI captures this construct by integrating results from more than twelve different polls. Cross-sectional regressions of earnings momentum profits and price momentum profits indicated that each variable had some ability to explain momentum effects. However, the authors had only eleven observations.

Turning to the international valuation paper, Lee described a general approach to international equity valuation using accounting-based “smart multiples,” incorporating industry-, country- and firm-specific factors to select peer firms and enable valuation of a target firm in the context of these peer firms. There are at least three situations in which comparable firms are useful. One is in making forecasts, a second is in inferring market value of a target firm, and third for studying a variable of particular interest. The variables of interest were the enterprise-value-to-sales ratio, the price-to-book ratio, the price-to-earnings ratio, and the price-to-two-year-ahead-forecasted earnings. The authors produce these ratios in “warranted” form. Briefly, the research design involves estimating a series of annual cross-sectional regressions of a valuation multiple (EVS, PB, PE, or PE2) on various explanatory variables. The estimated coefficients from last year’s regressions are used, in conjunction with each firm’s current year information to generate a prediction of the firm’s current and future ratio. They refer to this prediction as the firm’s “warranted multiple.” And the warranted multiple becomes the basis for identification of comparable firms in subsequent tests.

The authors test their approach by examining the efficacy of the selected comparable firms in predicting future (one to three year ahead) valuation ratios. The results show that comparable firms selected in this manner offer sharp improvements over comparable firms selected on the basis of other techniques, including industry and size matches. Moreover, more often than not, the comparable firm selected is from another country.

80. Foreign Currency for Long-Term Investors (Fall 2002)

Luis M. Viceira, Assistant Professor, Harvard Business School, distributed a paper by himself, John Campbell and Joshua White entitled: “Foreign Currency for Long-Term Investors.”

Conventional wisdom holds that conservative investors should avoid exposure to foreign currency risk. If they hold foreign equities, they should hedge the currency exposure of these positions. The proposition of this paper is that the conventional wisdom may be quite wrong for long-term investors. Domestic bills are risky for long-term investors because real interest rates vary over time and the bills must be rolled over at uncertain future interest rates. This risk can be hedged by holding foreign currency if the domestic currency tends to depreciate when the domestic real interest rate falls, as implied by the theory of uncovered interest parity.

Viceira began with the proposition that empirical research has documented time variation in investment opportunities. Robert Merton has shown that long-term investors generally care not only about shocks to their wealth but also about shocks to investment opportunities. This means that strategic asset allocation involves more than mean-variance asset allocation. Displaying annualized standard deviations of real returns, he showed that the volatility risk in
common stocks, while quite high at time horizons up to 40 years, tends to level off after that point and stocks become less risky than some fixed-income instruments. The time horizon is then important in determining riskiness.

Equity home bias and currency home bias are conceptually quite different. This paper was about currency home bias. A portfolio concentrated in domestic equities could still include foreign currency. And an internationally diversified equity portfolio could include only domestic currency if the foreign currency exposure is fully hedged.

It is true that a conservative short-term investor seeking to minimize the short-term variance of portfolio return will hold a negligible quantity of foreign bills, because the inflation risk to domestic bills is generally modest, while the short-term variability of the real exchange rate is high. But if the real exchange rate is mean-reverting, then real foreign currency risk does not grow proportionally with the horizon. It appears that while there are volatile short-run movements around a long-run equilibrium, the long-run equilibrium real exchange rate is fairly stable.

Viceira described the empirical model. It allows for a stationary real exchange rate and for time-varying real interest rates in each country. The mean long real interest rate is assumed to be the same in each country. So differences in expected returns are excluded. The investigation begins with a VAR in the domestic ex post real interest rate, foreign ex post real rate, and real exchange rate. Quarterly data from the first quarter of 1973 through the fourth quarter of 2001 were used, for country pairs: US vs. UK, US vs. Germany, and US vs. Japan. One interesting finding was that uncovered interest parity was rejected at the 10% level for all country pairs and at the 5% level for the US vs. the UK.

It turned out that average real interest rates were highest in Germany and lowest in Japan. The unconditional standard deviation of real interest rates was highest in the UK and lowest in Germany. German short-term debt therefore appeared very attractive. The UK and Japanese currencies appreciated on average against the dollar over the 1973-2001 period, while German currency depreciated. But the volatility of exchange rates was so great that the average changes were not statistically significant. Turning to inflation, the UK showed the most inflation volatility while Germany showed the least.

A simple VAR treated the home country and the foreign country symmetrically, and included each country’s ex post real interest rate and the real exchange rate. The results indicated that when the US ex post real interest rate has been high (perhaps because of negative inflation shocks), the dollar tends to strengthen subsequently in real terms against the pound. This is inconsistent with uncovered interest parity because a high US ex post real interest rate also predicts a higher real rate in the US relative to the UK, implying a positive excess return on US dollar investment relative to UK investment. Further tables reported on VAR results for the US and Germany and for the US and Japan.

Next, the researchers investigated what their VAR systems implied for the optimal portfolio choices of long-term investors. For each country pair, they calculated the optimal portfolio of a long-term US investor compared with the optimal portfolio of a long-term investor based in the foreign country. Results were reported for relative risk aversion coefficients of 1, 5, and 2000 (effectively infinite). Tables also
reported the portfolio that minimizes the variance of the real one-period return. This is the portfolio held by an extremely conservative short-term investor.

For the US and UK, when risk aversion equals one, the optimal portfolio for both the US and the UK investor is 50% domestic and 50% foreign. This results from the assumptions that the average long real interest rate is the same in the US and the UK, and that the real exchange rate is stationary with no time trend. But as risk aversion increases, investors pay less attention to average returns and more to the risks of domestic and foreign currency. With a risk aversion of 2000, the optimal portfolio for the US investor is long 101% domestic currency and short 1% foreign (UK) currency. This is very close to the short-term minimum-variance portfolio, long 100% domestic currency. But for a UK investor, as risk aversion increases, the optimal portfolio places greater weight on US currency. At a risk aversion of 2000, the optimal portfolio is 66% US currency and only 34% UK currency.

For the US and Germany, while at high levels of risk aversion the US investor will put 65% in Euros, the German investor will put 110% in Euros and short 10% in the US. For the US and Japan, both the US and the Japanese investor at the high risk aversion level will invest primarily in the domestic currency, but will place a significant proportion in the foreign currency.

In conclusion, foreign bills are unattractive to conservative short-term investors, but they can be attractive to conservative long-term investors if the foreign real interest rate is relatively stable, the domestic currency value moves with the domestic real interest rate, and the real exchange rate is mean-reverting. Empirically, this suggested that conservative long-term investors should hold the currency with the most stable real interest rate.

81. The Curse of Non-Investment Grade Countries: Excess Vulnerability (Fall 2001)

Roberto Rigobon, Assistant Professor of Applied Economics at the Sloan School of Management, Massachusetts Institute of Technology, distributed a paper entitled: “The Curse of Non-Investment Grade Countries: Excess Vulnerability.”

He began his presentation by observing that emerging markets seem to move together far too much to be easily explained. And he displayed a graph showing co-movement in all EMBI countries. The focus of his paper however was on the consequence of Moody’s upgrading Mexican debt to investment grade on March 7, 2000. The announcement and the anticipation of the upgrade led to an almost immediate drop in the average yield of sovereign debt as well as its conditional volatility. These improvements were not surprising, but what was perhaps surprising was that following the upgrade Mexico seemed to become immune to crises in other emerging markets, and particularly immune to the turmoil produced by crises in Turkey and Argentina. A graph showing daily yields on Argentinean and Mexican sovereign bonds from January 1999 to May 2001, shows that the two markets co-moved strongly prior to March 2000, but drifted apart after that. He also showed that the rolling variance of yields using a 60-day window was very similar for Mexico and Argentina prior to March 2000, but drifted apart after that. He also showed that the rolling variance of yields using a 60-day window was very similar for Mexico and Argentina prior to March 2000, while after the date of the upgrade the variance in Mexico has been falling while the Argentinean variance has increased more than five times.
There were three objectives of the research reported on. First, it studied whether or not the transmission of shocks was significantly altered by the rating upgrade or its anticipation. Second, the research analyzed in which dimensions the propagation mechanism between Argentinean and Mexican sovereign bonds has changed: is the propagation of shocks through means or through the second moments? And finally it evaluated the predicted fall in the unconditional correlations that can be attributed to the event.

The upgrade of Mexican debt to investment grade was an unusual event. In the last five years in Latin America there have been only two cases of the rating moving between investment and non-investment grades. In 1999, Columbia was downgraded from investment grade to non-investment grade and in 2000 Mexico was upgraded. Because the upgrade means that a broader set of investors, such as insurance companies, pension funds, and certain mutual funds, are permitted to hold Mexican debt, it means a shift in the investor universe. The event then permits the testing of theories of contagion based on the identity of investors.

The three main results of the research are: First it is possible to reject the hypothesis that the propagation of shocks is stable after March 7, 2000. The second result is the conclusion that there is a sizeable reduction in the propagation of shocks through the means, while the diffusion via second moments has remained relatively stable. And finally, the third result evaluates the predicted reduction in the co-movement due to the change in parameters taking into account the ARCH effects.

Rigobon identified eight theories of contagion. It may come about through a trade variable, where the change in fundamentals in one country forces a change in relative prices in the other. It may come about through a change in economic fundamentals in one country forcing the other to make a change, as when interest rates are changed. Financial contagion can come about by worsening of the health of the banking sector in one country. These three causes can be categorized as essentially economic or financial. Liquidity shocks can be another source, the presence of a common lender may be another source, when a fall in the value of assets in one country forces a bank to sell assets in the other. Changes in fundamentals in one market, as in a wealth shock, is another source of contagion. The two theories of greatest interest to Rigobon, however, are multiple equilibrium and political contagion. Multiple equilibrium contagion is characterized by changes in fundamentals in one country driving expectations in the other country. The shift in equilibrium occurs through expectations and not because of fundamentals.

Rigobon described his task as:

We would like to estimate $\beta$, what determines it (the channels), and its stability in $y_t = \beta x_t + \gamma z_t + \epsilon_t$

Where

$y_t$, $x_t$, are the observable returns in the two countries
$z_t$, are the common unobservable shocks
$\epsilon_t$, are the idiosyncratic shocks
And he then explained the difficulty:

The true model is:

$y_t = \beta x_t + \gamma z_t + \epsilon_t$
$x_t = \alpha y_t + z_t + \eta_t$

Which suffers from: Simultaneous equations, Omitted variables, and Heteroskedasticity.

He began by applying the DCC test (DCC stands for Determinant of the
Chance in Covariance matrices). The DCC is designed to test for the stability of a set of multinomial variables that are simultaneously determined and suffer from heteroskedasticity. The test is based on the assumption that the data can be divided into two sub-samples with a known break. The null hypothesis is that the heteroskedasticity is explained by the shift in the variance of only one of the shocks in the original system. The break in the Mexican case was chosen to be March 7, 2000.

In delineating the two sub-samples for the test, Rigobon selected three different windows: for the non-investment grade period he used the thirty days prior to the upgrade, and for the investment grade period he used 10, 20, and 30 days following the upgrade. The test provided assurance that the transmission mechanism between Mexico and Argentina was altered by the rating upgrade. This conclusion supports a theory of contagion in which the identity of investors explains the co-movement. Rigobon was confident that the drop in co-movement was not due to a liquidity shock, but to the expansion in the investor universe. However, the DCC is unable to indicate what coefficients, or aspects of the relationship, have changed.

To pursue this question, Rigobon made use of a “structural” ARCH model which facilitates estimation of the diffusion of shocks through means and second moments. From this analysis he concluded that there was a shift in the propagation mechanism following the upgrade on March 7, 2000. There was a sizeable reduction in the transmission of means but not in variances. About a third of the contagion between Mexico and Argentina could be attributed to a segmented investor market.

However, the reduction in co-movement cannot be fully explained because there were more liquidity shocks during the non-investment grade than during the investment grade samples, there were more international crises during the former periods than the latter, and there was more trade between the countries during the former than during the latter.

In concluding, Rigobon indicated that he regarded what he had done empirically as a first pass at the problem of disentangling contemporaneous propagation through means and variances and that more work is required on models with segmented asset markets explaining the co-movement.

Markets and Trading

82. Secondary Trading Costs in the Bond Market (Fall 2004)


The bond market is characterized by many securities that are infrequently traded with (until recently) almost no contemporaneous price transparency and almost no quotes. The motivation for the research was twofold: to examine how the lack of transparency affects secondary trading costs, and also to encourage prompt response to the need for transparency. Harris was able to say that within twelve months the US markets will have complete bond transaction transparency.

Important issues to be explored were: What are secondary transaction
costs in the bond markets and what determines these costs, and in particular, how does bond complexity affect transaction costs?

The authors examined all municipal (MSRB) and corporate (TRACE) bond trades, measuring average transaction costs for each bond. They then identified cross-sectional determinants of the cost and how costs change when bond trades become more transparent.


For the MSRB sample the data covered over 7 million trades in almost 500,000 bonds, for a total volume over 2,575 billion dollars, and the useable sample included over 5 million trades in 167 bonds, for a volume of 832 billion dollars. For the corporate (TRACE) sample, the data covered over 8 million trades in 69,000 bonds for a volume of 9,413 billion dollars and the final sample covered 6.6 million trades in 17,000 bonds for a volume of 5,079 billion dollars.

Complexity features in municipal bonds are important. These include call features, sinking funds, extraordinary call provisions, nonstandard interest payment frequency, nonstandard interest accrual methods, and credit enhancements.

