THE Q GROUP summary of proceedings

THE INSTITUTE FOR QUANTITATIVE RESEARCH IN FINANCE

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The Institute of Chartered Financial Analysts

THE FINANCIAL ANALYSTS RESEARCH FOUNDATION

the Financial Analysts Federation

THE Q GROUP

summary of proceedings 1976-1982

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SUMMARY OF PROCEEDINGS

PREFACE

The Institute for Quantitative Research in Finance, popularly called the "Q" Group or "Q", is a specialized professional service organization that has as its prime purpose staying abreast of and helping to advance the state of the art in investment management. The "Q" Group consists of more than 50 sponsor organizations from a broad range of financial institutions, consulting firms, pension fund sponsors and universities. It conducts seminars twice a year, funds research projects and periodically distributes research papers to its sponsors. The "Q" Group seminars present research results of practitioners in the field as well as those of academic representatives of leading graduate business schools. In addition, the results of research funded by the "Q" are presented to the seminar audiences.

Beginning in 1976, Dr. J. Peter Williamson, Professor of Business Administration at the Amos Tuck School at Dartmouth College, began preparing summaries of the semi-annual seminars. The summaries provide both a record of the meetings and a simple resume of the main points contained in each presentation.

As the number of seminars grew, it became evident that a compendium of the summaries, organized by subject matter, would be a valuable resource to Institute members. Anyone wishing to study a topic, such as duration or stock valuation models, could survey a significant amount of literature very easily. As the book of summaries progressed, it became apparent that it represented a unique and extraordinary source of information on many of the subjects that serious investment analysts are now studying.

The Institute of Chartered Financial Analysts (ICFA) and the Financial Analysts Research Foundation (FARF) recognized that the book, entitled "Summary of Proceedings", would be valuable to their members. After discussions between the "Q" Group and the ICFA's Continuing Education Director, Darwin M. Bayston, it was agreed that the ICFA would distribute "Summary of Proceedings" to its members. Simultaneously, the FARF, through its research director, Dr. Richard F. DeMong, agreed to act as a distribution agent for the "Q" Group and serve as the document's repository for those interested in acquiring knowledge in the field of financial applications of quantitative methods. The Financial Analysts Federation, through the offices of Executive Director John L. Dugan, has also offered its assistance in circulating the book to leading depository libraries and others who may find it of value.

Acknowledgement must be given to the many speakers who labored over their presentations to the seminar attendees and to the members of the "Q" Group Program Committee who chose the subjects and speakers. Acknowledgement must also be given to the "Q" Board of Directors, especially James L. Farrell, Jr., Chairman of "Q", and Arthur Williams III of Merrill Lynch, Chairman of the "Q" Administrative Committee, who saw the value of the document and the benefits of publishing it. Finally, we gratefully express our thanks and appreciation to Dr. J. Peter Williamson for his superb organizational effort in developing a group of diverse and often difficult topics into a meaningful and highly readable text.

We hope researchers and readers of this text find it to be an invaluable addition to their libraries.

Dale Berman
Secretary-Treasurer
The Institute for Quantitative
Research in Finance
New York, N.Y.
December 1983

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BONDS – DURATION AND IMMUNIZATION

1. DURATION ANALYSIS: PAST, PRESENT AND THE FUTURE (Fall, 1981)

A paper was distributed: "Duration Analysis in Bond Portfolio Management," by G. O. Bierwag, George G. Kaufman and Alden Toevs.

The work described in this session was funded by the IQRF. George G. Kaufman, John Smith Professor of Finance and Economics and Director of the Center for Financial Studies, Loyola University of Chicago, described it as an update of the duration paper given two years ago at a Q group seminar. He emphasized that the research was on duration, not immunization as such, although one use for duration is in implementing an immunization strategy.

Bond valuation models are generally of two kinds, those based on modern portfolio theory and those based on duration. While there has been a good deal of academic criticism of the duration models, the portfolio theory models have been generally disappointing and the duration models offer some practical advantages: they are easier to understand, they work better, they focus on risk reduction which is an important objective of those who manage bonds, and duration itself turns out to be a useful measure of bond risk.

Gerry O. Bierwag, Visiting Professor of Finance, University of Arizona, commented that new and different approaches to immunization are generally based on different ideas with respect to the sources of uncertainty in interest rates. Unexpected changes in the term structure could be attributed to a single factor or to several factors. In general, the fewer factors in the model the less satisfactorily the model will explain term structure changes and bond values. The more factors, on the other hand, the more complicated and expensive to run the model will be. The authors have therefore continued with a single factor model to see if a model of this simplicity will still be adequate for valuation and immunization purposes. The model reported in this presentation was a two-state model, corresponding to a stochastic process referred to by Bierwag as the "generalized additive stochastic process" (GASP).

Bierwag described in some detail the case of a bond investor with a defined planning period who anticipates a single interest rate shock during that period. The size of the shock is a one hundred basis point change, and the investor has assessed the probabilities that the change will be a rise or a decline. From those probabilities, it is possible to arrive at an expected return and risk configuration for any particular duration. Setting the duration equal to the length of the planning period, of course, will reduce the risk to zero. Bierwag suggested two reasons for complete immunization. Extreme risk aversion is one. But in addition, if the probabilities of a rise and a fall in interest rates are roughly the same there may be little to be gained by taking interest rate risk. Hence immunization will appear to cost very little in terms of foregone opportunities.

Alden L. Toevs, Assistant Professor of Economics, University of Oregon, discussed the empirical results. Ten year planning periods were used, with portfolios consisting of two bonds: a ten year and a twenty year maturity, both carrying a five percent coupon. The period of analysis was 1925 through 1978. Four different immunizing strategies were compared. For the first strategy bond portfolios were constructed using the Macaulay measure of duration. The second and third strategies corresponded to different duration formulas, specifically to the formula used to immunize against a discrete additive stochastic process, and the formula used to immunize against a discrete multiplicative stochastic process. The fourth strategy corresponded to the duration formula immunizing the Khang discrete multiplicative stochastic process. A fifth strategy was the GASP model proposed by the authors. A sixth strategy simply made use of maturity rather than duration.

Over the full time period the first five strategies performed better than the maturity strategy. The results of the first five were close, but the GASP strategy seemed to do a little better than the rest. Toevs considered the possibility that this conclusion resulted from the choice of data base. So the research, which had at first been based on Durand data, was repeated with CRISP data. The results were very similar.

The overall conclusion seemed to be that the duration model performed quite well. Toevs expressed the opinion that compared to some of the more complex models, including those that had been discussed earlier in the same seminar, the duration model performs well and is very much cheaper to use.

2. CONTINGENT IMMUNIZATION (Fall, 1981)

Martin L. Leibowitz, General Partner, Salomon Brothers, referred to a Salomon Brothers publication on January 28, 1981, entitled "Contingent Immunization," by Leibowitz and Alfred Weinberger. Much of his presentation drew on this publication and in particular its graphs.

In describing the concept of contingent immunization, Leibowitz observed that an active rather

than passive management strategy offers obvious advantages that appeal to institutional bond investors. But it may be appropriate to establish some limits to the risk being taken in that management. One approach to risk limitation will be to establish a minimum rate of return and install a procedure to assure with a high probability that the portfolio return will not drop below that minimum. So long as the active management is successful in achieving at least the minimum return, then immunization is unnecessary. But unsuccessful active management will at some point trigger a move to immunization. And the immunization will in effect "lock in" the established minimum rate of return.

Leibowitz stressed two critical assumptions lying behind the procedure. First, if interest rates move down very rapidly, and the trigger point is passed before the bond portfolio can be restructured to achieve immunization, then the whole strategy will not be as successful as it was intended to be. Second, the success of the strategy depends upon the ability and willingness of the portfolio manager to carry it out.

Leibowitz began with an example. The bond portfolio has a value of one hundred; the time horizon is five years; immediate immunization would guarantee a rate of fifteen percent, so that the one hundred would have grown to two hundred six at the end of five years. If the investor decides to pursue active management, there is a possibility of having more than two hundred six at the end of five years, but there is also a likelihood of having less. Specifically, if the one hundred is invested in a thirty year bond, a decline in interest rates will lead to more than two hundred six, but a rise in rates will lead to less.

The institution might decide to establish a minimum return of 14%, which would produce a value of one ninety-seven at the end of five years. Now the problem is how to permit active management but assure that the proceeds will be at least one ninety-seven at the end of five years. Leibowitz described with the aid of graphs how one would track the performance of the active management and identify the point at which unsuccessful management demanded immediate immunization in order to assure a terminal value of at least one ninety-seven. To do this one must track the value of the actively managed portfolio, as well as the interest rate at which immunization can be achieved.

The higher the minimum required return, of course, the greater the likelihood that active management will encounter the trigger point and the portfolio will be immunized, and therefore the less the opportunity for successful active management. Leibowitz showed graphically how one might tra off the potential benefits of active managem against the attractiveness of a high minimum retu

Simulations are under way to test the effectiven of the contingent immunization model. Leibow indicated that preliminary results confirmed expectations of the model, but the simulations not yet complete.

Monitoring and control of this immunization p cess has to reflect the fact that interest rates move rapidly. History suggests that a one hund basis point move in a thirty year U.S. Governm can easily take place in a week. In establishing trig points, and deciding when to begin a shift to an munized portfolio it becomes important to estim how long it may take to restructure the portf and how rapidly interest rates may move. Leibo referred to the "braking" process, by which the m ager begins to shift towards an immunized portf as the market moves against his actively mana portfolio.

All of his examples had been based upon a yield curve, shifting up or down but not chan shape, but Leibowitz indicated that his met could be generalized to different sorts of inte rate shifts. He also considered the possibility the target of the institution may be itself mo with interest rates. That is, whether it is neces that the one hundred grow to one ninety-seve to more or less than this amount at the end of years may depend on where interest rates are at end of five years. The contingent immuniza technique can deal with these moving targets.

In answer to a question, Leibowitz said that s actual portfolios are being managed on a contin immunization basis, but as yet he could repor measures of the technique's success. In answe another question he said that those using the nique generally began the "braking" process v rates available for immunization were a hun twenty-five to a hundred fifty basis points fron rate at which immunization had to be effecte order to achieve the minimum return.

3. BOND PERFORMANCE MEASUREMEN (Fall, 1981)

A paper entitled "A Risk Minimizing Strateg Multiple Liability Immunization," by Gifford and Oldrich Vasicek, was distributed.

H. Gifford Fong, President, Gifford Fong ,ciates, began by outlining the objectives of

performance measurement. First, the measurements should be accurate and reliable. Second, they should be informative for monitoring and diagnostic purposes, and for facilitating useful communications between manager and sponsor. Third, they should be simple and understandable and therefore related to management methods used by bond portfolio managers.

Since the performance of a bond portfolio is affected by the external interest rate environment and by the quality of management, one wants to be able to measure separately these two components. Further, one wants to be able to partition the management contribution into the contributions of specific management skills. The three components chosen here are at skills in maturity selection, quality or sector selection, and finally selection of a specific security.

In discussing the components of total return, Fong began by describing the separation of this return into the component due to the interest rate environment and the component due to the expertise of the manager. The interest rate environment was taken to be that represented by all outstanding U.S. Government bonds. The weighted average performance of these bonds therefore constituted a sort of naive benchmark. Any deviation of the performance of the actual portfolio from this benchmark was attributed to the manager's contribution.

The contribution of the interest rate environment was broken into two components. The expected performance is deduced from the term structure of interest rates at the beginning of the period. The unexpected component is simply the difference between the actual performance and the expected performance.

The contribution of management was separated into three components: the return from maturity management, the return from spread or quality management, and the return attributable to selection of specific securities. Fong commented that although one might look for a separate measure of timing ability, this is really embraced in the three components.

He next explained how the return from maturity management is determined. All securities held in the portfolio during the evaluation period are priced using the estimated U.S. Government term structure. That is, each issue is priced as though it had no default risk. The total return of the portfolio over the evaluation period is calculated using these default-free prices. The actual Treasury index return is subtracted from this rate to arrive at the maturity management contribution. What is measured then is the difference between what the portfolio accomplished by virtue of its particular maturity structure over what would have been accomplished using the maturity structure of the U.S. Treasury Index – the benchmark.

Determining the contribution of sector or quality management requires that each security be priced as though it were representative of its own sector or quality group. The bond market is classified by sector and quality groups. All securities are priced using the default-free rates from the U.S. Treasury term structure. The yield premium for each security is the difference between its actual yield and the yield determined from this default-free price. The yield premia are averaged over all the securities in a particular sector or quality group. Now, for a particular security in the actual portfolio the default-free price is determined from the U.S. Government term structure, the yield is calculated from this price, the appropriate premium for the sector or quality group is added, and the yield is converted back to price. When all the securities in the portfolio have been priced in this way, one once again calculates the total portfolio return using these prices. From this return one subtracts the external effect component and the maturity management component, to arrive at the return contribution for sector or quality management.

The contribution of security selection is obtained by simple subtraction. Since the maturity or duration management contribution has been identified, as well as the contribution of sector or quality management, the balance of the performance of the portfolio due to management is represented by security selection.

Fong illustrated the measurement system he had described by means of a sample report for the first half of 1981. First, the five components of the total return of the portfolio, as described above, were reported. In addition, the report showed the capital gain and the interest income components of the total return.

The second page of the report showed the five components of total return, and the capital gain and interest income breakdown, for each security for the period over which it had been held. Next, a transaction report showed for each security purchased its contribution to the portfolio return during the period held, and for each security sold what its contribution would have been had it been retained. Finally, the report tracked by month the portfolio market value and the cash account.

Several questions were asked about the treatment of cash in this particular performance measurement model. As the model stands, cash is treated as part of the portfolio and the performance measurement. Fong explained that the model assumed the cash balance, reflected the judgment of the portfolio

manager. He said that one could separate the cash balance and measure only the performance of the remaining bond portfolio. Several questions were also asked concerning the potential effect of constraints imposed by an institution on a portfolio manager. Fong explained that the model did not take explicit account of such constraints, but a number of participants suggested that it would be helpful if these constraints could be allowed for. There were some suggestions that the benchmark reference point, rather than consisting of all U.S. Government bonds, might consist of a portfolio subject to the constraints imposed by the sponsor. Vasicek agreed that constraints could be incorporated in the model.

4. A RISK MINIMIZING STRATEGY FOR SINGLE OR MULTI-PERIOD IMMUNIZATION (Fall, 1980)

A paper entitled "A Risk Minimizing Strategy for Multiple Liability Immunization," by Gifford Fong and Oldrich Vasicek, was distributed.

H. Gifford Fong, President, Gifford Fong Associates, began this session with a general description of the role of immunization as a portfolio strategy, including the traditional approach to immunization which consists simply of matching the duration of a portfolio to the investor's time horizon. This approach will be successful only so long as interest rate changes are not accompanied by any change in the shape of the yield curve. He described the objective of his strategy as an extension of immunization to deal with all kinds of interest rate change, and to provide for the meeting of multiple liabilities and not simply a single horizon payment.

Oldrich Vasicek then presented the mathematics of the new model. It turns out that when the portfolio must provide multiple cash flows in the future, and is immunized in the traditional way with respect to a given time horizon, the variation of the value of the portfolio from its expected horizon value is a function of the change in the slope of the term structure and the weighted variance of the liability payment dates around the horizon date. If those payment dates are closely concentrated around the horizon date, then the variation is low. If the payments are widely distributed in time, then the variation is high. Vasicek continued, to show that the necessary and sufficient conditions for immunization of a portfolio with respect to a given stream of liabilities are (1) that the duration of the portfolio equal the duration of the liability stream and (2) that the dispersion in time of the cash receipts of the portfolio be greater than or equal to the dispersion in time of the liability flows, with both dispersions measured by mean absolute deviation.

These conditions assure immunization against interest rate changes not accompanied by a change in the shape of the yield curve. For a stream of liabilities it is not possible to immunize completely against the risk of a change in the shape of the yield curve, but it is possible to construct a minimum risk portfolio using linear programming techniques.

G. Fong then returned to discuss four examples of the use of the risk minimizing technique. Each example used a four year time horizon, and a particular scenario of interest rate changes, described by five successive yield curves from time 0 to time 4. For the four cases, he reported the target rate of return and the realized return, after using the minimum dispersion technique to establish the initial portfolio and to rebalance the portfolio at each year end. The results were:

Target Rate of Return	Realized Rate of Return
11.68%	11.55%
9.91%	9.81%
11.64%	11.60%
11.64%	11.57%

In answer to a question, Fong pointed out that the minimization technique can deal only with a set of certain liabilities. He was asked about transactions costs and the relationship among cost, frequency of rebalancing, and minimization of risk. He answered that the examples did not incorporate any transactions costs, but that the risk minimization system showed for each rebalancing the transactions costs and the reduction in risk, so one could decide whether the risk reduction justified the cost. When he was asked about simultaneously immunizing both liabilities and assets from a change in inflation and interest rates, Vasicek answered that his next step may be the development of a system to do this.

5. IMMUNIZATION, LIABILITIES AND THE ACTUARY (Fall, 1979)

Robert L. Whalen, of Connecticut General Life Insurance Company, moderated five presentations and a panel discussion under this general heading. He commented that the topic had been suggested by a number of Q group members at the preceding Seminar in Santa Barbara, and he said it is becoming clear that

a pension fund's assets must be managed to objectives that are largely determined by the character of the fund's liabilities. However, one is likely to find that in fact actuaries and investment managers rarely get together to develop an investment strategy for a pension fund. A major purpose of the series of five presentations was to help the actuary understand investment management, and the investment manager understand the work of the actuary, as one step toward providing for a coordinated effort.

Whalen introduced William A. Dreher, of Peat, Marwick, Mitchell & Co., as an actuary who has always been knowledgeable about the asset side of a pension fund, and who has concentrated in his research and consulting on the relationship between the funding and the investment policies of pension plans.

Dreher began by noting that as early as 1973 his organization had put together a computerized financial planning model that tied together the asset and liability sides of the pension fund balance sheet. The integrated approach of the model has been used with about 30 major corporations to improve the quality of corporate decision making. At the same time, he confirmed Whalen's observation that generally actuaries and investment managers do not communicate well, and that indeed the initiative in coordinated planning may be coming from plan sponsors rather than the professional managers.

Dreher also observed that this is a particularly critical time in the life cycle of the U.S. retirement system, with unusual uncertainty, inflationary problems, and the implications of unfunded liabilities for the solvency of corporations. These uncertainties have led to conservative funding and investment policies, and the equity exposure of most corporate pension plans has been declining since about the summer of 1974. Yet over the five years ended September 30, 1979 the capital market relationships were reasonably normal; the S&P 500 showed a 16.8% total return, the Lehman Brothers Kuhn Loeb Bond Index showed a 9.8% rate of return and the inflation rate was slightly over 8%. So there was a real positive return on stocks and a small real return on bonds, suggesting that many of the pension plan investment decisions of the past five years have simply been wrong. But if inflation remains high we can expect that pension cost will rise and at the same time investment returns will probably be adversely affected, at least in real terms. He posed the question, how can we reduce risk without an excessive sacrifice of opportunities?

In presenting slides demonstrating the planning process, Dreher commented on the importance of the economic environment and the business outlook for the plan sponsor. There may be a number of objectives of actuarial policy, having to do with level and stability of costs, a high degree of security for plan participants, and equitable treatment of stockholders over time. These objectives are conflicting and a balance must be reached. A critical part of the process consists of the actuarial assumptions.

It is particularly important for the investment manager to be aware of the actuarial assumptions that are a function of general economic forces, specifically the investment return, the forecast of future pay increases, judgments with respect to the impact of social security, and the possible impact of cost of living features. A key element is obviously judgments about the future rate of inflation and it is critical that the inflation forecast be realistic.

Dreher identified five specific forecasts necessary to the actuarial process: the rate of inflation, returns on various classes of assets, risk premia associated with them, the proportions of the portfolio that will be held in each asset category, and the degree of conservatism to be built into the actuarial estimate. As an illustration he suggested an assumed rate of inflation of 4.5% (based on a 1977 opinion survey of business economists, for 10 to 20 years in the future), a real return of 3% on bonds and an equity risk premium of 4.5%, for a portfolio equally divided between stocks and bonds, with a 2% margin of conservatism for the stocks. This leads to an estimated long term nominal return of 8.5% for the portfolio. Allowing for costs of .75% leads to an appropriate actuarial rate of return assumption of 8%.

Next, a forecast is needed for the impact of inflation on future salary levels and benefits. Continuing with the example, Dreher illustrated the three elements of an actuarial salary forecast: an annual average 2% merit and seniority salary increase plus a general wage increase of 1.5% and an inflation assumption of 4.5%, giving a total salary increase of 8% annually over an employee's career. Whether or not these figures are appropriate in a particular case, it is important that they be realistic in terms of probable inflation, that they be internally consistent and rationally developed and appear sensible to the plan sponsor and to the professionals associated with the pension plan.

Dreher next turned to his pension fund financial planning model. It begins with a process for forecasting returns on stocks and bonds, and he repeated his caution that long term forecasts should not be determined by recent history. The model next takes into consideration the actuarial policy, based on assumptions consistent with those underlying the rate of return expectations. The characteristics of the workforce, future patterns of cash flow, and the funding policy of the sponsor are all incorporated.

The model, also reflects the balancing of objectives referred to above – cost minimization, stability and so forth.

Commenting on the discussion of immunization to come later in the day, Dreher observed that in general immunization is a feature of a very conservative strategy, while the planning model he had been discussing could embrace a wide range of risk tolerances and a broad set of plan objectives. The most useful concept of immunization focuses on the matching of cash flows from the investment program with cash flows to service liabilities.

Dreher went on to identify three long term applications of the immunization concept. First, one might identify a set of retired employees and ask the question what is the most effective way to fund their pension benefits, with immunization from the effects of uncertain reinvestment rates. For the plan sponsor, one obvious solution may simply be to purchase an annuity policy from an insurance company, either by a single premium paid upon the retirement of each plan participant or by a series of level annual premiums over the just few, say five, years following each retirement.

Another approach would be to estimate the cash flows to service the liabilities and to construct a bond portfolio with coupons and maturity payments matching those benefit payments.

Experiments with this technique, using government bonds and high grade corporate bonds, indicate that it is almost as effective as purchasing a terminal funding annuity contract and has two advantages: bond arbitraging is possible, and the plan sponsor retains the freedom to change investment policies and redeploy the portfolio into other classes of assets.

Techniques for matching cash flow requirements for benefit payments with investment cash flow can be applied not only to those currently retired, but to projected future retirees. The opportunity cost of complete matching is probably unacceptable for most pension plans, since the entire portfolio, and all future cash flows, may have to be dedicated to fixed income securities.

Five or ten year forward planning is a useful variation of this technique. It is implemented by structuring part of the current portfolio to generate the annual cash required for payments to both current and future retirees over the next "n" years. Forward protection of the projected cash strain can be assured by using part of each year's contribution to buy a guaranteed investment contract maturing in the nth year in an amount equal to the project benefit payments in that year. Tests performed by Dreher for one large and relatively mature pension fund indicated that five year forward protection of benefit cash flow would require a one third commitment to fixed income securities maturing within five years. Ten year matching would have absorbed three-fourths of the current portfolios, restricting equity exposure to 25%.

Another variation of the immunization concept is to buy mortgages. They generate more cash flow and may produce a higher total return than bonds of comparable duration. The default risk and servicing problems associated with mortgages can be avoided through the use of insured mortgage pool securities.

Dreher quoted Peter Moody, a British insurance company investment executive who recently served as president of the British Institute of Actuaries, and offered his personal opinion to the effect that bond immunization has a relatively limited role in pension fund investment management. It may be useful for plans with very high risk aversion, but it cannot be used to eliminate reinvestment risk without an unacceptable opportunity cost, since it forces the pension fund out of the equity market and into the shorter end of the debt market.

6. REVIEW OF IMMUNIZATION THEORY: CHARACTERISTICS OF PENSION LIABILITIES (Fall, 1979)

D. Don Ezra, of DDE Financial Consulting Services, began by observing that traditionally actuaries had revalued the assets of a pension fund downward when interest rates rose but made no corresponding reduction in the magnitude of the fund liabilities, so that an increase in interest rates had to be regarded as unfortunate for any pension fund. Research, however, demonstrated that in periods of rising interest rates the value of the liabilities declines, and that the sensitivity of the liabilities to interest rates is even greater than the sensitivity of the asset values. This research suggested that it might be possible to construct asset portfolios with the same sensitivity as that shown by the liabilities, so that the values of the assets and liabilities would move together when interest rates changed. The result would be to make the fund "immune" to interest rate changes. Immunization need not be an objective, but it can serve as a yardstick against which to measure risk in the sense of sensitivity to interest rate changes. A fully immunized plan is one free of interest rate risk, but one that cannot profit from successful timing.

Ezra went through the mathematics by which the sensitivity of the value of a portfolio to changes in interest rates is computed. The measure of the sensitivity is what we generally call "duration". He commented on some of the practical problems in com-

puting duration, leaving it to later speakers to elaborate on these. He observed as well that the same mathematics and the same duration concept apply to the pension fund liabilities.

He went through a number of examples to demonstrate the use of the duration measure for bonds, mortgages and stocks. Turning to pension liabilities, he observed that a pension plan creates a future financial liability that is essentially a debt instrument, somewhat different from the sorts of debt instruments that constitute assets of a pension fund. It tends to have a very long maturity, longer than an ordinary bond maturity. And it tends to be not truly fixed income, but to have its income indexed to salary levels. Just as a corporation issues debt obligations in order to take on capital projects, the creation of a pension liability is accompanied by the investment of funds in a portfolio of securities. But while the characteristics of the debt and the capital project taken on may be rather different, the characteristics of the pension liability and the capital market investment are rather similar. This similarity is something that must be carefully considered by the plan sponsor.

Ezra turned next to a sample set of cash flow projections covering benefits for accrued service under a final average pension plan. His tables showed not only the cash flows over future years but the present value of those flows, and the duration. For active employees, the duration of the expected pension outflows was quite substantial, on the order of 20 years. But for those already retired and on pension, the duration of the expected benefit payments was on the order of 7 years, a number comparable to the duration of a typical bond portfolio. The duration of the combination of expected cash payments to all present and former employees is likely to be on the order of 20 years.

Ezra turned next to the sensitivity of the expected benefit payments to inflation in salary scales. This inflation will affect the benefits of active employees but not the benefits of those already on pension. What was of particular interest in Ezra's example was that for the active employees the effect of a 3% salary escalation due to inflation would be completely offset by only a 1.5% increase in the rate of return on pension fund assets. The reason for this perhaps surprising result is that the impact of the salary escalation lasts only until the employee retires, while the impact of the increase in rate of return on invested assets lasts throughout the period of retirement, when benefits are being paid. All of this assumes, of course, that there are no cost of living increases given to pensioners. Ezra referred to the ratio of the needed increase in the asset rate of return to the salary escalation as the "degree of salary indexing". In this case, it was 50% for active employees and 45% for all active and retired employees. He commented that for most pension plans the degree of salary indexing generally ranges from about 40% to about 60%. Anything above 60% is unusual unless the pensions themselves are subject to cost of living increases. If the pension themselves are fully indexed for inflation then the degree of salary indexing will be about 100%.

From all this it was easy to see the point that Dreher had made earlier. The duration of the liabilities for benefits to those already on pension is on the order of 6 or 7 years and the degree of salary indexing (assuming no cost of living increases for pensioners) is zero, so that complete immunization might well be practical.

The pension liabilities for active workers present a somewhat different situation. It turns out that what has been defined as the degree of salary indexing is a measure of the change in interest rates required to exactly compensate for a change in the salary scale, so as to leave the present value of the pension liabilities unchanged. It also turns out that if the change in interest rates is actually equal to the change in salary level, the sensitivity of the present value of the liabilities is about half the duration of those liabilities, or in most cases around 10 years.

Ezra went on to discuss the sensitivity of the value of assets to a change in interest rates, where the income from the assets is growing, as in the case of a common stock with a growing dividend. It turns out, as might be expected, that if the growth rate in the dividend changes exactly in step with a change in interest rates, then the present value of the stock remains unchanged. The stock would be in effect a perfect hedge against changes in interest rates.

In concluding, Ezra pointed out that his example had confirmed Dreher's earlier suggestion that immunization of liabilities to those on pension might be achieved with a bond portfolio, in this case with a duration of 6 or 7 years. He had also demonstrated that the liabilities for those still in the workforce might be immunized by an asset portfolio with a duration on the order of 10 years if it can be assumed that a change in the rate of inflation will be immediately reflected in changes in the rate of return on the asset portfolio and in the employee salary level.

7. PRIOR AND CURRENT RESEARCH INTO THEORY AND USES OF IMMUNIZATION (Fall, 1979)

George G. Kaufman of the University of Oregon, began with a review of the theory of duration, starting

with Macaulay, who had proposed duration as a measure of the average life of a bond. Later research found that the sensitivity of the value of a bond to changes in interest rates is this same duration. The next step was the discovery that fixed future liabilities have a duration, just as do fixed income assets, and that if the duration of the liabilities is the same as the duration of the assets then both the assets and the liabilities will have the same sensitivity to changes in interest rates, and we have immunization in a rather primitive form. The first sophisticated modeling of immunization was designed to answer the question: under what conditions will an investor realize on a default-free portfolio of bonds a rate of return that is no less than the originally promised rate. This model was derived on the basis of an assumption that interest rates follow a stochastic process, and Kaufman described his and Bierwag's "immunizing duration" as depending on this same stochastic process. Kaufman used a simple example to show that when the immunizing duration is equal to the planning period, the impact of an interest rate change on the value of the bond is almost exactly offset by the impact on the reinvestment proceeds of the coupon interest. Control of duration can also be used to speculate on interest rate changes, rather than for immunization purposes. In this case, control of duration is better than control of maturity. That is, if an investor believes he is able to forecast interest rates and wishes to take advantage of this forecasting, he is better off working with duration than with simple maturity.

Kaufman went on to discuss the use of duration in risk measurement. For a default free instrument, the three elements of risk are the duration of the bond, the planning period of the investor, and the process by which interest rates change. Since investors have different planning periods, there can be no universally acceptable measure of risk for a particular investment asset. This has some implications for performance measurement, and Kaufman commented that performance measurement cannot be undertaken independent of the planning period of the investor.

G.O. Bierwag of the University of Oregon, continued with the discussion of the theory of immunization. The immunizing duration is related to a holding period yield curve and to a stochastic process by which the holding period yield curve changes. The conventional yield curve is a graph of yield to maturity against time to maturity, and strictly speaking there is a different yield curve for every coupon level. The holding period yield curve is the yield curve for a zero coupon bond. It traces what the yield would be on an instrument like a long term treasury bill. In introducing the stochastic process, the holding period yield curve (or term structure) is allowed to shift randomly over time. If the term structure is represented by a horizontal line and shifts only up or down, then the immunizing duration is simply Macaulay's duration, the measure discussed by Ezra. If the term structure is not flat and slopes upward, but shifts only up or down without a change in shape, then the immunizing duration is different. If the term structure is upward sloping and shifts not only up or down but also by way of a change in shape so that long term rates move more or less than short term rates, the immunizing duration is a still different measure. Bierwag pointed out that the appropriate measure for immunizing duration depends upon the process by which one expects interest rates to change and commented that there is no universally acceptable immunizing duration measure.

Bierwag moved next from the case of the single bond to the case of a bond portfolio, and showed the corresponding various measures of immunizing duration. An immunized portfolio is one for which the immunizing duration (derived from an appropriate choice of the stochastic process) is equal to the holding period horizon. For such a portfolio, the holding period return will not be less than the anticipated return, whether or not interest rates change. He went on to consider the possible holding period returns of portfolios for which the duration was deliberately set less than or greater than the immunizing duration.

All of the examples Bierwag had discussed up to this point were based on the assumption that a single change in interest rates might take place between the time of investment and the holding period horizon. He next considered the possibility of a sequence of interest rate changes during the holding period and commented that immunization was still possible, so long as the stochastic process for the interest rate changes could be correctly identified. Finally, he turned to the case where there is not a single planning period horizon, but where for example a number of liabilities must be met at different future dates. It is no longer enough that the immunizing duration of the asset portfolio should be set equal to the average duration of the liabilities. It becomes necessary to divide the asset portfolio into a sub-portfolio with a duration less than the shortest liability maturity and a sub-portfolio with a duration longer than the longest liability maturity.

Kaufman then dealt with actual historical interest rates, back as far as 1925. Using 10 year planning horizons, and portfolios made up of two bonds, one with a ten year maturity and the other with a twenty year maturity, and varying the portions of the two bonds at each year-end over the planning period.

Bierwag and Kaufman had tested various immunization strategies. Three of the four immunizing duration strategies almost always outperformed a simple strategy of holding a ten year bond, that is a bond whose maturity matched the planning period. What was particularly interesting was that the strategy using the simple Macaulay duration did quite well. Kaufman continued, using simulated interest rates rather than actual historical interest rates, to demonstrate the consequences of following immunization strategies based upon an erroneous choice of the stochastic process.

Finally, Kaufman indicated the research he and Bierwag are pursuing with support from the IQRF. In response to a question, he commented that he believed the immunization theory could be used for risky instruments, such as common stocks with uncertain dividend streams and callable bonds, through the use of certainty equivalents.

8. PANEL DISCUSSION ON IMMUNIZATION (Fall, 1979)

An abbreviated panel discussion, in the form of questions and answers, ended this part of the program.

Martin L. Leibowitz, General Partner, Salomon Brothers, asked for some discussion of the motivation for plan sponsors to make use of immunization. Len Wisner of Manufacturers Hanover responded that where there is a predictable cash flow liability schedule, immunization may be quite useful. Where a plan sponsor is considering a guaranteed investment contract it is quite possible that an immunizing bond portfolio will produce a better rate of return. In other cases, if the plan sponsor has set a five year planning horizon and wishes to minimize the risk of failure to meet a five year target, immunization may be helpful. He also referred back to the suggestions by Dreher and Ezra that the liabilities covering those already retired might lend them themselves to immunization. It is still too early to attempt to use immunization to solve the problems of an entire pension plan. William Dreher added his opinion that immunization so far offers little for the plan as a whole but is useful to deal with specific parts of a plan. Picking up on Kingsland's suggestion that the appropriate comparison is between expected returns and worst case results, Dreher suggested that the use of options and international portfolios may be appropriate in dealing with that worst case risk.

Turning back to Leibowitz's original question, the observation was made that immunization may enable a bank trust department to compete successfully with an insurance company for pension fund business. The case that had been referred to by a number of speakers – the liability for pensions to those already retired – offers an especially attractive opportunity for immunization, one free of the problems Bierwag and Kaufman had discussed. In this case the function of the cash flows from the bond portfolio is solely to satisfy the benefit payments, and there is no reinvestment.

9. IMMUNIZATION AND THE LIFE INSURANCE INVESTMENT PROCESS (Fall, 1977)

Irwin Vanderhoof distributed a paper: "The Interest Rate Assumption and the Maturity Structure of the Assets of a Life Insurance Company."