A particularly significant aspect of the research involved the development of econometric methods to determine transaction costs. We begin with the equation

\[ \log P_t = \log V_t + c_t Q_t, \]

where \( P_t \) and \( V_t \) are price and value, and \( Q_t \) indicates with values 1 or -1 whether the trade \( t \) was initiated by a customer buyer or seller. We add interdealer trades, with the relation:

\[ \log P_t = \log V_t + c_t Q_t + \delta_t I_t - \delta_t I_t^D \]

Where \( +\kappa_s Q_t + \kappa_s Q_s + \delta_t I_t - \delta_t I_t^D \) is the source of noise, or randomness.

Returns have drift, common and idiosyncratic components, and are random in bond specific value.

\[ r_{ts}^V = r_{ts}^V - \text{Days}_{ts} (5\% - \text{CouponRate}) \]

\[ \beta_{Avg} SLA_{Avgts} + \beta_{Diff} SLDDiff_{ts} \]

\[ + \epsilon_{st} \]

The cost function for municipal bonds is:

\[ c(S') = c_0 + c_1 \frac{1}{S'} + c_2 \log S' \]

And for corporate bonds is:

\[ c(S') = c_0 + c_1 \frac{1}{S'} + c_2 \log S' + c_3 S' + c_4 S'^2 \]

Finally, the regression model is:
\[ r_{ts}^P - \text{Days}_{ts}(5\% - \text{CouponRate}) = \]
\[ \beta_{\text{SLAvgSLAvg}_{ts}} + \beta_{\text{SLDifSLDif}_{ts}} + c_0(Q_t + Q_s) + c_1\left(\frac{Q_t}{S_j} - \frac{Q_s}{S_s}\right) \]
\[ + c_2(Q_t \log S_j - Q_s \log S_s) + \eta_{ts} \]

with an error term:
\[ \eta_{ts} = \epsilon_{ts} + Q_t \kappa_t - Q_s \kappa_s + t_t^\rho \delta_t - t_s^\rho \delta_s \]

with a variance:
\[ \sigma_{\eta_{ts}}^2 = \sigma_{\epsilon_{ts}}^2 + \sigma_{\kappa_t}^2 + \sigma_{\kappa_s}^2 + (2 - D_{ts})\alpha_k^2 \]

where \( D_{ts} = 0, 1, \) or \( 2 \) counts the interdealer trades among trades \( t \) and \( s \).

The strategy is to estimate the model without the indices for each bond, then to adjust prices to remove trade costs, to use repeat sales methods to compute the indices, and re-estimate the model with the indices.

The model is estimated with ordinary least squares for each bond. Pooled constrained weighted least squares is used to regress the squared residuals on independent variables to estimate the variance components. The model is re-estimated with weighted least squares with iterations until convergence.

The estimated cost for a given size is:
\[ \hat{c}(S) = \hat{c}_0 + \hat{c}_1 \frac{1}{S} + \hat{c}_2 \log S \]
And the estimate error variance is:
\[ \text{Var}(\hat{c}(S)) = \left[ \frac{1}{S} \log S \right] \sum \hat{c}_i \left[ \frac{1}{S} \right] \frac{1}{\log S} \]

The estimate error variance is important in telling us when the information is worth using.

Harris displayed most of the bond functions in graphical form. For municipal bond transactions, the mean cost per trade ranged from about 1.5% for a $5,000 transaction to perhaps 10 basis points for a $10,000 transaction. For corporates the costs were much lower, ranging from about 80 basis points to 5 basis points. For municipals, trading costs were higher for speculative bonds and about the same for all other quality (in general very high quality). For corporates, there were fairly clear differences among superior, investment grade, junk and defaulted.

For the municipals, bond complexity was important. Costs were significantly higher for complex bonds than for typical bonds, which in turn had higher costs than simple bonds. For municipals, time since issuance seemed to have little effect on transaction cost, but time to maturity made a difference with the shortest bonds having the lowest costs. For corporate bonds, transparency made a difference, with low transparency leading to higher transaction costs.

Harris next showed the results of cross-sectional regressions. This analysis helped to isolate effects by disentangling conflicting effects. The dependent variable is the average bond transaction cost estimate for a representative trade size. The dependent variable observations are noisy estimates for which we have estimates of the error variances which help us determine which observations to use. The regressors are inverse price, fixed costs (perhaps clearing costs), credit rating index, complexity features, age/maturity features, and size/scale features. From the regressions we obtain OLS residuals and regress these
residuals on a constant and on the error variances to obtain predicted variances. We use the inverses of the predicted variances as weights for the WLS analysis. The results for the complexity features for municipals were of particular interest. Callability cost 23 basis points. A sinking fund cost 15. An extraordinary call cost 9. Nonstandard interest payment frequency cost 2. Nonstandard interest accrual cost 9. Credit enhancement cost 11. For corporates, an attached call reduced the cost by 11 basis points, an attached put reduced it by 44 basis points, a floating rate reduced it by 12 basis points. A variable rate increased it by 6, a nonstandard accrual by 7, and maturity date extended or extendable by 5.

Transparency changes provided an opportunity to see the effect on costs. A “back of the envelope calculation” indicated a cross-sectional effect at a $100K trade size of a reduction of 3.8 basis points for TRACE-transparent transactions and 3.5 basis points for ABS listed bonds. The time-series effect was a saving of 10, 11, and 15 basis points for various comparisons and 5 and 7 basis point savings for BBB bonds. Harris guessed that a minimum saving was 5 basis points which when multiplied by $2 trillion in volume suggests a $1 billion aggregate saving. In summary, he noted that municipal and corporate bonds are expensive to trade, and that retail investors and perhaps even issuers would benefit if issuers issued simpler bonds. Finally, studies such as this one are essential inputs into the regulatory process. This study was certainly successful as such an input.

83. The Nature of Institutional Order Flow (Spring 2003)

Wayne H. Wagner, Chairman of Plexus Group, Inc. presented a series of real life examples of institutional trades showing distributions of trade sizes, costs of trading different sizes, and performance of different sized trades, with some interesting and sometimes troubling conclusions.

He began by describing a highly successful trade. On August 15, 2002 a large momentum manager sends to his trade desk an order to buy 1,745,640 shares of Oracle. The desk feeds the order to a trade management interface to Bloomberg B-trade. The trading is handled entirely electronically, with no human intervention. Trading is completed in 51 minutes at a rate of up to 153 executions per minute. There are over 1000 separate executions with an average size of 1,722 shares, just about the average trade size on both the NYSE and NASDAQ. The largest execution was 63,871 shares and the smallest was 13 shares. The closing price for Oracle on that day was appreciably higher than the price at the completion of the manager’s trading. What is particularly interesting is that the completion of the trade required a 1000:1 reduction from order size to trade size. Why must institutional sized trades be broken down to retail-sized orders for execution?

Wagner’s thesis was that:

- Managers need to know the true cost of implementing investment ideas.

- Money owners need to know how frictional costs affect their ability to accumulate financial assets.

- Marketplaces need to assess their ability to provide facilities that are:
  1. Efficient (low cost)
  2. Deep (low impact) and
  3. Liquid (low delay costs) market
  4. Fair (value flows to the end-men, not the middlemen)
He turned next to the Plexus data sample, which includes almost 900,000 orders from the 4th Q 2001 to the 1st Q 2002, an up-market, followed by over 400,000 orders from the 2nd Q 2002 down-market. The data came from 93 managers. The universe of orders was divided into 5 quintiles based on size of trades so that the dollars traded were the same in each quintile. The focus was on the cost of interacting with the market. Commission costs were excluded (an omission that some participants thought was important, and that Wagner explained was due to an absence of information). The Trade Cost was measured as the Execution Price – the Decision Price. As we go from the smallest trade size quintile to the largest, we find the cost per dollar traded rises from .04% to .90%. Wagner raised the question whether this is a liquidity cost (proportional to trade size) or a frictional cost (proportional to time to execute)? It appeared that selling was cheaper than buying, except for the largest quintile, where the reverse was the case.

Turning to how successful the decisions were, Wagner showed that buy decisions outperformed sell decisions (reflecting favorably on managers) but large trades did not outperform small trades. Managers appeared to be reacting to recent information, and it was not clear that the value of the information justified the high cost of large trades. One possibility was that the large orders were not based on information but were liquidity-motivated.

Some data on percent returns less median round-trip costs suggested that small to medium trade sizes performed best and the net value of a decision peaks very early, on the order of 5 days.

A closer look into the largest trade quintile suggested that a very large percentage took over a day to complete and a large percentage were not completed at all. So we come back to the great difficulty of prompt transactions at a large trade size.

Exploring possible institutional herding, Wagner presented price and trading data in TYCO from January - June 2002. There appeared to be very significant selling on the basis of news events and perhaps on the basis of price changes. However, over 3 down days in April there was a great variety of buying and selling and 9 managers both bought and sold during this period.

He turned to the second sample, the down-market in 2nd Q 2002. The spreads between large quintile buys and sells were very much larger than the spreads in up-markets. The direction of the market determines whether trades are liquidity consuming (costly) or semi-liquidity providing (inexpensive), and he noted that frictional costs grow faster than trade size. Managers who buy heavily in falling markets are well paid for providing liquidity.

A comparison of trading on the NYSE and NASDAQ showed the latter was more expensive (but commission costs are ignored) except for the largest order quintile purchases in rising and falling markets. Wagner observed that both the NYSE and NASDAQ are threatened by substantial loss of volume.

In his final conclusions, he argued that transactions costs need to be reduced, but that the answer is not with electronics. There is still room for a human Market Maker. Costs will come down only in response to demand from money owners and investors.
William N. Goetzmann, Edwin J. Beinecke Professor of Finance & Management Studies and Director of the International Center for Finance, Yale University School of Management, had prepared a paper entitled: “Estimating Indices in the Presence of Seller Reservation Prices,” by himself and Liang Peng of the College of Business, University of Cincinnati.

The paper and presentation concerned the accuracy of an index of asset prices when sellers use reservation rules that may include some component of private value. The reservation rules induce bias in transaction prices, and the authors developed a model in which the seller’s asking price is determined by private valuation while the buyer’s bid price is determined by the market valuation, and a transaction takes place only when the bid is higher than the ask. Goetzmann observed that the phenomenon applies to an index of housing values, art values, and stock values. In the art market, reservation prices in auctions introduce the bias. In the housing market, the bias is due to excessive asking prices, aversion to sales creating negative equity, and an absence of sales during down markets. In the stock market, the disposition effect (an aversion to taking a loss on the sale of a stock) biases the series of transaction prices.

There are two standard approaches for dealing with the problem. One is hedonic regression. Particularly in the case of residences, this regression allows for significant quality differences among houses. The measure of quality (number of square feet, for example) is included in a regression to improve a series of observed prices. A second approach is the repeat sale regression (RSR). In this case, the only data employed in creating an index series come from purchase and sale information for the same properties at different points in time. This is the method most commonly used in the real estate market. Applications are on-line appraisals, MBS valuation, risk-based capital requirements for government agencies, and a product only now in the development and testing stage: home equity insurance. Goetzmann displayed a number of web sites offering real estate valuation data compiled using the RSR.

In the art market, the RSR method is used for on-line appraisals, for art funds, and for the valuation of art in estates and for tax purposes. Further web sites showed art pricing services based on the RSR method.

Turning to securities markets, Goetzmann indicated that the hedonic regression is used to compute daily bond indices, for performance measures and mutual fund pricing. The RSR method is used in compiling high-frequency stock indices and indices for venture capital and private equity.

Goetzmann went on to describe a number of simulations designed to estimate how serious is the bias in a simple equal-weighted index, and to see whether the RSR method will correct the bias. Using housing price data, he tested the bias introduced by four different rules followed by sellers of houses. These were: sell only if the price exceeds the first day price in the simulation; sell only if the price exceeds the past maximum price; sell only if the price exceeds the purchase price; and sell only if the price exceeds the last period value. Average biases in the annual mean return estimate ranged up to 5%.

The idea leading to a solution to the seller reserve problem was that low transaction volume is an indicator of
periods when seller reserves most affect observations. Hence it seemed sensible to use volume as an instrument by which to estimate average seller reserve values and cross-sectional price variations from the index. We begin with a standard estimator, either the RSR or hedonic regression. Using volume fluctuations we back out the average seller reserve and the average cross-sectional variation around the index. With these estimates we run a conditional estimator, re-weighting observations that carry information about low-volume periods. The model does require good estimates of turnover, or volume. And it must deal with a non-linear relation between volume and bias. This means that simply regressing out the volume effects does not work well for important price moves.

The model proved to perform well in simulations. It was then tested on data for repeat sales of single family homes in Los Angeles from 1970-2001. There were 379,296 repeat sales. A graph of the housing price index computed by the RSR method and a corresponding index computed by the reserve conditional model proved quite interesting. The two indices tracked very closely from 1970 until around 1985. The model series rose quite sharply in 1988, although the RSR series rose only modestly. This difference Goetzmann attributed to a large extent to problems with data collection. Beyond 1988, the RSR series and the model series were roughly parallel, with the model series a little less smooth and considerably higher than the RSR series. Correspondingly, a graph of the estimated seller reserve ratio was quite high until it dropped in 1988 and then leveled off through 2001. Correspondingly as well, the transaction volume was quite low until 1988, when it rose steeply and continued at a high and somewhat rising level through 2001. The relationships were then intuitively consistent.

In concluding, Goetzmann observed that the model is an approximation, but that it works. It corrects sticky prices in down markets and takes some of the smoothing out of market indices. He believes that application to art, equities, bonds and other markets is worth exploring.

85. Why People Trade (Fall 2002)

Lawrence Harris is the Q-Group Research Coordinator, Fred V. Keenan Chair in Finance, USC (on leave) and Chief Economist, Securities and Exchange Commission. He distributed a copy of Chapter 8 of his just published book entitled: Trading and Exchanges: Market Microstructure for Practitioners.