Irwin T. Vanderhoof, Vice President, EQUI-Pension Department, Equitable Life Assurance Society, discussed techniques for handling interest rate risk in insurance companies and pension funds. These two institutions differ from most others in that their cash inflows (net premiums and contributions) and outflows (payments to beneficiaries) are highly predictable, and they offer their clients very long-term guarantees of investment performance. The long-term guarantee exposes the insurance company or pension fund to serious loss if interest rate forecasts are inaccurate. But the predictable nature of the cash flows makes it possible to turn to the technique of immunization, which serves to reduce or even eliminate the interest rate risk.

In principle, immunization consists of investing assets in such a way that the effect of a change in interest rates on the value of the invested assets will be exactly offset by an inverse change on future earnings. For example, if the assets have been invested in such a way that the expected interest rate will bring in just enough earnings to satisfy the liabilities, then a change in interest rates will upset that balance. A decline in interest rates will reduce the earnings on future cash inflows, but it will also raise the market value of assets now held. Immunization consists of arranging a fixed-income asset portfolio mix so that the loss of future earnings will be exactly balanced by an increase in the value of assets. The ability of the company to meet its liabilities will presumably remain unchanged.

Vanderhoof began with an example, to demonstrate first that even if interest rates are perfectly predictable, the choice of vehicle that is used for the investment of cash flows does make a difference to the profits of an insurance company. The cash flows

might be invested in short-term instruments, which would then be rolled over at changing interest rates. Or they might be placed in long-term bonds, maturing at the expected maturity of a contractual liability. Which vehicle is the more attractive, depends upon the sequence of predicted interest rates and the pattern of cash flows.

Immunization provides a technique for deciding how to invest the cash inflows. We designate the net cash inflow from life insurance operations in year t as B_t. This is premium payments, less expenses, cash surrender payout, and payments to beneficiaries as annuities or lump sum benefits. We designate the cash inflow from investments, including coupon income and maturity payments, in year t as A_t. Then at the interest rate the insurance company has assumed, the following equality should hold:

$$\sum B_t v^t = \sum A_t v^t$$

Sum over
future years

The term v^t is a present value factor. What this equation means is that the sum of the present values of cash flows from operations, through the maturity of the contractual claims, must equal the sum of the present values of the receipts from the assets in which cash from operations is invested.

Now, we want the above relationship to hold independently of interest rates changes. To determine under what conditions this will be true, we differentiate the expression above with respect to the interest rate and set the derivative to zero. These mathematical operations lead us to:

$$\frac{\sum tB_t v^t}{\sum B_t v^t} = \frac{\sum tA_t v^t}{\sum A_t v^t}$$

What the above equation means is that the duration (referred to as D_1) of the operating cash flows must be equal to the duration of the investment cash inflows. Setting the duration of the cash inflows from investments (by arranging an appropriate set of investment instruments) exactly equal to the duration of the operating cash flows (which for an insurance company are highly predictable), we completely eliminate any risk due to changes in interest rates.

There are some limitations to the value of this matching of durations, because as interest rates change so do durations, and hence an interest rate change will tend to destroy the equality we have established. Vanderhoof went through a second calculation, to establish the conditions under which the shift in durations will always work to the benefit of the insurance company. Mathematically, the result is this:

$$\frac{\sum t^2 B_t v^t}{\sum B_t v^t} < \frac{\sum t^2 A_t v^t}{\sum A_t v^t}$$

This equation establishes an inequality between the sensitivity (D_2) of duration to yield, for operating and investment flows.

The paper prepared by Vanderhoof described the calculation of duration for a variety of assets, including bonds, mortgages, and stocks. He referred to tables in the paper to illustrate the sensitivity of the values of these various assets to changes in interest rates, as well as the sensitivity of the duration for specific assets to changes in interest rates.

Next, Vanderhoof turned to tables showing durations and asset and liability values, under different interest rate assumptions, for the entire insurance industry at the end of 1970. For the industry, he estimated the present values of assets at interest rates ranging from 4% to 8%, as well as values for D_1 and D_2 at each interest rate. He did the same for liabilities, assuming a single model plan of insurance liabilities and a single model annuity. He then put the assets and liabilities together, to tabulate duration of liabilities at different interest rates. The most interesting conclusion was that at an interest rate of 6%, the duration of assets excluding equities was very much less than the duration of liabilities. This meant that, ignoring equities, a decline in interest rates would confront the life insurance industry with very serious problems, although a rise in interest rates would be very helpful. Adding in the equities, brings the duration of total assets somewhat closer to the duration of liabilities.

Vanderhoof's final point was that without knowing the duration of assets and liabilities, we do not know whether an institution is positioned to gain or lose from an increase or a decrease in interest rates. The institution may have an interest rate forecast, and may be attempting to shift its investments to benefit from that forecast. But without the duration calculations, one does not know whether the shift in position will be a move toward or away from immunization, let alone whether the shift will be beneficial. Hence, the institution cannot be sure what response is appropriate to the forecast.

In response to a question about what to do if the present value of liabilities is sensitive to inflation, as in the case of a pension fund for which prospective benefits can be expected to rise with inflation, Vanderhoof referred to another paper of his, entitled "Inflation, Expenses, Interest Rates and Benefits." In that paper he set out equations corresponding to the ones above, but incorporating inflation rates.

10. PASS-THROUGH SECURITIES (Fall, 1978)

Dexter Senft distributed a paper: "Pass-through Securities: An Introduction to How They Work and How to Measure Them."

Dexter Senft, Vice President, Fixed Income Research Department, The First Boston Corporation, provided an introduction to GNMA and FHLMC pass-through securities, and a detailed discussion of the problems in estimating cash flows and therefore the yield to maturity on these instruments.

The pass-through securities are participations in pools of mortgages, and the investor receives monthly payments in the form of interest and principal just as though he were holding a mortgage. Senft referred to a number of popular misconceptions about pass-through securities, and turned to the key issue, which is the probable principal repayment schedule for a pass-through. It is easy to calculate the scheduled principal payments, out to a final 30 year maturity. Unscheduled prepayments, arising because of a guarantor making good on a defaulted mortgage or through voluntary prepayments by mortgagors, are difficult to estimate. Senft began with the so-called "100% FHA-Experience" which is a set of FHA figures from the 1957 through 1975 period covering all 26 to 30 year mortgages insured by FHA. This historic prepayment record is a starting point, but there is little reason to believe that it is representative for any new pass-through issue. Prepayment patterns have changed for a variety of reasons, some of them having to do with coupon rates on the issues and with current interest rates. It is customary to estimate the prepayment schedule for any particular issue with reference to the FHA experience table. A "200% FHA experience" refers to prepayments at twice the percentage of prepayment shown by the FHA experience table. For GNMA issues in the 5½ to 9½ coupon range, the prepayment experience is likely to correspond to about 225% FHA.

The average life of a pass-through issue is very sensitive to the prepayment schedule. In the absence of prepayments, the average life for a 30 year maturity will be 20.85 years on an 8% GNMA. For the 100% FHA experience, the average life drops to 12.73 years; for the 200% FHA experience it drops to 8.79 years; and for the 400% FHA experience it drops to 5.41 years. These are average lives for new issues. For issues that have been outstanding for some time, the average life will be somewhat lower, since the number of years to the ultimate maturity will be less than the original 30. Senft illustrated this point with further tables, and went on to the crucial point, which is the calculation of a yield to maturity.

The yield tables used by traders in pass-through securities are all based upon the assumption of a 12 year life, or approximately the average life corresponding to 100% FHA experience. The use of this 12 year convention, and the tables based upon it, can lead to seriously understated yields. Senft presented tables comparing these conventional yields with what he has termed "honest to god" yields, tabulated for various FHA experience prepayment rates. For example, for an 8% GNMA issue, outstanding for one year, with a price of 91.75, the conventional yield to maturity is 9.14%, while the yield corresponding to a 200% FHA experience is 9.66%. For the same pass-through, two years after issue and still priced at 91.75, the conventional yield is still 9.14%, while the correct figure for a 200% FHA experience is 9.75%. The errors in using the conventional yield will be substantially larger if the prepayment is likely to be substantially faster than 200% FHA, and this will probably be the case for FHLMC issues.

But the conventional GNMA yields do worse than simply understating true yield to maturity. They give the impression that the highest coupon issues give the best yield to maturity. In fact the yield to maturity corresponding to a good approximation of prepayment experience shows just the opposite: the yield declines with an increase in coupon.

Finally, yield spread tabulations, between pass-through and treasury issues and between GNMA and FHLMC issues, can be quite misleading in magnitude and trend when they are based upon the twelve year average life convention.

Not only is the market for pass-throughs inefficient, because of the confusion about calculating yield to maturity, but Senft expressed the opinion that the volatility of GNMAs is somewhat higher than it should be. In answer to a question, he said that the FHA experience, modified as noted above, works fairly well for GNMAs but poorly for FHLMCs. He added that even in the case of the GNMAs it is very difficult to estimate the probable prepayment experience on a new issue. He said research at First Boston on this subject is continuing.

11. EVERYTHING YOU WANTED TO KNOW BUT WERE AFRAID TO ASK ABOUT THE TREASURY YIELD CURVE (Fall, 1978)

John Barry and Herbert Ayres distributed two papers bearing the title of the presentation, one technical and the other non-technical.

John V. Barry, Vice President, and Herbert F. Ayres, Vice President, J.P. Morgan & Co., Inc. presented a

theory of the structure of the government bond market. The theory casts doubt on a number of popular approaches to profiting from swaps and rate anticipation, suggests an approach to arbitraging, and discredits much of the published theory of bond markets.

Ayers began by describing the theory as originating in observations of successful bond trading. The first step was the axiomatic derivation of an equation to represent the government yield curve.

If one assumes that (1) any yield can be represented as a weighted combination of a shorter and a longer yield, and (2) the weights do not change with time, Ayres and Barry find the weights are exponential and predict the equilibrium yield curve should have the equation:

$$\gamma(m) = e^{-\lambda(m-m_o)}\gamma(m_o) + (1-e^{-\lambda(m-m_o)})\gamma(\infty)$$

where $\gamma(m)$ is the yield to maturity of a bond of maturity m, $m_o \leq m$,

$\gamma(\infty)$ is the yield on a consol (estimated from the curve for finite maturities), λ is an empirical constant.

Testing over the period July 1966 through August 1974 confirmed the form of the equation, and λ was found to be about .56.

The "residual" term, embracing the opportunities for swapping and arbitrage, was found to be "doubly stochastic, in time and maturity." In simpler language, arbitrage and swapping opportunities arise randomly and disappear.

Changes in the long rates and changes in the spread between the short rate and the long rate for governments, were found to be independent. Ayres argued that a shift in the yield curve comes about because of two independent changes in expectations. A shift in the long rate is the result of changed expectations with respect to the long term future, while a shift in the spread results from changed expectations with respect to deviations of short term factors, such as real growth and inflation, from their expected long term trends.

Barry dealt with use of the model, and discussed the conclusion that forecasting the direction of change in the yield on consols is the key to profits in the bond market. The strategy deduced from the model is very simple:
If the direction is down, buy everything, if up, short everything. He showed that successful forecasts of the direction of movement are almost as profitable as complete clairvoyance with respect to all government issues.

Ayres closed with the observation that their work concluded that the Capital Asset Pricing Model does not work for the bond market even though it is much simpler than the stock market. Duration, however, while it is not necessarily a risk measure, is the proper measure of price/interest rate sensitivity among bonds of comparable default risk.

12. THE MULTI-FIRM BOND ISSUE AS A RISK REDUCING AND FUND RAISING FINANCIAL INSTRUMENT (Spring, 1979)

Altman distributed a paper by himself and Paul Tubiana, "The Multi-Firm Bond Issue as a Risk Reducing and Fund Raising Financial Instrument."

Edward I. Altman, Professor of Finance, Graduate School of Business Administration, New York University, described multi-firm bond issues in France as an interesting financing device that might have some application in the United States. He began with the observation that investors are used to thinking about bonds in terms of industry or sector groups, or in terms of diversified portfolios. But issuers in the United States rarely think in these terms. There have been a few examples of joint ventures, in which a number of corporations pooled resources and floated bond issues for the ventures, but nothing quite like the multi-firm bond issues that can be found in other countries, particularly France and Japan.

Since World War II, over $7 billion have been raised in France by group corporate financing. And in the period 1971-1977, over 30% of all private debt issues in France were group financing issues.

The groupement was devised in France after World War II to enable small and medium size corporations to tap the public bond market. Most groupements consist of several firms in the same industry, although some have been organized across industry lines. The groupement is essentially a financing entity whose members are the corporations seeking financing. The public offering is made directly by the groupement, and the member firms draw down their shares of the proceeds, less the cost of flotation and the guarantee fund. The guarantee fund usually amounts to 10% of the issue, and will be invested, commonly in French government bonds. Each member of the groupement is liable for the repayment of its share of the issue, but the entire guarantee fund is available in the event of a default. So the investor is better protected in the case of a groupement offering than in the case, for example, of a U. S. – style bond fund. While the bond fund may offer the advantages of diversification,

the investor cannot avoid some loss if one bond defaults.

Altman's paper provided the details of a steel industry groupement offering of $25 million in 1976, and showed the calculation for each member of the cost of issue. The cost is a function of the interest rate offered to investors, the size of the guarantee fund, the investment proceeds of this fund, flotation costs, and the amortization schedule.

Altman had compared yields available to investors on groupement issues and on single corporate issues. One might expect to find the groupement issues yielding less, because of reduced risk. But there appears to be no consistent difference between the groupement and the individual issues. This may be due in part to the fact that the individual issues are always those of substantial companies, while the groupements include small and medium size companies. The role of the French government in rescuing companies and industries that find themselves in difficulty will also affect market yields.

While it is easy to see advantages to small issuers in the groupement device, Altman suggested that large companies may find advantages too, despite the fact that they may be joining companies with lower credit ratings. Use of the groupement may enable a large company to finance more or less continuously, raising small amounts at frequent intervals rather than arranging infrequent but large offerings.

The chief difficulty in adapting the groupement to the United States appears to lie in laws and regulatory agencies concerned with competition and anti-competitive practices. Even if a groupement were organized across industry lines, so as not to include any two companies that competed directly, Altman anticipated opposition from government agencies. He argued though that the groupement might offer competitive benefits through improved access to capital markets for small and medium sized companies. And he closed with a suggestion that there could be benefits to U.S. companies generally in an international market, with resulting productivity and employment benefits to the U.S. economy.

Responding to questions, he agreed that problems are presented when companies with different credit ratings are combined in a single groupement. The stronger companies would be making an apparent sacrifice in joining weaker companies for a common offering. Savings in administrative costs and advantages in continuous financing might overcome the disadvantage. Altman closed by commenting that his research was not yet complete and he would welcome suggestions from participants.

BONDS – PORTFOLIO MANAGEMENT

13. REAL RETURN MANAGEMENT (Fall 1982)

A paper entitled "Real Return Management" was distributed by Alan D. Segars.

Alan D. Segars, President, Real Return Investment Management Company, described a technique he has developed to achieve a long run positive real return on a portfolio of fixed income assets. There are two aspects to his methodology. The first is a new management input, which he called the "inflation hedge discipline," or "inflation hedge indicator." The second is a process which combines the inflation hedge discipline with interest rate anticipation.

Segars set out a number of objectives of real income investing. The first is the achievement of a real secular portfolio return. His procedure sets the minimum return objective as a 2% premium above the inflation assumption of a plan sponsor. The second objective is flexible, risk controlled management. He emphasized the aspect of manager flexibility, rather than sponsor control of risk. While immunization, perhaps in the form of contingent immunization, can be a part of the investment process, Segars sees it only as a last resort, when the inflation hedge discipline and rate anticipation have proved unsuccessful. A third objective is plan sponsor responsiveness. It is important that the process help to further understanding between the manager and the plan sponsor. A fourth objective is establishment of a link between constrained and unconstrained management. Unconstrained management is characterized by interest rate anticipation, while constrained management implies the imposition by the plan sponsor of risk control.

Segars presented data by months from 1969 through 1981 for real yields on CD's, and long treasury bonds. The investment vehicles used in his method of management are bonds, cash (that is, CD's), or hedged bonds. He presented a primary set of decision rules:

1. If real yields on cash exceed real yields on bonds then invest in cash.
2. If real yields on bonds exceed real yields on cash and exceed 1%, then buy bonds.
3. If real yields on bonds exceed real yields on cash but are less than 1%, then buy bonds hedged with futures contracts.

In answer to a question, Segars explained that the choice of the one percent figure in the decision rule was made on the basis of testing a variety of decision rules on the historic data.

A secondary set of decision rules provides for some flexibility on the part of the manager. Segars' point was that a set of entirely mechanical rules is not likely to prove satisfactory under all conditions. He described a number of conditions under which one would want to use the primary decision rules as a guide, but would deviate from these rules on the basis of judgment.

The simulation results indicated the success of the methodology over the time period tested. Segars went on to show results for defensive and offensive periods. The success ratio was 64% during offensive periods and 77% during defensive periods. Since the method appeared to work best in defensive periods, it would be appropriate to rely more on other inputs for management decisions in offensive periods.

Finally, Segars presented some annual comparative rates of return, for investment in CD's, bonds, hedged bonds, and an inflation hedged portfolio run using the decision rules he had described. The compound annual average rates of return for 1970 through 1981 for the four vehicles were 9.6%, 5.7%, 9.4%, and 11.6%.

14. BOND PERFORMANCE MEASUREMENT (Fall, 1978)

Peter Dietz, Vice President, Frank Russell Company, Inc., began by suggesting that a better title for this presentation might be "analyzing bond returns." He expressed the opinion that no satisfactory risk measure for bond portfolios has yet been devised, and the best one can do is to analyze returns. The model he and Russell Fogler had developed decomposed the total return on a bond portfolio into four components, one known in advance and three unknown until the end of the measurement period. The known component is the promised yield to maturity. The unknown components are the interest rate shift over the measurement period, the sector and quality differentials (the differences in return among four sectors and four quality ratings), and the residual which encompasses all other sources of gain or loss.

Russell Fogler, Associate Professor of Management, University of Florida, described the measurement process, referring to tables reproduced below. The promised yield to maturity is calculated first. This is quite straightforward, and can be calculated for a portfolio as the weighted average yield to maturity of the component issues at the beginning of the measurement period. Next we add the interest rate effects. We assume that the change in yield to maturity for a particular bond issue is the same as the change in yield to maturity for a U.S. Government bond of the same maturity. And we calculate the rate of return on the bond that is due to this shift in interest rates. Having identified two components of the total return

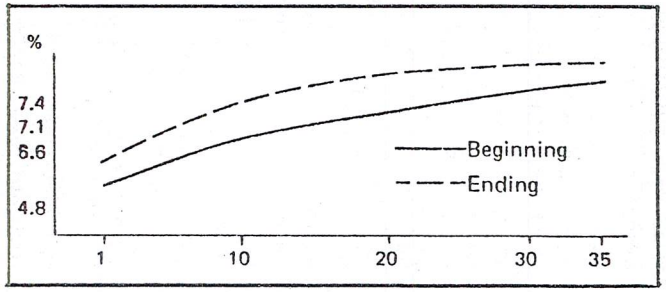
Capital Placement Division

BOND MARKET SUMMARY

January 1977—March 1977

GENERAL PERSPECTIVE

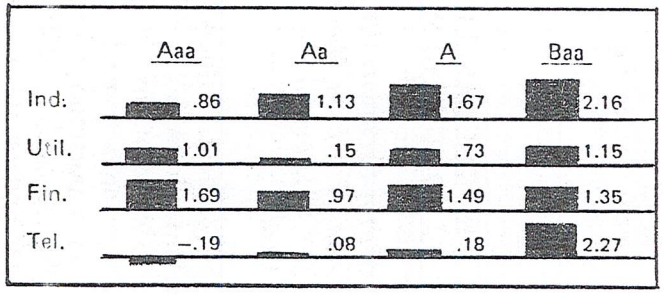
GOVERNMENT YIELD CURVE SHIFT



Government interest rates rose during the first quarter, with the greatest rise occuring in the intermediate range (approximately 70 basis points).

Other sectors had smaller rate rises, as shown below by the positive .87% as well as indicated by predominately positive sector/quality results in the accompanying chart.

SECTOR/QUALITY RETURNS (UNWEIGHTED)



The above statistics are the average excess return after subtracting yield-to-maturity and the impact of the shift in government interest rates. For example, Aaa Industrials averaged .86% better than a government bond of similar maturity, adjusted for the beginning yield-to-maturity differences.

Lower quality issues performed slightly better, and most sectors (except higher quality telephones) performed better than government bonds of similar maturity.

UNIVERSE TOTAL RETURN

Total Return		Adjusted Beginning Y-T-M		Interest Rate Effect		Sector/Quality Return		Residual
−1.25	=	2.06	+	−4.13	+	.87	+	−.05

For 1,497 issues with a dollar value of over fifty million, the average return was −1.25% for the first quarter. Most of this result was due to the overall rise in interest rates. The 1,497 issues had a dollar-weighted maturity of 19.5 years, coupon average of 7.9%, and a quality average of 2.3 (Aaa = 1, Baa = 4, lower = 5).

October, 1978

for the bond we subtract these components from the total return for the period to arrive at a residual. We then attribute this residual to the appropriate sector and quality rating. We continue this process for all of the bonds under observation, and then we calculate the unweighted average of all the residuals for each sector and quality rating. These are shown in the accompanying tables. We go back now to the individual issues. We have already calculated for each one the yield to maturity and the interest rate effect. We next identify the sector and quality return for this bond, by reference to our tables of returns for the four quality ratings and four sectors. We now have three components for the total return, and we simply designate the remainder of the total return as the "residual" or fourth component. As a reference standard, we compute the four components for the universe of bonds under observation. This also is shown in the accompanying tables.

Fogler went on to show how the method may be used to analyze the rate of return experience of a particular manager. The second set of accompanying tables show the total return and its four components for the manager's portfolio as of the beginning of the measurement period. The total return and its components for the market, that is the entire set of bonds under observation, are also shown, together with the differences between the component returns for the manager and the component returns for the market. The end result enables us to identify the sources of difference between the market return and the manager return. In the example, the manager outperformed the market for the first quarter of 1977 by 2.17% in total return. Of this, .08% was the result of holding a portfolio with a higher yield to maturity than that for the entire market. Another .29% of the superiority came from holding a shorter portfolio than the market and hence losing less as interest rates rose. The sector and quality characteristics of the manager's portfolio cost it .07% in return relative to the return on the market, and 1.8% of the superior performance is attributable to factors other than yield to maturity, shifts in interest rates and sector and quality spreads.

Dietz went on to show the use of the analytic method to compare three managers, identifying the sources of the rate of return differences among them. The differentials for each of the components of total return were consistent with what one would expect from observation of the maturity, sector and quality differences among the managers.

Dietz and Fogler both expressed the opinion that the "residual" component of return will probably average zero over time for any particular manager. They intend to examine a historic record of the component to see just how efficient the bond market is.

15. THE BASELINE PORTFOLIO AND BOND PORTFOLIO MANAGEMENT (Fall, 1978)

Martin Leibowitz distributed a paper: "Goal-Oriented Bond Portfolio Management: The 'Baseline' Method for Relating Short-term Performance to Long-Term Goals."

Martin L. Leibowitz, Partner and Manager of Bond Portfolio Analysis Group, Salomon Brothers, began by commenting on the unattractive features of reliance on a single total return measure for evaluating bond portfolio performance. Like Dietz and Fogler, he suggested a decomposition of performance to better understand just what the manager has done, and like Barry and Ayres, he noted that the effects of interest rate changes dominate all other elements of short term performance. His presentation was unique, however, in its recommended benchmark against which to judge the components of performance. The benchmark was his baseline portfolio.

The baseline portfolio could perhaps be identified as the portfolio that would be selected if the choice were made to rely entirely on passive rather than active management. Deliberate departures from the baseline portfolio would then be based upon strategic and tactical market judgments made by the portfolio manager. Once the baseline portfolio is established, one can judge proposed departures in terms of expected improvements in performance, and the risk inherent in those departures.

The most difficult part of the proposal was probably the establishment of the baseline portfolio for any particular fund. Leibowitz suggested beginning with the entire bond market as a potential baseline portfolio, examining how this particular portfolio would behave under various conditions, conditions of high and low interest rates for example, and modifying it to improve the return potential or reduce risk exposure in accordance with the general needs of the particular fund. The baseline portfolio might turn out, for a particular fund, to be very similar to a bond index. On the other hand, it might be unlike any bond index.

The actual portfolio chosen by a manager will differ from the baseline portfolio for a number of reasons. Judgments with respect to shifts in the level of interest rates and in the shape of the yield curve may call for departures in terms of average maturity and the distribution of maturities. Judgments with respect

MANAGER #1

First Quarter, 1977

Return Analysis (Beginning Portfolio)	Total Return		Adjusted Beginning Y-T-M		Interest Rate Effect		Sector/ Quality Return		Residual
1. Return of Beginning Portfolio	0.92%	=	2.14	+	(3.84%)	+	0.80	+	1.82
2. Market Return	(1.25)	=	2.06	+	(4.13)	+	0.87	+	(0.05)
3. Management Differential	2.17%	=	0.08	+	0.29%	+	(0.07)	+	1.87

Manager #1's static portfolio performed considerably better (+2.17%) than the market portfolio. This better performance was mainly attributable to 1.87% from "Other Selection Effects," which occurred on several bonds as shown below (Portfolio Review); also, about 0.29% additional return was experienced because of the shorter maturity of this portfolio (13.5 years) versus the market average maturity of 19.5 years.

Activity Factor	Total Reported Return	vs.	Return on Beginning Portfolio	=	Activity Factor
	0.30	–	0.92	=	(0.62%)

Account Descriptors	Universe	Manager
Maturity	19.5 Yrs.	13.5 Yrs.
Coupon	7.9%	8.2%
Quality	2.3	2.2

October, 1978

to spreads among sectors and qualities may call for quality and sector weightings that differ from those in the baseline portfolio. At the end of a performance measurement period, which may be fairly short, one can measure the performance that would have been achieved by the baseline portfolio, and compare it to the actual performance. This will give an overall evaluation of the short term success of the manager's deliberate departures from the baseline strategy, and should be more useful than a comparison between the performance of the actual portfolio and the performance of a market index or of the market as a whole, since it focuses on the effect of short term departures from a strategy that was judged to be appropriate over the long run for the particular fund.

An even more valuable application of the baseline methodology comes in the planning of departures from the baseline portfolio, rather than evaluating performance after the fact. Leibowitz discussed a manager's prospective evaluation of the trade-off between the expected additional return and the expected risk in a departure from the baseline portfolio. Risk in this context represents the likelihood of falling below the performance of the baseline portfolio. This sort of analysis can be applied to adjustments of maturity structures as well as to sector and quality strategy. Having identified what the manager proposes to do and why, one can construct scenarios reflecting changes in spreads, and shifts in the level and shape of the yield curve, and describe the expected performance of the baseline portfolio and of the manager's proposed portfolio for these scenarios. One can then judge the appropriateness of the expected return and risk trade-offs implicit in the manager's judgment.

The most important stage in the entire procedure seems to be establishment of the baseline portfolio. One participant suggested that one might begin with the actual portfolio rather than the whole bond market, and modify it by removing all of the positions taken by the manager that reflect his responses to short run predictions with respect to shifts in spreads and the yield curve.

16. BOND PORTFOLIO OPTIMIZATION (Fall, 1978)

H. Gifford Fong, President, Gifford Fong Associates, described the use of a mathematical optimizing model to assemble bond portfolios. Essentially, the model selects a portfolio so as to maximize the expected total return subject to a specified risk constraint.

The portfolio selection process begins with projections of shifts in the yield curve in the form of three scenarios. To each of the scenarios there is attached a probability, so that one can calculate for any particular bond the rate of return for that bond that goes with each of the scenarios and with the most likely yield curve shift. Fong commented, as others had previously noted, that shifts in the yield curve dominate the short-term performance of a bond. But shifts in quality and sector spreads will have some effect, and the model calls for a set of projected spreads for different qualities, sectors and coupons.

Once the scenarios, the probabilities, and the spreads have been supplied, the model considers each of the bonds currently held in a portfolio and each of the bonds that are candidates for purchase, calculating for each scenario and for the most likely yield curve shift the total return for each bond and a number of other performance measures, to a specified time horizon. The same performance measures are calculated for the portfolio currently held, and for a portfolio selected by means of a linear programming technique to maximize the expected total return.

The user of the model may impose a risk constraint. The risk measure used is the range from the best to the worst performance across the three scenarios. The user specifies the maximum permissible range, and the model will select the portfolio that stays within this range and offers the maximum expected return.

A number of other constraints may be imposed on the portfolio. Maximum and minimum concentration of the portfolio in each bond and in each group of bonds may be specified. Turnover constraints, for each bond and for the portfolio as a whole, and a duration constraint may be imposed. Transactions costs can be allowed for as a percent of the transaction value.

The final output of the model lists buy recommendations, sell recommendations, the optimal portfolio composition, the transaction costs incurred in reaching this portfolio, the expected performance of each component of the optimal portfolio, and a sensitivity analysis indicating the expected return that could be achieved by relaxing the constraints. Fong used a specific example to illustrate input and output for the model.

17. BOND PORTFOLIO ANALYSIS (Spring, 1978)

James Kaplan and James Pearson distributed a paper: "Bond Returns Under Conditions of Uncertainty," and Arthur Williams and Robert Kavee distributed a

paper by themselves and Franklin Hendler: "The Bond Market Line and Other Descriptions of Reward and Risk for Fixed Income Portfolios."

James Kaplan and James Pearson, Vice Presidents, Gifford Fong Associates, described a model for estimating the expected return and risk on a bond portfolio. Kaplan began the presentation, discussing some of the differences in the description and estimation of risk and return, between stocks and bonds. Echoing some of the uses George Oldfield had described for his model, Kaplan described the forecasting of returns on a bond portfolio as essentially estimating the change in value of the portfolio from the present to a future time at which a new term structure of interest rates will have been established.

Pearson continued the discussion, describing a forecasting mechanism that consists essentially of establishing yield curve scenarios, predicting a yield to maturity as of a specified time horizon, for every maturity that is of interest to a portfolio manager. A probability can be attached to each scenario, and he showed graphs illustrating the use of five equally weighted scenarios. The future performance of each issue in a portfolio can then be calculated, based on a particular scenario. The return on the issue will consist of price change, coupon receipts, interest earned on the investment of these receipts, and interest earned on the reinvestment of maturing issues. The computer model calculates the total return for each issue, for each scenario. Using the weights attached to the scenario, it then calculated an expected return for each issue, and a standard deviation that is derived from the results of the various scenarios. The end product is a graph of expected return, to a specified time horizon, and standard deviation of return, for every issue in the portfolio. Using this graph, the portfolio manager can identify the issues that apparently offer an inferior risk and return combination.

Arthur Williams III, Manager, Institutional Computer Services and Robert C. Kavee, Manager, Institutional Applications Development, Merrill Lynch, Pierce, Fenner & Smith, Inc., described the use of the market line concept at Merrill Lynch, to measure performance of bond portfolios. Williams began the presentation with a discussion of the problem that faced the Merrill Lynch performance measurement service in 1977. The service was offering rate of return calculations, which indeed measured what had happened to a bond portfolio, but it offered no guidance as to the "why" of that performance. What was required was a methodology that would provide separate measures of risk and return, that would be cost effective, and that would be easy for clients to understand.

The development of a new approach was aided by the substantial bond pricing operation at Merrill Lynch. Several thousand corporate and government bond issues are priced daily, and the bond pricing department maintains a Master Index (representing some $500 billion in governments and corporates) and 60 sub-indices. Williams presented a number of charts illustrating the performance of the Master Index, and relative performances of sub-indices, and went on to show an example of a market line analysis for a client bond portfolio. The market line is constructed from two points, plotted on a graph of return versus standard deviation. One point represents treasury bills, which are assumed to have zero standard deviation. The other point represents the return and standard deviation for the Merrill Lynch Master Index, for the time period under consideration. The performances of sub-indices and of the client bond portfolio are plotted, and their relationship to the market line gives an indication of inferior or superior performance.

Kavee discussed the rationale for the particular measurement model chosen. The possibility of developing bond portfolio beta coefficients had been explored, and a number of indexes had been tested as possible references for calculation of the coefficients. However, none of the indexes led to significant betas. Duration was considered as a risk measure, but was found to be unsatisfactory because part of the interest rate risk in a bond portfolio is a function of changes in the shape of the term structure of interest rates, as well as the level of interest rates. Finally, variability, as measured by standard deviation of return, seemed to be the best overall risk measure.

18. BOND INVESTMENT STRATEGIES (Fall, 1977)

Hugo Schielke distributed a paper: "Bond Investment Strategy."

The panel for this session consisted of Madeline Einhorn Glick, Vice President and Director, BEA Associates, Inc., Hugo J. H. Schielke, Chief Investment Officer, Treasurer's Department, International Bank for Reconstruction and Development, and John H. Watts, III, Vice President and Treasurer, Fisher, Francis, Trees & Watts. Madeline Glick began, with a description of an analysis at BEA Associates, Inc., that compared the performances of high and low grade stock and bond portfolios, constructed on the basis of rather simple criteria, with no credit analysis. John

Watts followed, with a discussion of problems encountered in establishing and adhering to risk guidelines, and Hugo Schielke concluded the panel with a discussion of the use of yield curve forecasts to form appropriate bond portfolio strategies at the World Bank.

Madeline Glick began with the observation that risk aversion on the part of bond investors usually takes the form of limitations in terms of bond ratings (e.g., nothing below single A), and maturity (e.g., nothing longer than 12 years). She and Pat Regan of BEA Associates carried out performance comparisons based upon two bond portfolios, one high-grade (AAA and AA) and one low-grade (BBB to CCC). Each portfolio consisted of 30 issues, chosen on the basis of fairly simple criteria. To be eligible, a bond issue had to be sizable (at least $25 million outstanding in 1971), with a maturity of at least 10 years, and issued by a company with publicly traded stock. No convertibles were included, no Canadian issues, no rails or captive finance companies. No more than one issue per issuer was included, and generally the choice was the largest and most actively traded issue outstanding. Each portfolio consisted of $15 million in bonds, and issues were included on the basis of equal dollar weighting as of June 30, 1971.

Once the high and low-grade bond portfolios had been made up, corresponding portfolios of the equities underlying these bonds were made up.

Over the six-year period, income was reinvested in the appropriate stock or bond issue at the end of each quarter. Redemptions were accounted for, as were pro-rata shares of sinking funds.

Rate of return results over the 24 quarters were as follows:

Portfolio	Value on 6/30/77 of a $1.00 Investment Made on 6/30/71	Avg. Annual Rate of Return
Low-grade bonds	$2.00	12.26%
High-grade bonds	$1.62	8.34%
Salomon Brothers Bond Index	$1.59	8.08%
Treasury Bills	$1.41	5.84%
Low-grade stocks	$1.67	8.93%
High-grade stocks	$1.67	8.97%
S & P 500 Index	$1.26	3.90%

The superior performance of the low-grade bond portfolio was achieved despite the fact that two companies whose bonds were included in the portfolio went bankrupt.

An analysis of variability in the 24 quarterly rates of return indicated that the low-grade bond portfolio contained a good deal of independent risk, while the high-grade portfolio tracked the Salomon Brothers Index very closely. The implication appeared to be that the high-grade bond market is rather efficient, and probably offers much less opportunity for skillful management than does the low-grade market. The high-grade stock portfolio had a rather low beta (.83) as might have been expected, while the low-grade portfolio had a high beta (1.34). In both cases, the correlation with the S & P 500 Index was rather low.

Risk adjusted returns for the stock portfolios revealed nothing spectacular, but after the bond portfolio returns had been risk adjusted, using duration, the high-grade bond portfolio showed a return of .41% over the Salomon Brothers Index return, while the low-grade portfolio showed an extra return of 4.18%. Further, the low-grade bond portfolio outperformed the high-grade bond portfolio in 71% of the 24 quarters.

John Watts began by describing two problems he has encountered at the outset of the process of developing bond portfolio strategy, and two more encountered in ongoing portfolio management. First, those responsible for supervision of a bond portfolio have difficulty thinking in terms of a time horizon longer than their own careers or job assignments. Second, in developing investment strategies, there is a tendency to go through allocation exercises assuming the alternatives can be represented by stock, bond and money market indexes, ignoring any interrelationships among stocks, bonds and money market instruments. Working with three indexes, and assuming they are unrelated, is likely to lead to an over emphasis on bonds, and unnecessarily low rate of return expectations.

The first problem encountered in implementing investment strategy had to do with disappointment in equity portfolios. Clients tended to be unsuccessful in persuading their equity portfolio managers to follow the equity strategies that had been agreed on. In particular, there has been a tendency in recent years for equity managers to reduce risk below the levels sought by clients. As a result, the clients have asked for increased risk in their fixed-income portfolios. A second, and related, difficulty in implementing strategy results from a tendency of clients to forget the strategies that have been agreed to. Once again, the likely result is pressure to increase the risk level of fixed-income portfolios. Watts argued that if investment risk is to be increased, it is generally better to raise the risk level in an equity portfolio, rather than to turn to greater risk in fixed-income portfolios.

He was encouraged by an increasing realization on the part of institutional clients that the strategic decision is a crucial step, and that strategy is something that calls for continuous review. His firm has found a single capital market line useful for evaluating the results of bond portfolio management. The performance of a series of indexes is plotted in terms of total return and risk (measured as total variability). To this plot is added the selected risk level of the particular bond portfolio, and finally the performance of the portfolio. Plotting the agreed on risk level has been particularly useful in helping clients, and is probably more valuable than measuring portfolio return itself.

Hugo Schielke completed the panel discussion with a description of the process by which decisions are made at the World Bank. This process begins with forecasts of yields on three-month and one-year Treasury Bills and five-year Treasury Notes, one, three and six months in the future. A second step adds a probability distribution to these yield forecasts, with each member of the Investment Strategy Committee supplying four forecasts, rather than one, for each instrument and each time horizon, ranging from a very low to a very high forecast.

The third step combines the distributions forecasted by the members of the Committee, to produce a consensus forecast, with accompanying standard deviations. From the consensus forecast, an expected rate of return is calculated. And from the standard deviations, a range of possible rates of return is calculated. The next step is to develop a range of possible rates of return at 10% and 90% confidence limits, from which one can see approximately the risk involved in each instrument.

Finally, a mathematical optimizing technique develops an efficient set of instruments, achieving the best risk and return combinations subject to constraints, including limitations on holdings of various instruments. The efficient frontier then represents the investment strategy, given the forecasts of the Committee members.

In the course of questions directed to the panel, there was some discussion of liquidity and marketability needs in a bond portfolio. Hugo Schielke explained that all of the holdings in the World Bank portfolio are highly liquid, so that the investment strategies need not take liquidity explicitly into consideration. John Watts commented that the BEA analysis may have ignored a sacrifice of marketability in the low-grade portfolio. One participant commented that the low-grade portfolio will tend to generate large amounts of cash, because of high current yields, and that this will tend to restore liquidity.

19. HOW TO STRUCTURE A PORTFOLIO ALONG THE YIELD CURVE (Fall, 1977)

Martin L. Leibowitz, Vice President and Director of Investment Systems, Salomon Brothers, presented an analytic process that would enable a bond portfolio manager to test the effects of probable and possible changes in the yield curve on his portfolio, and on alternative portfolios. The end result would enable the manager to see the effect of these changes in terms of probable rates of return and exposure to possible loss. The entire analysis was in terms reasonably familiar to professional managers, and should facilitate a comparison of risk and return for various portfolio possibilities, and the selection of the maturity structure representing the best risk-return tradeoff.

Leibowitz began by identifying three sources of return on a bond portfolio. The first is the familiar coupon interest. The second is the gain that comes about from a constant maturity structure. Over time, a long bond becomes a short bond, and over at least a portion of the normal yield curve, the result will be a decline in yield and a rise in price. These two sources of total return, coupon income and gain from constant maturity structure, Leibowitz referred to as "rollover yield," since they make up the total return that results from simply leaving bonds in a portfolio, allowing their maturities to shorten over time, and replacing short or matured issues with long issues.

The third source of total return he identified as gain from changing maturity structure. This is the gain (or loss) that results when the yield curve shifts down or up, so that prices correspondingly shift up or down. For any particular maturity we can calculate, and plot on a graph, the change in price that will accompany a change of one basis point in yield to maturity. This is the familiar bond duration.

Leibowitz introduced another term, horizon volatility. This is the change in rate of return to a chosen horizon, corresponding to a single basis point change in yield to maturity. This is a useful concept, since it measures directly the total performance of a bond over a future period. The concept was discussed in the preceding session by McCulloch. Horizon volatility is very similar to price volatility, since most of the change in total return to a time horizon is brought about by price change. Horizon volatility, like price volatility, increases with maturity. One can gain some feel for horizon volatility by plotting horizon return (the total return on a bond to a particular time horizon) against changes in the yield to maturity, effective at that horizon.

Horizon volatility, like duration, is not a complete

measure of the exposure of horizon return to a change in yields. It measures the sensitivity of the horizon for a particular issue to changes in the yield to maturity on that issue. But it does not measure sensitivity to changes in any other yield. A somewhat more useful concept, proposed by Leibowitz, is "proportional volatility." Proportional volatility is the sensitivity of horizon return not simply to changes in the yield on the bond being considered, but to changes in the yield at some benchmark maturity.

Once we have chosen a benchmark maturity, we can relate the sensitivity of returns on all bonds to changes in the yield at this benchmark maturity, through the proportional volatilities of the bonds. Porportional volatility for a bond is equal to horizon volatility multiplied by what Leibowitz referred to as a "proportional yield response factor." Horizon volatility has an objective, mathematically determined value. The proportional yield response factor calls for subjective evaluation. Specifically, it calls for an evaluation of the yield change at any particular maturity that will correspond to a unit yield change at the benchmark maturity. So proportional volatility is not an easy number to estimate for a particular bond issue. Proportional volatility will generally rise with maturity, as horizon volatility rises. But over some maturity ranges, this relationship may reverse, due to the effect of the proportional yield response factor. Leibowitz showed a graph on which proportional volatility rose with maturity up to a maturity of about 28 years, and then declined.

Having established the concepts necessary to his analysis, Leibowitz turned to set up a number of yield curve scenarios, suggesting that the portfolio manager might compare the present yield curve with the yield curve most likely to exist at his time horizon, together with optimistic and pessimistic yield curves at that time horizon. The manager can then plot horizon returns for each maturity, for each of his yield curve scenarios. What may be more useful, he can plot the horizon returns of bond portfolios, either the portfolio he holds or portfolios he is considering, for each of the scenarios. The most important scenarios are probably the most likely and the pessimistic horizon yield curves. The first will indicate the horizon return that is most likely for each portfolio under consideration, while the second will indicate the risk of loss for each of these portfolios. At this point it may be clear that some possible portfolios dominate others. That is, under both most likely and most pessimistic conditions some portfolios will be superior to others, and the others can be discarded from consideration. Other comparisons will not be as simple: one portfolio will produce a better horizon return for the most likely scenario, but a worse return for the pessimistic scenario, than a second portfolio. The choice between these two portfolios will depend upon the manager's risk-return trade-off.

20. BOND PORTFOLIO ANALYSIS (Fall, 1977)

Wayne Wagner distributed a reprint from Pension World, *authored by himself and Dennis Tito: "Definitive New Measures of Bond Performance and Risk." William Madden distributed a paper: "The Equivalent Bond Formalism: A Procedure for Determining Yields and Maturities of Bond Portfolios."*

Wayne Wagner, Vice President, Wilshire Associates, Inc., described a bond portfolio performance measurement technique making use of a bond market line, and duration as a measure of bond market risk. William B. Madden, Managing Associate, Index Systems, Inc., described an approach for determining the yield and maturity of a single bond that is equivalent to a bond portfolio.

Wagner began by showing some market lines, constructed by plotting quarterly rates of return on Treasury bills, and a number of bond indexes, against duration of the bills and the indexes. For the quarter ending June 1977, the points plotted lay very close to an upward sloping straight line. For other quarters, however, the fit of the points to the line was not as good. In particular, an index for Baa bonds was apt to plot above the line for periods during which returns had been high, and below the line for periods during which returns had been low. Since the market line treated duration as the sole risk measure, and the analysis did not account separately for default risk, any increase in risk premiums would lead to a graph in which low grade indexes plotted below the line and very high grade indexes above the line. The line itself was fixed by two points: the point corresponding to Treasury bills and the point corresponding to the Kuhn Loeb Bond Index.

Wagner then described briefly the measurement model, one that has been described in more detail in a paper published in *Pension World*. The model identifies four components of the difference between the realized total return on a particular bond portfolio, and the realized return on a bond index. The first component corresponds to the institutional choice of portfolio duration, which will in general be different from the duration of the index, and will lead to different rates of return. The second component corresponds to the manager's own choice of duration, presumably reflecting his forecast of interest rate

changes. His choice of duration may differ from the institutional choice, if he has been given some discretion. The third and fourth components reflect analysis and trading effects. Analysis effects come from the skill of the manager in his selection of the portfolio with which the quarter began. Trading effects is essentially a residual component, reflecting all that is left of the difference between the portfolio return and the index return.

To illustrate use of the analysis, Wagner showed a comparison of the performances of two funds run by the same manager. Overall, the performances of the funds differed substantially over approximately a six year period. An analysis of the return due to policy effects displayed no significant difference between the two funds. The same was true for effects of the manager's interest rate forecasting, and although the record showed differences in analysis effect in 1974-75, there was no net difference between the two funds over the full 1972-77 period. Trading effects, however, were significantly different. Around 1973, the performances of the funds separated, with one fund falling about 5% behind the other. This difference was maintained through the end of 1977. Wagner attributed the difference in trading effect to rapid growth of the poorer performing fund, with heavy investment of new cash flows, and consequently high transactions costs.

Most of the participants were puzzled at the very substantial apparent impact of these transactions costs, and a number of suggestions were offered as to how this might have come about.

Madden began by commenting that the commonly used method for computing aggregate maturity and yield to maturity for a portfolio, which is simply to calculate the market value weighted average maturity and average yield of the issues in the portfolio, is quite incorrect. He proposed a method for identifying an equivalent bond, a bond with a price equal to the value of the portfolio and with a volatility equal to the volatility of the portfolio. There is no direct analytical method to do this. There is in fact an infinite number of pairs of values for maturity and yield to maturity that will produce, for a given coupon, a price equal to the value of the portfolio. Once the second condition is imposed, however, and the volatility of the equivalent bond must be the same as the volatility of the portfolio, only one combination of yield and maturity is possible. Unfortunately, finding this pair is a matter of trial and error. Madden's paper presented the mathematics of the search process.

Some of the participants suggested that it might be simpler to determine the internal rate of return that discounts all of the portfolio cash flows back to the market value of the portfolio, taking this to be the yield to maturity on the equivalent bond. Madden pointed out that this was possible, but that it would imply that the maturity of that equivalent bond was the maturity of the longest bond in the portfolio. This bond did not fulfill his criteria for an equivalent bond. He agreed with other participants, however, that there may be different legitimate ways of specifying the criteria for an equivalent bond.

BONDS – PRICE CHANGES OVER TIME

21. AN ANALYSIS OF GOVERNMENT BOND PRICE CHANGES (Fall, 1980)

A paper by Richard McEnally was distributed.

Richard W. McEnally, Graduate School of Business Administration, University of North Carolina, discussed the decomposition of bond price changes over time as a useful way of understanding the forces that cause price changes and hence of judging risk exposure and making critical decisions in structuring bond portfolios.

He began by identifying four components of bond price change. The first is the price change due simply to the passage of time. If the price of a bond is above or below par value, then in order to maintain a constant yield to maturity price must gradually approach par value over time. This price change, for any time lapse, is easy to calculate. Second, with the passage of time the time to maturity for a bond decreases and unless the yield curve is perfectly flat, the yield to maturity of the bond will change. The change in yield is accompanied by a price change. Again, for a given yield curve it is easy to calculate this price change. Third, if the yield curve changes either its shape or its level as time passes there will be a further change in the bond price. If the shift in the yield curve is known, the change in price can be calculated. Finally, the price of the bond may change for reasons that are unique to that bond, such as a change in marketability, or for reasons that simply cannot be explained. It is generally impossible to calculate this fourth component of price change except by observing the actual price change over time and from it subtracting the first three components. McEnally illustrated the four components graphically and then presented in tabular form the results of observed price changes in U.S. Government bonds and notes by quarters, from 1965 through 1977.

The tabular and graphical presentations made it possible to see the relative magnitude of the four components of price change, and to see how these magnitudes varied from short to long bonds. A particularly interesting comparison was that between the anticipated price change, consisting of the first two elements referred to above, and the unanticipated change, consisting of the third and fourth elements.

The results described so far were cast in terms of average price changes. McEnally also presented variability in the components of price change in the form of mean absolute deviations. And once again it was possible to compare the variability of the four cost component elements and to see how the relative variabilities changed from short to long bonds. McEnally commented that the results suggest there is more variation over time in the anticipated elements of price change for short maturities than there is for long ones. But variations in unanticipated price change elements are greater for the long maturities.

During the discussion period, it was pointed that McEnally's analysis is similar in many respects to the baseline approach to bond portfolio strategy that had been presented by Martin Leibowitz at an earlier Seminar of the Q Group. In both cases, the performance of a bond or portfolio was separated into the normal or anticipated performance and the extraordinary or unanticipated performance, to gain useful insight into risk exposure and a risk-return tradeoff.

22. QUALITY OF MUNICIPAL BONDS (FAll, 1980)

A paper by Jack Treynor, Titled "On the Quality of Municipal Bonds," was distributed.

Jack L. Treynor, Editor, Financial Analysts Journal, began with a picture of municipal financial management dominated by a preoccupation with eleemosynary activities and lacking systematic economic analysis. Municipal finance is essentially an exercise in cost accounting and cash budgeting.

He professed to have no objection to cities helping those who need help, but argued that an analysis of costs and benefits is needed because there is a limit to municipal financial resources, and what is spent for one person is no longer available for another. He proposed to offer a set of considerations that a city should find useful in making spending and investment decisions, one that should prove equally useful to an investor in municipal bonds.

A city survives by attracting labor and capital and by exporting value added. Labor is free to come and go and the only "captive" resource the city can exploit is real estate. Hence the burden of municipal taxes must fall ultimately on real property. A tax on income for example, if it makes working in the city less attractive than working elsewhere, must be passed on or labor will leave. A tax on sales, if it makes prices higher than those of goods available, will send purchasers away. Only the owner of land cannot remove his exposure to city taxes except by abandoning his property. However a municipal tax is expressed then, ultimately its burden is felt as a property tax. For purposes of analysis, the revenue of the city can be taken to consist of real property taxes. From a series of a half dozen simple equations Treynor derived these conclusions:

1. Taxing and borrowing power are not independent, but two aspects of the same resource. The size of this resource is the aggregate market value of real estate in the city. The city's financial objective should be to maximize this value and therefore the resource.

2. In evaluating projects on which expenditures are to be made, the city should use as its cost of capital not the interest rate on municipal debt but the discount rate implicit in the value of real estate in the city. This is the rate that discounts expected rental income to arrive at market value for the property.

3. Expenditures by the city on purely eleemosynary projects, ones that cannot be expected to raise the value of real estate by increasing expected rental income, will reduce the value of the real estate and therefore the city's resources by the amount of the expenditures. It does not matter whether the expenditures are financed directly by tax revenue or by borrowing.

Using the set of simple equations, Treynor demonstrated that a property owner will abandon his property when its value becomes negative, that is when the value of the expected stream of rental income less tax payments becomes negative. He observed that this has happened in the South Bronx. Investors will cease lending to the city when the aggregate gross value of the city's real estate falls below the amount of debt outstanding. That is, when the value of the expected stream of rental income for all city property less the stream of expected operating expenses for the city (excluding debt service) falls below the value of debt outstanding. There will be at this point simply no rental revenue available to service further debt. The aggregate net value of the city real estate is just the difference between the gross value and the value of municipal debt. The city can consume this by borrowing more money or by increasing taxes. This net value is the city's sole financial resource.

The value of municipal debt is the present value of the debt service payments, discounted at the municipal borrowing rate. The gross value of real estate is the present value of expected rental income less municipal expenditures discounted at some appropriate rate. Since the rental income stream will have a substantial element of systematic risk not present in the debt service stream, the appropriate discount rate will be somewhat higher than the municipal borrowing rate. If expenditures by the city on a project are to leave the net value of real estate (and hence the city's financial resource) unchanged, the present value of the expected increase in the rental income stream will have to equal the amount of the expenditures. The discount rate to be used in evaluating projects is therefore the rate appropriate to rental income, not the municipal borrowing rate.

Finally, Treynor's analysis pointed to the market value of city real estate as the ultimate measure of the city's ability to service debt. Risk for the holder of municipal debt lies in unpredictable fluctuations in this value. The Black-Scholes option model explains the relationship between the value of a corporate obligation and fluctuations in the value of corporate assets. The same model relates the value of municipal debt to the value of municipal real estate. The model will therefore value the debt, and there is no purpose to qualitative rating of municipal debt.

23. CORPORATE BONDS: ELEMENTS OF VALUATION AND RISK (Spring, 1979)

Part of the presentation was based on a paper that was distributed: Michel Houglet, "Estimating the Term Structure of Interest Rates for Non-Homogeneous Bonds."

Michel Houglet, Graduate Student of Finance, University of California – Berkeley, and Barr Rosenberg, Professor of Business Administration, University of California – Berkeley & Principal of Barr Rosenberg Associates, presented a model for explaining prices of U.S. government bonds. The model combines a new method of term structure estimation with valuation adjustments for a number of other characteristics of government bonds. The maturity of a government bond is of course a major determinant of its price. But other determinants include call provisions, "flower bond" effects, current yield (because of tax effects), and the convenience of bills as compared to bonds and notes. An additional determinant for federal agencies is an adjustment for perceived risk. The model offers a basis for risk analysis and control in bond portfolio management, possible guidance to arbitrage opportunities, and some basis for analysis of performance.

Rosenberg introduced the model in general terms, describing its two functions: first to process the time stream of payments from a bond by applying a set of forward rates, and second by applying indexes of value (derived from a multiple regression) on other characteristics of the bond, such as a call feature, to make price adjustments for each.

Houglet described the procedure for the term structure. Traditional methods of estimating the term structure of interest rates, that is the set of forward rates or future spot rates that discount future coupon and principal receipts from bonds back to bond prices, generally assume that the bonds used in the calculations are homogeneous in all respects except maturity. And usually the analysis is limited to U.S. government bonds, because the credit risk is the same for all. However, even among government bonds there are differences in some characteristics, such as current yield. And these differences translate into value and price differences. This constitutes what Houglet called the non-homogeneity problem. His method of dealing with the problem was to construct an adjustment function that is a linear function of the significant factors.

A second problem arises from the fact that different bonds pay coupons and mature at different dates. Houglet's method of dealing with this problem was to estimate the discount function for a finite number of dates and to assume that the function between dates is an exponentially decaying function, the rate of decline being the forward rate between the dates. The result is a "piece-wise exponential" discount function. Once the set of dates has been chosen, for each bond the future stream of coupon payments and principal repayment is allocated to the dates. A payment not actually coincident with one of the selected dates is allocated between the previous and subsequent dates, and the allocation makes use of the forward rate over the interval. Once all the payments relating to all the bonds have been allocated, it is possible to apply the pricing formula, that is the discount function, to all of the payments without going to the unmanageable number of parameters that would result from using every date of every payment.

Finally, Houglet had to deal with estimation errors in the discount factor. His solution was a method for smoothing the term structure to produce a plausible set of forward rates.

In describing the output of the model, Houglet showed a comparison, in terms of the proportion of bond price changes explained, of his term structure model with two other models. One of these was a naive equal mean change model, that simply assumed the prices of all bonds changed by the same amount in the same time period. The third model was a duration model, relating price changes to the durations of individual bonds. While the duration model provided generally much better explanation than did the naive model, the term structure model performed consistently better than the duration model.

Rosenberg described the price adjustments for characteristics other than maturity. Since 1975, treasury bills, because of their convenience as compared with other government obligations, seemed to offer about 3 basis points less in return than other instruments. Agency obligations, because of greater perceived risk, offer 10 to 20 basis points more. Because of the tax advantage in discount bonds, current yields affect price and since 1975 each 1% of current yield accounts for about 4 extra basis points of return.

Rosenberg closed with a list of potential applications of the model. These included bond portfolio optimization, valuation of bonds in the absence of a market quotation (for private placements, for example, or for prospective issues) and attribution of returns on bonds and bond portfolios to different factors.

24. MEASURING BOND RISK (Spring, 1978)

George Oldfield distributed a paper: "The Behavior of Default-Free Spot Discount Rates."

George Oldfield, Visiting Professor of Finance, Cornell University, Graduate School of Business, described a model for the continuous determination of spot discount rates. Willard Carlton had described in the preceding session the estimation of the term structure of spot interest rates, at any point in time. Oldfield's work was directed essentially at following this term structure into the future, and estimating the likelihood of any particular configuration at any particular future point in time.

Oldfield's model begins with the proposition that default-free spot rates follow a continuous random walk, analogous to the random walk process that has been proposed for stock prices. In the case of the spot discount rates, the model does not incorporate any drift or trend. The first step in the model is a differential equation, representing the movement, or vibration, of a spot rate. The solution for the differential equation provides a forecast of the spot rate, at a future time, that is a function of the present spot rate, the future time interval, and the variance of the distribution of the spot rate. A transformation of the solution makes it possible to obtain the probability density function for the future spot rate. And finally we arrive at the mean, or expected value, of the future spot rate, and its variance. The mean or expected value is the present spot rate. The variance is proportional to the square of the present spot rate, and the rates are log normally distributed. (This means that spot rates are presumed always to be positive.)

Moving from individual spot rates to the term structure, incorporating a set of spot rates, we arrive at a multivariate function for the set of rates. The probability of a shift of the term structure to a new structure, within some specific bounds, depends upon the location and shape of the current term structure and on the covariance matrix for the spot rates. If the covariances can be estimated, then they can be used together with the current term structure to calculate confidence intervals for future spot rates and term structures.

Knowledge of the present term structure, and an estimate of the term structure at a future date, makes it possible to calculate the price changes, from the present to that future date, of all discount instruments held in a portfolio. And hence one can calculate an estimate of the rate of return on the portfolio from the present to the future date. And from the probability distribution of the future term structure we can calculate the probability distribution of the anticipated rates of return on the portfolio. The model therefore offers a way of estimating the expected return on a portfolio of discount instruments, and the distribution of expected returns, from the present term structure and the covariance matrix.

A number of questions were directed towards assumptions underlying the model, including the zero drift assumption, the log normal distribution, and the use of spot rather than forward rates as the critical variable. Oldfield agreed that the model could be modified to reflect expectations that there is a drift, although he pointed out that in the case of the common stock model the drift accounts for the expected return on a stock, while in the term structure model the term structure itself accounts for an expectation that interest rates may be rising or falling.

25. BOND QUALITY ANALYSIS (Fall, 1977)

Ed Altman and Bob Haldeman distributed a paper: "Zeta Analysis: A New Model to Identify Bankruptcy Risk of Corporations."

Edward I. Altman, Professor of Finance, New York University Graduate School of Business Administration, and Robert G. Haldeman described a new model for predicting corporate bankruptcy, and James H. Scott, Associate Professor of Finance, Columbia University Graduate School of Business, described a model for estimating the probability apparently perceived by investors, of default on a bond.

Altman began with the reasons for developing a new model. A number of bankruptcies in recent years have affected rather large companies, so that a great many investors have a stake in identifying bankruptcy candidates early. The sample of companies used by Altman, in testing the model, included 53 that have gone bankrupt in the years 1962 through 1975, and the average size of these companies was almost $100 million. The new model is one intended to be easily usable by analysts, and reflects recent changes in accounting principles. One of the most significant changes involves capitalization of lease obligations, and preparation of the data base underlying the new model required an extensive review of past financial statements in order to restate the figures to incorporate lease capitalizations.

After extensive testing of almost 30 financial variables, for use in the model, 7 were selected. These were return on assets, stability of earnings, interest coverage, the ratio of retained earnings to total assets, current ratio, the ratio of equity to total capital, and corporate size measured by total assets. The

single most important variable in predicting bankruptcy was found to be the ratio of retained earnings to total assets, essentially a measure of cumulative profitability. Stability of earnings was the second variable in importance, and third was the ratio of equity to total capital. Least important was the return on assets, but all 7 variables taken together were critical to the model's success.

The model makes use of discriminant analysis to compute for each company what Altman terms its "zeta score," and on the basis of these scores firms can be ranked in terms of likelihood of bankruptcy. The Zeta Model is essentially a ranking or classification model, and does not explicitly attach any particular likelihood of bankruptcy to a Zeta score or to a particular company. Given no prior expectations with respect to likelihood of bankruptcy, the model implies that a positive Zeta score puts a company in the non-bankruptcy class, while a negative Zeta score puts it in the prospective bankruptcy class.

Using the Zeta scores in this way, Altman reported tests of the model. The model had performed remarkably well. It had identified 70% of companies headed for bankruptcy, even when given data 5 years prior to the bankruptcy. Given data 1 year prior to bankruptcy, its accuracy was over 90%.

Altman discussed the appropriate cut-off Zeta score, for identifying companies that should be judged in danger of bankruptcy. Allowing for the fact that buying a company headed for bankruptcy is a much more serious mistake than avoiding a company not headed for bankruptcy, he had derived a cut-off score of -.337.

Robert Haldeman continued the description of the Zeta Model, referring to its success in identifying bankruptcy situations, predicting changes in dividends, and predicting changes in bond ratings. Out of 32 rating changes in the year ended August 1977, the model would have anticipated 75% on the basis of Zeta scores. Trends in Zeta scores would have enabled the user of the model to predict another 16% of the rating changes. Haldeman pointed out that predicting rating changes was not a major function of the model, although its success might inspire confidence among users. Predicting dividend changes, however, has proved to be a valuable use of the model.

While Altman's model makes use of accounting data to assess the credit worthiness of a company, Scott's model uses market evaluations of credit instruments to deduce market estimations of likelihood of default. He described his model as essentially aimed at answering the questions: What information can we find in bond prices with respect to perceived default risk in those bonds?

He began by hypothesizing a debt instrument with only one period remaining to maturity. If there is no default, the investor can expect to receive $(1 - t)R +$ par value, with t representing the tax rate applicable to the coupon interest payment, R. If there is a default, the investor can expect to receive some proceeds, designated 1A.

The expected value of the investment in the bond then will be equal to

$$(1 - F)((1 - t)R + \text{par value})) + F1A ,$$

where F is the probability of default,

Finally, assuming the bond is selling at par (to avoid mathematical problems of premiums or discounts), and that the appropriate discount rate for the investor is $(1 - t)r$, where t is again the investor's tax rate, and where r is the riskless interest rate, the price of the bond, D, is given by:

$$D = \frac{(1 - F)(1 - t)R + F1A}{(1 - t)r + F}$$

The relation above will hold for an instrument maturing more than one period in the future, if the term structure of interest rates is flat, and if the probability of failure, F, and the likely proceeds on default, 1A, are the same for all periods.

The yield to maturity of the instrument is now given by:

$$\frac{R}{D} = \frac{(1 - t)r + F(1 - 1A/D)}{(1 - t)(1 - F)}$$

We can rearrange the terms in this equation to identify F, the perceived probability of failure:

$$F = \frac{(1 - t)(R/D - r)}{(D + (1 - t)R - 1A)/D}$$

One can see intuitively that the numerator in the expression on the right hand side of this equation is the extra yield, above a risk-free rate r, that the bond offers. The denominator of the term on the right hand side represents the loss that will be suffered on default, as a fraction of the investment in the bond D. We cannot directly observe either F or 1A, so we must assume one in order to arrive at the other.

Scott took as an example a Consolidated Edison issue, the 9 1/8s of 2004, which sold at 100.25 on

October 19, 1977. On the same date, the yield on U.S. Treasuries was 7.78%, and he assumed a tax rate, t, of 25%. The following table shows pairs of values for 1A/D and F, that satisfy the equation:

Estimate of 1A/D	0	.25	.50	.75	.95
F	.009	.012	.017	.031	.084

Scott was asked about any evidence as to what one might expect in the way of a value of 1A/D. He answered that the studies by Hickman had indicated about 50%. This then would imply a value of .017 for F for this particular bond issue.

Scott went on to describe briefly formulas for estimating the expected loss on a portfolio of risky bonds, both for the investor whose tax rate is approximately equal to the average tax rate of all investors, and for the investor whose tax rate differs from this average.

26. ENERGY AND ECONOMIC GROWTH TO THE YEAR 2000 (Spring, 1980)

Edward L. Allen, Chief Economist, Institute for Energy Analysis, gave the opening address. He began by tracing the origin of the recent sharp increases in the price of oil, demolishing the myth that a shortage of oil was created by an oil company conspiracy. He turned next to a projection of energy demand in the United States, reporting that 1979 consumption was about 78 Quads (a Quad being 10^{15} BTUs) and that the projection for the year 2000 made by the Institute for Energy Analysis is about 95 Quads, reflecting annual growth of about 1% a year. This is down significantly from the 4% annual growth in the decade preceding the 1973 oil crisis.

Energy consumption is related to GNP. GNP can be thought of as the product of man hours and output per man hour or productivity. Growth of the labor force will probably continue to slacken, and productivity has dropped from about 2.5% a year to near zero. As a result, growth in GNP is likely to be in the 2 to 2.5% a year range. Coupling this slow economic growth with improved efficiency in energy use leads to the low expected growth in energy consumption.

Allen turned from energy consumption to energy supply. This year our total energy supply will come 75% from oil and natural gas, 18% from coal, 4% from hydro, and 3% from nuclear power. Imported oil supplies about 22% of the total consumption, up from 9% in 1965. Domestic output of both petroleum and natural gas continues to fall. Although we have very large supplies of coal, the environmental obstacles to its use are substantial and air pollution problems are likely to become more serious. The development of nuclear power is uncertain. Since the Three Mile Island incident, we have had a virtual moratorium on orders for new nuclear plants.

U.S. energy policy is leading to greater reliance on imported oil, which means OPEC oil. OPEC oil production of about 31.3 million barrels of oil a day in 1979 was about the same as 1973 production. Growth is likely to be less than what was predicted a couple of years ago and it appears that oil shortages are more likely than surpluses in 1985 and 1990. Average annual consumption in the 1980s will run about 20 billion barrels a year, and new supplies probably will not match this drawdown. The result is likely to be a cutback in economic growth, perhaps a dampening down rather than an abrupt change. The year 1979 has established beyond doubt that the nation faces a serious energy supply problem.

27. ENERGY MODELS (Spring, 1979)

Hirshfeld distributed a paper by himself and Leo Rapoport: "Energy Models – And What They Are Telling Us About the U.S. Energy Future."

David Hirshfeld, Consultant & Corporate Associate, Ketron, Inc., provided a general introduction to energy models, described a particular model and presented a set of forecasts derived from that model. In general, energy models are based either on engineering or economic analysis. The distinction is substantial and important. The former reflect technological limitations and physical resources, while the latter predict supply and demand responses to price changes. The former have generally produced quite pessimistic forecasts, while the latter have produced optimistic forecasts. In establishing any energy policy it is therefore important to consider what kind of model to use.

The particular model described by Hirshfeld–the LORENDAS Model–is a global model, dealing with sources and uses of oil, coal, gas uranium and electricity on a worldwide basis. It assumes a fixed demand schedule for energy, allowing for substitution of different energy sources but not for any changes in usage resulting from price changes. The analytic structure of the model provides for quite long lead times for the development of energy supplies, and incorporates limits to rates of resource development. It is very much an engineering rather than an economic model. It incorporates 6,000 constraints and 8,000 variables.

The projections discussed by Hirshfeld were based on a run of the model incorporating these assumptions: moderate growth in energy usage, moderate environmental protection regulation, standard government projections of probable gas and oil discoveries in the U.S., consensus expectations for foreign discoveries, and constant oil prices at 1975 levels. The output of the model included projections of exploratory drilling, oil and gas discoveries and production, energy imports, and generation of electric power, for both the U.S. and Europe. Hirshfeld also showed projections reflecting OPEC price increases.

Overall, the projections suggested that U.S. energy production and energy imports would not be greatly affected by OPEC prices. European production and imports would be even less affected. The reason was simply that there is not much room for increasing domestic production and therefore for reducing imports.

Hirshfeld pointed out that the projections are subject to at least three significant reservations. The model does not incorporate any of the non-conventional energy forms, such as oil sands and solar energy. It makes no allowance for possible conservation or for technological innovation that may improve the efficiency of energy usage. Nor does the model make any allowance for possible U.S. reliance on Mexican oil. Hirshfeld argued that this last qualification is probably not important because Mexico charges the OPEC price for oil, and its maximum production is very small compared to OPEC production.

EFFICIENT MARKETS AND PORTFOLIOS AND INVENTORY FUNDS

28. THE TRADING OF COMMON STOCKS BY TRUST DEPARTMENTS OF COMMERCIAL BANKS AND MUTUAL FUNDS AND THE EFFICIENT MARKET THEORY (Spring, 1980)

A paper bearing this title was distributed.

Randolph W. Westerfield, Professor of Finance, The Wharton School, University of Pennsylvania, described a study analyzing the effects of trading in common stocks by bank trust departments and mutual funds. The purpose of the study was a test of the efficient market theory and the ability of banks and mutual funds to outperform the market.

There are two explanations for a possible effect of the trading of banks and mutual funds on common stock prices. The first is an "information effect". If these institutions have information not generally available to other investors or have special skills at analyzing information, then they might be expected to buy stocks on the rise and sell stocks on the decline. Second, there may be a "price pressure" effect. The large quantity of purchases or sales by these institutions may by itself be enough to push prices up or down.

Westerfield made use of data available for quarterly portfolio changes of mutual funds and trust departments of banks filing their changes with the Comptroller of the Currency for the first quarter of 1975 through the first quarter of 1977.