People trade to invest, borrow, exchange assets, hedge risks, distribute risks, gamble, speculate and deal. In his presentation, Harris identified about thirty different types of traders, all participants in a zero-sum game. Summarizing the purpose of his presentation, and the chapter, Harris said: Investment managers get into trouble when they do not completely understand why they are trading. Problems occur when there is a difference between the true reason for their trading, and the reason for which they think they are trading.

It may be helpful to traders to identify where their activities fall in the taxonomy identifying the different types. A rather fundamental distinction is between utilitarian traders and profit-motivated traders. Profit-motivated traders have, or think they have, some comparative advantage. They may be better informed, or better at interpreting information for investment purposes, than other investors generally are. Market-makers, including specialists, on the other hand, recognize that they are at a comparative disadvantage when they trade with truly informed traders.
They are likely to lose money in such trades, and to be profitable they must trade with those who do not have an information advantage.

Economists sometimes call utilitarian traders *liquidity traders* because they need liquidity to accomplish their goals at a low cost. Utilitarian traders are not profit-motivated. Some of them, probably many of them, are simply shifting assets through time. Working people are setting money aside and investing it to provide for their retirement years later. Retired people are liquidating investments in order to have money to live on. Hedgers trade instruments that are closely correlated to the risks they face. Gamblers trade instruments that excite them. All are clearly at a comparative disadvantage compared to profit-motivated traders, and they can expect to contribute to the profits of those traders. Although utilitarian traders might regret consistently creating profits for informed traders, they benefit from the existence of a liquid market in which prices do move toward fundamental values. It is important for utilitarian traders to understand their situation and adapt their style of trading to it. For example, one thing they can do is to minimize transaction costs. For some utilitarian traders recognition of risks and ways to avoid them can be very important.

There is a wide variety of utilitarian traders and in his chapter Harris discusses seven major categories, pointing out what these traders can expect to accomplish (and what they cannot expect to accomplish).

Summarizing his discussion of utilitarian traders, Harris says: utilitarian traders use the markets to solve problems that originate outside the markets. Investors and borrowers use the market to move money forward or back through time. Asset exchangers use the markets to obtain items that are of greater value to them now than those which they tender. Hedgers use the markets to offload risks. Gamblers use the markets to obtain entertainment. Fledglings use the markets to learn whether they can be successful profit-motivated traders. Cross-subsidizers use the markets to move money from one account to another. Tax avoiders use the markets to minimize their taxes.

Profit-motivated trading is probably more exciting to most investors than is utilitarian trading. Informed traders acquire and act on information about fundamental instrument values. They trade when they believe that prices differ from fundamental values. Informed traders are the only traders whose trading causes prices to move toward fundamental values. It is particularly important that those who think they are informed traders really do have a comparative advantage. Harris pointed out that learning that one is not a truly informed investor can be an expensive education. Understanding one’s comparative advantage (or disadvantage) early in a trading career is very helpful. He discussed the category of futile traders and why they are unsuccessful.

There is no real substitute for reading Chapter 8 in Harris’ book. But here are “some points to remember” from page 200 of the book:

- Utilitarian traders trade because they expect to obtain some benefit from trading besides profits.
- Investors and borrowers move money through time.
- Hedgers exchange risks.
- Asset exchangers trade to obtain assets of greater value to them than the assets that they tender.
- Gamblers trade for entertainment.
• Profit-motivated traders trade only because they expect to obtain profits.
• Speculators trade on information about future price changes.
• Dealers profit from offering liquidity to other traders.
• Futile traders believe that they are profit-motivated traders, but they cannot trade successfully enough to profit in the long run.
• Pseudo-informed traders trade on stale information.

86. The Nasdaq Stock Market, Inc. (Spring 2002)

André Perold, Sylvan C. Coleman Professor of Financial Management, Harvard Business School, distributed a Harvard Business School case study entitled: “The Nasdaq Stock Market, Inc.” The case focused on a new trading system – SuperMontage – designed and proposed by Nasdaq and approved by the Securities and Exchange Commission in January 2001. The statement of mission was ambitious: “To facilitate capital formation in the public and private sectors by developing, operating and regulating the most liquid, efficient and fair securities market for the ultimate benefit and protection of the investor.” And the vision was if anything more ambitious: “To build the world’s first truly global securities market. A worldwide market of markets built on a worldwide network of networks linking pools of liquidity and connecting investors from all over the world assuring the best possible price for securities at the lowest possible cost. By continuing to shape the new world of investing, Nasdaq is challenging the very definition of what a stock market is and what it can be.”

Perold traced the development of the stock market beginning in Amsterdam in 1660, when the first publicly held company – the East India Company – was the only security traded. The basis upon which trading and speculation took place in Amsterdam in the 17th Century was remarkably like the basis for trading and speculation today. And some of the characteristics of the marketplace, including fragmentation and arbitrage, were also similar.

He then described some of what has been going on in U.S. securities markets in recent years. Turnover has gone up considerably, with the average holding period for stocks a long way down. The average trade size has gotten much smaller, with more transactions. Spreads have changed with the spreads for small transactions considerably narrowed and those for large transactions considerably widened. In fact, large transactors complain that there is less liquidity than there used to be.

In 1963 the SEC recommended that the National Association of Securities Dealers restructure the OTC market through the use of automation. The result was Nasdaq, with central computers initially connected to terminals in 500 marketmakers’ offices across the country. Only marketmakers were allowed to enter quotes on Nasdaq, and they had to maintain a two-sided market for a minimum of 100 shares at all times. Level I service furnished only a representative bid and ask quotation for a given stock and was intended for stock brokers who would convey the information to their clients on request. Level II service displayed the quotations of all the marketmakers in a given stock and was primarily used by professional investors. Level III service, to which only marketmakers had access, enabled them to enter updates to the prices and quantities they were quoting.
In 1984, with annual volume up to 15.2 billion shares, Nasdaq implemented its first order execution facility, the Small Order Execution System. SOES was limited to non-professional investors who placed orders with qualifying brokers. Dealers receiving these orders had to honor their bids and offers (price and size) for automatic execution up to 1000 shares. SOES became mandatory following the October 1987 stock market crash, when many investors were unable to trade. In 1988, with annual volume up to 31 billion shares, Nasdaq introduced SelectNet®, an order routing and execution service for institutional investors.

Nasdaq received significant transaction based fees for the use of SOES and SelectNet®, amounting to $395 million or 46% of total revenues in 2000. Its other main revenue sources in 2000 were quote dissemination services, which accounted for $258 million, and listing fees which brought in another $185 million.

Nasdaq viewed the New York Stock Exchange as its principal competitor. But by 2001, the greatest threat appeared to come from electronic communications networks. These markets were able to compete with Nasdaq by connecting buyers and sellers directly, bypassing intermediaries such as specialists and marketmakers. Perold showed some of the screens displaying bid, ask, and size, that investors could use to trade stocks. SuperMontage was proposed to compete directly with these ECNs.

There was some discussion as to just how investors used the ECN screens in order to initiate transactions, and a discussion of how SuperMontage would be used. The question posed by the case was whether SuperMontage would work. More specifically, how much order flow would Nasdaq be able to keep on its system, given that SuperMontage would put Nasdaq in direct competition with many of its liquidity providers, in particular ECNs? Was it worth giving up the monopoly on providing consolidated quote information in return for the emerging ECN business? And how would all these changes impact the investor?

Perold discussed the implications for market structure of the introduction of SuperMontage, and the implications for investment management. Some of the interesting questions were whether there is a need for dealer markets, or whether electronics are sufficient. Should we worry about fragmentation if markets are completely interconnected? What will happen to transactions costs? And how does an active manager trade a large block? Asked his personal opinion with respect to the probable success of SuperMontage he concluded it was very hard to predict.

87. Contagion Across Financial Markets: An Empirical Assessment (Fall 2001)

Mardi Dungey, Fellow, Economics Division, Research School of Pacific and Asian Studies, Australian National University, distributed a paper by herself and Vance L. Martin of the University of Melbourne titled “Contagion Across Financial Markets: An Empirical Assessment.”

She began her presentation with just what is meant by “contagion.” The word has been used to describe correlations between stock prices in different equity and currency markets, arising from various sources. The definition she uses, adapted from Masson, is that contagion is modeled as the effects of the residual in one market on the residual of the other, after controlling for all other forms of shock. The portfolio implication of contagion is reduced ability to diversify across...
markets. The policy implications have to do with international infrastructure. For example, the Malaysian finance minister in 1998 complained that “Malaysia is concerned that the risks of contagion from the Asian crisis have increased.” We also have reason to look for contagion between equity and currency markets. She showed correlation of Asian exchange markets and equity markets in 1997 and 1998, as well as some evidence of correlation between Australian and U.S. markets. So correlation is not limited to developing nations, but it does seem clearly more significant there. Further, there appears to be contagion between financial markets, with currency contagion running to equity contagion.

Her analysis was carried out using a latent factor model. This model removes the need to specify which fundamentals are important. Equity market returns are modeled as a linear combination of an equity market factor, common to all equity markets, and specific country and market factors. Currency market returns are modeled as a linear combination of a currency market factor, common to all exchange rates, and specific country and market factors. The model for bilateral exchange rate returns includes country factors for both currencies involved. Contagion from equity markets to currency markets is measured as the effect of the error term from the regression of the equity market factor on currency market returns. Contagion from currency markets to equity markets is measured as the effect of the error term from the regression of the currency market factor on equity market returns.

The model she used, combining the equity (s) and currency (e) markets was:

\[ s_i = M^e + C_i^s + Z_i^s + W + M_{i-1}^e + u_e \]
\[ e_{i0} = M^c + C_i^c + C_0^c + Z_0^c + W + M_{i-1}^c + u_s \]

where \( s_i \) is the return in stock market indices in country \( i \) at time \( t \), \( e_{i0} \) is the corresponding exchange rate return, \( M \) (market effect) is the market factor, \( C_i \) (unique effect) is the unique country-specific factor for the country currency and \( C_o \) for the country 0 (or numeraire) factor. \( Z_i \) (country effect) is the country specific factor, and \( Z_c \) is the country 0 specific factor, \( W \) (world effect) is a world factor for all markets, \( M_{i-1}^e \) and \( M_{i-1}^c \) are spillovers, and \( u_e \) and \( u_s \) are the residuals, that is the contagion.

To do the estimation Dungey made use of a GARCH model. The data were daily exchange rate and equity index returns, for South Korea, Malaysia, Thailand, Indonesia, the U.S. and Australia from July 2, 1997 through August 31, 1998. What we want is the proportion of total variance accounted for by each factor: market, unique, country, world, spillovers, and contagion.

From the results she concluded that with the exception of Indonesia, there is little evidence of contagion or spillovers from equity markets to currency markets, but substantial contagion from currency markets to equity markets. This was consistent with the general understanding of the East Asian financial crisis as originating in the currency markets and spreading to the equity markets.

In the equity markets over 90% of volatility in all countries except Thailand is attributable to either contagion or spillovers from the currency markets. The other dominant factor for Thailand is the common equity market effect and this may support an argument that equity markets in Thailand were in crisis far earlier than the currency crisis period.

The breakdown between the contribution of spillovers and contagion
in equity markets is of particular interest. Spillovers refer to the impact of explained common currency effects on the equity market returns. The markets where this is dominant are the developed markets of Australia and the U.S. and Thailand and Malaysia. The developed market results are not unexpected as they generally have better information processing capacity, and the Thai result may be reflecting its role as where the crisis originated.

The majority of exchange rate volatility in the sample was explained by the common currency market effect. The exception to this was the Australian dollar/U.S. dollar rate. This was the only bilateral rate in the sample not containing an Asian currency. It seems likely that in this case the common currency market effect is proxying for an Asian crisis latent factor. But the volatility of the Australian dollar seems to have been transmitted through the U.S. dollar rather than by a direct linkage of the Australian currency with the Asian currencies.

She went on to describe where the line of research should lead, and the next step she proposes is to incorporate the role of money markets in her approach.

88. Commonality In Order Flow: Its Sources and Its Effects on Trading Costs and Returns (Fall 2001)

Jarrad Harford, Assistant Professor of Finance, Lundquist College of Business, University of Oregon and Aditya Kaul, Assistant Professor of Finance, University of Alberta, distributed their paper “Commonality In Order Flow: Its Sources and Its Effects on Trading Costs and Returns.” The research was supported by The Q-Group®.

Kaul began the presentation with a series of questions the researchers were investigating.

- How pervasive is order flow commonality?
- What explains order flow commonality - Institutions or individuals?
- Are the common effects in order flow, returns and costs linked, and how?
- He turned next to the relevance of the research results for investors:
  - Implications for investor ability to avoid liquidity risk - e.g. does selling in one sector depress prices and costs elsewhere?
  - Implications for effectiveness of portfolio diversification strategies - If order flow patterns influence return correlations.
  - Implications for optimal trading strategies - Depends on the relation between aggregate order flow and prices/costs.
  - When should an investor trade?

The research was based essentially on pairwise correlations for stocks using order flow, effective spreads and returns. The data were signed trading activity (buys distinguished from sells), trading costs and returns for stocks in the S&P 500 and non-S&P samples in fifteen-minute intervals over the trading days in 1986 and 1996. The S&P sample constituted all S&P 500 stocks on the NYSE. The non-S&P sample comprised 75 NYSE stocks randomly selected from each volume quintile. Excluded from the samples were ADRs, REITs and securities with an average price below $10, and securities with less than 100 trades per year. The trade signing convention identified a trade with a prices above the midpoint of the spread
as a buy and one with a price below the midpoint as a sell. Trade sizes were classified in three ranges: 100-400, 500-9900, and 10,000 or over shares. The order flow statistic measures a signed number of trades. The effective spread was calculated as the difference between the price and the midpoint of the bid/ask spread, doubled. Returns were based on quote midpoints. The transaction and quote data for 1986 came from the ISSM tapes, and for 1996 came from TAQ CDs. The data source did not identify the parties to a transaction as individual or institutional, but the authors drew inferences from the sizes of the transactions and their time of day. (A supplementary analysis was carried out using TORQ data, for the three months November 1990 - January 1991, covering 144 stocks, where the parties to the transactions were identified.) For both years, analyses were carried out on the time intervals from 9:30 am to 3:00 p.m., and from 3:00 p.m. to 4:00 p.m. The intuition here was that in the last hour of the day institutions would be especially active.