He dealt separately with banks and mutual funds. For the banks, he tabulated for each quarter the total trading by all investors in each of the common stocks held by the banks. He then tabulated the aggregate sales and the aggregate purchases of each of these stocks by the banks. Next he divided the stocks into ten deciles. The first decile included the stocks for which net sales by the banks was a high percentage of total trading. The tenth decile included stocks for which net purchases by the bank was a high percentage of total trading. The same procedure was followed by the mutual funds. For each of the deciles Westerfield calculated the average price change for the stocks in that decile, and the total outstanding market value of the stocks in that decile. All of these results were averaged over the nine quarter period, and some characteristics of the data sample emerged. For the mutual funds, the stocks heavily purchased by the funds rose in price far more than the stocks heavily sold. For the banks, stocks purchased rose about as much as stocks sold. Mutual fund trading tended to be in smaller companies than bank trading, and tended to dominate total trading in the smaller companies.

Next, the study turned to consider the effect of bank and mutual fund trading on the common stock rates of return. For the banks and for the mutual funds Westerfield took the stocks in the first and tenth deciles referred to above, that is the stocks that were heavily sold and the stocks that were heavily purchased. For each of the three months in each quarter under study he calculated the rates of return on the stocks in the decile and the "abnormal" rates of return. The abnormal rate of return was the excess return over the return that would have been predicted by the market model, based upon a 60 month regression of the stock rate of return on the S&P 500 Index return. For each of the quarters under study, Westerfield traced the abnormal return for the first and tenth deciles for each of the three months in the quarter and for the twelve months preceding and the twelve months following the quarter. These results were averaged to produce a final product that showed for 27 months the abnormal average returns by month for the first decile stocks and the tenth decile stocks, and the difference between those abnormal average returns. It is this last figure that tells us whether the stocks purchased tended to outperform the stocks sold.

For the banks, the result was what Westerfield termed a "classic price pressure effect". During the early months in the 27 month period, the stocks purchased outperformed the stocks sold. The same was true during the three months in the test quarter. But in the months following the test quarter the stocks that had been sold tended to outperform those that had been purchased. Although the results were not statistically significant, they suggested that heavy purchases by banks tended to push stock prices up and heavy sales tended to push prices down, and when the trading by the banks declined, the prices tended to recover.

For the mutual funds, the results were quite different. In this case, Westerfield found what he termed a classic case of "information effect". The stocks purchased tended to outperform the stocks sold up through the quarter being tested, and then continued to hold their own with the stocks sold. The implication was that the mutual funds were able to identify under-valued and over-valued stocks, and by the time the funds had finished buying the former and selling the latter the prices had adjusted to correct levels.

Westerfield's final conclusion was that his employment of a new test methodology and new data indicated that banks possess no special information and produce no significant price pressure effects by trading in common stocks. In contrast, mutual funds do possess special information and the value of this information has been fully exploited by the end of the

trading period. But he pointed out that his study does not identify the profitability of the trading by the banks or mutual funds, since the data simply record changes in position between the beginning and end of a quarter, and it is not possible to calculate the profitability of the position change. Moreover, he noted that at least some of the trading might have been motivated by a deliberate shift in the risk level of a portfolio rather than by a conviction that stocks were over or under-valued, and his test could not distinguish these possible reasons for trading. He did observe that in the aggregate the mutual funds outperformed the bank trust departments over the time period tested by about 4% a year.

29. AN EFFICIENT MARKETS THEORY OF EXCHANGE PARITIES (Spring, 1979)

Treynor distributed a paper entitled "An Efficient Markets Theory of Exchange Parities."

Jack L. Treynor, Editor, Financial Analysts Journal, began by describing the foreign exchange market as equivalent to a very efficient securities market, with currencies serving as securities and security prices represented by exchange parities. He argued that trading pressure should have little effect on parities, and the only useful inside information would concern impending actions by central banks.

The three assumptions underlying this picture of the exchange market are: (1) the central bank effectively controls the short-term domestic nominal interest rate; (2) stability of the domestic economy requires that the control be used sparingly, and beyond the "real rate horizon" one would not expect any current departure from normal real rate policy to continue; (3) the Interest Rate Parity Theorem always holds. The theorem is represented by the following equation for the pound and dollar:

$$\left(\begin{array}{l}\text{Spot exchange}\\ \text{rate in dollars}\\ \text{per pound}\end{array}\right)\left(\begin{array}{l}\text{1 + U.S.}\\ \text{nominal inter-}\\ \text{est rate}\end{array}\right)=\left(\begin{array}{l}\text{1 + U.K.}\\ \text{nominal inter-}\\ \text{est rate}\end{array}\right)\left(\begin{array}{l}\text{Forward exchange}\\ \text{rate in pounds}\\ \text{per dollar}\end{array}\right)$$

Treynor gave an intuitive explanation for the theorem, demonstrating that it rests on simple logic, and then introduced the possibility that the nominal rates in the equation represent distortions of the natural real rate which will be restored at the real rate horizon. This led to a slightly more complicated equation, making use of current nominal rates, the natural real rate, inflation rates in the two countries, and the real rate horizon. He next introduced another time horizon, at which one would expect that exchange parity would be determined solely by the purchasing power ratio between the two countries. In other words, the rates of inflation in the two countries would account for the exchange partiy. These assumptions, plus some algebra, yielded his final equation:

$$\begin{array}{l}\text{Spot exchange}\\ \text{rate, units of}\\ \text{currency 1 per}\\ \text{unit of cur-}\\ \text{rency 2}\end{array} = \left(\frac{\text{present price level in country \#1}}{\text{present price level in country \#2}}\right) \times \exp\left(\begin{array}{l}\text{current real rate in}\\ \text{country \#2 minus}\\ \text{current real rate in}\\ \text{country \#1}\end{array}\right) \times \left(\begin{array}{l}\text{real rate}\\ \text{horizon}\end{array}\right)$$

The equation defines the spot exchange rate in terms of the current ratio of price levels in the two countries and an exponential factor proportional to the difference between the real interest rates in the two countries, and the real rate horizon.

A number of interpretations can be drawn from the equation. Should the central bank in one of the countries change the current nominal interest rate, and therefore the real rate, there will have to be a corresponding change in the spot exchange rate. This means that a foreign investor cannot use domestic investments to bet on changes in domestic central bank policy. What he makes on the bank policy change he will lose on the corresponding change in the spot rate.

But the foreign investor buying domestic securities *is* taking a risk on the domestic economy. He also takes a risk on possible interest rate changes by his own central bank.

An investor can take a position in a foreign securities market and attempt to "time" economic activity in that market, having hedged all uncertainty with respect to the real interest rate in that market. Alternatively, he can take a position in the exchange market, and attempt to "time" the real interest rate in a foreign country, having hedged all risk related to economic activity in that country. Treynor's comment was that the investor should be quite certain which kind of timing he is attempting, since he cannot do both at once.

Treynor's final conclusions stated these implications: (1) An investor who invests in foreign securities takes a risk on the real interest rate only in his own country; (2) he takes an economic activity risk in the countries in which he invests, (3) the betas that are important in a world capital asset pricing model are the economic activity betas, not betas reflecting both an economic activity and an interest rate risk.

30. RESEARCH CONCENTRATION AND THE EFFICIENT MARKET (Spring, 1978)

David Baker distributed two papers: "Research Concentration and the Efficient Market," and "Think Small."

David A. Baker, Portfolio Strategist, Drexel Burnham Lambert, Inc., presented the proposition that the efficient market hypothesis, if it ever was satisfactory, is becoming less satisfactory.

Equity research is becoming more concentrated, inefficiencies exist outside the areas of concentration, and investors can identify these areas through the Research Concentration Ratio.

Baker argued that the efficient market theory rested on the premise of "redundant" research, and that this redundancy has been disappearing. He noted that over 5 million former shareholders have left the stockmarket, and that a substantial number of brokerages have disappeared. Many analysts have abandoned their field, and there has been a substantial trend toward concentration. Baker used statistics from the *Institutional Investor* to illustrate the increasing concentration of leading analysts in a few brokerage houses. He quoted other statistics to indicate the concentration of research on industries and on companies. For the S&P 500 index, about one-half of the attention of security analysts is devoted to about one-fourth of the companies, with 5% of the companies receiving virtually no regular coverage. The concentation applies to industries, as well as to companies.

Baker presented detailed statistics on research concentration, and explained his Research Concentration Ratio. He ranked all companies in the S&P 500 index, on the basis of the estimated number of Wall Street analysts regularly following the company. He then divided the set of 500 companies into deciles, and assigned a rank of one to a company in the 50 most researched companies, and a rank of ten to a company in the 50 least researched. His paper included a list of all 500 stocks, with their rankings.

Although as a general rule, the larger companies are more heavily researched than the smaller, Baker pointed out that there are large firms that are not heavily researched.

In answering the question whether research concentration is a guide to investment opportunities, Baker referred to the historical differences between the performances of value weighted indexes and equal weighted indexes. The superior performances of the latter indicate superior performances of small companies.

Some have questioned whether the superior performance of the small, less researched companies, has been accompanied by a corresponding higher risk level, so that on a risk adjusted basis they may not have outperformed the larger companies. Baker referred to analyses indicating that the price fluctuations of non-S&P 500 stocks have been similar to the fluctuations of stocks in the index. He expressed some skepticism at the use of the beta coefficients, but observed that the higher betas of the smaller companies fall short of explaining the higher return.

Some would argue that liquidity requirements restrict institutional investors to heavily capitalized companies. Baker acknowledged the importance of liquidity, but presented statistics suggesting that concentration on larger companies has been greater than necessary.

31. THE EFFICIENT PORTFOLIO AS MARKET MAKER (Spring, 1978)

Tony Estep distributed a paper: "The Efficient Portfolio as Market-Maker."

Tony Estep, Vice President, Burns, Pauli & Company, Inc., introduced his topic with the comment that his remarks could be addressed to two kinds of market maker: an institution with a large diversified portfolio, engaging in market making activities, or a broker-dealer, acting as regular professional market maker and therefore having to maintain a portfolio. The second case was to be the focus of his discussion, but he noted that much of what he would say would also apply to the first.

He began by observing that the source of income to the market maker is the spread between his bid and ask prices. And he noted that a dealer who estimates his profit at half his *own* spread may be mistaken, since the true profit will be one half the "inside spread," and this inside spread is the spread between the highest bid price and the lowest asking price in the marketplace.

As a practical matter, since the flow of buy and sell orders is not balanced, the dealer is forced to maintain an inventory. The behavior of this inventory portfolio is an important element in the profitability of his business. Estep outlined the general portfolio optimization procedure that one would expect a conventional investor to follow, and indicated how this might be modified for the professional market maker. For the market maker, there are some special risk measures, including the risks that accompany dealing with investors who may have superior information. And on the return side, the portfolio not only pro-

duces an investment performance but makes it possible for the market-maker to earn revenue from his market-making activity.

Estep offered some further comments on the matter of trading against informed investors. Forecasts taken from the Value Line Investment Survey showed positive forecasting ability, and forecasts of institutional investors performed even better. A dealer would want to do at least as well as an investor using the Value Line Forecasts. Even this will leave him vulnerable to investors who make still better predictions.

The market-maker also faces a liquidity risk. Since trading volume and the level of the market tend to move together, when volume is down spreads are reduced and variability is up.

Diversification presents special problems to the market-maker. Order flow is likely to lead to concentration, and therefore an increase in the specific risk of the portfolio. Rebalancing, which requires turning to competing dealers, will be expensive.

Estep described the estimation of the dealer risk in terms of fundamental risk in the valuation of stocks held, a beta coefficient risk, an excess specific risk, and a liquidity risk. All of these risks can be put together to adjust the expected returns of stocks in the dealer's portfolio, and one can then use an optimizing procedure similar to those used for conventional portfolio investors.

In concluding, he suggested that the dealer is at a serious disadvantage compared to portfolio investors with large financial resources, at least unless the dealer has a significant source of revenue that is not correlated with his market making inventory.

Some questions were raised as to why a market-maker must rely on a long portfolio, why he cannot rely on short positions. Estep suggested that the options market may offer an opportunity to place less reliance on a long position. In answer to a question why gambler's ruin is a particular problem for the dealer market maker, Estep replied that this problem accompanies the undiversified portion of the portfolio, which is particularly significant for the market maker. He was also asked why it is not possible for the dealer to design an optimal strategy that includes both the makeup of his portfolio and the spreads at which he can profitably alter that portfolio. Estep believes that this strategy may simply put the dealer out of business making markets, although it would be ideal for the investor holding a large portfolio, but willing to make markets whenever that is attractive.

32. INVENTORY FUNDS: CONCEPTS AND IMPLICATIONS FOR SPONSORS, INVESTMENT MANAGERS AND BROKER DEALERS (Spring, 1978)

Wayne Wagner and Carol Zipkin presented a paper: "The Inventory Index Fund: Using an Index Fund to Accommodate Active Equity Manager Trades."

Wayne Wagner, Vice President, Wilshire Associates, began the discussion. At a previous Seminar in the Fall of 1976, he had described how an inventory index fund might work in principle, and had discussed the results of simulations of the use of such a fund. At this session he discussed further simulations and also described the experience of an operating inventory index fund.

Such a fund can be useful for a retirement plan with assets of $50 million or more (Wagner suggested that perhaps the minimum should be around $100 million), with multiple managers and a commitment of a substantial portion of the total assets to be an index or market fund. The inventory fund then serves two purposes: it operates as an index fund for investment purposes, and it absorbs a portion of the trading among the active equity managers, reducing transactions costs.

When one active manager is buying a security at the same time another active manager is selling it, or at nearly the same time, the inventory fund can serve as a conduit, with no transactions costs. Even if the stocks bought and sold by the active managers are not the same, but represent the same industrial sector, the performance of the inventory fund may be almost unaffected by buying one stock from one manager and selling another to a second manager. Even further, to some extent the index fund can simply buy from an active manager who wishes to sell, or sell to an active manager who wishes to buy, perhaps sustaining a temporary imbalance in the desired diversification, but adjusting this later at a low transaction cost.

Wagner described the mechanics by which an active manager who wished to buy or sell a stock would offer to transact with the inventory fund. If such a trade were completed, it would avoid any transactions cost, or physical transfer of securities.

The inventory fund should be an index fund, for a number of reasons. An index fund will be well enough diversified to avoid taking on undue specific risk when it trades with an active manager. It will be in a position to buy or sell reasonable quantities of many stock issues. Trading with active managers can be carefully controlled so that the performance of the inventory fund stays within a specific range of the index itself.

Savings from the use of an inventory fund derive

from the lower management fee associated with an index fund and the savings in transactions costs when active manager trade with the fund rather than in the securities market. Wagner's presentation assumed fees for management and custodianship of .25% of assets for actively managed portfolios, and .1% of assets for passive portfolios. He assumed turnover rates of 50% and 6%, and transactions costs of 1.5% and .5% (one way), for active and passive management. He offered some estimates of cost savings, to which Carol Zipkin later added actual savings for a portfolio she described.

Wagner pointed out that the cost savings are accompanied by two disadvantages. The index fund is subjected to higher turnover than it would experience if it were not also an inventory fund, and there will be tracking errors. That is, the performance of the index fund will deviate from the performance of the index itself. The compromise between transactions cost savings and these disadvantages is one that can only be established on the basis of the plan sponsor's judgment.

Glenn Kent, Manager of Investments & Investor Relations, Honeywell, Inc., described experience at Honeywell, Inc. with an inventory index fund. The total Honeywell pension fund is invested 30% in fixed income securities, and 70% in equities. The equity portfolio, worth about $200 million, is invested 40% in a diversification fund, 30% under active conservative management, and 30% under active aggressive management. The diversification fund is currently restricted to issues in the S & P 500 Index. It is managed by American National Bank, and actually contains 250 issues. It is expected to track the S & P 500 Index with an R^2 of at least .99 and a standard error of no more than 2%. In fact it has been doing better, with an R^2 of about .997.

Honeywell expected to reduce fees and transactions costs substantially, particularly when there is a change in active managers. There is no fixed rebalancing schedule for the inventory fund, and in fact it has been rebalanced only once, when an active manager was terminated.

There have been significant transactions cost savings, as much as $386 thousand in eight months. At the same time, there have apparently been no significant effects on the beta or the alpha of the inventory portfolio, and no serious deviations from the performance of the index.

Kent indicated a number of key considerations that have to do with establishment of an inventory index fund. There must be a preference for a separately managed passive market portfolio. And this fund should amount to approximately one-third to one-half of the total equities held. Cost advantages will be greatest where there is a large number of active managers, with high turnover, and non-diversified portfolios. It is important to establish in advance, limits to the deviations from the index performance that will be tolerated.

He commented that while use of the inventory fund will tend to nullify good judgments of the active managers, if those benefits are long-term, the nullification will be very small.

In conclusion, he observed that there does not seem to be any major swing to the use of inventory index funds.

Carol Zipkin, Vice President, Bankers Trust Company, described six months history (the last four months of 1977 and the first two of 1978) of an inventory index fund managed at Bankers Trust. The $53 million fund represents 15% of the total equities in the pension plan. Ten active equity managers make use of the fund. (The number has recently increased.)

The fund is aimed at matching the S & P 500 Index, through a carefully designed sample of securities. Trading with active managers is permissible so long as the holdings of the index fund are within .6% of the optimal position.

Zipkin offered a number of tables illustrating the experience of the fund. It was able to accommodate 37.3% of total equity activity, accommodating 50% of the 535 inquiries directed to it by active managers. While the active managers were not required to deal with the index fund, over 95% of the activity that could be accommodated by the fund was actually directed to it.

Some of the activity took the form of directly counter-balancing transactions, where one active manager was selling, and another was buying, the same securities. A significant amount of trading by the inventory fund was offsetting within sectors. That is, the securities bought from one active manager belonged to the same sector as those sold to another. Some transactions were actually executed at zero transaction cost with another passive fund.

There has been only one rebalancing of the fund, in January, 1978. Zipkin described the rebalancing activity, which gave an incentive to brokers to minimize market impact.

Over the six-month period, Zipkin reported a cost saving of about $450 thousand, on the assumption that the cost of transactions in the securities market would have been 1.5% (one way).

Dean LeBaron, President, Battermarch Financial Management Corporation, suggested that while the use of an inventory index fund may be a transitional solution to the problem of transactions costs, it does involve setting up extra machinery to deal with the

symptoms of a problem rather than with the problem itself.

The inventory index fund seems to obscure the difference between active and passive management, since the passively managed fund absorbs the activity of the actively managed fund. LeBaron thought this was justified if it would lead to heavier reliance on index funds, but he expressed some apprehension that the half-way stage might become permanent.

LeBaron suggested that there are alternative ways of accomplishing the cost savings offered by the inventory fund. Active trading in the securities market itself can be conducted so as to reduce market impact significantly. A computerized fourth market can substantially reduce transactions costs. Plan sponsors could put more emphasis on efficient trading by their managers. He expressed the opinion that there are still extraordinary inefficiencies in securities transactions, and that the persistence of these inefficiencies has given Batterymarch, which has achieved substantial efficiency, a significant advantage over its competitors.

In answer to a question whether there are indeed other ways to accomplish the transaction cost savings, Wagner replied that there are different ways, but that the inventory index fund is particularly well adapted to the manner in which pension funds operate. A number of questions concerned the likelihood that trading with the inventory fund will nullify whatever benefits an active manager brings to the pension fund. There was some skepticism that the benefits of active management tend to be long-term, and hence will not be negated by an immediate transaction with the inventory fund, followed by a rebalancing of that fund within three months or so. A number of suggestions were made, as to why truly successful trading by the active manager will inevitably injure the performance of the inventory fund.

33. IS THE INDEX FUND THE PRUDENT COURSE OF ACTION? (Fall, 1976)

A paper by this title was distributed.
This presentation was one of four under the heading "Impact of ERISA on the Investment Process." The other three were "Tests of Prudence," "Interpreting the Prudent Man Rule," and "Panel: Further Perspectives on the Prudent Man Rule."

Walter Good, Executive Vice President, Lionel D. Edie, Inc., undertook to place index funds in perspective, to point out that they are neither a "cop-out" nor the wave of the future.

He identified three assumptions underlying the choice of an index fund, which must be tested for their validity. First, the market is efficient, and skill in evaluating stock prices cannot contribute to investment success. Second, the risk and the total return expectation of a portfolio are the only two characteristics of interest. And third, there is a quantitative relationship between risk and expected return, one always being proportional to the other.

Duplicating the performance of the S&P 500, or any index consisting of many stocks, presents the problem of controlling transaction costs. Using a smaller number of issues in a portfolio to approximate the index may save on transaction costs, but of course it will lead to increasing variation between the performance of the fund and the performance of the index. Limitations on the portfolio holdings may appear to be dictated by legal prudence standards, leading to further deviations between the performance of the fund and the performance of the index. Low transaction costs are always an objective of the index fund, but how low the costs can be brought may depend upon the size of the index fund, the frequency of additions and withdrawals, and the techniques used to minimize transaction costs.

Special problems are raised if the holder of an index fund wishes to raise or lower the risk level and therefore the expected return on the fund. An index fund that seeks to duplicate the S&P 500 index will have the same risk level and the same expected return as the index itself. According to capital market theory, lowering the risk level of this index fund is accomplished by diverting some of the assets to a risk-free investment, such as treasury bills. And raising the risk level is accomplished by increasing the investment in the index fund through the use of leveraging. The former technique is probably practical, but the latter is generally not, at least for a pension fund.

A managed portfolio will be preferable to an index fund only if it can provide a better ratio of expected return to risk. If the active manager is to achieve this goal, he should follow an approach that begins by controlling risk, and then try to modify selection so as to improve the ratio of expected return to risk through investment skill. This is a very different matter from the more traditional practice of simply looking for issues that are undervalued. An investment manager can control risk with a much smaller number of stocks than are likely to be found in an index fund. With a smaller number of issues he should be able to bring transaction costs low compared to the costs of an index fund. In the end, the ability to select undervalued stocks may be only a minor part of delivering a managed fund performance that rivals the performance of the index fund.

34. THE INDEX FUND AS MARKET MAKER (Fall, 1976)

Wayne Wagner, Vice President, Wilshire Associates, described the results of an analysis carried out by Wilshire Associates to identify transaction cost savings that might result from allowing active managers to trade with an index fund representing a portion of pension fund assets. The trading might be initiated by the index fund itself or by an active manager. When the manager wished to buy or sell a stock he would first consult the index fund manager, who might agree to accept or supply all or a part of the stock, depending upon the impact of the transaction on the index fund. Any part of the transaction not accepted by the index fund would take place in the open market. Periodically the index fund would undertake rebalancing transactions, to invest new cash contributions, to generate cash withdrawals, or to offset past transactions with active managers. In rebalancing, the index fund manager would propose purchases and sales to the active managers, who might or might not accept, depending on their own portfolio strategies. Once again, transactions not completed among the managers would go to the open market. For all of these "in-house" transactions, the price would be the closing price for the day, and there would, of course, be no transaction cost at all.

Wilshire Associates conducted a simulation, for a 150 million dollar fund involving five active managers and an index fund. A series of over 1,000 actual transactions by the active managers entered into the simulation, as though each had been brought to the index fund manager. Acceptance of the proposed transaction depended upon the extent to which it would "unbalance" the index fund. The trading was said to be "tightly constrained" when transactions were not acceptable if they changed an industry or company holding from its "correct" proportion of the index fund by more than .2% of the fund's assets. Trading was "loosely constrained" when a transaction was permitted to result in three times this "unbalancing."

The index fund was assumed to consist of 250 stocks, performing closely enough to the S&P 500 index that one could predict with 95% confidence that its annual rate of return would be within 1% of the index rate of return. It was assumed that the management fee for the index fund would be .1% per year, and that round trip transaction costs would be .5%. For the active managers the annual fee was assumed to be .25% per year, and the transaction costs were assumed to be 1.5%. The transaction record for the active managers indicated a turnover of about 33% a year. Introduction of an index fund therefore involved immediately three cost savings: a reduced management fee, reduced cost per transaction, and a lower number of transactions. In addition, there was the possibility that a substantial substitution of "in-house" transactions for open market transactions would further reduce costs.

Simulations were conducted assuming the index fund made up 25%, 40%, and 50% of the total pension fund. For each of these percentages, the simulations tested trading initiated only by the index fund, trading initiated by the index fund and by the active managers under the "tight constraints" described above, and trading initiated by the index fund and by the manager under the "loose constraints."

Even with no "in-house" trading initiated by the active managers, the simulations indicated substantial cost savings. Trading initiated by the active managers under "tight constraints" added another 50% to the savings, and "loosely constrained" trading initiated by the active managers increased the cost savings by another 10 to 20%. The level of savings ranged from about $370,000 with 25% of the fund in an index fund and no trading initiated by active managers, to over $1 million with 50% of the fund invested in an index fund and "loosely constrained" trading by the active managers.

The turnover of the index fund increased, of course, as it satisfied the trading needs of the active managers, because of the extra rebalancing required. With no "in-house" trading initiated by active managers the index fund turnover was less than 1% a year. It reached a maximum of 18% a year, with 25% of fund assets in the index funds, and "loosely constrained" trading initiated by the active managers. However, over the full range of simulations the beta of the index fund varied by no more than .01, and variations in its alpha were negligible. It appeared that substantial transaction costs savings were possible.

It was suggested by one of the participants that the effect of the "in-house" trading was to nullify benefits to the pension fund of successful trading by an active manager. This would be true at least for decisions by an active manager vindicated in the short run (less than a calendar quarter). Transactions that were successful in the long run could still pay off, because the rebalancing of the index fund, following the "in-house" transaction, would alter the overall asset composition of the total pension fund.

The question was raised why any company would want to retain five active managers and also make use of an index fund. The answer appeared to be that a corporation might be reluctant to abandon the use of active managers, while at the same time wishing to

make at least partial use of an index fund and seeing an opportunity along the way to substantially reduce transaction costs.

Wagner pointed out that "in-house" transactions would mean that managers would not have commissions available to pay for research, and this might make the scheme unattractive to them. On the other hand, their performance records would be enhanced by the reduction in transaction costs. Overall, the "in-house" transactions would tend to make the active managers look better and the index fund look worse.

FOREIGN EXCHANGE

35. FORECASTING EXCHANGE RATES (Spring, 1979)

Dr. Ramond distributed a paper, "Forecasting Exchange Rates," and a paper by Professor Richard Levich, "Analyzing the Accuracy of Foreign Exchange Advisory Services: Theory and Evidence."

Charles Ramond, President, Predex Corporation, described the methodology and the success record of exchange rate forecasting by his company, Predex Corporation. He began with a discussion of why exchange rate forecasting makes sense today. Since 1973 floating exchange rates have given us a chance to relate variations in these rates to economic variables, and have made possible the use of econometric analysis for forecasting.

Raymond discussed some of the methods that are used for econometric forecasting, and explained his own company's choice of method. Their method combines the use of trade flows and capital flows to predict the future exchange rate between two currencies. These flows are predicted on the basis of economic forecasts that rest on judgment rather than a mechanical model. While some forecasters use general equilibrium models that simultaneously forecast economic variables and exchange rates, Ramond agreed that these models are very vulnerable to errors in their structure. He believes that the risks of making mistakes in the economic predictions that go into Predex forecasts is less important, and commented that Predex has been able to identify the variables that are the most important and to focus attention on them.

So far as trade balances are concerned, Ramond indicated that he has found cumulative balances, rather than month by month or quarter by quarter balances are the key to foreign exchange rates. The original Predex work consisted simply of forecasting exchange rates between two currencies as a function of the ratio of the cumulative trade balances for the countries. This, he explained, worked quite well over a period during which the economies of the countries were well synchronized. But when the economies got out of phase, capital flows began to play a major role and the model performed very badly. So it had to be adapted to incorporate capital flows, and Predex discovered that the ratio of growth in the money supply to growth in national income was a satisfactory key to capital flows. As a practical matter it was found that data on industrial production and a consumer price index are generally available earlier than national income data, so the product of production and the price index was substituted for income.

The end result then is a model that forecasts the exchange rate between two currencies as a function of the ratio of the cumulative trade balances for the two countries, and of the money supply and income growth ratios for the two companies. As an illustration, Ramond offered the following expression for a forecast of the exchange rate between the German Deutschmark and the U.S. Dollar.

$$XR_{\frac{US\$}{DM}} = f\left\{\frac{CB_{Ger,}}{CB_{US}} \quad \frac{MS_{Ger,}}{MS_{US}} \quad \frac{Y_{US}}{Y_{Ger}}\right\}$$

XR is exchange rate; CB is cumulative trade balance, MS is money supply growth, Y is national income growth and equals growth in industrial production times consumer price index.

He commented that he was not revealing the precise form of the function, observing that Predex had tested many forms before choosing one.

There are three major limitations in the forecasting methodology. First, the results can be no better than the forecasts of economic variables that went into the model. Second, the economic variables must be consistently related to the exchange rates, or in other words there must be no structural changes in the model over the time period for which exchange rates are being forecasted. And third, the relationships in the model must be more important in determining exchange rates than events outside the model.

Ramond commented on the success of Predex forecasts, particularly as compared to forecasts by competitors. He referred to an evaluation by Professor Richard Levich reviewing the performance record of exchange rate forecasting services. Levich had identified the Predex service as the one with the best record.

Commenting on the success of Predex in forecasting exchange rates between the U.S. dollar and European currencies, and its lack of success in forecasting the exchange rate between the U.S. and Canadian dollars, Ramond said that the structural relationships that work for the European currencies simply do not work for the Canadian dollar. Predex has been making use of a single model for all currencies, but is discovering that a special model is necessary for the Canadian dollar.

Among the questions asked by participants, one concerned the significance of different rates of inflation in two countries. Ramond replied that the model he had described implicitly took account of different inflation rates. Inflation entered into the forecast of income growth, and was also reflected in the cumulative balance of trade figures.

In describing how a subscriber might make use of

the Predex service, Ramond referred to tables furnished by the service showing differences between Predex forecasts of exchange rates and the forward market rates. Where the Predex and the forward market rates are widely divergent, then the suggested action is to cover either foreign currency liabilities or foreign currency assets, depending upon the direction of the difference. For example, the most recent Predex publication suggested that it would be appropriate to cover long positions in the British pound and short positions in the Japanese yen.

36. INTERPRETING DISCLOSURES OF THE EFFECTS OF CHANGING PRICES (Fall, 1980)

A paper by William H. Beaver was distributed.

William H. Beaver, Graduate School of Business, Stanford University, began with the proposition that FASB Statement No. 33, calling for supplementary disclosure of current cost information, is one of the least understood accounting rules. He devoted the first part of his presentation to the conceptual aspects of disclosure, and made four points. First, it is critical to distinguish between anticipated and unanticipated inflation. Second, historical cost accounting already reflects the inflation that was anticipated at the time assets were purchased. Third, constant dollar accounting generally leads to income measures that are not capable of interpretation. Fourth, current cost accounting, while not intended primarily to deal with inflation, is a legitimate method for dealing with unanticipated inflation.

Beaver's principal focus was on two measures of profitability: the nominal and real rates of return on an asset. If we know the inflation rate it is easy to convert one rate of return to the other, so that the two rates have equal information value. At this point in his presentation, Beaver assumed that all goods and services are subject to the same inflation rate. He further assumed a world of certainty, with all inflation taking the form of anticipated inflation. He then turned to historical cost accounting to show that it provides perhaps more information then is generally recognized, in an inflationary environment. The value of the information is not diminished by high inflation rates, so long as those rates are fully anticipated.

Beaver turned next to constant dollar accounting or what is sometimes termed price level adjustment accounting. His point was that this method leads to results capable of interpretation only if the historical cost depreciation schedule assumed zero inflation. In this case, the rate of return given by the constant dollar accounting method is the real rate of return on the asset. Usually, however, one does not know what inflation rate was implicit in the historical cost depreciation schedule.

The third method Beaver described is current cost accounting, something very similar to what the Securities and Exchange Commission means by replacement cost accounting. In its pure form, current cost accounting is a market value accounting method and always leads to numbers capable of sensible interpretation. The book value of an asset is always the current cost of the asset. However, the procedures for implementing current cost accounting, specifically for depreciation, introduce some accrual accounting and generally do not lead to measures capable of sensible interpretation.

Beaver next turned to report empirical results of a study of current cost disclosures under the SEC Accounting Series Release No. 190 and their relationship to security prices.

Previous research had suggested that disclosure of replacement cost data produces no stock market reaction. Beaver's current research differed somewhat from the earlier work, and was aimed at finding out whether earnings derived from replacement cost accounting show a higher correlation with stockholder returns than do earning derived from historical cost accounting. The source of data was the Compustat Replacement Cost Tape, and the sample consisted of 1,070 firms for the years 1976 through 1978. For all three years, on average, replacement cost figures were higher than historical cost figures for depreciation, for cost of goods sold, inventory, gross plant and net plant. As might have been expected, the ratio of stockholders' equity at replacement cost to stockholders' equity at historical cost was greater than one, as was the ratio of market value of stockholders' equity to stockholders' equity at historical costs. What was perhaps surprising was that the ratio of market value of stockholders' equity to stockholers' equity at replacement cost ranged from about .9 to about .7 over the three years. Given a perfect market for corporate assets, this ratio should have been one.

Beaver had calculated four earnings measures: historical cost income per share, sustainable income per share, cash flow, and economic income (return on stockholder equity using replacement cost accounting). He reported that historical cost earnings showed the highest correlation with stockholder security returns. Beaver went further, and used a two stage regression to demonstrate that sustainable income data add no information to historical cost income data in terms of explaining security returns. His final conclusion had to be that the best explanation for stock price movements over the years is to be found in historical cost earnings figures.

A number of questions were asked concerning the puzzling relationship between the market value of stockholders' equity and the replacement cost of net assets. Beaver commented that revaluing debt as well as assets would make the relationship even more puzzling. He did not know what the effect might be of adjusting for off-balance sheet assets and liabilities. In answer to a question about a possible connection between accounting methodology and industrial activity, Beaver answered that he thought the principal impact was felt by way of a tax system based on

historical cost accounting. He doubted that investment decisions were influenced by the accounting method.

37. STOCK RETURNS, REAL ACTIVITY INFLATION AND MONEY (Spring, 1980)

A paper bearing this title was distributed.

Eugene Fama, Graduate School of Business, University of Chicago, described the starting point of his research as the puzzling contradiction between the traditional view of common stocks as a hedge against inflation and the evidence that common stock returns and inflation have actually been negatively related since 1953. Fama's hypothesis was that returns on common stocks are positively related to measures of real economic activity like capital expenditures, and the real rate of return on capital. At the same time, inflation is negatively related to these same real activities. In a measurement of the relationship between common stock returns and inflation then, inflation serves as a proxy for real economic activity. We would expect that if both inflation and real economic activity were used in combination to explain common stock returns, the economic activity variables would dominate and inflation would have little independent explanatory power.

This hypothesis was largely supported by the empirical testing. In the annual tests, the negative relationship between returns and both expected and unexpected inflation disappeared when measures of future real activity were included as explanatory variables in the stock return regression.

The first step in Fama's research established the negative relationship between inflation and real economic activity. He used two models. The first expresses the inflation rate for period t, I_t, as a function of an expected real return for the period, ER_t, a one period interest rate observed at the beginning of the period, TB_t, and unexpected inflation for the period, n_t. The model is expressed by:

$$I_t = -ER_t + TB_t + n_t$$

This is a model used before by Fama to explore the relationship between inflation and interest rates. From regressions of inflation rates on treasury bill rates, he computed estimates of expected inflation and unexpected inflation.

A second model was based on money demand theory and the quantity theory of money, estimating expected inflation as a function of money and real activity growth rates. The model for annual tests took the form:

$$I_t = .0405 + .42\ DTB_t + .67\ BG_t - .32\ DRGNP_t - .67\ DRGNP_{t+1} - .19\ DRGNP_{t-1} + n_t$$

Where DTB_t is the change in the annualized 3 month treasury bill rate over the year up to time t, BG_t is the annual growth rate in the money supply base, and $DRGNP_t$ is the growth in real GNP in year t.

As can be seen, inflation was positively correlated with the money supply base and the rise in interest rates, and negatively correlated with growth in real GNP, affected primarily by growth in the following year, to a lesser extent by growth in the same year, and to a still lesser extent by growth in the preceding year.

The two models–the interest rate model and the money demand model–proved to have similar descriptive power. Moreover, the correlation between the expected inflation rates from the two models was very high.

Fama also calculated the simple correlations between annual inflation and measures of current and future real activity. These simple correlations were negative, so combining this result with the relationships established in the preceding equation suggests that for real economic activity to lead to increased inflation there would have to be a strong positive correlation between the money supply and real activity growth rates. In fact, however, Fama found that the correlations are small and often negative. This then provides an explanation for the stagflation phenomenon. a money supply that is not well coordinated with growth in real economic activity. And it suggests that slowing economic growth is more likely to increase inflation than to reduce it.

Turning to the relationship between common stock returns and real economic variables, Fama showed regressions of the returns on changes in the capital expenditure ratio, changes in the real rate of return on capital stock, growth in industrial production, and growth in real GNP. The change in the following year in the capital expenditure ratio explained over 50% of the variance of the return. The change in the real rate of return in the following year explained about 40% and the change in real GNP in the following year explained about 68%.

Having established the positive relationship between real stock returns and future real activity and the negative relation between inflation and future real activity, Fama turned to the final step in the

research: the test of whether the observed stock return-inflation relationships simply reflect the more fundamental relationships between stock returns and real economic activity. Substitution of measures of real activity for inflation rates, and combinations of measures of real activity with inflation rates established that expected inflation was indeed serving as a proxy for the economic activity measures. Unexpected inflation was not so clearly a proxy. The annual tests indicated that it was, but the monthly and quarterly tests indicated that it was not. Fama suggested that the monthly and quarterly findings might be the result of the manner in which the tests were conducted, but he could not be entirely sure. The research could not completely explain the effect on common stock returns of expected inflation without including the money base growth rate, a variable that is itself highly correlated with the expected inflation rate. In the end we do not have a complete explanation for the decline in expected real stock returns during the period since 1953, although we know enough not to blame the decline on inflation.

38. INCOME DURING INFLATION (Fall, 1977)

Henry C. Wallich, Member, Board of Governors of The Federal Reserve System, opened the Seminar with a discussion of stock and bond investment during an inflationary period. In commenting on the recent effects of inflation, he pointed out the danger of "money illusion," which leads people to look at the value of their assets in current dollars, without fully realizing what has happened to the purchasing power of those dollars. Comparing the value of assets to the level of income largely avoids "money illusion," because both are affected by inflation. Governor Wallich noted that financial assets of American households reached 4 times disposable income in 1968, but had fallen by 1976 to a little over 3 times disposable income. And with the stock market decline in 1977, they must have fallen to a still lower ratio.

The bad experience in financial assets has to some extent been offset by a happier experience with real estate. The value of land and residences owned by households has risen from 110% of personal income in 1968 to 113% in 1976.

Turning from these statistics on the effects of inflation on asset values, Governor Wallich moved to a comparison of bond and stock investment in a period of high inflation. A number of investors, suffering from the recent poor performance of the stock market, seem to see in high-yielding bonds a more attractive alternative.

Governor Wallich referred to Irving Fisher's proposition that interest rates are made up of a "real" rate and the expected rate of inflation. In principle, the inflation premium should protect the bondholder against loss of purchasing power. In practice, however, he pointed out, there is no mechanism to guarantee the bond investor that the inflation premium is always available. More important, the tax-paying investor is subject to income tax on this inflation premium, which is actually a return of principal. He would have to reinvest virtually the entire after-tax proceeds on a bond, just to offset his loss in purchasing power. Investment in tax exempt bonds is no better: the tax-free yield is just about equal to the expected inflation rate, and once again it would be necessary to invest the entire proceeds, to maintain purchasing power.

This inability of after-tax proceeds to take care of lost purchasing power and at the same time produce spendable income, creates a dilemma in the case of trusts set up for an income beneficiary and a remainderman. In general, the law favors the income beneficiary by awarding him the entire interest, including the inflation premium, and forcing the remainderman to absorb the loss due to inflation.

Should inflation worsen, which Governor Wallich thought unlikely, the position of bond investors would, of course, worsen. Should inflation be brought under better control, which he thought likely, then interest rates should decline and bond prices should rise. But call features of bonds will limit the extent to which bondholders can profit from this rise.

Equities have indeed performed poorly in recent years. Governor Wallich commented that the real value of the Standard and Poor's 500 Index today stands at about its 1956 level. So 20 years of retained earnings have added nothing to the real value of common stocks. He attributed the low value of common stocks to the very low level, when they are correctly computed, of corporate profits. Businessmen may have suffered from "money illusion." The stock market, however, has not suffered from the illusion. It has perceived that true profits are very low and accordingly put a very low value on equities.

Governor Wallich suggested that analysts may be too much impressed by recent history, and too pessimistic about the ability of business to improve its profits. He commented that a low level of investment in new assets, which we are experiencing, is the natural result of very low values on existing assets. At these low values, it makes more sense to purchase existing assets than to invest in new ones. But this low level of investment in new assets will lead to

capacity limitations, which will in turn tend to push up corporate profits. The only alternative to such a development would be large scale government financing of new investment, something Governor Wallich did not expect this nation to turn to. He closed with an expression of confidence that normal "real" rates of return would be established.

Asked by one of the participants whether increases in the money supply are the source of inflation, Governor Wallich replied that inflation can indeed be traced to the money supply, but that the rate of growth in the money supply must serve many purposes, not simply the control of inflation.

Asked about the likelihood of nationalization and government financing, as the answer to low levels of investment in real assets, Governor Wallich answered that he was not pessimistic. He did feel that there are real dangers in the tendency of the stock market to oscillate between euphoria and despair, and hoped that analysts might overcome their tendency to think in extremes.

INTEREST RATES: FEDERAL RESERVE POLICY

39. THE FED SINCE OCTOBER: MONEY OR INTEREST RATES? (Fall, 1980)

The opening address of the Fall, 1980, Seminar was given by A. James Meigs, Economist, Oppenheimer and Company, who focused on the obsession of the Federal Reserve with the management of interest rates to protect financial markets. Almost exactly a year ago, in October 1979, Volker made his famous announcement with respect to Federal Reserve changes of policy. As a result, financial markets are today more volatile than they were a year ago and those in the markets still cannot figure out what the Federal Reserve is doing or why.

Meigs organized his talk into four parts: The Federal Reserve preoccupation with interest rates and what this has done to capital markets, the procedures announced a year ago, what went wrong and why, some speculation on what the Federal Reserve should do and why it may do something else, and what is likely to happen to the financial markets.

The Federal Reserve, like the Bank of England, seems convinced that the financial markets are fragile and unstable and must be protected from the shock of quick interest rate changes. The Fed therefore tends to act to resist interest rate changes either up or down, and in doing so tends to amplify both business booms and recessions. A number of members of the Board of Governors have attempted to justify a preference for interest rate targets over money aggregate targets. Meigs traced the consequences of this choice from the 1940's up to the 1970's, when Arthur Burns indicated that the money supply target was actually the more important. What the Fed did, however, was to attempt to control growth in the money supply by changing the federal funds rate. When the relationship between this rate and growth of the money supply turned out to be quite uncertain, and the Open Market Committee appeared reluctant to change the federal funds rate anyway, the result of the policy was even wilder swings in interest rates and money supply than had been seen in the 1960's. Inflation exploded in 1974 and we had a serious recession in 1974-75. In explaining what went wrong, Meigs pointed out that the open market desk would purchase governments, putting reserves into the system and bringing the federal funds rate down briefly. But it was actually adding high powered money to the money supply, so the money stock multiplier was at work while the Fed was watching the federal funds rate.

By the 1970's the financial markets had rediscovered Irving Fisher, who in 1895 said that "Inflation expectations are the chief determinant of nominal interest rates." In the process of re-learning this lesson we saw rising inflation drive up interest rates, disintermediation of savings institutions that could not compete for funds, difficulties of institutions with long term fixed rate financial assets, demoralization of the long term bond market, a rising tax burden, attempts by individuals to shift from financial to real assets, increasing use of floating rate instruments, and extraordinarily volatile interest rates resulting from high and uncertain inflation.

In October 1979, Volcker indicated that the Fed would aim at changing reserves directly rather than by way of interest rates. Had this change of policy been clearly explained, clearly understood, and believed by the financial markets we might have expected both inflation and interest rates to decline. In fact, the result was increased uncertainty in the financial markets.

In describing what should be done, Meigs had four proposals: stop all efforts to influence interest rates; fix the target growth rate of a single monetary aggregate, any one will do; eliminate the lagged reserve requirement that has caused great difficulty; announce a target growth rate for one aggregate and indicate how the target will be reached. He was pessimistic that any of this would be accomplished. The motivation of those who carry out Fed policy, and the motivation of the Fed itself, discourages change and fosters confusion and complications. Actions of the Fed can be effective only if they are correctly understood and acted upon by the financial markets. But the last year has shown a total inability of the financial markets to understand what the Fed is doing or is about to do.

Meigs' final advice was to prepare for high and highly variable inflation rates for the coming years, as an inevitable product of an independent Federal Reserve.

In the discussion that followed, a number of points were made. The Federal Reserve cannot stand up to poor fiscal policy in an election year. Indeed one of the functions of the Fed is to accept the blame cast upon it by Congress and the President for the pain inflicted by inflation and high interest rates. There are effective procedures to control the money supply, the Fed is aware of them and of the futility of controlling interest rates. Given people who really wanted the Fed to work, it would work.

40. AN EQUILIBRIUM MODEL OF BOND PRICING AND A TEST OF MARKET EFFICIENCY (Fall, 1981)

A paper entitled "An Equilibrium Model of Bond Pricing and a Test of Market Efficiency," by Michael J. Brennan and Eduardo S. Schwartz was distributed.

Michael J. Brennan, Professor, University of British Columbia, reported on work supported by IQRF funds. He provided a description of the model itself and of the underlying theory. The most important assumption is that the price of a government (default free) bond can always be expressed in terms of the values of two factors, the short rate and the long rate. The short rate is in principle the yield on a currently maturing government discount bond, and as a practical matter was taken to be the yield on a thirty-day Treasury bill. The long rate is in principle the rate on an infinite maturity government bond and as a practical matter was taken to be the yield on a government bond with a maturity in excess of twenty years. The model lends itself to adjustments for coupon effects, and indeed the testing reported by Schwartz allowed for these effects. Brennan pointed out that it also lends itself to adjustments for option features, such as a right on the part of the holder to shorten or extend the maturity. The work reported at this seminar did not exploit this feature of the model, nor did it deal with other possible applications of the model for risk assessment in performance measurement and for immunization. The use reported here was essentially the identification of bond pricing errors, which could be used to make trading profits.

The assumption that the price of a bond is determined by the short and the long rate implies that the whole term structure is determined by those two rates. The single parameter necessary to establish the yield curve from the short and long rate is the market price of risk. This parameter is established essentially by a trial and error process that finds the value of the parameter producing the term structure that best fits empirical data.

The actual rate of return on a bond over a time period is represented as the sum of the expected return and the unexpected return, with the unexpected return a function of the unexpected changes in the short and long rates. If there are to be no arbitrage opportunities, then the excess of the expected return on a bond over the short risk-free rate is a function of the risk in the bond with respect to the short rate and the long rate. This can be spelled out as:

excess expected return = (market price of short term rate risk x sensitivity to the short rate) + (market price of long term rate risk x sensitivity to the long rate).

This relationship leads to a differential equation for the price of a bond. Solving the differential equation is aided by a simple boundary condition: at maturity, for a zero coupon bond the price of the bond must equal face value. As Brennan had previously explained, estimation of the parameter representing the market price of short rate risk was accomplished by an iterative procedure aimed at producing the best fit to empirical data.

Eduardo S. Schwartz, Associate Professor, University of British Columbia, discussed application of the model to data available on the CRISP U.S. Government bond data file, covering twenty-one years from 1958 through 1979, and containing over eleven thousand monthly prices on 317 bond issues. The model was estimated for the full twenty-one years. It was also estimated on the basis of the data for the first ten years and then used to predict prices over the subsequent ten years.

The most interesting practical result of the work was the table of pricing errors detected. The root mean square errors were on the order of 1.5%. That is, a dollar fifty on a one hundred dollar price. In a regression of holding period returns for the bond, adjusted for coupon and maturity, it turned out that the most significant coefficient was that on the price error term. Schwartz commented that 15% of the error is corrected within thirty days and 30% is corrected within ninety days. It appears that if an investor could actually have bought and sold bonds at the prices tabulated in the CRISP file, extraordinary profits could have been achieved using this model.

In answer to a question, the authors said that they have not compared the pricing performance of their model to the performances of simpler models. Brennan commented that this was not particularly important to them because their model lent itself to bonds with option features, bonds that simply could not be dealt with by a simple model. There was a question about coupon effects, and Schwartz replied that perhaps surprisingly the model did not disclose any tax effects related to coupons. In other words, the model indicated that the present value of a principal payment in the future was essentially the same as the present value of a coupon payment, despite the different tax treatments to a tax-paying investor.

41. TAX INDUCED EFFECTS ON THE YIELD CURVE (Fall, 1981)

Two papers were distributed, one by Stephen Schaefer entitled "Tax Induced Clientele Effects in the Market for British Government Securities: Placing Bounds on Security Values in an Incomplete Market," and one by Jeffrey Nelson and Stephen Schaefer entitled "The Dynamics of the Term Structure and Alternative Portfolio Immunization Strategies."

Stephen M. Schaefer, Professor, London Business School, explained that he would be dealing with two topics, represented by two papers. The first was the tax structure of bond prices and the second was some recent work by himself and Jeffrey Nelson on immunization. The two topics are linked in that an understanding of tax effects leads to an understanding of the term structure which in turn leads to methodology for immunization.

The standard formulation for the price of a bond represents it as the present value of the stream of coupon and redemption payments, each discounted at a rate corresponding to the term structure. Various methods, including regression analysis, can be used to estimate the individual discount rates. In order to identify the role played by income taxes one might assume a single tax rate and then make use of data on all outstanding bonds to find the tax rate that produces the best fit of calculated prices to observed prices. Schaefer prefers to assume that there is a tax induced clientele effect. Investors in a particular tax bracket will buy only those bonds yielding a satisfactory after-tax return, and will ignore bonds with similar maturity characteristics offering a lower after-tax return. Rather than assume a single tax rate then, and try to find the rate that best explains all bond prices, Schaefer preferred to work through a series of tax rates, determining for each which bonds would be appropriate.

Schaefer's methodology was to determine, for every tax bracket and every bond, whether that bond was dominated by a portfolio of other bonds. A bond is dominated by a portfolio if the portfolio delivers cash flows which are at least as great as those from the single bond, at a lower price. One would expect that an investor would simply avoid purchasing such a dominated bond and would purchase only bonds not dominated by a portfolio. Schaefer's empirical results indicated, as one might expect, that the higher the ratio of capital gain contribution to coupon contribution in the yield to maturity, the higher the tax rate of the investor for which the particular bond was not dominated and would therefore make an appropriate investment. The results then confirmed the tax clientele hypothesis.

Schaefer turned next to his immunization paper and explained an immunization strategy as one in which a portfolio of bonds is managed such that its value is as close as possible to the value of another asset which he designated the target. The simplest immunization techniques are based on two assumptions: that movement in the term structure can be described by a single factor and that there is unit sensitivity of the term structure to this single factor. Schaefer's methodology relaxes both assumptions. As in Brennan and Schwartz's model, the holding period rate of return on a bond equals the expected return plus the sensitivity to change due to surprise in one factor multiplied by the magnitude of the surprise, plus the sensitivity to the magnitude of surprise in a second factor multiplied by the change in that factor. Brennan and Schwartz had chosen as their two factors the short and long rates. Schaefer added consideration of the spread between the long and short rates, and the intermediate rate.

Schaefer concluded that the first differences in the short and long rates could be taken essentially as measures of surprise in both of those rates. From this it was possible to estimate the sensitivities of the spot rates at different maturities to the surprises in the short and long rates, using simple regression. Schaefer showed some graphs of sensitivity for different maturities, indicating that the sensitivity to changes in the long rate is close to one for all maturities, while the sensitivity to changes in the short rate is about one for very short maturities, but drops to around .25 at longer maturities.

Having established the term structure and the sensitivity of the term structure to long, intermediate and short rates, Schaefer was able to test five immunization strategies. In testing the strategies, he selected an actual bond as the target and sought an immunizing portfolio, the value of which would track the price of the target bond.

Four of the strategies performed about equally well. The first of these simply made the weighted average maturity of the portfolio equal the maturity of the target. The second strategy was almost as simple: substituting duration for maturity. The third strategy was based on the long interest rate as a single factor, and used the sensitivity of the term structure to changes in that rate. The fourth strategy was a two factor strategy, using the long rate and the spread between the long rate and the intermediate rate. The fifth strategy, the one that clearly underperformed the other four, was a single factor strategy making use of the short rate.

Schaefer explained his somewhat surprising results in this way: because it turns out that the sensitivity

of the term structure to the long rate is close to one at all maturities, there is almost no difference between conventional immunization (matching duration) and the strategy based on the long rate. And for the bonds making up the sample, there was very little difference between portfolios arrived at by conventional immunization and portfolios arrived at through the two factor model based on the long and intermediate rates.

42. AN ARBITRAGE APPROACH TO YIELD CURVE ANALYSIS (Spring, 1981)

Stanley Diller distributed two articles: "Analyzing the Yield Curve: A New Approach," and "The Futures Market Influence on Long Coupon Spreads".

Stanley Diller, Vice President, Financial Strategies Group, Goldman, Sachs, began with a brief discussion of yield curves, and their importance as the dominant factor in the fixed income market. There are two ways to construct a yield curve given yields to maturity and duration of a set of bonds. The purely statistical method simply fits a smooth curve through a series of plotted points, with no regard to any theoretically preferred shape of the curve. A second approach allows theory to dictate the shape of the curve and then achieves the best fit of the selected shape to the data points.

Diller described the theory he uses to construct a yield curve as having two parts. First, he relies on Hicks' theory of short-term changes in long-term rates. Hicks argued that changes in short rates lead to expectations of further changes of a lesser magnitude. Expected changes in the long rate are the average of the expected changes in the short rates, and, because the expectations of changes in short rates diminish as the rates become more remote, will be less than the immediately expected changes in short rates.

Second, the "breakeven yield change" best expresses investor expectations with respect to long bonds. Diller does not believe in a picture of investors forecasting forward rates several years in the future. He imagines an investor purchasing a long bond for a short holding period in preference to a short instrument the duration of which matches the holding period, only because the expected rate of return over the holding period is as great for the long bond as it is for the short instrument. This equivalence comes about because of an expected price change in the long bond over the holding period, and the yield change associated with this price change is the breakeven yield change. This breakeven yield change can be calculated for any long bond for any holding period for which there is a corresponding short instrument. Diller's article includes tables and graphs of breakeven yield changes. Using Hicks' logic one can construct a smooth curve from a table or graph of breakeven yield change, and one can then transform the breakeven yield change curve into a yield curve. The end result is a yield curve derived on the basis of a theory of investor behavior coupled with Hicks' theory of the relation between expected changes in long rates and expected changes in short rates.

Diller observed that following his methodology one generally arrives at quite different yield curves for different markets. The yield curve for municipal bonds may be sloping upward, for example, while a treasury yield curve is sloping down. Part of the explanation for these different shapes lies in differences in transactions costs. This means that what some analysts might regard as anomalies in spreads between the yields on different kinds of instruments are not anomalies at all. Extraordinary spreads simply represent transaction cost differences.

Diller does not agree with the liquidity premium explanation for the shape of the yield curve. He argued that the least liquid part of the market is the very short end–maturities of a month or so. The most liquid maturity is probably around six months. He said that while segmentation does not play a significant role in the shape of the long portion of the yield curve it is quite important in determining the shape at the short end. There is a surplus of lenders for very short maturities and a surplus of borrowers in the three to six month range.

43. ECONOMIC FORCES UNDERLYING INTEREST RATES (Spring, 1981)

Jack Treynor, Editor, Financial Analysts Journal, began with a brief discussion of a model Stanley Diller had just presented (see "An Arbitrage Approach to Yield Curve Analysis") representing the yield on a long bond as a function of duration, the impact of the Hicks effect, and two market parameters–the bill yield and the first breakeven yield change. He compared this to a somewhat similar model presented at an earlier Q group seminar by John Barry and Herb Ayres. In both cases, the interest rate model had made use of two market parameters. Treynor found it of interest that a two parameter model seemed to provide a remarkably good representation of the term structure of interest rates.

Treynor next turned to the relationship among the nominal and real rate of interest and the inflation rate both short and long. The familiar Fisher equation

relates the nominal and real rates by way of inflation expectations. Treynor took issue with two of Fisher's assumptions. One is that the real rate of interest is constant and the other is that causation flows from the real to the nominal rate, by way of inflation expectations. Treynor's contention is that at the long end the causation may flow from real to nominal rates but that this is not true at the short end, and the real rate is not constant. At the short end, the clearing rate is the nominal rate and it is this rate that the Central Bank controls. Indirectly the Central Bank controls the real rate at the short end, because short run inflation is generally a known quantity.

Treynor's next step was to demonstrate that at the long end any rational market consensus of the future real rate will be Keynes' natural rate of interest. This is the rate that leads to steady employment and the rate that one would expect the Central Bank to aim at bringing about. At the long end then, it seems reasonable to expect causation to flow from the real to the nominal rate.

Treynor's description of government interest rates embraces four independent variables: the real and the nominal long and short rates. He discussed briefly the economic significance of the four. At the short end, the inflation rate is essentially given and the nominal rate reflects the current demand for money and the Central Bank policy. At the long end, the real rate is the natural rate and the expected rate of inflation is the rate that appears socially and politically tolerable or even desirable. At the present time that rate seems lower than the current rate of inflation.

Treynor next developed what he called the burden ratio. This is the ratio of the burden of U.S. government obligations, that must be borne by taxpayers, to the value of real rents from capital in the economy. From a representation of the burden ratio it appears that in order to make private investment attractive, the government can act to reduce the burden ratio by either raising the rate of inflation or lowering the real rate of interest.

The next step was a simple demonstration that since the nominal short rate can never be negative, the real short rate must always be at least as large as the deflation rate. The history of inflation and interest rates in the United States shows a number of periods of deflation, and the deflation rate has sometimes been as large as 10%. At such a time the short real rate is as large as 10%. This high real rate slows the economy, deflation increases, and the downward spiral continues. Treynor's contention was that until recent decades the government did not have satisfactory control over the money supply and the phenomenon of deflation, high real rates and a serious depression was fairly common.

Finally, Treynor proposed that the economy is always in one of two states. In the first, government money is trusted and the government has the power to drive down the short nominal rate. In the second, only metallic money is trusted, and the government cannot control the money supply and drive down the nominal short rate. In both states, any problems with the short nominal rate will be projected into long rates and will affect investment. How does the economy move from the second to the first state? Treynor's answer is that wages are set in metallic money, persistent deflation results and this leads to a high real rate discouraging investment. Only after prolonged serious dislocation does the economy get back to normal. How does the economy move from the first to the second state? Treynor's answer is excessive emphasis on the control of inflation.

44. ARBITRAGE IN U.S. GOVERNMENT SECURITIES USING DIRECT ESTIMATES OF THE TERM STRUCTURE (Fall, 1980)

A paper by this title, by James V. Jordan and Willard T. Carleton, was distributed.

James V. Jordan, College of Industrial Management, Georgia Institute of Technology, reported on research he had done with Will Carleton. The work was based on the Carleton-Cooper method of direct estimate of the term structure, a method described by Willard T. Carleton, Graduate School of Business Administration, University of North Carolina, at a 'Q' Group Seminar a few years ago. As Jordan pointed out, using the familiar yield curve to estimate the term structure, although it is probably the easiest and most widely used method, introduces bias. The Carleton-Cooper method, based on a regression analysis, was designed to avoid this bias.

The Carleton-Cooper model produces, from the observed prices of a set of government securities at a particular point in time, a picture of the term structure of interest rates at that point. For each of the securities in the sample set, the term structure will give an estimated or expected price. Differences between the actual quoted prices of the securities and these estimated prices suggest overvaluations and undervaluations in the market place and consequent opportunities for arbitrage profit. Jordan's research focused on the use of the term structure model to identify and exploit these opportunities.

Jordan began with a general discussion of arbitrage. One looks for abnormal spreads between the prices of two securities and on the expectation that

the spreads will return to a normal level, one buys one security and sells short the other. The identification of abnormal spreads is sometimes based upon historical data and an expectation that over time there is a normal spread for every pair of securities and prices will eventually adjust to that spread. More sophisticated methods are sometimes based on yield curves. But as Carleton and Cooper had pointed out, the use of yield curves introduces a bias. Jordan showed how the yield curve analysis can give the illusion of an abnormal price spread, when the use of the Carleton-Cooper model would show that the spread was entirely normal and no arbitrage opportunity existed.

Jordan reviewed the Carleton-Cooper model, presenting the results of some tests of the model's apparent validity, and commented that there is evidence that the model fails adequately to take into account all of the tax aspects of bond trading. The implication was that the model can be expected to work best in a market environment in which tax factors are not very important.

Turning to his own arbitrage model, he observed that its value rests on the proposition that the market randomly misprices bonds, that the mispricings are rapidly corrected by market movement, and that the magnitude of the mispricing is large enough for a trader to make a profit by taking a long and a short position when the mispricing is first discovered and closing out the position when the market has corrected itself. During the period of correction, of course, interest rates may be rising or falling and the shape of the yield curve may be changing. In taking the arbitrage position, one has to hope that these other changes are essentially random and no more likely to reduce the profit in the arbitrage than they are to increase it.

The tests of the model were based upon four two-week periods characterized by four rather different yield curves in terms of shape of curve and level of interest rates. The model provided an estimated price for each bond in the sample. The differences between estimated and actual prices were examined. Differences greater than 1.25 standard deviations from the mean difference were considered evidence of mispricing. Over-priced bonds were paired with under-priced bonds and over the four sample periods, from 15 to 48 arbitrages were set up. For all four test periods, the spread on average moved as predicted and the model might therefore be considered successful. However, in all four periods, the profit due to the spread change was offset in part by a downward movement of the prices of all of the bonds involved. In two of the periods, carrying costs were positive and in two they were negative. The average total profits, before allowing for transactions costs, were positive in all four test periods. But they were smaller than the transactions costs themselves, for high and medium levels of transactions cost, and in three out of four cases for low level transactions costs. A model could be said to have worked satisfactorily only for a dealer with no transactions costs at all.

Jordan closed with some suggestions as to the conditions under which the model works best, and the refinements he proposes for the model itself.

In the discussion following the presentation, Jordan was asked about extension of the model to deal with callability and sinking funds. He replied with some suggestions as to how this might be done, but indicated doubt that the model could be adapted to corporate bonds. It was pointed out that all of his tests had been based upon bond price quotations from the *Wall Street Journal,* and he was asked what effect this might have had on the test results. He expressed the opinion that a bond trader, with access to quotations during the day, should be able to produce better results.

45. ESTIMATION AND USES OF THE TERM STRUCTURE OF INTEREST RATES (Spring, 1978)

Willard T. Carleton distributed a reprint of: Carleton and Cooper, "Estimation and Uses of the Term Structure of Interest Rates," The Journal of Finance, *vol. 31, September, 1976, pages 1067-1083. The article acknowledged IQRF support.*

Willard T. Carleton, Professor of Business Administration, The University of North Carolina, presented three versions of the mathematical relationship between the price of a bond, and the stream of coupon payments and redemption proceeds that can be expected from it. One relationship made use of spot rates, assuming a unique discount rate for each coupon payment to be received at a different date in the future. The second made use of unique one-period forward rates, a rate for every time period up to the maturity of the bond. And the third made use of the familiar yield to maturity. The first and second are mathematically related, so that if the spot rates are known then the forward rates are easily calculated, and vice versa. Carleton suggested that the use of the third relationship rested on no more than a wish for simplicity, and difficulty in coping with an array of spot or forward rates. But if we could successfully deal with these difficulties, and arrive at a measure of the term structure of the spot rates, we might accomplish a good deal. For example, since each of

the spot rates or forward rates has an inflation element in it, we could get a much clearer picture of the impact of a change in inflation expectations, on fixed income securities. We would also be in a much better position to identify temporary deviations of prices or yield spreads from their normal equilibrium level. Hence bond traders would be better equipped to identify and profit from anomalies in prices and yields.

Carleton described in general how he established a regression model to estimate the spot rates. He worked with U.S. government issues, to eliminate default risk. He commented that the equation he had introduced, relating the price of a bond to the stream of expected coupons by way of a set of spot rates, was in a form somewhat similar to a regression equation, with the spot rates serving as regression coefficients. Treating the relationship as a regression equation, he suggested some obvious conditions that might be imposed. We would want a zero intercept in the regression; the coefficients should all be positive (each receipt must have a positive present value); the coefficients should all be less than 1 (the spot rates should all be positive and therefore the present values should be less than the face values of the receipts) and should be monotonically declining (a payment to be received two periods in the future should be more heavily discounted than a payment to be received one period in the future). Since the model is to estimate spot rates over future time periods, it is important that the source of data include bonds with coincident coupon payment dates. Fortunately, this is characteristic of most U.S. government issues.

Carleton also discussed application of the term structure estimates for stock valuation. He used a stock valuation model analogous to the expression for the price of a bond, treating dividends as an uncertain stream of future payments, that requires adjustment to its "certainly equivalent" stream, that is almost entirely analogous to a stream of bond coupon payments.

He closed with a brief description of research to come, discussing some of the difficulties that will be encountered as the data base is expanded beyond U.S. government issues to include some federal agencies and perhaps even corporates. As the time horizon is extended, tax effects may become more of a problem. Indeed, they may already cause some distortion in the results of the research already carried out. This became clear in Carleton's response to a queston.

46. ANALYZING THE TERM STRUCTURE OF INTEREST RATES (Fall, 1977)

McCulloch distributed a paper: "Analyzing the Term Structure of Interest Rates." Schaefer distributed a paper by himself and S.D. Hodges: "A Model for Bond Portfolio Improvement."

J. Huston McCulloch, Assistant Professor of Economics, Boston College, described the "Instantaneous forward interest rate curve," and discussed its value in bond portfolio management. Stephen Schaefer, Professor, London Graduate School of Business Studies, described a model for bond portfolio improvement, based on the proposition that regardless of interest rate forecasts, all bonds cannot be equally attractive to investors subject to widely varying tax rates.

McCulloch described the instantaneous forward interest rate curve as a graph on which are plotted the rates that are expected to characterize the market year-by-year into the future. If there were no taxes, and if all debt instruments were discount instruments, like Treasury bills, rather than coupon bearing instruments, it would be easy to construct such a curve. The curve represents interest rate expectations, and these are implied in the more familiar yield curve. But, because of taxes and coupon effects, deriving the forward rate curve from the yield curve is a difficult and imprecise exercise.

The forward rate curve has some attractive properties, for a bond manager. Assuming zero coupon instruments (that is, instruments like Treasury bills), the difference in total return that would be shown between two instruments with maturities m_2 and m_1, for a shift in forward rates of Δ_r, is given by

$$\frac{-(m_2 - m_1)\,\Delta_r}{\Delta_t}.$$

where Δ_r is the anticipated change in forward rates (apply equally to all forward rates), Δ_t is the holding period over which this change takes place, and m_2 is greater than m_1.

To take a specific example, suppose m_1 = 10 years; m_2 = 15 years; Δ_t = 1 year; and Δ_r = 10 basis points. Evaluating the expression above gives –50 basis points, which means that the 10 year instrument will produce 50 basis points more in total return than the 15 year instrument, over a year during which forward rates rise by 10 basis points. The expression then provides a quick and convenient device for computing the relative advantages of two maturities, for any forecast of a shift in future rates.

In general, we would not expect the forward curve to shift uniformly. In this case, in the expression above, Δ_r is the average change in forward rates, averaging the shifts corresponding to m_1 and m_2. This leads to the conclusion that if the forward curve shifts in such a way that the new curve crosses the old curve, the crossover maturity is of special interest. One can use a forecast of this crossover to identify the maturities that will have the best experience and those that will have the worst experience, from an anticipated shift in the forward curve. All of this was illustrated by McCullough in the form of graphs.

Schaefer's model is designed to choose an appropriate set of bonds, once the investor has selected the portfolio maturity structure. This selection may depend upon future cash needs of the investor, or it may simply reflect judgments with respect to interest rate changes, and an attempt to profit from those judgments. In any case, Schaefer's model requires that the investor already know the set of future cash flows he wants his portfolio to deliver. The model will then tell him how he can acquire those cash flows, through an appropriate selection of bonds, at the lowest possible price. As a practical matter, the selection of bond issues to be included in the portfolio is apparently not very sensitive to the desired set of cash flows. The model can quite usefully be applied to indicate appropriate changes in an existing portfolio, without any particular analysis of possible changes in maturity structure.

The usage of the model described by Schaefer was limited to default-free bonds. Presumably it could be applied to any class of bonds with homogeneous default risk, but not to a mixture of high-risk and low-risk bonds. The portfolio need not be constrained to deliver precisely the required flows, if it is assumed that a surplus inflow in one period can be saved for use in a later period. Schaefer's paper described the use of the model to reduce the cost of an actual tax exempt portfolio by about 1.5%, simply by finding a set of bonds offering the same cash flows, at a price 1.5% below the market value of the portfolio actually held.

The model has the form of a linear program, and it therefore generates what are called "shadow prices." These take the form of an opportunity cost term structure, from which one can derive the forward rate curve described by McCulloch in his discussion. While this is an interesting feature of the model, Schaefer commented that there are better techniques for estimating forward rates.