Harford took over the presentation and turned to the summary statistics which provided some comparisons between 1986 and 1996 broken down by the early and later portions of the trading day. S&P total volume was up more than non-S&P total volume, and more in the last hour of the day than in the earlier period. The effective spread for S&P stocks was down about 50% for both buys and sells. For the non-S&P stocks the effective spread was down about 40% for both buys and sells.

The correlations reported were the medians for pairwise correlations. That is, for each pair of stocks in the S&P group and in the non-S&P group order flow figures were correlated, and then returns, and then trading costs. The order flow correlations were much higher for the medium sized trades, which appeared to characterize institutions. They were also higher during the last hour of trading than during the preceding period. For the non-S&P stocks, the correlations were all quite low. The median correlations for returns were higher in 1996 than in 1986, higher in the last hour of the trading than in the preceding period, and much higher for S&P stocks than for non-S&P stocks. These results are all consistent with the increased importance of S&P stocks because of indexing, and the increased importance of institutional trading.

The correlation of effective spreads in 1986 was fairly low and about the same for S&P stocks and for non-S&P stocks, with the sell spread somewhat higher than the buy spread.

The next regression tests were undertaken to explain order flow. The dependent variable was the total signed medium or small trade order flow for a stock in a fifteen-minute period, and the independent variables were aggregate S&P order flow, lagged returns for S&P stocks, and order flow for non-S&P stocks. The regression results indicated strong order flow effects of aggregate S&P order flow and lagged returns for S&P stocks, and of non-S&P order flow for non-S&P stocks. It turns out that order flow for S&P stocks is influenced positively by aggregate S&P order flow and lagged returns, and negatively by non-S&P order flow and returns. Non-S&P stocks are influenced positively by non-S&P order flow and negatively by S&P order flow and returns. The effects were strongest for the medium sized trades, stronger in the closing hour of the day, and stronger in 1996 than in 1986. The negative correlations suggest substitutability between S&P and non-S&P stocks.

The next set of regressions reported were designed to explain order flow commonality. Signed order flow for
each stock was related in a time-series regression to aggregate S&P signed order flow, aggregate signed order flow for the non-S&P market and for the stock's industry, lagged S&P 500, non-S&P and industry returns, and the previous period's order flow and return for the stock itself. Some interesting conclusions could be drawn from medium sized trades for S&P stocks.

The coefficient on aggregate S&P 500 signed number of trades is always significantly positive, meaning that there are more medium trades in an index constituent stock when other S&P 500 stocks are being traded, and these trades are of the same sign. The increase in the strength of the co-movement at the end of the day, when index funds are most active, and over time as indexing has become more common, strongly points to indexing as the cause.

The performance of the index provides another source of commonality with a lag. This is consistent with feedback effects from returns to trades.

The coefficient on aggregate medium non-S&P order flow is consistently negative indicating that when there is an excess of buys in all non-S&P stocks there is an excess of sells in individual S&P stocks. This is inconsistent with broader market influences moving all stocks in the same direction and suggests a substitution effect.

There is strong evidence of common effect induced by medium industry order flow, which has the largest coefficient of all the common factors. The positive coefficient on lagged industry returns suggests feedback trading. The evidence that lagged own returns negatively affect trading is consistent with profit taking. The regressions also indicated positive autocorrelation in order flow.

Next, the effective spreads and returns for each stock were regressed on its own order flow, aggregate order flow for the S&P stocks, and aggregate order flow for non-S&P stocks. It turns out that for S&P stocks, price changes and trading costs for buys are lower when S&P order flow is dominated by buys but there is no symmetric effect for sells. Index fund buying activity in these years could explain the difference between buys and sells. For non-S&P stocks, price changes and trading costs for buys are larger when non-S&P order flow consists of buys and costs for sells are also larger when non-S&P order flow consists of sells. The explanation for what is going on appears to involve specialist strategy.

There are some implications for investors in the results. Selling of S&P stocks drives down non-S&P stocks so moving to non-S&P investments is not helpful in this case. Correlated order flow could affect correlations of returns and portfolio variance. Diversification strategies may not be as effective as some have thought. We get no clear message as to whether when aggregate order flow is heavy we have a good or bad time to trade.

89 Market Liquidity, Trading Activity, and Order Imbalance (Spring 2001)

Richard Roll, holder of the Allstate Chair in Finance at the Anderson School of Business Administration, UCLA, distributed two papers by himself, Tarun Chordia, and Avanidhar Subrahmanyam. The first, to be published in the Journal of Finance, was entitled: "Market Liquidity and Trading Activity," and the second was: "Order Imbalance, Liquidity, and Market Returns."
Roll began with the first paper and discussed the data underlying the analysis reported in both papers. The data set covered transactions on the New York Stock Exchange for the calendar years 1989–1998, 2779 trading days. Every transaction was time stamped, with price, number of shares, associated bid and ask, and the depth corresponding to each. There were approximately 3.5 billion transaction records. Roll described a number of filters applied to remove apparent errors and anomalous records, affecting less than 0.02% of the records. For each transaction seven variables were defined. These were the quoted spread, the percent quoted spread (the quoted bid-ask divided by the mid-point of the quote in percent), the effective spread (the difference between the execution price and the mid-point of the prevailing bid-ask quote), the percent effective spread (the effective spread divided by the mid-point of the prevailing bid-ask quote), depth (the average of the quoted bid and ask depths), dollar depth (the average of the ask depth times ask price and the bid depth times bid price), and the composite liquidity (percent quoted spread divided by dollar depth). These data items were averaged over the stocks traded on each trading day. In addition, three variables were calculated: the total share volume each day, the total dollar volume each day, and the total number of transactions each day.

The questions explored in the first paper were:

- How much do liquidity and trading activity vary over time?
- Are there regularities in the time-series of daily liquidity and trading activity? For example, are these variables systematically lower or higher during certain days of the week or around scheduled macroeconomic announcements?
- How does recent market performance influence the ease of trading on a given day?
- What causes daily movements in liquidity and trading activity? Are they induced, for example, by changes in interest rates or in volatility?

In addition to the data described above, from the NYSE records, the research required interest rates, term spreads, quality spreads, daily stock returns (CRSP Index returns), identification of the day of the week on which trading was taking place, and identification of holidays, with dates of announcement of GDP, unemployment and CPI.

Responding to the first question above, Roll showed that the effective spread and the proportional effective spread had steadily declined in the latter half of the time period studied, with an abrupt decline in both depth and spread around June 1997, when the minimum tick size was reduced from 1/8 to 1/16 on the NYSE. Effective spread was considerably smaller than quoted spread, evidently reflecting within-quote trading.

In response to the second question, there proved to be far more volatility in volume and in transactions than in other variables, including spreads and depths. Spread changes were negatively correlated with depth changes, but there was little correlation between changes in the market-wide quoted and proportional quoted spread and share or dollar volume. Effective spread measures were actually positively correlated with share and dollar volume. Further, the correlations between various spread changes and the number of transactions were also positive.
What was perhaps more interesting was that every series except price exhibited statistically significant negative first order autocorrelation with some evidence of negative second order autocorrelation. Fifth order coefficients were uniformly positive and about half of them significant, indicating the presence of a weekly seasonal (because the trading week is five days). The four spread measures had the largest negative first order autocorrelation coefficient of all variables. The evidence suggested that negative serial correlation is an inherent property of the true time-series process followed by liquidity.

Turning to the third question above, the possible effect of market performance, Roll discussed the importance of the signed concurrent daily return, a measure of recent market history, in the form of a signed 5-day moving average of past returns, and a measure of recent market volatility.

Overall, the evidence can be summarized as follows:

- Quoted spreads, depths, and trading activity respond to short-term interest rates, the term spread, equity market returns, and recent market volatility.
- Depth and the composite measure of liquidity respond to recent market trends.
- Effective spreads respond strongly to equity market returns, recent market trends, and recent market volatility.
- Spreads respond asymmetrically to contemporaneous market movements, increasing much more in down markets than they decrease in up markets.
- There is strong evidence that liquidity and trading activity drop on Fridays relative to other days of the week.
- Tuesday tends to be accompanied by increased trading activity and increased liquidity relative to other days of the week.
- Depth tends to decrease and trading activity tends to increase around major holidays.
- Both depth and trading activity increase prior to announcements of GDP and unemployment rates.
- Impending CPI announcements do not seem to influence either liquidity or trading activity. Evidently, inflation has been relatively easy to predict in the U.S. recently.

The second paper dealt specifically with the effect of order imbalances. For this analysis it was necessary to identify each transaction as either buyer-initiated or seller-initiated, and the authors used the Lee and Ready algorithm published in 1991. Three order imbalance variables were: OIBNUM (the number of buyer-initiated less the number of seller-initiated trades on a day), OIBSH (the buyer-initiated shares purchased less the seller-initiated shares sold on the day) and OIBDOL (the buyer-initiated dollars paid less the seller-initiated dollars received on the same day). An interesting result was that market order imbalances have significant positive autocorrelations up to five daily lags but the S&P 500 return has no autocorrelation of any significance.

Summarizing the conclusions to be drawn in this second paper, Roll reported:

- Order imbalances are strongly and positively autocorrelated.
• Order imbalances are strongly related to past market returns. There is evidence of aggregate contrarian behavior; signed order imbalances are high following market crashes and low following market increases. Since returns on the S&P500 are virtually uncorrelated, this is evidence that investor actions to correct temporary mispricing are effective and of the appropriate magnitude.

• Changes in market-wide liquidity are strongly and non-linearly related to changes in the market-wide order imbalance. A high order imbalance in either direction is associated with low levels of liquidity.

• Liquidity changes are predictable from market returns, but not from order imbalance. In particular, down market days tend to be followed by days of decreased liquidity. Up market days tend to be followed by days of high liquidity, but the carry-over is weaker.

• There is a strong positive relation between market returns and contemporaneous order imbalance.

• Surprisingly, up-markets tend to be followed by continuations while down-markets tend to be followed by reversals. However, as might be expected, the explanatory power is not very strong. Overall, the evidence suggests that market microstructure effects are quickly absorbed by the market; there is only weak evidence that daily signed market returns can be predicted to any significant degree using past values of liquidity and order imbalances.

• Order imbalances are strongly related to contemporaneous absolute returns after controlling for market volume and market liquidity. This underscores the importance of accounting for order imbalance in addition to volume, as a determinant of return volatility.

90. Liquidity, Volatility and Trading Costs Across Countries and Over Time (Spring 2001)

Ananth Madhavan, Managing Director of Research, ITG, Inc., distributed a paper by himself, Ian Domowitz and Jack Glen entitled: “Liquidity, Volatility and Equity Trading Costs Across Countries and Over Time.”

By way of introduction, Madhavan observed that execution costs can substantially reduce or even eliminate portfolio alphas, and he provided an example. Dimensional Fund Advisors 9-10 fund is a passive index fund of stocks in the smallest 9th and 10th deciles of New York Stock Exchange traded stocks. Although apparently an index fund, the fund has achieved mean returns of something over 200 basis points above the index return, with less volatility. Research by Keim, reported by Madhavan, indicated that the fund’s trading strategy added about 204 basis points.

In the first part of his presentation, Madhavan undertook to examine the magnitude of equity trading costs across countries and over time. In the second part he set out to analyze the determinants of costs, the interaction of costs, liquidity and turnover, and to discuss the implications for international portfolio management and diversification.

With respect to the costs themselves, he relied on global trade data from Elkins/McSherry, Inc., covering 135 investing institutions and brokers, over 42 countries, for active trading strategies only. Macroeconomic
data came from IFC, the World Bank and local markets. Explicit costs include such things as commissions, fees and taxes. Implicit costs consist of price impact. Price impact is calculated by Elkins/McSherry with reference to a benchmark taken as the mean of the day’s open, close, high and low prices.

There is a large variation in trading costs from 22 basis points in the Netherlands to 184 basis points in Venezuela. The mean cost is 60 basis points which can be compared with custody and management fees of approximately 35 basis points. Explicit costs are about \(\frac{2}{3}\) of the total except in North America. The correlation between explicit and implicit costs is positive, ranging from .09 to .31. A number of graphs illustrated the relative importance of explicit and implicit costs in North American markets and in a number of regional markets. Costs have been falling over the past five years and implicit costs have been falling three times faster than explicit costs. Adoption of automated systems, primarily in emerging markets (where costs are very high) have helped to bring costs down. In developed markets, automation has reduced implicit costs. Further influences are competitive pressures from new markets, increasing competition for order flow, and a shift in investment strategies to find liquidity and minimize costs.

Turning to the determinants of costs, Madhavan began with correlation analysis. He confirmed that implicit costs are inversely related to market capitalization, and positively related to volatility. Explicit costs are not correlated with the variables he had explored: turnover, market capitalization, volatility, automation, and emerging markets.

The two-way comparisons suffer from a number of limitations. They ignore interaction among key variables. The joint interaction of turnover, volatility and costs is particularly important. Madhavan had therefore developed a panel-data model to investigate dynamic relations among these key variables both across countries and through time. Volatility is taken as exogenous, influencing trading costs and turnover and ultimately returns, while trading costs themselves influence turnover and hence returns.

Summarizing results set out in tables, he reported that lower trading costs substantially increase turnover as does higher volatility. Higher market capitalization leads to reduced volatility, reduced cost and reduced turnover. Higher volatility increases cost but reduces turnover, with a net increase in returns of about 5%. Turning to effects on diversification, there are important difference between optimal portfolios ignoring transaction costs and those allowing for transaction costs.

Finally, Madhavan discussed how one might deal with transaction costs. Monitoring costs is important, and Madhavan elaborated on monitoring. Trading less aggressively and reducing turnover can reduce costs. Accommodating to lack of liquidity can also help.

In conclusion he said:

- Equity trading costs vary widely and are economically significant
- It is crucial to understand interaction of volatility, costs, and turnover
- In a global context, costs may dramatically affect the benefits from international diversification
- One can improve investment performance by focusing on measurement, analysis and control of trading costs.
Mergers & Merger Effects

91. On Purely Financial Synergies: Implications for Mergers and Structured Finance (Fall 2005)

Hayne E. Leland, Arno Rayner Professor of Finance & Management, Haas School of Business, University of California, Berkeley, made available a paper, entitled “Purely Financial Synergies and the Optimal Scope of the Firm: Implications for Mergers, Spin-Offs, and Structured Finance.”

The research considered multiple activities with imperfectly correlated cash flows and zero operational synergies. These activities could be separated financially through separate incorporation or the use of special purpose entities, allowing each to optimize its financial structure. Or they could all be conducted within one entity with a single optimal financial structure.

The focus of the research was on this choice, that is, the choice of optimal scope. Scope decisions include mergers, spin-offs, joint ventures, and structured finance. One way to express the questions is: How should activities be grouped into firms?

Financial synergies favoring use of a single entity can be positive or negative. One effect is always negative or zero. This is the loss of separate limited liability of two or more entities. The leverage effect can be positive or negative. Separation could give greater tax benefits.

Leland set out a simple model of optimal capital structure.

We consider two periods, $t=0$ and $t=T$ with risk neutral investors. The random operational cash flow is $X$ at time $T$, and the mean cash flow is $Mu$. The activity value at $t=0$ is

$$X_0 = \frac{1}{(1+r_T)} \int_{-\infty}^{\infty} X dF(X) = Mu/(1+r_T).$$

With a single activity no-debt firm with limited liability, the value is

$$H_0 = \frac{1}{(1+r_T)} \int_{0}^{\infty} X dF(X).$$

Note that the value of limited liability is:

$$L_0 = H_0 - X_0 = -\frac{1}{(1+r_T)} \int_{0}^{\infty} X dF(X) \geq 0.$$

And finally with lognormal $X$, $L_0=0.$
The after-tax value of the unlevered firm is

\[ V_0 = \frac{1}{(1 + r_T)} \int_0^\infty (1 - \tau) X dF(X) = (1 - \tau) H_0. \]

If we use zero coupon debt, we get:

- Principal \( P \), Market Value \( D_0(P) \), Interest paid \( I = P - D_0 \)
- Interest \( I \) is tax deductible; no tax rebate if loss \( X < I \)
- If default, we lose fraction \( \alpha \) of cash flow \( X \).

Next we define

- \( X^Z = \) value of \( X \) at which tax is zero \( (X_Z = I) \)
- \( X^d = \) value of \( X \) triggering default \( (note \ X_d > X_Z) \)

\[ X^d = P + \frac{\tau}{(1 - \tau)} D_0(P). \]

Value of Debt:

\[ D_0(P) = \frac{P \int_0^{X^d} dF(X) + (1 - \alpha) \int_{X^d}^\infty X dF(X) - \tau \int_{X^d}^\infty (X - X^Z) dF(X)}{1 + r_T}. \]

Value of Equity:

\[ E_0(P) = \frac{1}{1 + r_T} \left[ \int_{X^d}^\infty (X - P) dF(X) - \tau \int_{X^d}^\infty (X - X^Z) dF(X) \right]. \]

Value of Firm:

\[ v_0(P) = E_0(P) + D_0(P) = V_0 + TS(P) - DC(P) \]

where \( TS(P) = \) expected PV of tax savings from leverage
\( DC(P) = \) expected PV of default costs
Note: \( TS(P) - DC(P) = \) value of leverage

Optimizing the capital structure means choosing the debt \( P = P^* \) to maximize firm value: \( v_0(P) = E_0(P) + D_0(P) \).

Define

\[ v_0^* = E_0(P^*) + D_0(P^*) = V_0 + TS(P^*) - DC(P^*) \]
Appendix A of his paper derives closed form expressions for $D_0$, $E_0$, $T_S$, $D_C$ and $v_0$ (as functions of $P$) when $X$ is normally distributed. We can then numerically optimize $v_0(P)$ to find the optimal $P^*$.

Leland presented an example for a BBB-rated firm for which the optimal leverage ratio was 51.8%.

He concluded that financial synergies are more likely to favor the single business entity (which may mean favoring a merger) when:

- Correlation of activities is low
- Volatility of individual activities is low
- Firms have similar volatility and default costs.

92. Price Pressure Around Mergers (Fall 2003)

Mark Mitchell, Principal, CNH Partners, made available a paper by himself, Todd Pulvino and Erik Stafford, entitled: “Price Pressure Around Mergers.”

It has been well documented that acquiring companies that use their stock as the merger consideration experience announcement period abnormal returns between -2% and -3%. Common interpretations of the price reactions are that acquirers use stock as the form of payment when their stock is overvalued and that the market perceives the merger to be a value-destroying investment project. However, evidence presented in this research suggests that a substantial part of the negative reaction to stock merge announcements is due to downward price pressure caused by merger arbitrage short selling of acquirers’ stocks around merger announcement dates.

The effects of short selling differ significantly among the various types of merger arbitrage. For cash mergers, the merger arbitrage trade consists of buying shares of the target firm and holding until the merger closes. Where the acquirer pays in stock rather than in cash the exchange ratio may be fixed or floating. In the case of a fixed ratio, at announcement the acquirer agrees to exchange a fixed number of its shares for each target share. Following the announcement, the merger arbitrageur sells the acquirer short and buys the target according to the fixed ratio. The median short interest increase was found to be 40%. The evidence supports the hypothesis that the short selling is likely to lower the stock price of the acquirer.

In a floating-exchange-ratio merger the ratio is determined during a pricing period that is usually three months after the merger announcement. Arbitrageur short selling takes place during this pricing period rather than at the time of the merger announcement. The acquirer’s stock price actually tends to rise at announcement, but declines on average 3.2% during the pricing period, consistent with the price pressure from the short selling. Over the subsequent month the price rebounds 2.5% on average. It is important that the pricing period typically occurs just before the merger closing, so that uncertainty is resolved before the beginning of the pricing period, and price changes during the period are not likely to result from new information.

In cases where the merger triggers an addition to or deletion from the S&P500 Index, or even one that requires a rebalancing of the Index, it is also likely to stimulate trading that is not information-based.

Mitchell began his presentation with a review of prior work, including a
presentation to the Q-Group® at the Fall 1989 Seminar (“Do Bad Bidders Become Good Targets?”). An article in 1989 focused on the effects of anti-takeover provisions in proposed federal legislation in October 1987. The result of the proposals in the House Ways and Means Committee was a substantial decline in the S&P 500, and an even more significant decline in the prices of takeover targets. Hedge funds suffered significant losses and two-thirds of merger arbitrage shops simply shut down. The experience illustrated the devastating consequences to the merger arbitrage strategy of the failure of mergers to take place.

The data used in the research covered 2,130 mergers during 1994-2001. Of these 736 were cash mergers, 64 were floating exchange ratio stock mergers, 244 were collar mergers and 1,086 were fixed exchange ratio stock mergers. Short interest data came from the NYSE, Nasdaq, and AMEX over 1994 to 2001. Some of the results are shown in the following table.

### Cumulative Average Abnormal Returns Around Merger Dates

<table>
<thead>
<tr>
<th></th>
<th>Cash (No Hedge)</th>
<th>Floating-Exchange Ratio Stock (Late Hedge)</th>
<th>Collar Stock Mergers (Dynamic Hedge)</th>
<th>Fixed-Exchange Ratio Stock (Early Hedge)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Announcement Date [-1, +1]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAAR</td>
<td>0.96%</td>
<td>0.58%</td>
<td>-0.88%</td>
<td>-2.73%</td>
</tr>
<tr>
<td>t-statistic</td>
<td>3.48</td>
<td>1.28</td>
<td>-1.97</td>
<td>-10.57</td>
</tr>
<tr>
<td>N</td>
<td>736</td>
<td>64</td>
<td>244</td>
<td>1,086</td>
</tr>
<tr>
<td><strong>Closing Date [-1, +1]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAAR</td>
<td>0.07%</td>
<td>0.73%</td>
<td>0.47%</td>
<td>1.18%</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.38</td>
<td>1.63</td>
<td>1.27</td>
<td>5.61</td>
</tr>
<tr>
<td>N</td>
<td>621</td>
<td>58</td>
<td>219</td>
<td>880</td>
</tr>
<tr>
<td><strong>Pricing Period (variable length)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAAR</td>
<td>n.a.</td>
<td>-3.18%</td>
<td>-0.97</td>
<td>n.a.</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-2.79</td>
<td>-1.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>59</td>
<td>221</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pseudo Pricing Period</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAAR</td>
<td>-0.05%</td>
<td>n.a.</td>
<td>n.a.</td>
<td>0.43%</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>628</td>
<td></td>
<td></td>
<td>894</td>
</tr>
<tr>
<td><strong>Entire Event Window [Announcement –20, Close + 20]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAAR</td>
<td>5.58%</td>
<td>-0.38%</td>
<td>-0.92%</td>
<td>0.41%</td>
</tr>
<tr>
<td>t-statistic</td>
<td>4.92</td>
<td>0.14</td>
<td>-0.45</td>
<td>0.38</td>
</tr>
<tr>
<td>N</td>
<td>563</td>
<td>55</td>
<td>202</td>
<td>876</td>
</tr>
</tbody>
</table>
Consistent with the notion that short selling by merger arbitrageurs exerts downward pressure on the acquirers’ stock, the announcement period abnormal returns are negative for fixed-exchange ratio and collar stock mergers. Cash mergers and floating-exchange ratio stock mergers are associated with positive announcement period abnormal returns on average. More interesting, however, are the average abnormal returns during the pricing period for floating-exchange ratio stock mergers, which are significantly negative. In particular, the cumulative average abnormal return (CAAR) is –3.18% (t-statistic = –2.79) for floating-exchange ratio mergers. The CAAR on announcement is positive, at 0.58% and over the entire event window it is -0.38%.

Mutual Funds & ETFs

93. The Economics of Mutual-Fund Brokerage: Evidence from The Cross Section of Investment Channels (Fall 2005)

David K. Musto, Associate Professor of Finance, The Wharton School, University of Pennsylvania, distributed a paper entitled “The Economics of Mutual-Fund Brokerage: Evidence from the Cross Section of Investment Channels,” by himself, Susan Christoffersen and Richard Evans. The research was supported by The Q-Group®.

The main goal of the paper was to compare mutual fund investment through three channels: captive brokers, unaffiliated brokers and no-load investment. Captive brokers are brokers representing only one family of funds, whereas unaffiliated brokers in principle represent no particular family, and the no-load investment comes in with no broker at all. A new database facilitated a closer examination than had previously been possible, providing not only monthly inflows and redemptions for the funds, but also the sales loads, identified by who got them. The authors were then able to classify funds that use only captive brokers, and those that use only unaffiliated brokers. Some funds use both but these are less useful because their redemptions are problematic to interpret.

The question researched was to what extent the value of brokers to investors and to funds depends on their incentives. The distinction between captive and unaffiliated brokers is the key, as it separates two potentially disparate qualities of advice, the former skewed toward the interest of the fund family, and the latter toward the investor.

Family-level concerns can be important at the fund level. Of concern is whether flows into a fund cannibalize flows into the rest of the family, and conversely, whether flows out of the fund remain nonetheless in the family. These questions relate directly to the choice of investment channel.

It is interesting that loads actually paid are generally a good deal lower than the maximum load identified on the CRSP data files, as is shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Received by Brokers</th>
<th>Paid by Investors</th>
<th>Max Load on CRSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captive</td>
<td>1.59%</td>
<td>2.28%</td>
<td>4.38%</td>
</tr>
<tr>
<td>Unaffiliated</td>
<td>2.19%</td>
<td>2.62%</td>
<td>4.97%</td>
</tr>
</tbody>
</table>
The authors rank the past year’s return for each objective investment category, for each month, and interact dummy variables of broker channel in a regression on redemptions, new inflows and net flows as a percent of total net assets of the fund for each month. There is historically a convex relationship between flow and performance. That is, a graph of net flows into funds against past performance shows an upward sloping curve. The most important result was in the redemption equation, where the coefficient on ranked returns for a captive sales force was very low, consistent with the hypothesis that a captive sales force is much less apt to move money out of bad performers without better alternatives in the family. This contrasts strongly with the high-sensitivity of redemptions to performance in the unaffiliated brokerage channel. Further regressions, using six-month performance following redemptions, indicated that unaffiliated brokers use information about future prospects to switch investors out of the fund, whereas captive brokers do not. However, across all years, the captive broker cost 2.28% while the unaffiliated broker cost 2.62%. Redemptions of unaffiliated brokers also significantly outperformed those of no-load investors.

From the fund family’s perspective, it turns out that redemptions from the family are not sensitive to the fund’s performance for captive funds, although there is some sensitivity for the fund itself. This is consistent with the captive broker channel keeping the money in the family even as it exits the fund. Sensitivity of inflows to past returns is not significantly different between the captive and unaffiliated channels. A captive sales force appears to help a fund family retain flows from a poor performer but not deflect inflows from a high performer to another constituent fund.