The dual values furnished by the linear program are the discount factors for the future periods. These factors, of course, correspond to the forward rates, and can be used to discount the after-tax cash flows from each bond, to give a present value for the bond. Subtracting the current market price, gives a net present value for each bond. These net present values were shown in a table in Schaefer's paper, and he pointed out that the net present value so calculated could never be positive, that it would be zero for all bonds included in the final portfolio, and that any bonds for which the present value was negative would be eliminated in arriving at the final portfolio. A tabulation of these net present values make it possible to identify the bonds that are least attractive, and it is generally possible to see intuitively why they are least attractive, although intuition is not likely to give a precise quantitative estimate of how unattractive they are. In the example shown, which was the selection of a portfolio for a tax exempt institution, the least attractive issues were deep discount bonds, presumably offering satisfactory after-tax returns to a tax-paying investor, but not to a tax exempt investor.

In answer to a question, Schaefer agreed that a number of portfolio improvements made by the model were apparent to the institution holding the original portfolio. There had been a reluctance to dispose of unattractive issues, because this would involve the recognition of losses. What the model did, in Schaefer's words, was to "put an explicit price on the management's stubbornness."

47. GOLD: SPECULATION OR HEDGE? (Fall, 1977)

In introducing his topic, Bruno Solnik, Professor, Centre d'Enseignement Superieur des Affairs, Paris, France, commented that while interest in international diversification, including the use of gold as an investment, has come only recently in the United States, Europeans including European institutions have been gold investors for a very long time. He set out to consider two questions. why it makes sense to consider gold as part of an international investment strategy, and what form a gold investment might take.

He began with some statistics on long term rates of total return from 1925 through 1978. Over that time period an initial investment would have been multiplied by 90 for common stocks, by 5 for bonds, and by 10 for gold. At the same time the consumer price index quadrupled. He raised the question why would an investment in gold have grown ten times while the consumer price index grew only four times. His answer was that gold is a scarce resource, and that far from finding productivity improvement in the production of gold we can observe that the cost has actually risen. Turning to a more recent period, 1973 through August of 1979, he displayed another set of appreciation figures. In this case gold showed a 2.3% monthly average rate of return, the S&P Composite Index showed a .5% monthly return and the consumer price index rose by .7% per month. But the variability in the rate of appreciation for gold was much higher than the variability for either the stock index or the price index.

The correlation between the performance of gold and the performance of other assets is also a matter of some interest. Over the longer time period the correlation between gold and the S&P 500 Index was −.14, while over the recent period it was −.36. The correlation between the price of gold and the consumer price index was not large, but was positive over both time periods. So gold does appear to be a hedge against inflation and a hedge against the risk in common stocks. Solnik commented that he could see no great merit to the calculation of a beta coefficient for gold against the S&P 500 Index, but in fact the coefficient was −.23 for the longer period and −.63 for the recent period. What he stressed was the negative correlation between gold and the U.S. Stock market. His view was that for a very long time those who have invested in gold have rarely done so in the expectation of a speculative profit, but have generally been looking for a hedge against a variety of calamities. And gold makes sense today not as a speculation but as a form of diversification.

Turning to an example, he commented that a portfolio invested 90% in common stocks, and 10% in gold would have shown a lower standard deviation in return than a portfolio entirely invested in stocks, over almost any historic period. In answer to a suggestion that one might attempt to construct a perfect hedge using stocks and gold, but that capital market theory would suggest that the return on this hedged portfolio would simply be the risk free rate, Solnik agreed. And he reminded the audience that over the 1925 through 1978 period, stocks had performed much better than gold, even when we ignore the storage and insurance costs that may be associated with gold ownership.

Solnik turned next to the ways in which an institution might invest in gold. First is the ownership of the metal itself. He commented that the market for gold metal is large and that gold is valuable in every part of the world.

A second possibility involves gold futures. There is a substantial volume in these contracts, but the margin is very high and Solnik did not believe these form an attractive vehicle for institutions.

There are two outstanding issues of bonds indexed to gold. Both are issues of the French government and are very popular with investors. The first issue is the so-called Pinay Issue. The 4.5% coupon is not indexed to gold, but the redemption price is. The investor may redeem his bond at any time, and the redemption price is reset every six months, on the basis of the average price of the French gold Napoleon coin over the preceding six months. Solnik commented that this presents an interesting opportunity for the investor, since once a new redemption price is set it remains constant for six months, while the investor is accumulating information on what the average price of the Napoleon will be, and therefore what the next redemption price will be. The second of the indexed bonds is the so-called Giscard Bond. The coupon is the value of 6.8 grams of gold, and the repayment amount, 10 years hence, is the value of 90 grams of gold.

A fourth possibility is gold mining stocks; a fifth is options on gold itself; and a sixth is options on the gold index bonds and gold mining stocks.

Solnik presented some statistics on five gold related investments: gold metal, South African gold mining stocks, the Napoleon coin, and the two bonds already described. Over the period 1973 through August 1979, the beta coefficient of an index of the stocks, the coin, and the two bonds, relative to gold metal, averaged less than one. And on average each of these investment media produced a higher return than did gold metal. Solnik discussed some of the reasons why the various gold related investments outperformed gold metal itself. The bonds constitute a particularly interesting case. The prices of the bonds are affected

by expectations of the long term performance of gold, and therefore do not react fully to short term movements in the gold price. More specifically, he presented a valuation model for the Giscard Bond. The model incorporates both an expectation with respect to the trend in the price of gold and a discount rate comparable to the going rate on bonds not linked to gold. From the model, and the quoted price of the bond, one can deduce the implied expectation with respect to the price of gold. As of mid-October the implied rate of appreciation was – 4% per year. If the price of gold actually drops by 4% a year, the investor will have received simply the "normal" bond return of 10% to 11%. If the price of gold remains constant, then the investor will achieve an extra 4%, for a total of 14 to 15%.

In answer to a question about the fundamental analysis of gold as an investment, Solnik said he had little advice to offer, but believed that the factors affecting the fundamental value of gold do not change rapidly over time.

48. PANEL DISCUSSION ON INTERNATIONAL INVESTING (Fall, 1979)

Jan Twardowski, Vice President, Frank Russell Co., moderated a panel discussion on internationally diversified portfolios and five presentations.

Twardowski began by reviewing the theoretical case for international equity diversification. He showed a table of market capitalization and GNP weightings for the U.S. and 12 other nations, pointing out significant differences between the two weightings for some countries. He then showed average returns for the decade 1969-78 for 7 foreign equity markets, together with currency returns. Both the foreign market and the foreign exchange results contributed to superior performance of foreign investments. Turning to the risk dimension, Twardowski showed correlations between the S&P 500 Index and foreign markets, both before and after adjusting for currency exchange. Standard deviations in returns for the foreign markets showed the risk reduction accomplished by international diversification. A separation of variance into two components, local market variance and currency variance, showed that the latter contributed only a minor part of the total. Twardowski suggested that the small currency variance may be in part due to the existence of fixed exchange rates for about half of the decade over which the variance was calculated. Finally, he showed the reduction in standard deviation for various percentages invested in foreign equities, as well as the increase in rate of return when risk reduction took the form of international diversification rather than a bond component.

The four panel members added their own practical experience with international equity investing, to Twardowski's theoretical base. Peter Haight, Vice President, Fiduciary Trust, discussed the experience of the U.N. pension fund, one of the oldest international portfolios managed in New York. His comments were directed chiefly at difficulties in making performance comparisons, and in presenting portfolio and index rates of return he noted the weaknesses in the Capital International indexes, a point that was to be repeated by subsequent speakers.

Joel Swanson and Mark Tapley, Vice Presidents, Morgan Guaranty Trust Co., discussed the experience of Morgan Guaranty, with an international pool of over $500 million, probably the largest managed in the U.S. apart from the U.N. pension fund. They reported both risk reduction, compared to the S&P 500 Index, and superior returns. Essentially, their experience supported the rationale Twardowski had given for international investing.

Gary Bergstrom, Acadian Financial Research and The Ford Foundation, focused on the Ford Foundation experience with managers of foreign portfolios, rather than the foreign equities themselves. He discussed the use of active and passive managers, the different strengths and weaknesses of active managers, and some of the Foundation's turnover in managers.

49. INTERNATIONAL PERFORMANCE MEASUREMENT (Fall, 1979)

John Chiene, Senior Partner, Wood MacKenzie & Co. (London), began by describing briefly the history of performance measurement, especially of internationally diversified portfolios, at Wood, McKenzie and Company. He then identified the four parts of the presentation to be given by him and by Dugald M. Eadie, Partner, Wood, MacKenzie & Co. (Edinburgh). The first would cover the calculation of rates of return at the index level, the second would involve the choice of a standard against which to judge portfolio performances; the third would deal with the analysis of performance results; and the fourth would deal with practical experience of the firm in compiling and using performance figures.

He showed a table of quarterly rates of return to local investors in the U.S.A., Japan, the United Kingdom, and Germany for the first quarter of 1974 through the third quarter of 1979. Quarterly and annual rates of return were calculated from chain linked monthly rates which in turn included both

income and appreciation. Monthly income was always calculated as 1/12 of the index yield at the beginning of the month, and the indexes representing the four markets were the Standard and Poors Composite Index for the U.S., the Tokyo New Stock Exchange Index for Japan, the Financial Times Actuaries All Share Index for the UK, and the Commerzbank Index for Germany. These indexes were chosen in preference to the Capital International Indices, because at least in the case of the UK market the Capital International Index is biased towards large companies.

Over the 5 3/4 year period, the geometric average annual rates of return were 17.6% for the UK market, 11% for Germany, 9.2% for Japan, and 6.7% for the U.S.A. A second exhibit showed for the same quarters and for the Japanese, UK and German markets the movement of currency exchange rates against the U.S. dollar. A third exhibit combined the local rates of return of the first exhibit with the exchange rate movements of the second exhibit to show rates of return to U.S. investors for the four markets for the same 1974 through 1979 period. The geometric mean annual rates of return were now 19.7% for Germany, 16.4% for the UK, 13.4% for Japan and 6.7% for the U.S.A. Chiene commented that the figures demonstrate the extreme importance of market timing when dealing in the markets.

Turning to the second topic, the setting of standards against which to judge international portfolio performance, Chiene proposed three choices. For a U.S. investor, the Standard and Poors Composite Stock Index will serve as a standard for purpose of determining whether international diversification delivers positive results relative to an exclusively domestic investment policy. The second choice is a multinational stock index, which is appropriate for judging a fund that is able as a practical matter to invest on a worldwide basis. The Capital International indices are the most comprehensive and appropriate for this second choice, and a fourth exhibit showed the market weights for an index covering all of the important markets outside the U.S.A. and one that included the U.S.A. The major non-U.S. markets are those in Japan, the UK and Germany, and all of the non-U.S. markets together are about equivalent in size to the U.S. market.

A third choice of standard is one that is tailor made for a particular fund, and Chiene referred to this as the client's "notional fund." This index will be made up of indexes for different foreign markets weighted according to the initial distribution of assets among those markets selected by the client. The index would be adjusted for cash flows as though each cash flow were apportioned to the different market indexes as of the date of the flow. Chiene commented that this third choice has the benefit of flexibility to meet any distribution of assets across foreign markets that may appeal to a client, but that it does suffer from a lack of objectivity. Its great advantage is that it can embrace practical constraints on the use of foreign markets.

Dugald Eadie discussed the third topic—calculations and analysis of results. He observed that in comparing the performance of a particular fund against a standard, one would like to see separately the effect of two kinds of decisions: the proportionate allocation of money among various foreign markets, and the choice of individual securities within each market. He presented a fifth exhibit showing this for a particular portfolio. A sixth exhibit showed the same breakdown but for the absolute rate of return achieved by the particular fund rather than the excess over the return on the comparison standards. Eadie commented that the sixth exhibit can be useful for identifying the contribution made by trading activity during the period. He observed that Wood, McKenzie and Company and its clients have very little interest in risk measurement, but a seventh and an eighth exhibit provided standard deviation and correlation data for a number of national market indexes. He did not believe that the Capital International World Index could be combined with regression analysis to give an international market line. He did not think there is any such thing as a risk-free return in the international markets, or such a thing as risk-adjusted return.

Turning to the fourth topic—practical experience with international performance measurements—Eadie commented first on the difficulty in simply gathering accurate and appropriate data on stock indices and currency exchange rates. Exchange controls and withholding taxes present special problems that may affect different clients differently. Sometimes there are separate "official" and "investment" currency exchange rates. A second practical difficulty concerns accounting systems. For example, it is common in the United States to use the date a purchased security is paid for as the date the security comes into the portfolio. This rule does not work well in foreign markets, and Wood McKenzie brings a security into the portfolio as soon as the client owns it.

The third practical aspect of the performance measurement service has to do with the interpretation of results. Eadie stressed the importance of the participation by the investment manager in any discussion and evaluation of results.

A question was raised as to the use of international diversification by pension funds based in countries other than the U.S.A. Wood McKenzie and Company have no client plans in Japan, Switzerland or Germany and the two speakers and a number of partici-

income and appreciation. Monthly income was always calculated as 1/12 of the index yield at the beginning of the month, and the indexes representing the four markets were the Standard and Poors Composite Index for the U.S., the Tokyo New Stock Exchange Index for Japan, the Financial Times Actuaries All Share Index for the UK, and the Commerzbank Index for Germany. These indexes were chosen in preference to the Capital International Indices, because at least in the case of the UK market the Capital International Index is biased towards large companies.

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pants generally agreed that there are no trusteed pension plans of any significance outside the U.S., the UK and Canada.

50. INTERNATIONAL FIXED-INCOME INVESTING (Fall, 1979)

Gregory A. Barnett, Assistant Manager, The Bank of Bermuda, Ltd., began by observing that the potential for international diversification to improve risk-return characteristics of a portfolio is even greater for bonds than it is for equities. The performance of the major world bond markets from 1970 to 1978 validates the efficient market hypothesis that the world portfolio is the most efficient.

U.S. managers have been reluctant to go into foreign markets because of doubts about their ability to forecast those markets. But the benefits of the larger market may more than make up for any reduced forecasting ability.

As of the end of 1978, the world bond market (8 foreign countries plus the U.S.) was $2.3 trillion, of which the U.S. accounted for 54%. The value of the stock markets in the same 9 countries amounted to $1.5 trillion of which the U.S. accounted for 53%. The non-U.S. bond market is simply too large to ignore.

Barnett showed a table of returns for government bonds in the major national bond markets for 1970-78. The U.S. market outperformed those of Canada and Australia but was well behind those of France, the Netherlands, Japan, West Germany and Switzerland. Currency movement accounted for much of the difference. He observed that the wide dispersion of returns across markets, from 6.2% per year in the Canadian market to 18.5% in the Swiss market, argues strongly for diversification.

Another slide showed that the volatility of returns in the foreign markets, when measured in local currency, was not very different from volatility in the U.S. market. In U.S. dollars, the foreign markets were much more volatile. But the correlation among markets was very low so a diversified portfolio offers the prospect of reduced volatility. Currency movements account for much of the lack of correlation, and therefore the correlation among West German, Dutch and Swiss markets was relatively high. Exchange rates among the three are fixed.

Barnett next showed returns and variabilities for diversified portfolios, ranging from 100% U.S. to 100% foreign. The foreign component was assumed to be made up of the 8 non-U.S. markets weighted by capitalization. As the foreign content increased, so did the return. Volatility declined, reaching a minimum at 30% foreign content. Return per unit of volatility reached a maximum at about 50% foreign content. Barnett noted that a 50:50 U.S. and foreign weighting corresponds to the roughly equal market values of the U.S. and non-U.S. bond markets.

He went on to compare international diversification for stocks and bonds. Foreign bond markets showed relatively high volatility—2.3 times the volatility of the U.S. bond market compared to the foreign stock market volatility of only 1.3 times that of the U.S. stock market. But the correlation of foreign bond market returns with U.S. bond returns was much lower than the correlation for stock markets. The risk reduction through international diversification was greater for bonds than for stocks, up to a 30% foreign portfolio. Beyond 30% the volatility of the bond portfolio rose rapidly, while that of the stock portfolio continued to decline, to a 50% foreign weighting. Hedging the currency risk, however, can bring down the risk of an international bond portfolio.

51. ACTIVE VS. PASSIVE INTERNATIONAL MANAGEMENT (Fall, 1979)

John Koeneman, Senior Trust Investment Officer, State Street Bank & Trust Company, discussed passive management and David Testa, President, Rowe Price-Fleming International, Inc., presented the case for active management. Testa observed that choosing between active and passive management in an international context is particularly difficult because of a lack of performance data for both kinds of management and inadequate research on the efficiency of the international market. The only available truly international investment management records are those of the offshore mutual funds, of which there are only a few, and those of the small number of U.S. practitioners that have an extensive record, including Fiduciary Trust and Morgan Guaranty. The performances of these groups, however, strongly suggest that value can be added by active management. A detailed examination of the record suggests that the primary opportunity has been in overall portfolio structuring, in terms of country and asset choice. There is evidence that in some individual international markets, such as Japan, value can be added through stock selection.

Two conditions favor successful active management. First, the international manager operates in a more diversified environment and has more opportunity for market selection, then the purely domestic manager. It seems reasonable to expect that

different markets move on their own internal dynamics, and the international manager benefits from an expanded ability to diversiy the risks present in an individual market and will therefore capitalize on opportunities that a domestic investor may pass up. Second, the international manager can achieve superior diversification relative to a passive standard, by taking advantage of the range of investment alternatives available. For example, in the energy area the role of the international oils is a dominant one on a market weighted basis. But the active manager may find that selective investment in nationally oriented oil investments will produce a more diversified exposure to the business and market opportunities present in that industry.

Evidence supporting the success of active management in terms of stock selection is most persuasive relative to the Japanese market, which is the largest non-U.S. market in the world equity system. There is evidence to suggest that institutional investors have achieved superior results relative to the market index, and further that foreign investors have been able to outperform domestic institutional investors in their equity selections. This evidence can be seen in the records of the limited number of long standing public funds that have invested almost exclusively in Japan.

In considering the alternative of indexing, Testa said it is important to recognize that the index, as currently structured, represents an accident of various national financial systems and is to some extent a reflection of prior success of individual economies. He believes that an index portfolio does not provide the properly structured diversification of investments into the smaller, more dynamic economies nor into the stronger, better managed economies that would best serve a U.S. investor seeking to diversify his exposure to our relatively mature economic system. In his opinion the index investor is pursuing a lagged measure of historic success in an environment that is highly dynamic.

Finally, Barnett noted that there was a significant positive correlation between exchange rate movements and inflation differentials among countries. This is important to the U.S. investor seeking a real rate of return on bonds in excess of the U.S. inflation rate.

52. STRUCTURING THE INTERNATIONAL INVESTMENT MANAGEMENT PROCESS (Fall 1979)

Keith Ambachtsheer, President, Canavest House, began by reviewing the days discussion of international investing. Recent history seemed to suggest that internationally diversified portfolios had offered both higher returns and less variability than domestic portfolios. Ambachtscheer offered little assurance that the excess returns will persist, but he believed that the risk reduction effects are permanent. He referred to the work by Don Lessard that had already been cited to the effect that there may be risk premia within national securities markets that will disappear or at least become smaller as international diversification spreads and investors begin to operate in a true world market.

Earlier discussion had dealt with both active and passive management of international portfolios. Ambachtsheer limited his remarks to active management, and specifically to active management based on modern portfolio theory. His concern was with implementing this active strategy and he saw four parts to the process: establishing the overall investor objectives, making judgments about the future, translat- the judgments into portfolio decisions, and maintaining a control and review of the process.

He suggested beginning with estimates of what the risks and rewards will be in a perfect market. This involves estimating risk free rates in all the countries in which one might invest, forward currency rates for the currencies involved, and expected returns and variability for stocks and bonds in those national markets. Initial estimates might be based on recent actual performance data. These efficient market estimates would then be taken to those who are responsible for making actual forecasts. If the actual market forecasts differ from these perfect market expectations then there is some basis for an active strategy. What matters now is the predictive ability of the forecasters, and Ambachtsheer referred to the "information coefficient" that he had discussed at preceding Q Group Seminars. It may be possible to carry over some of the information coefficients based on U.S. and Canadian stock selection ability, to international investing.

Ambachtsheer suggested a specific methodology for converting predictions not explicitly in the form of rates of return into useable rates. The forecaster can be asked to express a bullish or bearish opinion relative to the perfect market expectations. If we have an idea of the underlying distribution of rates of return in each market, and the frequency of bullish or bearish conditions, then from the predictor's description in words of his forecast we can come up with a numerical expected rate of return. As an example, Ambachtsheer suggested a risk free return of 10%, and a risk premium of 4% as the perfect market estimates. A forecaster with an IC of .3 is bullish about the particular market, which can be translated

to mean that his expected return implies an increment of 3.6% above the perfect market expectations. Numerical forecast of this kind can then be fed into an optimizing technique, to arrive at specific portfolios.

As a further illustration, Ambachtsheer related the experience of a French institution considering five national stock markets, seven bond markets, gold and cash as investment media.

In his closing remarks on control and review, Ambachtsheer said he had nothing to add to the preceding discussion of performance measurements as such, but stressed the importance of using risk equivalent efficient portfolios as a base for performance comparison.

James L. Farrell, Jr., Vice President, Citibank, N.A., discussed an application of the methodology Ambachtsheer had described, for structuring the management of an international portfolio, the International Securities Fund, at Citibank. This fund is diversified across Japan, West Germany, the United Kingdom, the Netherlands, France and Canada and may also invest in Hong Kong, Singapore, Australia and Switzerland. The major position of the fund will be in equities, but bonds and cash equivalents are also eligible. Currency outlook is an important factor in evaluating the different national markets. The fund size is currently about 50 million dollars, and there are about 160 stocks in the portfolio.

Rate of return forecasts are developed essentially along the lines discussed by Keith Ambachtsheer. Risk measures are historical standard deviations and correlations for the period since exchange rates were allowed to float. Farrell provided a table covering eight foreign markets and showing a forecasted return and an information coefficient for both the currency and equities in each market, as well as a total return and standard deviation for each market.

Farrell next described the use of a standard portfolio optimization routine, making use of the risk and return forecasts, to generate a set of efficient portfolios. He showed a graph of these portfolios in terms of expected return and standard deviation, as of September 30, 1979. It appeared that the current portfolio could be improved by increasing expected return at the same risk level, or by reducing risk at the same time expected return level. Farrell discussed what both of these shifts would involve, in terms of changes in the portfolio cash position and shifts among foreign markets.

He concluded with some comments on control and review of the decision making process. The process was first put in place in March 1979, and through the end of September there is evidence of above average forecasting success with respect to stocks and bonds, but a general lack of success with respect to currencies. The forecast horizon, however, was a full year and the evaluation applied to only the first half of this period.

53. INTERNATIONAL INVESTING WITH MULTIPLE MANAGERS (Fall, 1978)

Gary Bergstrom, Acadian Financial Research, began with a brief review of the established advantages of an investment strategy that incorporates international portfolios. Reported studies indicate that national stock markets have their own cycles, and the correlations between markets are sometimes quite low. Five academic studies carried out from the early 1950's to the mid-1970's reported a 30 to 60% risk reduction through international diversification. Bergstrom pointed out that none of these studies allowed for the costs of international investing, and all were based upon historic performances of stock market indexes. Referring to actual international stock portfolios, Bergstrom noted that the Putnam International Fund, over 7½ years, had shown about 30% less risk than the S&P 500, and had achieved a slightly better return.

Turning to the matter of multiple manager selection, Bergstrom commented that most U.S. investors are seeking some risk reduction through international diversification but are also hoping to benefit from successful active management. He observed that the quality of foreign stock markets is not up to United States standards, but that the lack of information in foreign markets may provide opportunities for active management. He suggested that there are three management styles that are worth examining for international portfolios. One style is represented by the fully active international manager, moving assets among the foreign markets, but usually possessing no special expertise about particular stocks in a particular market. A second style is represented by the regional specialist, seeking to achieve superior performance in one nation (Japan, for example) or region (continental Europe, for example) because of ability to analyze that market and the stocks in it. Finally, a third style is represented by the passive or index manager, generally restricting investments to high quality, liquid stocks in the eight to ten most liquid markets. The object here is simply superior diversification. Over time one would expect this third style to lead to a performance equivalent to that of a combination of foreign stock indexes.

In choosing among the three styles, one should be aware that performance studies indicate that on average foreign active managers have not done as well

as the stock indexes. This should not be too discouraging, however, since similar conclusions have been drawn with respect to the average of active management in the United States.

In putting together an international investment program, Bergstrom suggested that it would be appropriate to make use of both active and passive managers. The performance of the passive manager would provide a valuable benchmark against which to judge active managers. And he believed that such a combination would be more appealing to a pension investment committee than the choice of a single style of management.

MARKET TIMING

54. OPTIMUM TIMING OF BOND REFUNDINGS (Spring, 1979)

Kalotay distributed a paper: W. M. Boyce and A. J. Kalotay, "Optimum Timing of Bond Refundings."

Andrew J. Kalotay, Dillon, Read & Company, Inc. described a study begun in 1975, to assist the Bell System in financial planning. At that time the system had approximately $30 billion in callable debt outstanding, and the debt issues of 1970 were becoming callable in 1975. The project was completed in late 1976, and the conclusions were used to justify substantial refundings in that year.

Kalotay used a specific example, concerning AT&T 7.75s of December 1, 1977 to point out that the marketplace can make serious mistakes in the valuation of callable bonds. The price of that issue dropped by more than a full point in October, 1976, when a call was announced. Kalotay's comment was that the call should have been anticipated and the issue should have been trading essentially as 30 day commercial paper.

The end product of the refunding decision analysis is a "stopping curve," which shows for each month during the life of a callable issue the critical refunding interest rate, below which the company should refund. The stopping curve automatically takes into consideration the possibility that refunding at a more attractive rate may be possible in the future. It is based on an assumed log normal distribution of bond yields with no trend. That is, it assumes future interest rates cannot be forecasted.

Kalotay described in general terms the anlysis that leads to the stopping curve. It begins with the relatively simple analysis of whether to refund an outstanding issue, at a given current bond yield. This is an analysis that can be performed at any time, and requires only a knowledge of the rate that would have to be paid on the refunding issue. But since refunding is possible at monthly intervals over almost all the life of an issue, the decision at any one point in time must take account of the possibility of a more profitable later refunding. It is here that dynamic programming comes into play, and combines the complete set of decision points, making use of the assumed distribution of future interest rates, to deliver the stopping curve.

When the analysis was complete it turned out that a fair approximation to the stopping curve, at least if there is a substantial period to maturity, is a rule to call the issue when the refunding rate is more than 125 basis points below the coupon on the outstanding issue.

Kalotay offered the general observation that the call provision on a bond issue is generally beneficial to the issuer and the investor, because most investors are in lower tax brackets than issuers. Even without the tax rate differential, there is a tax benefit because the call premium is deductible to the issuer and generally treated as capital gain to the investor. He closed with a suggestion that the analysis he had described is useful in at least three applications other than bond refunding. These are the valuation of put options, conversions of convertible floating rate notes, and actions on Canadian extendable and retractable instruments.

55. CYCLICAL TIMING: MORE RETURNS FOR LESS RISK (Fall, 1978)

A paper co-authored by Robert F. Vandell, Diana R. Harrington and J. Stephen Levkoff, entitled "Cyclical Timing: More Return for Less Risk" was distributed.

This presentation, by Robert Vandell, Research Director, and Diana Harrington, Research Associate of the Financial Analysts Research Foundation, demonstrated that risk in an equity portfolio could have been substantially reduced over past time periods and at the same time rate of return could have been increased, by the use of very simple cyclical timing strategies.

Vandell opened the presentation by describing cyclical timing as an attempt to reduce downside risk in a portfolio without a proportional reduction in return. The obvious way to reduce the risk in an equity portfolio is to shift partially into bonds. Using the terminology of the Capital Asset Pricing Model, one would expect such a shift to lower the beta coefficient of the portfolio and produce a flatter "characteristic" line. In this case, the hope was that cyclical timing might convert the straight portfolio line into an upward sloping or J-shaped line, indicating high volatility in rising markets and low volatility in falling markets.

The empirical tests of more than one timing strategy achieved the desired objective, and also gave some insights into portfolio risk and its measurement. The research involved six timing strategies, and the results of two of these were reported in the course of the presentation. The first strategy called for quarterly shifts in the mix of stocks and bonds in a portfolio, depending upon the performance of the stock market in preceding quarters. A sequence of quarters in which the stock market decline called for shifts from bonds to stocks, while a sequence of quarters of market rise called for shifts from stocks to bonds.

Transactions costs were allowed for, and the performances of the stock and bond components were assumed to be represented by the 51 years of historic returns recorded by Ibbotson and Sinquefield. The performance of the timing strategy was compared with the performance of a portfolio with a constant stock-bond mix, rebalanced quarterly. A number of return measures were used in comparing the timing strategy to the constant mix strategy, including annual average compound rate of return, and wealth relative at the end of the 51 year period. A variety of risk measures were also used, including a beta coefficient, a standard error of estimate, a portfolio standard deviation, and a semi-variance, a measure focusing on downside risk. Several new risk measures designed to show how risk changed with time provided helpful perspective. By all measures, the timing strategy substantially outperformed the constant mix strategy.

A modification of this strategy added a timing element to the fixed income component of the portfolio, to shift between bonds and bills. The result was a small improvement in performance.

A second strategy concentrated not on the short-term cycles normally associated with business activity but on longer-run bull and bear market cycles. It bought equities when a bear market bottom was being approached and sold when a bull market top was coming. The strategy was successful, and was improved still further when timing was added to the fixed income investments.

Diana Harrington described in some detail the measurement criteria and the strategies tested. The most remarkable result was the reduction in risk, particularly in periods for which rates of return were negative.

Vandell summarized the conclusions of the study, emphasizing the evidence that supports early findings of misspecification of the Capital Asset Pricing Model, and evidence of correlation between equity and debt markets. He also raised questions about the broader implications arising from such findings as the feasibility of a J shaped portfolio line and the changing character of risk over time.

56. MARKET TIMING (Spring, 1976)

Much of the discussion of this topic stemmed from a 1975 article by William F. Sharpe, Professor of Finance, Stanford University, entitled, "Likely Gains from Market Timing,"* and some of the response which that article engendered. Research results presented by James Farrell, Investment Officer, College Retirement Equities Fund, simulations prepared by Keith Ambachtsheer, and commentary by William Sharpe all offered new and practical guidance to the value of timing and particularly to the profitable implementation of market forecasts.

James Farrell introduced the subject, identifying three elements to the market timing process: first is the ability of managers or their advisors to foresee market movement; second is the ability of an investment management organization to take advantage of forecasts; and third is the kind of market environment that makes forecasting profitable. Farrell concerned himself most with the third of these elements, leaving the first to a future seminar, and the second to Sharpe and to Keith Ambachtsheer, whose presentations are discussed below.

Farrell said he believed some consulting services had shown an ability to forecast the stock market, and reported some tests that he had run on the importance of the market environment and the apparent success of mutual funds in making correct forecasts. He considered the period 1957-68 to be one of fairly stable stock markets, offering minimal opportunities to profit from accurate forecasts. On the other hand, he considered 1969-75 to be a period offering wide fluctuations and substantial opportunities to exploit good forecasts. A series of simullations showed what might have been accomplished by shifting fund assets back and forth between cash and equities (represented by the S & P Index) with perfect timing, and with something less than perfect timing. It turned out that opportunities to profit from market timing were considerably greater in the later period than in the earlier period, and there were substantial gains to be achieved from less than perfect timing. Farrell next reported an analysis using quarterly data on cash and equivalents for fifty-six mutual funds over the period 1958-75. He found that for all of the funds cash and equivalents generally averaged around 10 percent of total assets, falling at times to less than 1 percent and rising at times to around 20 percent. So, for each fund, he tracked the deviation of the percent in cash and equivalents from the average percent for that fund, and calculated the additional rate of return the fund could have achieved from these deviations, assuming the cash to be invested in treasury bills and the balance in the S & P 500 Index. Farrell pointed out that the test was not a perfect one, since the defintion of "cash and equivalents" may be somewhat ambiguous, the fluctuations in cash balances may be in part a function of

**William F. Sharpe, "Likely Gains from Market Timing," Financial Analysts Journal, March-April 1975, pp. 60-68.*

redemptions and sales rather than a reflection of market forecasting, and his analysis was based on cash percentages at the beginning of each quarter, when the percentages were probably changing throughout the quarter. Still, given these limitations, the analysis indicated that the funds had accomplished relatively little in the 1958-68 period, the period of stable markets, but had accomplished something in the period 1969-75, the period of more substantial fluctuation. Even in this later period, however, the gains due to timing were apparently not very significant.

William F. Sharpe and Keith Ambachstscheer continued the discussion of market timing, with presentations focusing on the use of forecasting ability. Sharpe began, referring to his 1975 article and to criticism of that article, chiefly by Ambachtsheer, to the effect that Sharpe had pictured a less than perfect forecaster making rather poor use of his partial ability to predict the market. Sharpe observed that even if our forecasting ability is less than perfect, if indeed we have any forecasting ability at all, then we cannot be worse off using that ability so long as we use it in the best possible way. But if we make less than the best use of it, then we may be worse off than if we had made no use of it at all.

Sharpe picked up and emphasized a theme suggested by a number of earlier speakers, to the effect that the starting point for the asset mix is an understanding of the client's risk preferences and the money manager's assessment of the capital markets. When the manager foresees a major market move, then his assessment and the client risk preferences may indicate a shift in the portfolio. But before a shift is made, the manager must consider the transaction cost in this shift (and the very difficult question of the appropriate time over which to amortize this transaction cost) and also the cost of a possible mistake in the forecast. Sharpe particularly stressed the need to insure that the shift in the portfolio, to reflect the manager's assessment of the markets, maintain a risk level that is appropriate to the client.

Since there are two costs of implementing market forecasts, the transaction cost and the cost of being wrong, it is important to assess predictive ability before attempting to implement predictions. Sharpe's observation was that we never really have a track record to test forecasting ability adequately, but he referred to some research he is carrying out with Stewart Hodges to make estimates of the forecasting ability of analysts

Ambachtsheer discussed ways to make the best possible use of market forecasts, given that the forecasts are less than perfect and that investment managers know that they are less than perfect. He referred to his 1974 article, "Profit Potential in an 'Almost Efficient' Market,"* in which he had dealt with the matter of measuring ability to predict the market and reported some testing of institutional forecasting ability. In this presentation he made use of a series of examples in which he assumed a manager has a forecasting ability represented by a coefficient "C" which is known to the manager, and that he uses this ability to come up with a prediction "U" of the extent to which the stock market will outperform or underperform its average, during the coming time period. The manager then adopts as his best market forecast for the period:

(1) Adjusted Market Forecast = Average Market Performance + C X U
= 12.76% + C x U

(The 12.76% was the average market rate of return for 1934-1972, which was accompanied by a standard deviation of 18.17%.) With this forecast for the stock market, and a knowledge of what can be earned in treasury bills, the manager determines which of stocks and treasury bills are likely to be the more profitable during the coming period. This leads to a preference for 100% investment in stocks or 100% in treasury bills. But a risk limitation now comes into operation. Ambachtsheer assumed that the portfolio strategy would embrace a willingness to take on the downside risk implicit in a buy and hold strategy, but no more than this. Since downside risk for a buy and hold strategy, using the numbers above, could be represented by 12.76% – 18.17% = –5.4%, the strategy of the manager would be to maximize the expected rate of return on the portfolio subject to:

(2) Expected portfolio return–standard deviation of portfolio return $\geqslant$ – 5.4%.