Summarizing his conclusions, Musto observed:

- Flows through captive and unaffiliated brokers are close on the way in but far apart on the way out
- From the family’s perspective, only no-load flows are significantly convex
- Unaffiliated brokers add their value on the way out
- Maximum loads are a weak indicator of the level and cross section of actual loads

94. New Developments in Financial Engineering (Spring 2005)

Richard Michaud offered an introduction to the financial engineering part of the program. Index Exchange-Traded Funds (ETFs) build on four historical financial engineering innovations: mutual funds, index funds, program trading and Superdot technology.

Mutual funds were a major innovation in asset management. They offer professional management and diversified portfolios. The pioneer was Massachusetts Investment Trust (MIT) in the 1920s, with only one class of investors, a published portfolio and redemption on demand. The innovation was very successful and U.S. equity mutual funds are a three trillion dollar industry. Mutual funds were and are the cornerstone of Boston’s financial economy and world importance.

Index funds were another important financial engineering innovation. Introduced in the 1970s, they offer lower cost, reliable performance, and historically higher than average performance relative to active management with similar benchmarks.
Often implemented within a core-satellite framework, index funds are a major component of today’s investment industry.

Program or index trading arose in the 1980s to arbitrage price discrepancies between an index portfolio and its associated future. Superdot technology enabled efficient and convenient index trading. Index arbitrage results in very efficient market pricing of many indices.

Index ETFs can be characterized as Superdot enabled index fund program trading accessible to individual investors via stock exchange listing. ETFs are a two hundred plus billion dollar industry that is growing very quickly. Important reasons for growth include enhanced tax efficiency and generally lower expense ratios relative to traditional index fund investment. ETFs are an important institutional-quality tool for financial advisors for facilitating a number of investment strategies.

Two of the three ETF presentations focus on expanding the ETF framework for active management. Active ETFs pose many interesting financial engineering and regulatory issues. While still under development, active ETFs may allow intra-day trading and stock exchange listing for institutional investment strategies. Benefits may include the development of new investment strategies and democratization of institutional asset management.

**Actively Managed Exchange Traded Funds: Risk Modeling As An Enabling Technology**
*(Spring 2005)*

Charles (Tony) Baker, Managing Director, ETF Marketplace, American Stock Exchange, had made available a brief paper entitled “Actively Managed Exchange Traded Funds: Risk Modeling As An Enabling Technology.”

He began with the simple structure of a mutual fund, its primary creation through cash investment for new shares, and the continuing purchase of new shares for cash and redemption of shares for cash. He moved next to the structure of a mutual fund as an exchange traded fund (ETF). The AMEX Specialist becomes the intermediary between the mutual fund and the investors. Investors buy ETF shares from, and sell them to, the specialist. Only the specialist transacts directly with the mutual fund. A specialist purchases new ETF shares from the mutual fund in exchange for a stock basket and redeems ETF shares by receipt of a stock basket. The process works satisfactorily at present for index mutual funds. The holdings of the mutual fund are known to everyone, because the composition of the index is known.

When we turn to actively managed ETFs we encounter two problems. First, the manager of the actively managed fund does not want to disclose the fund holdings. And second, it is necessary to reveal the net asset value so buyers and sellers of the shares know what they are buying and selling, during the trading day. Both the SEC and the marketplace require publication of at least an estimated net asset value every 15 seconds. Further, the specialist with which the mutual fund trades its shares must be able to hedge its inventory. Baker described the American Stock Exchange plan for dealing with these problems.

First, the manager proposes a fund selection universe. This is the array of stocks from which the actively managed fund may select its holdings. The universe is likely to be fairly large, for protection of the secrecy of actual
holdings. Second, the actual fund holdings at the end of a day are run through a principal components analysis, to determine exposure to multiple factors. The quality of the modeling process is key to the entire operation. Baker described the factors as not pre-specified. They are in fact determined by the data. By definition, the factors are common to all securities, and transient factors are captured. The next step is to draw from the established universe the IIV (intra-day indicative value) portfolio. The objective is an IIP that matches as closely as possible the actual fund portfolio in performance over the entire day. Each day the IIP is updated, using the modeling inputs from the actual portfolio the night before. During the trading day the value of the IIP can be published every 15 minutes, as a close approximation to the true value of the active portfolio.

The IIP serves a further purpose. It is the IIP that the specialist can use to hedge its inventory and to transfer to the actual portfolio for cash or receive from the actual portfolio for cash. The end result is that the specialist does not know the composition of the actual portfolio, nor do the investors on a day-by-day basis. But they are able to know within a close tolerance the net asset value of the actual portfolio and the specialist is able to deal with the fund and hedge its inventory to its satisfaction.

Baker described a number of tests that had been run to see how closely the IIP matched the performance of actual actively managed portfolios.

He began using the S&P 500 index fund as an example of the actual portfolio and measured the differences between the value of the IIV and the value of the actual portfolio at ten-minute intervals for periods of several months up to a year. The differences were measured in terms of an average, a standard deviation, maximum, minimum, and the skewness of the distributions of differences. For the year 2001, and the S&P 500 Index, the average difference was 0.016%, with a standard deviation of 0.200%. Moving to an actual actively managed portfolio the management of which was willing to submit to the test, he found for the first half of 2001 an average difference of 0.023% and a standard deviation of 0.241%. For a second actual actively managed portfolio for several months in 2004, he found an average difference of 0.010% and standard deviation of 0.085%. What seemed particularly important from these measurements was that specialists appear to be satisfied that these differences were tolerable.

He went on to discuss the hedging processing in more detail, and displayed a graph showing at one-minute intervals, on a single day in 2002, the price of the actual portfolio, the price of the IIV portfolio, and the price of the hedge portfolio. The average difference between the actual and the IIV portfolio was 0.011%, and between the actual and the hedge portfolio was 0.054%. This seemed to be satisfactory to specialists. Baker’s conclusion was that the Exchange has a modeling solution that successfully addresses the needs of the fund manager, the specialist, and investors.

95. The Nuts and Bolts of ETFs (Spring 2005)

George U. Sauter, Chief Investment Officer and Managing Director, The Vanguard Group, reviewed quickly the structure for ETF index mutual funds, and noted the exemptive relief needed to create an ETF. Under SEC regulations, mutual fund securities must be redeemable, and of course this is not true for an ETF, except with respect to the specialist. Second, every investment company security transaction must
receive the NAV next determined. Third, there is a prospectus delivery requirement for every secondary market trade. And fourth, investors who own more than 5% of a registered investment company are “affiliates” and may not invest or redeem in-kind. Justification for exemptive relief had been explained by Baker in the previous presentation, in terms of the procedure the American Exchange had developed.

Sauter observed that ETFs are not in themselves a new product. They are another way to distribute an old product and this is important to mutual funds that can expect to reach a much broader range of investors if they can be traded as ETFs. The problem, as Baker had pointed out in the previous presentation, is that index mutual funds are easily adapted to the ETF form but actively managed funds are not.

Sauter went through in some detail the mechanics of the process that had been described in general terms by Baker (No. 94). He also went into the characteristics of indexed ETFs. Conventional index mutual funds generally offer low cost, broad diversification, and relative tax efficiency. ETFs add flexible trading without the wait for the 4 p.m. pricing time, with short-sale availability and with margin purchases as well. Whether ETFs are low cost index funds compared to the conventional funds is not so clear. Sauter pointed out that there are 106 ETFs with conventional alternatives. Of these about 69% compete against lower cost retail or high net worth alternatives. An interesting issue concerns shareholder record keeping costs that are borne by the fund organization itself in the conventional case, but by the brokerage community in the case of ETFs. He raised the question will the brokerage community continue to eat the cost of shareholder record keeping, or will brokers charge asset based fees?

In closing he raised the question of whether we are looking at a sea change in the way funds are distributed.


He began by noting the extraordinary success of ETFs in the United States, having grown to $226 billion in less than twelve years, while it took US mutual funds more than sixty-six years to grown to $8 trillion. He continued with a comparison of annual shareholder costs for actively managed funds operating in the traditional equity mutual fund manner, with those for “a new equity fund” that he envisions, having many of the characteristics of an ETF.

He assumed a basic expense ratio of 1% for each category of fund, and portfolio composition trading costs inside the fund of 1.5%. He attributed 1.4% to share trading liquidity costs. This is the cost of allowing investors to buy into the fund and to redeem their shares without any extra charge, shifting the entire cost to all of the shareholders. He attributed another 0.35% to leakage of investment information, partly because of trading practices, and another 0.35% to what he called the “fund supermarket.” This he contrasted with the use of specialized share classes providing custom management fees and marketing fee arrangements to accommodate different types of shareholders with investment objectives that coincide with the objective pursued by the fund. Again, for the traditional equity mutual fund he estimated costs of up to 2% as a
performance penalty from over-sized funds. Total annual costs he then estimated at up to 6.60% for the typical actively managed mutual fund and 2.50% for his “new equity fund.”

He offered a number of suggestions for features of the “new funds,” to a large extent building on the expectations for actively managed ETF funds. He proposed a cut-off time at 2:30 pm for investor purchases and redemptions of shares, to be brought about at the 4:00 pm closing price. This would give managers time to compare purchase with redemption volumes and arrange for an orderly handling of the net difference at reasonable prices. The free liquidity problem is dealt with by the use of ETFs, where investors deal with the specialist rather than with the fund itself.

He offered a number of ways in which information leakage might be reduced or stopped. Conversion of a single ETF share class into specialized share classes would bring all similar accounts into one pool, and disclosure would be fund disclosure, quarterly with a sixty-day lag.

He discussed at some length the failure of active management. Berk and Green, in a presentation to the Q-Group® meeting in the Fall of 2003 (No. 97) concluded that there are indeed managers with superior skills, but that the managers deliver superior performance for only a limited time. The difficulty is that rational investors find those skilled managers and invest heavily so that the funds become overly large and the managers are unable to deliver the performance they achieved with a smaller fund. The problem is a conflict between incentives for the manager and for the investor. Something has to be done to limit the growth of a fund and at the same time change the manager compensation so that it does not depend entirely on the fund size. He suggested specifically capping funds, raising fees on institutional share classes, and raising fees on ETF share classes.

Previous presentations had described the risk factor model the American Stock Exchange proposes to use to develop a comprehensive proxy portfolio that would closely track the behavior of the actual fund portfolio. Gastineau proposed a significantly different factor model application. The combination of posted creation and redemption baskets and proxy values for the fund produced by his factor model application would provide as much information on the actual portfolio as the portfolio manager feels she can appropriately release to the market, and no more. The package of information released would be reflected in the combination of the frequency of publication of precise proxy values, the parameters of the distribution from which increments and decrements for the precise proxy values are drawn, the composition of the creation and redemption baskets, the factor model output, and the absence of leakage through non-fund products. By managing these five elements, Gastineau believed, the portfolio manager controls the information revealed, protecting current shareholders while providing as much information as possible to minimize fund share trading spreads.

In concluding, he said: “As the discussion of opportunities for higher investment management fees in response to superior performance on a smaller pool of assets suggests, there is no reason why a structure that better utilizes the talents of skilled active managers cannot compensate these managers more generously at the same time that it provides better results for investors.”
97. Mutual Fund Flows and Performance in Rational Markets (Fall 2003)

Jonathan B. Berk, Harold Furst
Associate Professor of Management Philosophy, Haas School of Business, University of California at Berkeley, made available a paper by himself and Richard C. Green entitled: “Mutual Fund Flows and Performance in Rational Markets.” The research was supported by The Q-Group®.

Berk began with the proposition that most academics and many practitioners believe that active managers as a group have no skill. His response is that the misperception is based on the incorrect idea that the average return to investors is a reliable measure of the skill of a manager. The facts are that active managers do not outperform passive managers and that active manager returns are essentially unpredictable. Investors chase performance, hence flows in and out of mutual funds are sensitive to past performance. One interpretation of these facts is that they are evidence for efficient markets. Even active managers cannot beat the market, so there can be no return to gathering information. Another interpretation is that the facts are evidence against the rational market paradigm.

Berk’s response is an attempt to derive a standard rational asset pricing paradigm’s prediction of:

- The returns to active management
- The skill level of active managers
- The flow of funds
- The volatility of returns
- The probability of survival

Berk’s model assumes that asset markets are perfectly competitive. Management talent is a scarce resource but it does exist. There comes a point when the costs of running a portfolio are increasing in the amount of assets under management. The increasing costs are essentially trading costs. All participants are symmetrically, but not fully, informed.

With respect to managers, some have an ability to pick stocks. Nobody, including the managers themselves, initially knows who the skilled managers are. Berk assumes that stock picking ability is limited to idiosyncratic risk. That is, managers are unable to time the market. He also assumes that when active managers reach the end of attractive active choices they invest the remainder of their funds passively.

Investors chose between active managers and putting their money in a passive benchmark by inferring managerial ability from managers’ track records. Since markets are competitive, on the margin investors must be indifferent between these choices.

The result is that in expectation all managers, whether passive or active, must offer the same return to investors. Hence the expected excess return is always zero. On average active managers do not beat the market. But the average return achieved by active managers tells us nothing about their average skill.

An equilibrium is achieved through the flow of funds. A skilled manager can do well charging high fees on a small asset base. The performance attracts a flow of funds and increases assets and costs. Finally, the manager resorts to a degree of passive management. The manager continues to profit from lower fees on a larger asset base. In the competition among managers and the flocking of investors on the basis of past performance, excess returns to the investors are driven to zero. But skilled managers continue to profit.
Berk presented the results of empirical research on the flow of funds by Ellison and Chevalier. The flow of funds clearly increased with excess returns for funds aged two years. For ten year old funds the relationship curve was somewhat flatter, and especially flat over the portion of the graph for negative excess returns. Even for the two year old funds the curve was somewhat flatter for negative excess returns than for positive returns. The cost to managers of doing badly appears not as great as the benefit of doing well.