For a proportion XM of the total portfolio invested in the stock market and a proportion XO invested in the market the year before:

(3) Expected portfolio return = XM (Expected market return) + (1–XM) (Treasury bill rate) – (XM–40) (Transaction cost = 2%).

(4) And Standard deviation of portfolio return = XM (Standard deviation of market return) = XM (18.17).

If it turns out that the limitation in (2) has not been met, then the manager has to try a smaller proportion in stocks until it is met.

Ambachtsheer simulated the performances of twelve managers, three each with forecasting abilities represented by C = .1, .3, .5 and .7.

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*Keith Ambachtsheer, "Profit Potential in an 'Almost Efficient' Market," The Journal of Portfolio Management, Fall, 1974, pp. 84-87.

For each manager, he computed a "forecasting error" based on "C" and the variance in the market. From this he simulated what the manager's expectation of the market might have been in each year, what adjusted forecast the manager would have used as in equation (1), what mix of assets he would have arrived at after imposing the limitation in equation (2), and what would have been the *actual* performance of that mix (adjusted for transactions costs).

For each forecaster, a 39-year record was computed, and shown below is an extract from Ambachtsheer's Table 9.

Table 9

Forecaster	"C"	Proportion of Correct Predictions	Average Rate of Return
A1	.1	59%	11.1%
A2	.1	44%	9.8%
A3	.1	67%	11.4%
B1	.3	67%	9.9%
B2	.3	67%	13.1%
B3	.3	74%	14.9%
C1	.5	82%	14.9%
C2	.5	67%	13.9%
C3	.5	74%	15.5%
D1	.7	82%	16.3%
D2	.7	85%	16.7%
D3	.7	79%	16.1%

In the table, the forecasters with abilities represented by C = .1 are identified as A1, A2 and A3. Those with ability C = .3 are B1, B2 and B3, and so on through C = .5 and C = .7. Since the simulations of the market performance and of each forecaster's prediction of the market include a random element, the successes of A1, A2 and A3 were not identical, although the forecasts for each were based on the same level of ability. None of these three achieved an annual rate of return as high as the 12.76% stock market average. The "proportion of correct predictions" is the proportion of times the stock market was correctly predicted to outperform treasury bills plus the proportion of times it was correctly predicted to underperform. The Average Rate of Return can be compared to the 12.76% that would have been achieved by a "buy and hold" strategy. It appears that an ability represented by C = .5 or .7 clearly paid off, while at C = .1 it did not, and at C = .3 it did at times. Ambachtsheer deduced that if the manager can correctly predict the market about two-thirds of the time, and if he knows this to be his ability, he can successfully use his forecasts to improve portfolio performance.

Sharpe pointed out that the Ambachtsheer analysis did not allow for adaptation of the portfolio shifts to the risk preferences of a particular client, and a number of participants commented on the difficulty in knowing just what a manager's forecasting ability is. There was also a discussion of the best ways in which to make use of a variety of predictions by different analysts or managers, so as to achieve the maximum benefits of diversification.

57. STOCK INDEX FUTURES: THEORY AND PRACTICE IN A NEW MARKET (Fall, 1982)

**Stephen Figlewski distributed a paper: "Stock Index Futures: Theory and Application in a New Market."*

Stephan Figlewski, Associate Professor, Graduate School of Business, New York University, began with some comments on the potential for the use of stock index futures. He observed that the stock market is very much larger than some other cash markets that have already developed successful futures markets. Stock index futures offer direct risk management of equity portfolios at low costs. Hedge strategies make it possible to eliminate or reduce market risk while following active stock selection policies. Conversely, index futures can be used to adjust market risk in pursuing an active market forecasting strategy. Selling stock index futures is a particularly attractive alternative to short sales of stocks, which are for many institutional investors practically impossible.

He described the three indexes on which futures contracts are available–the Value Line Index, the S & P 500 Index, and the New York Stock Exchange Composite Index–and the contracts that accompany each. Briefly, the unit of the contract is $500 times the value of the index, the contract months are March, June, September and December, margin is approximtely 10%, positions are marked to market daily, and delivery takes the form of a final cash settlement.

The brief history of trading in stock index futures (the three contracts were introduced only in February, April and May 1982) means that only a limited supply of data is available for empirical testing. Figlewski presented a number of results based on the data he had. Changes in the three indexes themselves are highly correlated. Changes in the futures market are also quite highly correlated with the indexes and with each other. What was of particular interest was the high correlation between the futures market for one index and the cash market for another index. This suggests a rather high versatility of futures contracts for hedging many kinds of stock portfolios.

Figlewski traced through two theoretical explanations for the relation between the value of an index and the value of a futures contract on that index. Having calculated for September 30, 1982 the theoretical value of the futures contract on the New York Stock Exchange composite index, using both models, Figlewski had found that the actual futures price was significantly below the theoretical price. He offered some possible explanations for this apparent inefficiency. The one that seemed most likely to him is that investors prefer to be short in the futures market and long in the cash market.

He turned next to two possible strategies for an institutional portfolio to take advantage of the apparent inefficiency. One would be to invest cash inflows in a combination of money market securities and index futures. According to some of the participants, the legal obstacles to a pension fund carrying out such a strategy have now disappeared. A second strategy would be to select a trading stock portfolio that tracks an index rather closely, and then to trade between this portfolio and a combination of a money fund and futures contracts.

Figlewski turned finally to hedging strategies, and derived the mathematics for a risk minimizing hedge ratio, that is the ratio of the value of the index units sold short to the value of the stock portfolio held long. If the hedge is to be left in position until the maturity of the futures contract, the hedge ratio turns out to be the beta coefficient of the stock portfolio. But if the hedge is to be lifted early, then the risk minimizing hedge ratio is somewhat different, the risk reduction is not complete, and Figlewski presented figures for the effectiveness of hedges over one week holding periods. One might expect that close to its expiration date a futures contract would become more effective for short term hedges. Not enough data have been accumulated yet to test this proposition.

There was considerable discussion of how the index futures market seems to have performed. Some participants observed that in a rising market the apparent discount in the futures price tends to diminish, while in a falling market it tends to increase. Others observed that over time the discounts from theoretical values seem to be diminishing and the market may well be becoming more efficient.

58. DEBT OPTIONS (Fall, 1982)

Albert Madansky distributed a paper entitled "Debt Options."

Albert Madansky, Professor, Graduate School of Business, University of Chicago, gave a presentation on the valuation of options on bonds and of options on bond futures. He declared at the outset that although the Black Scholes stock option valuation model was being used for the valuation of these bond options, this use was quite inappropriate.

Rendleman and Bartter had developed a binomial model for the valuation of bond options. The model pictures interest rates varying randomly over time,

with rates moving either up or down, with a constant probability, by a constant increment over each unit of time. The model produces a distribution of interest rates over time, a binomial distribution which over a long period of time will approach the normal distribution. From the distribution of interest rates it is possible to derive a corresponding distribution of bond prices.

To go one step further and derive a distribution of values of call options on a bond, one establishes a neutral hedge position by purchasing a bond and selling the appropriate number of calls. This number is the one that will produce the same return on the hedge position whether interest rates move up or down. Madansky displayed three corresponding distributions, one for interest rates, one for bond prices, and one for call options on the bond.

He next reported an analysis of yields on three and six month treasury bills that demonstrated quite clearly the lognormal distribution assumption was inappropriate. What he did then was to work with the actual distribution of the treasury bill option yields to construct a distribution of bond yields from which the distributions of bond prices and option prices could be deduced.

Next, Madansky turned to options on bond futures contracts. We now have almost four years of history on bond futures trading on the Chicago Board of Trade. It turns out that yields on futures contracts follow a lognormal distribution. It also turns out that the mean value of the distribution of the logarithm of adjusted annual yields was about .25. Finally, the price distribution was determined from the yield distribution and Madansky arrived at a model that, for an assumed standard deviation of log yield between .18 and .20 produced theoretical numbers extremely close to the actual values of options traded during the first few days of the existence of the market for bond futures options.

59. INTEREST RATE FUTURES: APPLICATIONS (Fall, 1982)

Seymour N. Lotsoff distributed a set of exhibits to accompany his presentation.

Seymour N. Lotsoff, President, S.N. Lotsoff and Associates, discussed a number of ways in which interest rate futures positions can be used to control the rates and maturities on both assets and liabilities. His first example concerned the use of futures to effectively convert a three year loan priced daily at the prime rate to a loan at a "fixed" rate of interest. The actual loan was for ten million dollars at the thirteen week average bank prime rate plus 2%. When the loan was initiated at the beginning of 1978 the prime was 7.75% and the loan rate was 9.7%. Over the life of the loan, through the fourth quarter of 1980, the loan rate rose fairly steadily to end at 18.43%. The objective in using the futures contract was essentially to lock in the 9.75% rate for the full three year period. Lotsoff presented the methodology for establishing the appropriate hedge and adjusting that hedge through the life of the loan. He traced quarter by quarter over the life of the loan the change in the loan interest figures at 2% over prime and the gain or loss in the futures contract. Over the period the result was to bring about an average effective interest rate of 9.65%, whereas the unhedged average rate would have been 14.3%.

Turning to a case involving long-term obligations, he showed how one can use futures contracts to effectively change the duration of such an obligation. Next, he considered the case of hedging a two year note in the absence of a two year futures contract. A combination of a treasury bill futures contract and a treasury bond futures contract would serve the purpose.

Finally, he described the process by which a bank dealt with an asset-liability imbalance. Sometime in July, the bank anticipated taking on a liability in September and having funds to invest. The objective was to lock up the 14.02% rate available on investments in July. Lotsoff went through the methodology for establishing the appropriate futures contract in July so that as yields dropped between July and September the profit on the futures contract made up for the lost opportunity rate on the September investment.

There had been some discussion of basis risk in using futures contracts for hedging, and in answer to a question Lotsoff commented that he thought the actual basis risk in the hedges he had discussed was probably somewhat less than many people supposed.

60. PANEL DISCUSSION: THE FUTURE FOR NEW FINANCIAL INSTRUMENTS (Fall, 1982)

Albert Madansky, Professor, Graduate School of Business, University of Chicago, discussed a specific application of the use of bond options. He referred to some comments by Martin Leibowitz in a 1981 article in the *Financial Analysis Journal* on the ratio of yields on the tax exempt bonds to treasury yields. Leibowitz had observed that this ratio tended to return to an average of about .74, and that one might

make money when deviations from this ratio were substantial. Madansky observed that it might be attractive to take a long position in municipals and a short position in treasuries. However, the actual short position might be difficult to achieve. Selling call options on treasury bonds or treasury bond futures could be more attractive. He presented the results of a simulation extending from January 1977 through August 1982, representing a long position on municipals combined with the sale of call options on treasuries. The average quarterly return through August 1982 would have been 1.937%.

Stephan Figlewski, Associate Professor, Graduate School of Business Administration, New York University, extended his discussion of stock index futures to cover some proposed contracts, including one the Comex plans to establish based on the Wilshire stock index. He suggested that in the interest of reducing basis risk it may be more important to have a wider variety of expiration dates for contracts than to have a wider variety of indexes represented by futures contracts.

One participant asked whether the creation of the futures and options markets that had been discussed simply meant a revival of the bucket shop with an aura of respectability, and whether the end result might be a substantial diversion of trading and liquidity from the bond and stock markets. The panel members felt strongly that the options and futures markets can only help establish better prices for the underlying stocks and bonds.

61. THE VALUATION AND RISK CHARACTERISTICS OF CONVERTIBLE SECURITIES (Spring, 1982)

Andrew Rudd, Managing Partner, Barr Rosenberg Associates, gave a presentation describing a valuation model for convertible securities developed by Rudd and Barr Rosenberg. The model is quite complex, and he undertook to give at this session an overall impression of how it is constructed and how it works, with some of the insights and results obtained from the model. His presentation was organized under four topics: What the Convertible Market Consists of, Valuations that Have Been Proposed, Risk Characteristics of Convertible Securities, and Imperfections in the Convertible Market.

In describing the universe of convertible bonds, convertible preferred stocks and warrants, Rudd commented on the great difficulty one has in obtaining good data on many of the outstanding issues. In particular, many issues are traded quite infrequently and it is difficult therefore to construct complete series of market rates of return.

Introducing the valuation topic, Rudd commented on two other models that have been proposed to deal with convertibles, and indicated why he was offering a third. The Brennan and Schwartz model, which is based upon the approach of Black and Scholes to option valuation, is theoretically sound, but impractical for everyday use because of the enormous number of calculations required. A model proposed by Ingersoll also follows the Black and Scholes approach, but appears to have some serious defects in dealing with the call feature in a convertible.

Rudd proposed four key features in a convertible that must be dealt with by a model. There is a default option available to the common shareholders of a corporation. They can always turn over the corporation to the bondholders and this is in effect what happens when a corporation goes bankrupt. There is a conversion option, by which bond or preferred holders may convert to common stockholders. There is generally a call option, exercisable by the issuing corporation. And there is often a sinking fund option, also exercisable by the corporation. In addition, Rudd proposed two state variables, both incorporated in his model. One is the value of the corporation and the other is the interest rate. The Rudd and Rosenberg model considers for each year seven possible states of the corporation and eleven possible states for interest rates. In other words, the range of possible values of the firm in each year is represented by seven discrete possibilities (plus the possibility of bankruptcy), and the range of possible interest rates is represented by eleven discrete rates. The highest of the seven corporate value states is defined to be the state with a 5 percent probability of achievement attached. The lowest of the seven also has a 5 percent probability attached. The intermediate states reflect somewhat higher probability.

What the model does, in very general terms, is to simulate forward year by year the set of seventy-seven combinations of firm value and interest rates, up to a horizon year. The interest rates are simulated from the term structure of interest rates at the starting year. That is, the model allows the implicit forecast of interest rates at the starting date to establish the possible interest rate states up to the time horizon. The simulations of firm value follow a stochastic process, relying on the capital asset pricing model for valuation, and allowing for all scheduled financing payments such as interest, dividends and sinking funds, as well as simulating the exercise of options. Rudd displayed graphs of the process for Chrysler and for AT&T. The forward simulation

process provides estimates of the value and the risk of the firm for seventy-seven survival states plus eleven bankruptcy states for every year up to the horizon year.

Next, the model discounts the values back year by year to the starting time point. The discount rate depends upon the risk of the firm at each state. The risk is a function of two elasticities, a stock market elasticity and a bond market elasticity. From the value of the firm, the values of the individual securities can be derived.

In describing the risk characteristics of convertible securities, Rudd pointed out that the performances of these securities are linked to the stock and bond markets, and the model produces elasticities for each linkage. The model produces theoretical values for the elasticities, while one can obtain empirical values from regression analysis. One interesting question then was how good the theoretical values are. Rudd described cross-sectional tests that showed the theoretical risk measures related to the underlying common stock were very good, while the theoretical bond market eleasticities did not appear to be significant. Why this should be so, and in turn just how the bond market affects convertibles, is not yet clear.

62. USE OF OPTIONS IN ALTERING PORTFOLIO RETURN DISTRIBUTIONS (Fall, 1982)

A paper entitled "Using Options to Alter Portfolio Return Distributions," by Richard Bookstaber and Roger Clarke was distrbuted to participants. The research for this paper and presentation was financed by the IQRF.

Roger Clarke, Associate Professor of Finance, Graduate School of Business, Brigham Young University, introduced his subject by discussing the difficulty faced by managers who would like to incorporate option strategies in stock portfolio management. While it is easy to understand in principle the advantages to be gained from the use of put or call options, it is impossible intuitively to predict the effect of an options strategy on the distribution of expected overall portfolio returns. And in the absence of some way to estimate that effect, portfolio managers may be somewhat reluctant to make use of options. Clarke and Bookstaber therefore set out to develop a methodology for estimating the distribution of expected returns for a portfolio of stocks and options. Along the way, they hoped to achieve a second objective, to gain some insights into ways of improving the use of options in stock portfolio management.

They attempted a theoretical solution to the distribution problem, but found that even for moderate sized portfolios this was extraordinarily difficult. So they turned to an approximate algorithm, one that could be easily used and that would converge quickly, as the portfolio size increased, to the theoretical solution.

Clarke described the algorithm very briefly. They began with the single index model for expected returns on stocks. This model relates the expected return on a particular stock to its beta coefficient, the expected return on the market, and the risk free rate. The expected return on optioned shares is split into one distribution, with its own probability, for conditions leading to exercise of the call, and a second distribution for conditions leading to expiration of the call unexercised. Given these distributions, one can construct distributions for the entire portfolio. Iterating through all possible market returns will then give the distribution of all expected returns for the portfolio. Clarke described the process as involving three steps. The inputs for the first step are the expected return for the market, the standard deviation of market returns, the risk free rate and the time horizon. The second set of inputs is for the individual stocks, and includes for each stock the beta coefficient, the price of the stock and the number of shares held, and the dividend on the stock. Finally, for each option dealt in, the inputs are the option price, the exercise price, and the time to expiration.

He presented in tabular and graphical form, a comparison of distributions derived from the algorithm and distributions derived from monte carlo simulations. Visual inspection of the graph suggested that the algorithm approaches the simulation results for portfolios of twenty or more stocks. For smaller portfolios, there are significant differences between the distribution derived from the algorithm and the distribution coming from simulation.

Clarke described a number of limitations in the algorithm. First, it uses the single index model and assumes that error terms among stocks are uncorrelated. This is equivalent to ignoring industry effects. Second, while the algorithm does include dividends, these must be treated as certain. Third, the holding period for the stock must coincide with the time to expiration date for the option. This limitation, of course, makes it possible to avoid having to incorporate an option valuation model in the algorithm. Fourth, the option position must be held over the entire holding period. And fifth, as noted above the algorithm is only appropriate for portfolios of twenty or more stocks.

Richard Bookstaber, Associate Professor of Economics, Graduate School of Business, Brigham Young

University, reviewed a number of examples, showing how particular option strategies modify the distribution of expected rates of return on a stock portfolio. Taking a strategy of writing covered calls, he showed how the distribution changes as the use of calls increases, until finally the entire portfolio is subject to call options. Similarily, he showed the results of writing options increasingly in the money.

An important point Bookstaber made was that the mean return and variance statistics are quite unsatisfactory in themselves for assessing the usefulness of an option strategy. Higher moments are quite important. Bookstaber stressed that it is critical to look at a picture of the distribution before drawing conclusions as to the attractiveness of a strategy. To take a simple example of this, both the writing of call options and the purchase of put options reduces variance, but the call writing strategy reduces upside variance, while the purchase of put options reduces downside variance. So variance reduction by itself is not a measure of the usefulness of an option strategy.

One participant asked whether the research had led to any favored option strategy. The answer was that the use of options is generally attractive for investors whose utility functions are not quadratic. But the speakers had no particular option strategy to recommend. In answer to another question, the speakers said they had not yet examined the usefulness of possible options on index futures. They observed that the use of an index futures contract alone, without an option, would not change the distribution of portfolio returns unless the futures contract were used dynamically.

63. DIFFERING OPTION VALUATION MODELS AND THEIR APPLICATIONS (Fall, 1981)

Mark Rubinstein's paper, "Nonparametric Tests of Alternative Option Pricing Models Using All Reported Trades and Quotes on the 30 Most Active CBOE Option Classes from August 23, 1976 through August 31, 1978," was distributed.

Mark E. Rubinstein, Professor of Finance, University of California, Berkeley, reported on work that had been supported by the IQRF. He explained his overall objective as a review of the implications of various option pricing models, to try to establish which were best.

The best known option valuation model is the Black-Scholes model. This model makes use of seven variables: the current stock price, the risk-free interest rate, the time to expiration of the option, the option striking price, the annualized stock volatility, the dividends to be paid on the stock, and the ex-dividend dates. Given these variables, the model delivers a value for the option. Rubinstein observed that the model can also be used to produce an estimate of the annualized stock volatility, if the value or price of the option is supplied. He referred to a volatility estimated by use of the Black-Scholes model as "implied volatility."

Two key assumptions of the Black-Scholes model are that the stock price follows a continuous path and that the volatility of stock returns is constant. Rubinstein pointed out that there are alternative option pricing models based on different assumptions. He described five of these: the displaced diffusion formula, the compound option formula, the absolute diffusion formula, the pure jump formula, and the diffusion jump formula. He illustrated with a table the slightly different option values derived by these models for any particular set of the variables discussed above. Similarly, given observed option prices, the models produced slightly different estimates of implied volatility of the underlying stock. It was on the basis of the implied volatilities that Rubinstein proposed to seek out the best performing of the models.

First, he presented the implied volatilities from the various models as multiples of the volatilities implied by the Black-Scholes model. From this it was easy to see under what conditions a particular model tends to understate the implied volatility relative to the Black-Scholes model, and under what conditions it tends to overstate the Black-Scholes implied volatility. For example, the displaced diffusion model understates the Black-Scholes implied volatility more and more as the time to expiration of the option increases, and it overstates the Black-Scholes implied volatility more and more as the striking price of the option increases. If this pattern could be shown to correspond to deficiencies in the Black-Scholes model itself, then one would have a basis for concluding that the displaced diffusion model is better than the Black-Scholes model.

Rubinstein discussed in some detail the data he used for investigating the validity of the various models. He was able to obtain from the CBOE a record of option transactions and quotes, with precise dates and times, and corresponding stock prices. He first aggregated the CBOE records into a single consolidated record during consecutive time intervals within a day during which the recorded stock price remained unchanged. That is, he established a consolidated record of all the option transactions that took place while the stock price remained unchanged. He then imposed six criteria of his own that selected

about five percent of the consolidated data base for use in testing the option valuation model.

For each consolidated record, Rubinstein calculated the volatility implied by the Black-Scholes model. Each consolidated record was placed in one of twenty-five categories, representing five ranges of time-to-option-expiration and five ratios of current stock price to striking price. The categories then represented a range from options very near maturity to options very far from maturity and from options deep out-of-the-money to those deep in-the-money. Matched pairs of options records were then selected to discover the extent to which the Black-Scholes model produces biased implied volatilities, the bias being a function of the time to expiration or in-or-out-of-the-money.

The original data set covered trades and quotes from August 23, 1976 through August 31, 1978. Rubinstein divided his sample into two time periods: August 23, 1976 through Oct. 21, 1977 and Oct. 24, 1977 through August 13, 1978. The empirical procedure described above, then, was performed for both the first and the second periods. He stated his conclusions on the Black-Scholes model as follows:

1. For an out-of-the-money or deep-out-of-the-money call: the *shorter the time to expiration,* the higher its implied volatility.
2. For an at-the-money call: in the *first period,* the *longer the time to expiration,* the higher the option's implied volatility; in the *second period,* the *shorter the time to expiration,* the higher the option's implied volatility.
3. In the *first period,* with the sole exceptions of very near maturity deep-out-of-the-money and out-of-the-money calls, for calls with the same time to expiration: the *lower the striking price,* the higher an option's implied volatility.
4. In the *second period,* for the most part, for calls with the same time to expiration: the *higher the striking price,* the higher an option's implied volatility.

Rubinstein attempted to match the biases to the characteristics of his five alternative option models described above. No one model seemed to match all of the observed baises. For the second period alone, however, the displaced diffusion model can explain all the biases.

Two issues were raised in the discussion following the presentation. Rubinstein said that he had not translated the volatility biases into price deviations. That is, the Black-Scholes model, although biased, might still deliver values close enough to actual prices to be quite satisfactory for practical purposes. He had thought about but could not explain what phenomenon might have shifted the pattern of bias related to time to expiration between the first and second periods. The empirical results seemed to suggest that in the first period investors anticipated rising volatility over time, while in the second period they anticipated falling volatility, for all of the stocks in the sample.

64. OPTIONS AND THE EFFICIENT FRONTIER Fall, 1978)

Andrew Rudd distributed a paper: "Using Options to Increase Portfolio Return and/or Decrease Risk."

Andrew Rudd, Assistant Professor, School of Management, Cornell University, discussed the use of options in improving portfolio efficiency, and identified the conditions under which the options might be used to increase the return on an equity portfolio, to decrease the risk, and to accomplish both at the same time.

He made use of the Black and Scholes expression for the value of an option, which incorporates the stock price, the exercise price, the riskless rate of interest, the time until the option expires, and the standard deviation in return for the stock. He was able to deduce that the writing of fairly priced calls will increase the return on an equity portfolio if the expected rate of growth in the stock price is less than the risk free rate. Purchasing fairly priced calls will increase return if the opposite relation holds–and the expected growth rate in the stock price is greater than the risk free rate. This conclusion seems quite in accord with intuition. At the same time he demonstrated that purchasing a fairly priced put will increase return if the expected growth rate in the stock price is less than the risk free rate, and writing the put will increase return if the expected growth rate is greater than the risk free rate. Once again, ths is in accord with what intuition tells us.

Risks in an equity portfolio can be reduced either by writing a call or by purchasing a put. This can be arrived at mathematically, as can the conclusion that writing covered calls *always* reduces risk.

Simultaneously increasing return and reducing risk can be accomplished only by simultaneously writing calls and purchasing puts when the expected growth rate in the stock price is less than the risk free rate. But this relationship cannot hold if the existing portfolio is efficient. An efficient portfolio cannot contain a stock for which the expected return is less than the risk free rate (correlations among stock returns

are all assumed to be positive). An existing portfolio may, of course, be inefficient because for various reasons, perhaps potential tax liabilities, portfolio managers are compelled to retain assets they believe are overvalued.

In summary, Rudd noted that the mathematical conclusions were consistent with intuition and with the arguments Roger Murray had raised in his opening presentation on the advantages of the use of options in managing institutional portfolios.

65. PANEL: HEDGING AGAINST INTEREST RATE CHANGES (Fall, 1978)

Papers distributed were "Hedging Against Changing Interest Rates," by Frank J. Jones, and "GNMA Futures: Stabilizing or Destabilizing?", by Kenneth C. Froewiss.

Robert L. Whalen, Director Investment Research, Connecticut General Life Insurance Corporation, moderated a panel of three speakers who discussed the use of the interest rate futures market. The discussion covered techniques for using the market for speculation or hedging, the value of the interest rate futures market to different kinds of institutions, and the impact of the futures market on the spot market.

Frank Jones, Vice President for Research and Chief Economist, Chicago Mercantile Exchange, gave a brief hsitory of the futures market, which began with GNMA futures in 1975, and has extended to treasury bill and commercial paper futures. A futures market in four to six year treasury notes will be coming, and there are proposals for futures markets in corporate bonds and in the Dow Jones Industrial Index. Jones identified five uses for futures markets–speculation, an alternate form of investment, arbitrage, tax deferral, hedging and arbitrage uses. He presented a number of examples of long and short positions taken as hedges or speculation, and he used a number of illustrations of spread positions to show how one might speculate on shifts in the level of interest rates and on shifts in the slope of the yield curve.

Jones also showed how one might use futures contracts as an alternative to outright ownerhsip of treasury bills, increasing rate of return without increasing risks. The purchase of a short treasury bill and a strip of treasury bill futures may prove more profitable and no more risky than purchase of a long treasury bill. The transaction is very similar to an arbitrage, in that it makes use of apparent mispricing in the market.

Whalen commented on the frequency of mispricing in the futures market, and the opportunity for profiting from mispricing. What is particularly surprising is that the opportunities seem to have increased as the futures market has matured.

Richard Sandor, Vice President, ContiFinancial, discussed the emergence of the interest rate futures market as a natural response to some needs that were created by the market in GNMA pass-throughs. He said the futures markets are dominated by dealers of intermediate size working with limited capital. These firms can take substantial positions in the spot market and protect themselves by selling futures. He described pricing in the GNMA futures market by saying that the longer maturities traded like commodities while the market in short maturities is essentially a market in forward rates for bills. Arbitrage in the short market has been quick to eliminate mispricing, but there are still some discrepancies in the long end of the market. The principal reason seems to be a shortage of collateral, making it difficult for an arbitrageur to sell short in the spot market and buy in the futures market. He said that insurance companies and pension funds should be taking advantage of these opportunities and eliminating price discrepancies but regulations have held them back. The futures market in commercial paper is also essentially a dealer market, and there are more opportunities for profit than there would be if regulatory constraints were not keeping institutions out.

Kenneth Froewiss, Economist, Federal Reserve Bank of San Francisco, discussed the impact of futures trading on the spot market. He said the United States Treasury has expressed fears that trading in futures will disrupt the spot market. He reviewed a study of the GNMA futures market, and was able to show that since trading began in GNMA futures the spot market has become more efficient. He could not say that it is futures trading that has improved the spot market, but he could conclude that the futures trading has not had a destabilizing effect on spot market prices.

66. THE PRICING OF HAKANSSON CERTIFICATES AND EUROPEAN OPTIONS (Spring, 1977)

Robert Ferguson and Joel Rentzler distributed a paper: "The pricing of Hakansson Certificates and European Options".

Robert Ferguson, Vice President, Bradford Trust Company and Joel Rentzler, Doctoral Candidate,

Finance Department, New York University, presented this paper, which was based upon work presented to the Q Group at an earlier seminar by Hakansson and on an article of his in the Financial Analysts Journal. The "Hakansson Certificate" proposed by Ferguson and Rentzler might be thought of as similar to a call option but very much more flexible, offering all that a call option does and much more. Or it might be thought of simply as a conceptual scheme that gives us an approach to value virtually any sort of uncertain future cash flow.

Financial instruments have generally proliferated to provide investors with an ever widening range of claims against corporations. The, as yet, hypothetical Hakansson Certificate adds enormously to this range. A Hakansson Certificate entitles the owner at some specified future date to the market value of a share of a specified common stock, so long as that market value lies within a certain range. If the market value of the stock lies above or below that range, then the Hakansson Certificate is worthless on the specified date. The Certificate has some similarity to a call option, but there is no striking price and there is an upper limit as well as a lower limit to the range of the stock price over which the Hakansson Certificate has a pay-off.

To take an example given by Rentzler, the present stock price might be $15 a share and a particular Hakansson Certificate might have a pay-off at a stock price between $19.50 and $20.50 per share at the specified date. If on that date the stock is selling below $19.50 or above $20.50 the certificate will be worthless. But if the stock is selling within the range, then the certificate will entitle the owner to the stock price.

Hakansson Certificates would be created, of course, by owners of the underlying stock, just as call options are written. The owner of one share of stock is in a position to see a complete set of Hakansson Certificates, covering the range of possible stock prices from 0 out to infinity.

The real value of the Hakansson Certificate, as a financial instrument or simply as a concept to assist in valuation, lies in the fact that combinations of Hakansson Certificates can be put together to match virtually any pattern of equity claims. For example, a set of Hakansson Certificates can be assembled to offer the purchaser a return of exactly $5.00, should the stock price at the future date lie between $20.00 and $22.00, exactly $2.00 if the stock price lies between $25.00 and $29.00 and exactly $8.50 if the stock price ends up between $1.00 and $45.00. Combinations of Hakansson Certificates can duplicate call options and put options.

The main contribution of the Ferguson and Rentzler paper was to demonstrate a method of valuing Hakansson Certificates, and therefore any combinatio of Hakansson Certificates. The valuation method is based upon the Black and Scholes model for valuing call options. The end result is, of course, a method for valuing virtually any sort of claim to the future value of equity assets.

67. SIMULATED STOCK-OPTION PORTFOLIOS FOR FIDUCIARIES (Spring, 1977)

Sheen Kassouf distributed a paper: "Option Pricing—Theory and Practice."

Sheen T. Kassouf, Professor of Economics, University of California, Irvine, began by pointing out that there has been in the four years since the Chicago Board Options Exchange opened, a continuous explosion in option trading and in academic activity in the development and testing of valuation and trading models. Evidence of investment characteristics of different option programs is still emerging, and we are in the midst of controversy about market imperfections, the decline or disappearance of these imperfections, and the implications for institutions.

More specifically, some recent but as yet unpublished academic research casts doubt on the value of writing call options by institutions, as compared to a strategy of purchasing call options. While the purchase of call options may be a very unlikely strategy for most institutions for a number of practical reasons, the research may still be of interest in suggesting the relative value of an option writing strategy. Kassouf presented some simulation results of his that demonstrate the attractiveness of an option writing program, and he offered a critique of the new research on option writing and option buying.

The following table summarizes the difference between buying and holding the 30 Dow Jones Industrial Stocks, and buying these stocks but simultaneously writing call options on them.

TABLE

100 Quarters to Jan. 31, 1975	Buy and Hold Dow Jones Industrials	Buy and Hold Dow Jones Industrials and Write Options on Them
Average quarterly rate of return	2.74%	4.20%
Standard Deviation of return	6.74	3.63
Compound Annual Growth	9.69	16.54

Transactions costs were allowed for and it was assumed that option premiums averaged 6%. The table shows that the optioned program was more profitable than the strategy of simply holding the stocks, and the variability was lower. Kassouf found that even if the option premium was as low as 4.75%, the optioned strategy dominated the stock buy and hold strategy. At this level of option premiums the compound growth rates were the same for the two strategies, but the volatility was lower for the optioned strategy.

Kassouf next turned to comparable simulations to show the results of buying call options. A 100% investment in call options is likely to introduce too much variability in rate of return, and allocation of funds between call options and treasury bills seems to be called for. Kassouf tested the performance of programs ranging from 80% in treasury bills and 20% in call options to 100% in treasury bills with no call options. His results showed clearly that buying the stocks and writing covered options had worked out better than buying a combination of options and treasury bills. But he commented that the new research to be reported by Merton, Scholes and Gladstein reached the opposite conclusion, after finding that the best combination for the option purchase program was 90% short-term investment and 10% call options. Kassouf indicated why he disagreed with the conclusions of this research.

One participant asked why Kassouf believes the success of past option writing strategies is likely to continue into the future. Kassouf answered that even if the option market is or becomes efficient, and options are priced according to a theory of market efficiency, options have patterns of returns that are not linearly related to the stock market rates of return. So they increase diversification possibilities and will continue to offer attractive alternatives to portfolios diversified among stocks and bonds. Another question concerned current premiums on call options. Kassouf answered that they are around 4.9% for 90 day options, not inconsistent with simulations of his showing optioned portfolios to be superior to stock buy and hold portfolios. Another participant asked why the decline in premiums was not simply evidence of growth in the supply of call options through increased institutional writing of these options. Kassouf answered that he thought the decline in premiums reflected more a contraction in demand than an expansion of supply.

PENSION FUNDS

68. PENSION FUND MANAGEMENT IN THE 1980s. (Spring, 1981)

Following Jim Farrell's welcoming speech, George F. Russell, Jr., President, Frank Russell Company, gave the opening address at the Spring 1981 Seminar. His theme was this question facing the private pension system: How are plan sponsors (especially small to medium sized companies) to achieve better than average results with approximately $400 billion of pension fund assets? And how will they deal with the $3 trillion the Department of Labor is forecasting for the private pension system 15 years from now?