Finally, Berk explored the question how skilled are managers. His model indicated that about 80% of managers generated an alpha in excess of the fees they charge. Berk concluded that not only was his rational model consistent with much of the empirical evidence, but it was also consistent with a surprisingly high level of skill among active managers.

**Options & Option Markets**

98. Informed Trading in Stock and Option Markets (Fall 2002)

Stewart Mayhew, Assistant Professor, University of Georgia, and Office of Economic Analysis, US Securities and Exchange Commission, distributed a paper by himself and Sugato Chakravarty and Huseyin Gulen entitled: “Informed Trading in Stock and Option Markets.” The object of the research was to find how much price discovery occurs in the option market, and how much in the underlying stock market. One might think that the options market would be preferable for informed trading, since the same amount invested in call options can produce a much greater profit than investment in stocks. And if informed traders do trade in the options market we would expect to see price discovery in that market. New information should be reflected in option prices before it is reflected in the underlying stock prices. But there is little direct evidence of this phenomenon. This work was supported by the Q-Group®.

Mayhew’s opinion was that the lead-lag studies that had been applied to the problem were simply unsatisfactory because they failed to distinguish between permanent price changes, representing new information entering the market, and transitory changes, which may result from mispricing or temporary order imbalances. To know where informed trading occurs we should focus on only the permanent component. In this case, the researchers applied a methodology established by Hasbrouk (1995), to the stock and to the at-the-money call options, and found evidence of significant price discovery in the options market. On average, about 17 or 18 percent of price discovery occurs in that market, with estimates for individual securities ranging from about 12 to 23 percent.

The analysis was based on five years of transactions data for sixty stocks listed on the New York Stock Exchange, with options trading on the Chicago Board Options Exchange and on no other exchange. Stock market and quote data were obtained from the Institute for the Study of Securities Markets database for the period 1988-1992. Trades and quotes from the options market were obtained from the Berkeley Options Database. The sixty stocks were those with most actively traded stock options on the CBOE over the period.

The procedure was to derive implied stock prices from option prices. This called for volatility measures, and the researchers used implied volatilities based on a lagged observed option price
and lagged observed stock price. The stock price implied by the option price could then be compared with the stock price in the stock market.

It turned out that across the sixty stocks, the average lower bound on the information share attributable to option markets is 17.32 percent, and the average upper bound is 18.09 percent. These averages were significantly different from zero at the 1% level. Stock-by-stock results in the form of time-series averages across five years of daily estimates ranged from 11.76-12.19% for Atlantic Richfield to 23.31-23.52% for Chrysler.

Since the mean information shares were not equal across stocks, the researchers went on to see whether the amount of price discovery in option markets is related to observable market characteristics. A cross-sectional regression indicated that option volume is positively related to the amount of price discovery, while stock volume is negatively correlated. The coefficient on the option spread was negative and the coefficient on stock spread positive, indicating that price discovery is more likely to occur where spreads are narrower. The coefficient on volatility was positive, indicating greater option price discovery for high volatility stocks.

Time-Series tests indicated that estimates of the option information share are fairly stable over time.

While the main analysis was based exclusively on near-term, near-the-money call options, the researchers did explore price discovery in put options and options that are in- or out-of-the-money. It turned out that the at-the-money calls gave the highest information share, but the differences from the earlier results were not great.

In closing, Mayhew commented that the next step will be to perform the analysis implementing their technique in periods immediately prior to announcements of important corporate events.

99. Real Options: A Survey of Theory and Applications (Spring 2001)

Cyrus A. Ramezani, Associate Professor of Finance, College of Business at the California Polytechnic State University, distributed an outline by himself and Alan Jung.

Ramezani began with an overview of real options, describing them, providing a taxonomy, listing the reasons why real options can be valuable, and going on to discuss difficulties in implementation. The value of real options lies in its usefulness as a framework for structuring business decisions. For example, it can be an improvement on discounted cash flow for capital budgeting. While it is relatively easy to conceptualize real options, it is not easy to detect them. The parameters that can be used to value financial options are very hard to quantify for real options. And it may be difficult to translate the value of a real option into observable performance metrics like return on investment, return on equity, and economic value added.

(Jonathan B. Berk presented a paper at the Fall 1998 Q-Group® Seminar entitled: “Valuation and Return Dynamics of New Ventures,” in which he described valuation of a project with no current cash flows essentially undertaking an R&D program with several sources of uncertainty. Real options played a major role in his analysis. This summary can be found in Volume 5 of Q-Group® summaries at page 162.)
Two key ingredients in real option value are management flexibility and uncertainty of investment cash flows. Both flexibility and volatility add to the value of the option. One can then think in terms of a chart with four quadrants, with low option value corresponding to low volatility and limited managerial flexibility and high value corresponding to high volatility and a high level of managerial flexibility. Ramezani suggested low volatility with high flexibility tended to lead to low option value whereas high volatility but low flexibility would probably lead to high option value.

The next step was identifying variables that measure managerial flexibility and those that measure volatility. For measuring managerial flexibility he proposed expenditures on investment activities from the firm’s statement of cash flows relative to sales, book value of assets, and market value of assets, as well as research and development expenditures relative to sales or other measures. For uncertainty he proposed volatility of quarterly sales growth, of cash flow growth, and of monthly returns, both in terms of market volatility and idiosyncratic volatility.

For performance measures he proposed economic value added, market value added, Tobin’s Q, return on investment, return on equity, and some other basic ratios.

His next step was to make use of COMPUSTAT data for 1998 from which he drew a sample of 2926 firms with “clean” data. He calculated economic value added and market value added, taking other measures from COMPUSTAT’s own calculations. He ended with four measures of managerial flexibility: investment cash flow/sales, investment cash flow/book value, investment cash flow/market value, and R&D/sales. And he chose five measures of volatility: volatility of quarterly sales growth, of quarterly cash flows, of monthly returns, risk as measured by beta, and idiosyncratic risk (the residual from applying CAPM). Data were sorted by the median of variables, and companies were allocated to the four quadrants referred to above.

A regression took the form of the performance measure regressed on a vector of the explanatory variables. The results showed that the conditional means of the performance measures were significantly different for each quadrant. The coefficients of control variables were also very different. Statistical tests indicated that a different model is needed for each quadrant. The adjusted r-squared ranged from 0.20 to 0.67. Ramezani presented tables showing the beta risk, the idiosyncratic risk, and the total risk for the HH and LL quadrants.

The main industries in the HH quadrant were mining and oil and gas extraction, chemicals chiefly pharmaceuticals, semiconductor equipment, electronic computers, semiconductors, and communication and software. The main industries in the LL quadrant were construction, food, newspapers and periodicals, plastics materials and synthetic resins, pharmaceutical preparations, primary metals, electronic computers, transportation equipment, and general merchandise stores.

The main industries in the high volatility but low flexibility quadrant were chemicals, communications equipment, semiconductors, apparel, miscellaneous retail, direct mail advertising, and software. Those in the low volatility but high flexibility quadrant were oil extraction and refining, food, paper, pharmaceuticals, electronic computers, semiconductors, motor vehicles, air transportation, and computer software.
Finally, he concluded that performance measures for firms with valuable real options are significantly higher than those without such options. Equity prices also seemed to reflect the value of real options. Looking forward, he indicated further enhancements to be incorporated in the model include pooling time series/cross sectional data, correcting for heteroskedasticity, expanding the list of explanatory variables, and removing companies that fall fairly close to the intersection of the four quadrants.

Short Selling

100. Go Down Fighting: Short Sellers vs. Firms (Fall 2003)

Owen Lamont, Visiting Professor of Finance, Yale University School of Management, made available a paper entitled: “Go Down Fighting: Short Sellers vs. Firms.” The research was supported by The Q-Group®.

The basic hypothesis of the research was that short sale constraints can allow overpricing of stocks. The constraints Lamont looked at were endogenous, those deliberately imposed by firms. Firms can constrain short sellers by taking legal or regulatory action and by taking technical action such as publicly coordinating a short squeeze.

There are two requirements for overpricing of stocks. There must be some “nonstandard feature” such as irrationality, and there must also be short sale constraints. Lamont described the mechanics of short selling and the reasons why short sales may not be possible. Shares are not always available for lending: The lending market does not work well. In addition to direct financial costs there are impediments to short selling that include legal, cultural, and institutional constraints, difficulty in finding shares to borrow, and recall risk. Shorting demand, shorting constraint, and overpricing go together. No one would want to short stocks if they were not overpriced, and they would not be overpriced if they were not hard to short.

Lamont was concerned with actions taken by firms themselves to curtail short selling. The research was performed on three categories of events. First were belligerent statements about short sellers, ranging from threats of legal action to detailed refutations of short sellers’ claims. The second was actually taking legal action or requesting regulatory action against short sellers. The third was actually taking technical action to prevent short selling. All events had to be explicitly linked to short selling: The firm had to state that it was taking action with the purpose of impeding short selling. The data themselves were news reports found in Lexis-Nexis and Dow Jones. It was important that the events had been the subject of public information.

Lamont described the sorts of statements, and provided quotations indicating belligerence on the part of firms. He provided examples of legal or regulatory action to inhibit short selling, and examples of technical action. Technical actions included urging shareholders not to lend shares, announcing stock repurchases explicitly in response to short sellers, and using employee stock ownership plans to buy shares and frustrate short sellers. Other technical action included forcing shareholders to return certificates to a transfer agent, making them unavailable for lending.

In all, the data included 326 events and 270 firms, from March 1977 to May 2002.
The event firms were larger in size than the median of the universe of firms in CRSP. Their market-to-book ratios indicated that they were growth firms since they were in the upper quartile of valuation. They had very high trading volume in the month before the event. Even twelve months before the event the event firms had high turnover.

The test of the overpricing hypothesis involved calculating market adjusted returns subsequent to the events. In the following table returns are average monthly returns, assuming purchase on the last day of the month in which the event was publicly observed. The returns are adjusted by subtracting the return on the CRSP value weighted index. The t-statistics, in parentheses, use standard errors adjusted for the clustering of dates in calendar time. The first column reports one month returns. The second column reports twelve month returns and the third column reports the returns from the end of twelve months to the end of thirty-six months that is, for the second and third years taken together.

### Market Adjusted Returns Subsequent to Events

<table>
<thead>
<tr>
<th></th>
<th>One Month</th>
<th>One Year</th>
<th>2 to 3 Years</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>t to t +1</td>
<td>t to t +12</td>
<td>t +12 to t +36</td>
</tr>
<tr>
<td>All belligerent</td>
<td>-2.80 (1.07)</td>
<td>-2.22 (2.75)</td>
<td>-1.16 (1.90)</td>
</tr>
<tr>
<td>All legal</td>
<td>-4.53 (1.94)</td>
<td>-2.27 (2.54)</td>
<td>-0.92 (1.18)</td>
</tr>
<tr>
<td>All technical</td>
<td>-3.86 (1.08)</td>
<td>-2.66 (1.95)</td>
<td>-1.50 (1.14)</td>
</tr>
<tr>
<td>All events</td>
<td>-3.27 (1.94)</td>
<td>-2.34 (3.65)</td>
<td>-0.95 (1.61)</td>
</tr>
</tbody>
</table>

The return figures are impressive, although it should be noted that it was not necessarily possible for investors to achieve them, since in all of these cases short selling had been seriously impeded. However, they clearly supported the hypothesis of overpricing.

Lamont pursued the matter further, looking for evidence of short squeezes. Twenty-four events were characterized by firms urging shareholders to withdraw shares from the lending market. On the day of this event volume showed a distinct spike, but there was not a statistically significant price change. Nor was there a decrease in the short interest, which actually rose around these events.

In conclusion, significant short sale constraints produce low returns and indicate overpricing. There is direct evidence that firms care about their stock prices and seek to prop them up by actively attempting to curb short selling. The evidence further suggests that short sellers are useful in detecting fraud.

### Takeover Defenses

#### 101. Takeover Defenses of IPO Firms (Fall 2002)

Jonathan M. Karpoff, Norman J. Metcalfe Professor of Finance, Graduate School of Business, University of Washington, distributed a paper by
himself and Laura Casares Field entitled: “Takeover Defenses of IPO Firms.” This work was supported by the Q-Group®.

He began with a quotation expressing the prevailing view about takeover defenses at IPO firms: “Firms go public in easy-to-acquire form: no poison pill securities, no supermajority rules or staggered boards. Defensive measures are added later, a sequence that reveals much.” The logic behind the prevailing view came in three parts: takeover defenses lower firm values; there are no significant conflicts between IPO managers and pre-IPO investors (that is, no agency costs); hence managers will avoid defenses.

In fact, of course, the researchers had discovered that takeover defenses are quite prevalent at IPO firms. For 1,019 firms, from 1988-1992, the percent of firms making use of nine specific takeover defenses ranged from 2% for anti-greenmail provisions and poison pill provisions to 85% for blank check preferred stock provisions.

A second prevailing view, to the effect that few of the IPO firms add defenses following the offering, was likewise quite wrong. For the IPO firms examined, within five years there were 142 new poison pills, and 50 new classified boards.

So what was the logic for fairly extensive use of takeover defenses in IPO firms? Defenses might serve the interests of managers but not other shareholders. Defenses might be a substitute for pecuniary managerial compensation. And defenses might be seen as increasing share values, by helping to secure higher future takeover premiums.

Three sets of tests examined the use of takeover defenses, motives for takeover defenses, and their effects. The sample of 1,019 IPO firms included all US non-financial firms with IPOs from 1998-1992 at an offering price greater than a dollar and by way of firm commitment underwritings. The comparison of the use of takeover defenses by IPO firms and by a sample of 524 offerings by seasoned corporations indicated a mean number of takeover defenses in nine categories was 2.0 for IPO firms and 3.4 for seasoned firms. Excluding the popular blank-check preferred stock, the means were 1.2 for IPO firms and 2.5 for seasoned firms. The percentage of the firms incorporated in Delaware (which has laws discouraging takeovers) was 59% for the IPO firms and 52% for the seasoned firms.

The second set of tests, concerning characteristics of IPO firms that make use of defenses, indicated that managers are most likely to deploy defenses when their personal job benefits are high, when they bear little of the cost in terms of lost share value, and when they can act independently of non-managerial oversight. These conclusions run counter to the argument that takeover protection is a substitute for managers’ pecuniary compensation, and they suggest some degree of agency conflict even at the IPO stage.

The third set of tests examined whether takeover defenses in fact help increase expected takeover premiums for IPO firms. A total of 168 of the sample firms were acquired within five years of their IPOs. There were sufficient data to estimate the determinants of acquisition likelihood for 163 of these firms. Logistic regressions were performed in which the (untransformed) dependent variable is 1 for these 163 firms, and 0 otherwise.

The first model used independent variables that have been examined by previous researchers, consisting of assets and leverage, to which were
added a number of measures of the firm’s asset structure and performance. In general the research found a greater degree of predictability in acquisition likelihood than have other researchers who examined seasoned firms. The coefficient for assets was positive and quite significant, as was the liquidity coefficient. The coefficient for market-to-book ratio was negative and significant.

In a second model, several aspects of the firm’s governance structure were included: Venture, Developed, Board Independence, Board Size, Boss, State Law, and Delaware Incorporation. Two variables represented the firm’s defensive posture: Takeover Defense at IPO, and New Takeover Defense after IPO. The coefficient for board independence was positive and significant, indicating that strong outside board representation tends to facilitate the acquisition of IPO firms. Acquisition likelihood was negatively and significantly related to new takeover defenses after the IPO. And most important to the researchers was that the coefficient for takeover defense at the IPO was negative and significant.

Turning to effects on takeover premiums, the results indicated that the presence of a takeover defense was not significantly related to takeover premiums in either the first or second model. Takeover premiums also were not significantly related to whether the firm was incorporated in a state with an antitakeover law. The one variable significantly related to takeover premiums in both models was the prior three years’ stock return: Firms with strong stock performance, when acquired, earn smaller takeover premiums than firms with poorer stock price performance. In summary, IPO firms have takeover defenses, but fewer than are found at seasoned firms. IPO firms are more likely to have defenses when managers’ personal benefits of takeover protection are high, when managers’ personal costs are low, and when freedom from oversight is high. Defenses decrease acquisition likelihood but do not increase takeover premiums.

Overall, the research concluded that when they can, IPO managers shift the cost of takeover protection onto non-managerial shareholders. Thus, there frequently exists some agency conflict even at the IPO stage. IPO firms’ equity agency problems differ from those at seasoned firms only in degree, and not in kind.

**Time Diversification**

102. Time Diversification (Fall 2003)

Jack L. Treynor, President, Treynor Capital Management, Inc., proposed an investment strategy achieving time diversification. For the buy and hold investor, terminal wealth is the result of compounding periodic returns. The return in each period increases or decreases the investor’s exposure to dollar risk. Time diversification means dollar risk exposure in each period that is independent of prior periodic rates of return. His presentation was an extension of a presentation he had given at the Spring 2002 Q-Group® seminar. (No. 40).

We assume the investor chooses a diversified equity portfolio. The annual standard deviation is assumed to be 20%, close to the figures given in *The Millennium Book* by Dimson, Marsh and Staunton. The standard deviation of the 100-year sample mean is therefore 2%.

Treynor’s first table showed the expected dollar gain over a period of years for a risk exposure of $1 in each year. At a 7% annual risk premium, and a 64 year horizon, the expected gain is
just the arithmetic mean excess return, that is 7%, multiplied by the number of years, to give 4.48. A second table showed the standard deviation of terminal wealth. For the 64 year horizon it is $\sqrt{64 \times 20\%}$, or 1.60. A third table showed the expected dollar gain from the first table divided by the standard deviation from the second table and in the case of the 7% excess return and 64 year time horizon, that ratio is 2.80. In other words, the expected gain is 2.80 standard deviations greater than zero. The probability of losing money is extraordinarily low.

Treynor next developed his investment strategy. We let $x$ equal the level of the market with constant relative risk and $y$ equal the value of the portfolio with constant dollar risk. If the following holds for every value of $x$

$$\frac{dy}{dx} = \beta \frac{dx}{x}.$$  

But if this holds for every market level $x$ we have

$$\ln y = \ln x^\beta + \ln k$$

$$y = kx^\beta.$$  

So beta can also be defined as the *power* of the market level that predicts an asset’s dollar value. The second term in the approximation corresponds to an asset with a beta of two. The dollar risk in a diversified asset is the dollar risk in the market, times the rate of change of the asset’s value with respect to the market. Here are the rates of change.

Exact

$$\frac{d}{dx} \ln \left(\frac{x}{a}\right) = \frac{1}{a} \left( \frac{1}{x} \right) = \frac{1}{x}$$

Bear in mind that, if the risk in the market’s *rate of return* is stationary across time, then its *dollar risk* is proportional to the market level $x$. So for the exact logarithmic asset the product is

$$\left( \frac{1}{x} \right) x = 1.$$  

How accurate is the risk? The rate of change of the approximation with respect to the market level is

Approximate

$$\frac{d}{dx} \left[ 2 \left( \frac{x}{a} \right) - \frac{1}{2} \left( \frac{x}{a} \right)^2 - \frac{3}{2} \right] = \frac{1}{a} \left( 2 - \frac{x}{a} \right).$$  

When the market level $x$ is at its beginning value $a$ the dollar risk is the product

$$\frac{1}{a} \left( 2 - \frac{a}{a} \right) a = 1.$$  

If the rate of return on the market is indeed stationary, then the dollar risk on the logarithmic asset is also stationary. So the variations in dollar risk imposed by the approximation portfolio are equal to its approximation errors. The following table demonstrates how the standard deviation in our portfolio moves away from .20 as \( x \) moves away from the starting value \( a \). A column headed \( \sigma_{dx} \) shows the standard deviation of the market’s absolute risk, the fourth column shows the rate of change of the approximation portfolio with respect to change in the stock market level, the fifth column is the product of the third and fourth columns, and the last column shows the percent error as we stray from \( x=a \).

<table>
<thead>
<tr>
<th>( x/a )</th>
<th>( x )</th>
<th>( \sigma_{dx} )</th>
<th>( \frac{dx}{dy} )</th>
<th>( \sigma_{dy} )</th>
<th>Percent error</th>
</tr>
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<tbody>
<tr>
<td>1.30</td>
<td>1.30a</td>
<td>0.26a</td>
<td>0.70/a</td>
<td>0.1820</td>
<td>9.00</td>
</tr>
<tr>
<td>1.25</td>
<td>1.25a</td>
<td>0.25a</td>
<td>0.75/a</td>
<td>0.1875</td>
<td>6.25</td>
</tr>
<tr>
<td>1.20</td>
<td>1.20a</td>
<td>0.24a</td>
<td>0.80/a</td>
<td>0.1920</td>
<td>4.00</td>
</tr>
<tr>
<td>1.15</td>
<td>1.15a</td>
<td>0.23a</td>
<td>0.85/a</td>
<td>0.1955</td>
<td>2.25</td>
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<tr>
<td>1.10</td>
<td>1.10a</td>
<td>0.22a</td>
<td>0.90/a</td>
<td>0.1980</td>
<td>1.00</td>
</tr>
<tr>
<td>1.05</td>
<td>1.05a</td>
<td>0.21a</td>
<td>0.95/a</td>
<td>0.1995</td>
<td>0.25</td>
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<tr>
<td>1.00</td>
<td>1.00a</td>
<td>0.20a</td>
<td>1.00/a</td>
<td>0.2000</td>
<td>0.00</td>
</tr>
<tr>
<td>0.95</td>
<td>0.95a</td>
<td>0.19a</td>
<td>1.05/a</td>
<td>0.1995</td>
<td>0.25</td>
</tr>
<tr>
<td>0.90</td>
<td>0.90a</td>
<td>0.18a</td>
<td>1.10/a</td>
<td>0.1980</td>
<td>1.00</td>
</tr>
<tr>
<td>0.85</td>
<td>0.85a</td>
<td>0.17a</td>
<td>1.15/a</td>
<td>0.1955</td>
<td>2.25</td>
</tr>
<tr>
<td>0.80</td>
<td>0.80a</td>
<td>0.16a</td>
<td>1.20/a</td>
<td>0.1920</td>
<td>4.00</td>
</tr>
<tr>
<td>0.75</td>
<td>0.74a</td>
<td>0.15a</td>
<td>1.25/a</td>
<td>0.1875</td>
<td>6.25</td>
</tr>
<tr>
<td>0.70</td>
<td>0.70a</td>
<td>0.14a</td>
<td>1.30/a</td>
<td>0.1820</td>
<td>9.00</td>
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Variable Annuities

103. Managing the Risk of Variable Annuities: A Decomposition Methodology (Spring 2005)

Thomas S. Y. Ho, President, The Thomas Ho Company Ltd, had made available a paper by himself and Blessing Mudavanhu, Vice President Credit Risk Analytics, Merrill Lynch & Company, entitled “Managing the Risk of Variable Annuities: A Decomposition Methodology.”

Ho observed that the market of variable annuities has grown tremendously in recent years and has become a significant part of our capital
markets. These equity and interest rate structured products offer a broad range of guarantees, whose risks are typically borne by the insurers’ balance sheets. The management of the risk of these guarantees is an urgent problem to address. In this paper the authors apply a decomposition methodology to identify the risks of the guarantees. They then discuss the hedging strategies in managing those risks within the context of an investment process. He identified a number of the guarantees (in effect, options) that are embedded in variable annuities.

Variable annuities are retirement products sold by insurance companies to individuals, for both qualified and non-qualified accounts. The insurance companies manage the retirement contributions over a duration, the accumulation period, for a fee, in their separate accounts. This is a simple concept, but in practice variable annuities are complex structured equity and interest rate products. The complexity arises from the multitudes of options that insurers offer their policyholders, particularly in the form of guarantees embedded and not detachable in these products.

The option Ho had chosen to focus on is the guaranteed minimum income benefit (GMIB) that offers the policyholder the option of receiving the account value or an annuity at the end of the accumulation period. This option leads to a complex mix of equity and interest rate risks embedded in the guarantee. In providing these guarantees the insurance companies have to bear both the market risks and the insurance risks on their balance sheets. In their paper, the authors describe only the salient features of the guarantee that is relevant for their paper. They assume that the variable annuity is a single premium product.

The premium is invested in an equity index.

The return of the index is given by a martingale process with an expected return of \( \mu \) and an instantaneous volatility of \( \sigma \) over a one month period. Let \( S(n) \) be the index value at time \( n \), where each time period is one month. Then

\[
S(n+1) = S(n) \exp(\mu - 0.5\sigma^2 + \sigma Z)
\]

where \( Z \) is the standardized normal distribution.

The fee of the variable annuity is paid monthly, and is a constant proportion of the account value at the end of each month. At the end of the accumulation period \( T \), the policyholder can elect to receive the account value or a zero coupon bond, with maturity \( T^* \). The authors use a zero coupon bond instead of an annuity, equal payments over a period of time, for clarity of exposition. A zero coupon bond can capture the impact of interest rate risks on the variable annuity. The model seeks to capture the key features of the option embedded in the GMIB which is the equity put option with a stochastic strike price. The model assures that the GMIB and the variable annuity can be viewed as standard contingent claims on the market interest rate and equity risks. Specifically, we assume a perfect capital market and use a discrete time model, a binomial lattice model with monthly step size to value the variable annuity and the GMIB.

The authors use the two-factor Ho-Lee model (2004) to model the interest rate risk. The characteristics of the model Ho set out as:

- Arbitrage-free 2-factor interest rate model
- No negative interest rates in valuing annuity
• No explosive interest rates in modeling equity return
• Recombining lattice
• Decouples stock return and bond rates
• Specify the interest rate distribution consistent with the market prices

To determine the initial set of benchmark securities to construct the replicating portfolio of the GMIB we begin with investigating the imbedded options in the GMIB. Suppose that there is no interest rate risk. Then the insurer has sold an equity put option to the policyholder with the expiration date at the end of the accumulation period. The strike price is the present value of the annuity on the expiration date.

Suppose that the underlying equity has no risk. Then the equity index becomes a cash account and the premium is invested in cash. In this case, the GMIB is similar to a bond call option. At the end of the accumulation period, the policyholder has an option to exchange the “annuity” for the account value. When interest rates remain low, the annuity value would be high at the end of the accumulation period and the account value would be low. The policyholder would elect to take the annuity at a cost to the insurer.

To replicate the embedded equity options, the authors use a series of equity put options on the equity index of different strike prices with the same expiration date, the end of the accumulation period. To replicate the interest rate risk, the authors use the bond call options with different strike prices but with the same expiration date.

To search for the optimal hedging portfolio, a step-wise regression is used. This iterative process allows us to identify the hedging instruments that can reduce the R squared significantly. Ho displayed the simulation results of the decomposition of the GMIB and the variable annuity. The result of the decomposition is a series of hedging instruments, including cash, equity puts, and bond calls.
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• SEMINAR PROGRAMS 2001-2005
### SEMINAR PROGRAMS

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The Tactical and Strategic Value of Commodity Futures
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Claude Erb, Managing Director, Trust Company of the West

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The Vanguard Group

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