Russell described small to medium plan sponsors as navigating in a fog without radar, and he pinpointed five sources of their confusion. First, these plan sponsors suffer from lack of knowledge. It has taken the Russell organization 11 years to educate very large plan sponsors on the value of real estate in a pension portfolio. Persuading plan sponsors to engage in international diversification presents an even greater challenge. If the largest sponsors are this slow to learn, the small and medium sized sponsors are in real trouble.

Second, plan sponsors that rely on business publications for information about pension investment strategies are receiving an abundance of misinformation. Major articles in recent years in some of the most respected business magazines have claimed that equities have lost their appeal, that real estate is unsatisfactory for pension funds, that options have failed and that analytic and performance methodologies making use of beta coefficients are dead. Third, the small and medium size sponsors suffer from a traditionally political manager selection process. Personal friendships and business affiliations are likely to dictate selection of a manager, rather than a careful screening of talent. Fourth, many small and medium sized sponsors do not understand what Russell calls the "mystery of performance". They simply do not realize that even good managers will show up in the fourth quartile at times, and failing to realize this they are likely to change managers at the worst possible time.

Finally, in those happy circumstances when the sponsor seems to have found a good manager and is pleased with the performance record, all too often the individual responsible for managing the portfolio moves to another firm, and the sponsor is despondent. Russell suggested that the importance of a particular portfolio manager to a firm may be greatly exaggerated and observed that in the manager selection process a record of low turnover of management staff is an important criterion.

In looking ahead to the prospective six fold increase in private pension assets over the next 15 years, Russell addressed three areas. First, he said we will need more and better money managers. There are at present about 1,000 managers of pension fund assets, and there could be another 1,000 in the next 15 years. If money management firms are to do the job demanded of them they will have to devise ways to reduce manager turnover and they will have to motivate more people at the graduate student level to want to become money managers. Increased use of multiple managers by plan sponsors will help to stabilize the money manager industry and improve performance.

Second, asset allocation will have to improve. Russell identified asset allocation as probably the single most important decision to be made by a plan sponsor. And in the coming years the assets to be allocated will include fixed income, stocks, futures, real estate, equity related mortgages, and international holdings of equities, fixed income assets and real property.

Finally, we will have to be far more creative in devising vehicles and organizations to handle the vast increase in pension assets. Russell mentioned his own organization's efforts to provide management for small and medium sized pension funds, and the importance of making multiple manager services available to them. He closed with the observation that there are significant opportunities in managing these funds and room for much creativity.

69. PANEL: WHAT'S ON THE SPONSORS' MINDS? (Spring, 1981)

David E. Tierney distributed copies of a paper: "The Relationship between Plan Sponsor and Investment Manager."

The panel chairman, Peter O. Dietz, Vice President, Frank Russell Company, explained the purpose of this session as an opportunity for money managers to find out what plan sponsors need and want.

Robert R. Evans, Manager, Employees Benefit Assets, Xerox Corporation, described briefly the pension and profit sharing funds at Xerox, and the objective of minimizing downside variability through diversification while achieving a rate of return in excess of the inflation rate. The funds are invested at least 65% in U.S. equities, up to 10% in non-U.S. eqities, up to 15% in real estate equities, and up to 10% in debt instruments with equity participations. He discussed

the manager selection process, and expressed the opinion that Xerox may have 20 or 30 managers by the end of 1990, when its funds are likely to amount to move than $5 billion.

David Meagher, Pension Investment Specialist, Monsanto Company, discussed the pension plan operation at Monsanto and identified his key problem as how best to make use of multiple managers. An equity position of $800 million represents 67% of total plan assets, and is divided into 36% quality growth, 14% secondary growth, 35% growth and income, and 15% income/basic value. Meagher said that managers were chosen on the basis of their long term performance record and for their style of management. He observed that the use of multiple managers does involve the danger that skills of different managers will tend to offset one another and the end result may be a market rate of return. Monsanto has found the average residual risk of active managers to be about 6.9%, while for the total combined portfolio the residual risk is about 3.8%. So there is a significant diversification effect in using multiple managers. The equities are managed by two banks, an insurance company, and ten investment advisors. Fixed income assets are managed by three banks and two advisors. Real estate is in the hands of four managers and two firms manage optioned equities.

In total the asset allocation process, which is managed by the company, involves 29 different alternative kinds of assets. Long term policy guidelines are necessary for strategic allocation, subject to short term shifts for tactical reasons. For strategic allocation, a general optimization approach, similar to the Markowitz portfolio selection model, can be used.

David E. Tierney, Administrative Manager-Investments, Standard Oil of Indiana, discussed plan sponsor objectives and money manager objectives, contrasting what Standard Oil of Indiana is looking for with what its managers are looking for. A clear conflict arises over the subject of non-market risk, something that had been a focus of discussion in the preceding session. Tierney showed graphically that for a reasonable information ratio on the part of the money manager, the higher the non-market risk the better off the plan sponsor can expect to be. But at the same time, high levels of non-market risk do not pay off for managers in the form of fees and they significantly increase the likelihood of an unacceptable performance that may lead to loss of a sponsor client.

The panel members were asked how they were integrating pension plan liability expectations into the design for management of plan assets. Evans and Tierney replied that their companies anticipated positive net contributions for many years and little likelihood of asset liquidation to meet liabilities. Meagher indicated that Monsanto has used simulations extensively, and is confident that even under current high inflation conditions it has a satisfactorily funded plan. In response to further questions, both Tierney and Meagher expressed the opinion that plan sponsors have to be prepared to accept the degree of residual risk their managers feel comfortable with, even though they would prefer more aggressive behavior on the part of those managers.

70. PENSION POLICY AND THE CAPITAL MARKET (Spring, 1981)

Irwin Tepper distributed his paper: "Consequences of Providing for Retirement Income Through Advance-Funded Versus Pay-As-You-Go Programs."

Irwin Tepper, Associate Professor of Business Administration, Harvard Business School, identified three elements of pension policy: benefit design, investment policy and funding policy. He spoke briefly on the first two of these elements, and then turned to funding. The private pension system is generally well funded, and there are four ostensible reasons for funding.

First, funding forces plan sponsors to recognize costs. Tepper's opinion was that to the extent this reason is valid it rests on informational inefficiencies, and the inadequacies of actuarial or accounting explanations of cost. His belief is that within a few years at the most these informational inefficiencies will be cleared away, and plan sponsors will be well aware of the cost of pension plans whether or not they are funded.

The second reason for funding is the avoidance of inter-generational transfers. Again, once informational inefficiencies are gone and the true costs of a pension plan are evident to investors, the stock price of a corporation will adequately reflect the pension liabilities the corporation has taken on. So the stockholders at the time the liability is taken on will be those who pay for it.

The third reason is furtherance of a national public policy that favors increased savings and capital formation. The initial premise is that workers who are promised pensions will tend to spend more on consumption and save less than they would have saved in the absence of a promised pension. So in order to make up for the lost savings and investment on the part of the workers themselves it is necessary that the corporation promising the pensions take on additional investment. It may appear that this is just what is

happening when a corporation funds its pension plan and the pension trustee invests the contributions in corporate securities.

Tepper's argument, however, was that this apparent increase in savings and investment through pension funding is no more than an illusion. He proposed two ways in which a corporation can obtain the funds used to make pension contributions. The corporation could borrow the money. In this case, as Tepper demonstrated, the corporation takes on obligations that are exactly matched by the new assets of the pension fund. In the aggregate, the issuance of obligations by corporations is just matched by the acquisition of obligations by pension funds, and there is no change in savings and investment. To the extent that pension plan contributions are deductible for income tax purposes, there will actually be an increase in savings and investment in the corporate sector. But when the whole economy is considered, including the government sector, the net effect will depend upon how the government deals with the loss of tax revenue that came about through the transfer of assets from corporations to their pension funds. There may or may not be a net increase in savings depending upon whether the government acts to reduce consumption or to divert savings.

The second way in which pension contributions could be financed is through reductions in dividends paid to stockholders. Whether this will lead to increased savings depends upon whether stockholders reduce their consumption as a result of reduced dividends, or whether they maintain the consumption and simply reduce savings. Tepper's argument was that since the wealth of the stockholders has not declined in a substitution of retained earnings for dividends, they are unlikely to reduce their level of consumption and therefore we might expect once again that there will be no overall change in the level of savings and investment. He referred to some empirical work that seemed to confirm this judgment.

The only remaining reason for funding pension liabilities is the protection of pensioners and potential pensioners. In theory, the best assurance that pensions will be paid as promised is the funding process that transfers assets from the corporation to a pension fund trustee. Tepper argued that as a practical matter two things tend to defeat this protection. First is a pension fund investment policy that favors risky equities over debt instruments. Second are actuarial procedures, particularly those governing amortization of losses, that provide inadequate protection to pension beneficiaries with respect to the conflicting claims of corporate creditors and shareholders.

Tepper concluded with some comments on probable future developments. Protection of pension beneficiaries will rest less on funding than on direct responsibility of a corporation for its pension liabilities. Corporate assets, in addition to pension fund assets, will serve to back the pension liability. At the same time, pension claims will rise in priority among other claims against the corporation. As pension liabilities become direct liabilities of the corporation, the credit markets will take this into account and corporations will discover that their credit standing is immediately affected by pension promises. At the same time then, the funding issue will largely disappear and the entire pension process will be subject to the discipline of the capital market.

71. EMPLOYERS' ACCOUNTING FOR PENSION BENEFITS (Spring, 1981)

Frank Block's paper: "Pension Accounting," was distributed.

Frank E. Block, Member-of-the-Board, Financial Accounting Standards Board, began with a brief description of Accounting Principles Board Opinion No. 8 and the successor FASB Statement No. 36, dealing with pension plan disclosure by plan sponsors. He then turned to some of the issues facing the FASB that must be dealt with in a new statement presently scheduled for publication in 1983.

The funding process—the process by which the level of cash contributions is determined—will be left entirely to actuaries. Funding level is not the concern of the accounting profession. Accounting for pension fund expense will continue to rely to a significant extent on actuarial expertise. But the FASB is unlikely to continue its acceptance of a wide variety of actuarial assumptions and procedures. The FASB has been trying to identify and understand the choice of methods and assumptions open to an actuary, and in the statement to be published it may insist on the use of particular actuarial methods for expense reporting purposes. The result is quite likely to be a set of accounting rules that will lead to greater year to year fluctuations in reported earnings than do the present rules. Actuarial procedures generally tend to smooth reported earnings, while the preference of accountants is for immediate recognition of gains and losses related to a pension fund. Given the preference of corporation managements for low earnings variability, it is likely that the new rules will find management searching for ways to better control fluctuation in the value of pension plan assets. And this in turn is likely to affect demands made by plan sponsors on their money managers.

Block's final message was that money managers will have to understand the actuarial process in order to be able to respond adequately to the new needs of plan sponsors.

72. A CORPORATE FINANCE VIEW OF PENSION FINANCE (Fall, 1980)

A paper by John W. O'Brien was distributed.

John W. O'Brien, Vice President, A.G. Becker Incorporated, presented an intriguing description of an arbitrage opportunity for corporate pension fund sponsors. He led up to his proposal with a discussion of a series of publications beginning in 1972 dealing with funding and investment policy for pension funds and introducing the concept of the augmented balance sheet, one combining corporate and pension fund assets, and corporate and pension fund liabilities, to form a sort of consolidated balance sheet for both the corporation and its pension fund.

Next O'Brien went through his arbitrage proposal step by step. He began with a corporate pension fund with assets of $P entirely invested in a common stock index fund. First, the pension fund sells all of its stock and invests the proceeds in bonds. The value of the fund does not change nor does the value of the sponsor company. The reduction in the earning power of the pension fund assets is exactly offset by the reduction in risk, and the market value of the stock sold exactly equals the market value of the bonds purchased.

The systematic risk of the corporation has changed. If this change is regarded as undesirable, then the original risk level must be restored. To do this, the corporation issues $P worth of bonds and uses the proceeds to repurchase its own stock. The end result is a combination of corporation and pension fund with its original systematic risk unchanged.

The result of these transactions is an arbitrage with the corporation issuing $P of bonds and the pension fund purchasing $P of bonds. O'Brien showed that the net annual benefit to the shareholders of the corporation of this arbitrage is $P x T x (1-T) x R, where T is the corporate tax rate and R is the interest rate on the bonds. If this net annual benefit is assumed to extend in perpetuity, the present value is P x T. This benefit to the stockholders has come from somewhere. O'Brien reviewed the possible effects of the arbitrage on bondholders, employees and pensioners, fiduciaries responsible for the pension fund, and the Pension Benefit Guarantee Corporation, concluding that none were any worse off for the arbitrage, and all might be better off. The source of the benefit was found to be the U.S. taxpayer, since the stockholder benefit derived from the arbitrage consists entirely of tax savings.

In the course of a lengthy and lively discussion of the proposal, O'Brien conceded that the precise structuring of the arbitrage, the quantities of debt and equity to be purchased and sold, might differ somewhat from his simple proposal. In other respects, he defended the arbitrage as originally proposed.

73. INTEGRATION OF ASSET ALLOCATION AND FUNDING POLICY DECISIONS USING STOCHASTIC SIMULATION (Fall, 1979)

Howard E. Winklevoss, Winklevoss and Associates, Inc., picked up from earlier speakers at this Seminar the theme of integrating pension plan design, investment policy and funding policy and described a simulation methodology for bringing this about.

He criticized an asset allocation policy based only on the level and variability of portfolio yield, one that ignores cash flows, the level and variability of contributions, and the level and variability of funding ratios. He argued that in evaluating any policy or combination of policies, our focus should be on contributions and funding ratios and not on level and variability of asset returns. He presented some examples to show that the rate of return measures can be quite misleading as indicators of an appropriate risk level.

Winklevoss described a specific methodology for performing stochastic simulations and forecasting the behavior of a pension plan. His first step was to set up the current year population of the plan, segregated by age and service, by sex and possibly by levels within the company. The plan membership is then forecasted over a number of years, perhaps as many as 50 but most of the simulations used as examples in this presentation were over a period of 15 years. Winklevoss stressed the importance of using plan-specific decrement rates (for mortality, retirements, and terminations) for these forecasts. He said for plan memberships over 500 it is generally satisfactory to do a deterministic forecast of plan membership. For smaller groups it may be appropriate to do a stochastic membership forecast.

The next step is a simulation of inflation and asset yields. The model described by Winklevoss performs 300 iterations of the forecast, based on specified asset allocation and portfolio characteristics. Seven classes of assets can be dealt with, plus the inflation variate.

The next step is a stochastic simulation of payroll and benefits for those retiring, based on the inflation variate that came out of the preceding step.

The next step is to put together the asset simulation with the payroll and benefit simulation to come up with cost and funding ratios.

The final step is to search for the optimal contribution and funded ratio risk. One tests the results of alternative asset allocations, alternative funding policies, and possibly alternative plan designs in the context of alternative capital market scenarios, searching for the best combination of asset policy, funding policy and plan design.

Winklevoss next provided a brief introduction to pension cost fundamentals. He discussed normal cost and supplemental cost, plan assets, unfunded liabilities, and the asset target. Following this he showed a typical deterministic financial forecast for a pension plan, and traced through membership, payroll, assets, normal cost, initial supplemental cost, future supplemental cost, total contributions, investment earnings, and benefit payments. Winklevoss described this deterministic forecast as a baseline forecast, and then showed what might happen if there were one or two unexpected events during the forecast period. He described the usual stochastic forecast as a baseline forecast subject to constant unexpected up and down fluctuations in assets. Liabilities were still treated as following a deterministic path.

Next he turned to his own simulations, representing a combination of Rosenberg stochastic asset simulations and Winklevoss stochastic liability simulations. He did not discuss the details of the simulation process, but showed graphs of the final product–forecasts of contribution rates and funded ratios, emphasizing the expected result (the 50th percentile) and the worst or highest cost result (the 90th percentile).

Next he turned to a specific case example, testing the effect of a change in the actuarial interest rate on the asset allocation decision. Specifically, he showed the result of simultaneously raising the interest rate from 6% to 8% and changing the asset allocation from 80% bonds and 20% stocks to 20% bonds and 80% stocks. The second policy is obviously riskier in terms of the assets alone, but the overall result was to reduce risk in terms of contribution cost.

A second case example tested the effect of a change in the asset valuation method on the asset allocation decision. More specifically, two ways of reducing cost variability were compared in this case example: shifting the asset mix from a predominantly stock portfolio to a predominantly bond portfolio, and shifting from annual valuation of assets to the use of a 5 year moving average value.

A third case example tested the effect of a change in the funding method on the asset allocation decision.

Finally, a fourth case example tested the effects of a change in the method of amortizing actuarial gains and losses on the asset allocation decision. Once again, the point was that it may be possible to combine a shift to a riskier and probably more profitable asset strategy with a change of actuarial method to come out with a plan that is no riskier in terms of contribution cost.

74. PENSION FINANCIAL POLICIES IN THE PRESENCE OF UNCERTAINTY (Fall, 1979)

Louis Kingsland, of Wilshire Associates, introduced his subject as the classical operations research problem of decision making under conditions of considerable uncertainty. He offered some new and as yet unpublished insights into ways of dealing with the problem in the context of pension funds.

He began with the premise that risk in pension fund assets cannot be avoided, whatever the possibility may be for immunization, but this risk must be controlled and kept to a level that is prudent in relation to the expected returns. He agreed with some of the preceding speakers that the best way to deal with the pension fund is through integration of both asset and liability management. But he commented that it is extraordinarily difficult to persuade even the plan sponsor to take an integrated view and that as a practical matter the investment manager has no influence whatever over such things as funding policy and can only develop an investment strategy on the basis of what he is told about funding policy, actuarial assumptions, benefit levels, and so on. Kingsland therefore limited his approach to the narrow problem of asset management in the context of a number of given conditions.

He drew a clear distinction between the investment policy for the assets and the actuarial procedure by which the plan is valued. The actuarial valuation is limited by a number of legal constraints that do not apply to the setting of investment policy. For example, the actuarial valuation may not take account of the likelihood of future increases in benefits, while it may be highly appropriate for this likelihood to be reflected in investment policy.

Despite the very long time horizons for pension plans, Kingsland believes that investment strategy horizons are generally on the order of 3 to 5 years. The major uncertainties faced in developing the strategy are those associated with investment policy and

with inflation. Wilshire Associates has for some years been using simulations to deal with both the asset and liability side of pension plans, in order to incorporate uncertainty.

Kingsland next presented an example, taken from a corporation with a plan for which the benefits depend only on years or hours of employee service. The funding method was entry age normal, and this is an important element in the simulation process. Vested liabilities were $200 million. The assets were about $60 million, leaving unfunded vested liabilities of about $140 million. The work force was expected to grow at 3% a year, the benefit formula increase for the hourly workers was expected to be about 7.6% a year. And it was anticipated that a cost of living increase would have to be granted to retired former employees. On the asset side, rate of return assumptions were 12% plus or minus 20% for equities, 9% plus or minus 8% for bonds, and 6% plus or minus 1.5% for treasury bills. Half a dozen different asset compositions were selected, covering a range of expected rates of return and in each case constituting "efficient" portfolios, such that they offered the maximum amount of return for their level of risk.

Kingsland showed a table of the median annual return, percentile returns, and standard deviations in returns for each of the six, but commented that comparisons in terms of rate of return are not really satisfactory. Comparisons need to be made in terms of dollars that can be assessed against a balance sheet and an income statement. He, therefore, presented comparisons in terms of the dollar magnitude of assets and liabilities, unfunded liabilities, and costs for the planning horizon of 5 years. In addition to point estimates of these measures, he provided a risk dimension by way of a range of unfunded liabilities and costs for each asset composition. Kingsland commented that in the past those who use simulations have tended to look at two tables or graphs, one focusing on the degree of funding of liabilities and the other focusing on cost. In both cases one could examine the probable result of a particular investment strategy and the range of possible outcomes. What Wilshire has recently accomplished is a combining of these two measures in a concept he referred to as "ultimate cost". This ultimate cost is the present value of the cost of the plan up to the planning horizon and beyond. Each simulation produces a set of annual costs up to the planning horizon, so the present value of this set of costs is easily calculated. The present value of the cost beyond the planning horizon is simply the present value of the unfunded liability as of the planning horizon. And each simulation shows this unfunded liability, so its present value is easily calculated. The end result then is a table of distributions of ultimate costs for each of the six asset compositions. In each distribution one can identify the most likely cost and the worst cost. From the example, it appeared that a portfolio invested 70% in equities presented about the best tradeoff between average and worst cost.

In response to a question, Kingsland observed that as the planning horizon lengthens, more aggressive strategies become acceptable. A heavy reliance on equities might be compatible with a short planning horizon if the manager has great confidence in his timing ability, and therefore selects high expected rates of return with low standard deviations for the short horizon.

75. ERISA: IMPLICATIONS FOR ASSET MANAGEMENT (Fall, 1978)

The text of Professor Murray's remarks has been made available by the IQRF.

Professor Roger F. Murray, Professor Emeritus of Finance, Graduate School of Business, Columbia University, opened the Fall, 1978 seminar with a generally encouraging view of the Proposed Regulations under the Employee Retirement Income Security Act. He observed that private pension funds represent the only major financial institution that has been allowed to develop without detailed regulations with respect to asset selection and management. He saw ERISA as continuing this fortunate status, substituting a specific prudent man rule, one consistent with modern portfolio theory, for the detailed regulations that govern other financial institutions.

Murray commented that there had been a lively debate over the proposal. Some had looked for quite specific guidelines; some wanted safe harbors in the form of investment practices that were guaranteed to be "prudent". But he felt that the regulations had taken an appropriate course in discarding some of the narrow historic rules and opening the way for application of modern portfolio theory. The emphasis seems to be on insuring that investment policy is consistent with the particular needs of the pension fund. Projected rates of return are to be judged relative to the funding objective of the fund. Prescriptions for controlling risk go beyond permissible kinds of assets to focus on the entities in which the fund invests and on diversification to deal with economic, political, technological, and sociological risks.

Professor Murray turned specifically to the use of options in controlling risk. He observed that writing call options, a procedure already in use, can reduce

the standard deviation of returns in a portfolio by as much as 35%, with a smaller reduction in rate of return. But he observed that there are other ways to use options to reduce risk. He referred to the "fiduciary call". An institution could purchase a moderately out-of-the-money call, putting into escrow sufficient funds to exercise the call, and investing these funds short term. Assuming the call premium was appropriate, the pension fund would have purchased at a fair price protection against downside volatility. For example, with Digital Equipment priced at 47 and 7/8's per share, and a $50 call priced at 3 and 7/8's, instead of purchasing 100 shares at 47 and 7/8's, the pension fund might purchase a call on 100 shares, and end up either paying the 3 and 7/8's for downside protection in the event the stock price closes below 50, or owning the shares at a net outlay of about 50 in the event the stock closes above 50. Murray commented that the reduction in downside volatility could be obtained at the price of a modest sacrifice in potential rate of return. He suggested the use of the "fiduciary call" could be more prudent than outright purchase of the stock.

He went on to describe the "fiduciary put". A pension fund would write a put option, transferring into escrow the purchase price it would be called upon to pay if the put were exercised. The result is to earn the proceeds of the put if the stock price rises, and to own the stock at a below-market price, if the price falls. Murray commented that the label "fiduciary" is not just cosmetic. The escrow provision integrates the option and a cash reserve. The fiduciary call provides a specific limit to the risk of loss. And because a unique feature of the pension fund of a strong employer is the predictability of cash flows for several years ahead, the use of fiduciary puts is a clear example of a prudent way in which to exploit this predictability. He noted that fiduciary options are not the only new techniques for reducing risk in a pension fund. Trading in treasury bill futures can have the same effect.

In closing, Murray noted that the Labor Department is still studying comments on the proposal regulations, and there will probably be no final regulations until the first quarter of 1979. It is possible that there will be changes before the final regulations are published, but Murray takes comfort from the apparent direction of the regulatory thinking, and commented that pension fund managers and sponsors can go back to work with the expectation that the rules will prove more productive than most ever dared to think.

76. TESTS OF PRUDENCE (Fall, 1976)

This presentation was one of four offered under the heading "Impact of ERISA on the Investment Process." The other three were "Interpreting the Prudent Man Rule," "Panel: Further Perspective on the Prudent Man Rule," and "Is the Index Fund the Prudent Course of Action?"

Jack Treynor, Editor, Financial Analysts Journal, introduced the general topic of the impact of ERISA on the investment process. He began with the proposition that the concept of market efficiency implies two dimensions to prudence. A portfolio should be thoroughly diversified in order to eliminate all but market risk; and the level of market risk should be appropriate to the investor.

Now if this view of prudence is correct, then there are almost no definition no "sound" or "unsound" securities, and one need have no concern about the possibility that a single holding is "imprudent." Still, even enthusiastic supporters of market or index funds have tended to add to the two dimensions of prudence described above a further requirement that the portfolio manager maintain "reasonable knowledge" about the individual securities in his portfolio. If "reasonable knowledge" means knowing what other investors know, then we are simply back to the efficient market hypothesis: It will neither enable an investor to find "good" securities nor prevent him from buying "bad" ones.

Knowledge of securities however–the product of security analysis–does have value when a portfolio is subject to active management and to trading. Trading incurs costs, including commission costs and market spreads. The research ideas on which trades are based must have sufficient value to at least offset these costs of trading. So there is a third dimension to "prudence," and this is "trading prudence." Trading prudence demands high quality security analysis, analysis that offers a reasonable expectation of at least justifying transaction costs. To satisfy this dimension of prudence the security analyst is more important than ever.

77. INTERPRETING THE PRUDENT MAN RULE (Fall, 1976)

Gary Klesch distributed a paper: "Interpreting the Prudent Man Rule."

This presentation was one of four offered under the heading "Impact of ERISA On the Investment Process." The other three were "Tests of Prudence," "Panel: Further Perspectives on the Prudent Man Rule," and "Is the Index Fund the Prudent Course of Action?"

Gary Klesch, Director, Securities Market Policy, Department of the Treasury, began with a discussion of the probable effects on capital markets of ERISA. The prudent man standards of ERISA affect the investment of over $210 billion in the securities market, and although the primary purpose of the standard of prudence is to protect pension plan beneficiaries, Klesch expressed the hope that the courts would not ignore its potential effect on capital markets.

The ERISA prudent man rule has clearly created uncertainty in the investment community. It is hard to tell precisely what effect this uncertainty has had in investment practices, becaue introduction of the rule was accompanied by a bear market that had its own effects. But whether motivated by the ERISA prudent man standard or by the market decline, investors have moved from equities to fixed income securities, and have tended to concentrate equity investments in large and well established companies. Smaller and lower quality companies have experienced increasing difficulty in raising new equity capital.

There is some evidence that uncertainty over the ERISA prudent man rule may have reinforced the "flight to quality," in the responses by the 29 largest bank trust departments in the United States to a 1975 questionnaire submitted by Senator Bentsen.

Klesch went on to discuss what he believes are three incorrect interpretations of the ERISA standard. First, some have taken the ERISA prudent man rule to mean that every pension fund must be managed by a hired professional manager. Klesch argued that while professional management is clearly appropriate for large pension funds, it is not necessarily required for small plans.

Second, some have interpreted the ERISA prudent man rule to require that each individual holding in a portfolio be judged prudent solely by reference to its own characteristics, rather than on the basis of its relationship to the entire portfolio. Klesch argued that modern theory of portfolio management, and common sense, require that the prudence of each investment be evaluated not in isolation, but by the way its purchase would affect the riskiness of the entire portfolio.

Third, some have interpreted the diversification requirement in ERISA as requiring diversification beyond common stocks into fixed income securities, real estate, or money market instruments. He argued that the diversification requirement simply calls for diversification across a range of economic activities but not necessarily among categories of assets.

Finally, Klesch discussed specifically index funds and their implications for the capital markets. While taking no position with respect to the prudence of index funds, and indeed arguing that this prudence cannot be judged in the abstract but must be judged in the context of concrete factual situations, he expressed concern that increased use of index funds could result in an increased concentration of investment in large and financially strong companies. He added, however, that the development of index funds today is far from a point at which they threaten to distort the functioning of the securities markets.

78. PANEL: FURTHER PERSPECTIVE ON THE PRUDENT MAN RULE (Fall, 1976)

Papers distributed were: Eugene B. Burroughs, "Impact of ERISA on the Investment Process: Principles of Prudence"; and Robert Pozen, "The Prudent Person Rule and ERISA: A Legal Perspective."

This presentation was one of four under the heading, "Impact of ERISA on the Investment Process." The other three were "Tests of Prudence," "Interpreting the Prudent Man Rule," and "Is the Index Fund the Prudent Course of Action?"

Eugene Burroughs, Chairman, Investment Policy Panel of Pension Benefit Guaranty Corporation and Investment Manager, International Brotherhood of Teamsters, discussed the prudent man test of ERISA from the perspective of a pension fund investment administrator.

He referred to both absolute and relative standards of prudence. Loyalty and integrity are the most important of the absolute standards; relative standards reflect the diversity in pension plans and differences between pension plans and other trust funds.

A pension plan fiduciary can expect to be judged by prevailing circumstances, which will include the state of the art in investment risk measurement, the creation of new investment vehicles, and changes in inflation conditions.

The ERISA diversification requirement may cause special problems. Burroughs suggested diversification of assets not only across broad asset categories but within each broad asset category, ie., growth stocks, cyclical stocks, value stocks etc. But over-diversification can lead to difficulties in coordination, and investing beyond the managers' expertise.

Bernard Curry, Senior Vice President, Morgan Guaranty Trust Company, commented that the prudent man rule in ERISA is almost entirely the work of the American Bankers Association, and reflects the common law prudent man rule which has presented a few problems for corporate trustees. The ERISA diversification requirement may be new as a matter of law, but probably most trustees already followed a diversification policy. While some have interpreted the diversification requirement as extending to diversifi-

cation among managers, the Committee Report accompanying the legislation suggests that diversification must simply be appropriate to the circumstances. Multiple management may be worthwhile, but unless the managers are selected for special skills this procedure fosters mediocre performance.

Although the prohibited transaction provisions of ERISA are superficially quite reasonable, they have created serious difficulties because it is very hard for banks to avoid innocent but technical violations.

In closing, he pointed out that corporate management must realize its co-fiduciary status when it interferes with the fund manager's activities. Providing guidelines as to risk tolerance, however, will probably not involve the corporation in direct responsibility for specific investment decisions.

Robert Pozen, Associate Professor of Law, New York University Law School, dealt chiefly with legal constraints on pension fund investment management. In discussing the fiduciary duties of pension trustees before ERISA, he noted that the common law prudent man rule conflicted with three important principles of modern investment practice. Courts focused on the performance of individual securities rather than on the performance of entire portfolios; they gave short shrift to diversification as an investment strategy; and they emphasized the avoidance of capital loss at any cost, rather than evaluating returns relative to risks incurred.

Turning to the ERISA standards, Pozen noted that ERISA explicitly prescribes diversification, replaces the prudent person with the prudent expert in pension fund management, and forbids the use of exculpatory clauses. A corporate fiduciary, however, can minimize its liabilities under the statute by allocating as much responsibility as possible to an investment manager. A certain degree of indemnification may also be possible.

Pozen expressed the opinion that the three shortcomings of the common law prudent man rule referred to above need not apply to the ERISA rule. The statutory standard is consistent with evaluation of the whole portfolio, rather than individual components, for a diversified portfolio. Diversification is clearly called for under ERISA, and evaluation of portfolio performance relative to risk incurred is consistent with some interpretations of the statute.

For defined benefit plans, pension obligations are largely guaranteed by funding requirements and termination insurance, so that the taking of risk in investments appears to benefit the employer rather than employees and therefore to violate the "exclusive purpose" test of ERISA. But employees may still suffer from poor performance: insured benefits may be below expected benefits, unvested employees may forfeit expected benefits; and pension promises may be less generous than they would otherwise have been. Defined contribution plans place the risk of portfolio performance on employees rather than employers. In order to give employees a reasonable chance to implement risk preferences, it is probably best to offer a two part pension plan, one involving equities and the other fixed income securities, as in CREF-TIAA.

The combination of negotiated commission rates and the exclusive benefit rule of ERISA threaten the use of "soft dollar"payment for research by pension managers. However, section 28(e) of the Securities Exchange Act of 1934 explicitly overruled ERISA and permits the use of "soft dollars" to purchase research. Pozen expressed the opinion that this section should be repealed.

Finally, Pozen suggests that it might be appropriate for a number of pension funds to band together to bring a declaratory judgment suit to test some of the interpretations of the ERISA prudent man rule.

One of the participants asked the panel about the declaratory judgment suggestion. Curry replied that he had thought about it and that it might be appropriate, but some of the participants felt that even if a court would entertain a declaratory judgment suit it would want to give a very narrow decision that might not be very useful to pension plans generally.

Another participant asked whether it is necessary to have a set of objectives for each manager, when a fund makes use of multiple management. Burroughs replied that he did not think it necessary to have a separate statement of objectives for each manager, although there should be some rationale for having made the manager choices.

In answer to a question about section 28(e), Klesch commented that it was included in the Securities Exchange Act because small broker-dealers and small investment managers said they needed it in order to compete with large firms.

79. PENSION FUND FINANCIAL PLANNING (Spring, 1976)

The paper was "Pension Fund Financial Planning."

The planning model described by Richard Michaud, Senior Research Officer, The Boston Company, involved a much more elaborate analysis than those of Deitz and Smith (See "Two Simple Models for Asset Allocation," under "Stock Portfolio Models and Asset Allocation"), differing from those two chiefly in modeling the liability as well as the asset management side of the pension fund. Michaud began with a model of the actuarial process, by which the funding requirements of the plan were determined. His model

simulated, in one example, the aging of a company's work force over time and the progression of wages, to compute the actuarial value of the pension fund liabilities over time. Then the model simulated rates of return on pension fund assets and from this, together with the value of the liabilities and the funding policy, deduced both probable fund values and probable contribution requirements for future years.

Like Dietz and Smith, Michaud made use of historical bond and stock returns to estimate average rates of return for each asset and variability in rate of return. Unlike Dietz and Smith, Michaud assumed bonds were carried at amortized book value, so that the variablility in bond rates of return reflected only the reinvestment of coupon income and the proceeds of maturing issues, at new issue rates that varied from year to year.

Use of the Michaud model begins with a series of simulations to estimate pension liability. Modeling the actuarial process and simulating these liabilities disclosed some weaknesses in the actuarial assumptions the company was actually using, and suggested that true pension liabilities might be considerably larger than those the actuary had projected. Once the pension liabilities had been estimated, the model considered different stock-bond mixes for the pension fund assets and simulated the investment performance of the fund over future years, and consequently the contributions that might be required in order to fund the liabilities.

There are a number of ways of making use of the results of this simulation model, but the most important end product of the simulation takes the form of projections of the status of the fund at future points in time and the contributions required over future years. The former are of particular importance to potential beneficiaries, who are looking to the fund as the source of their retirement income. The latter are of particular importance to the company, for which contributions are an expense. In both cases, the results are presented in terms of probabilities. That is, the model indicates the most likely status and a most likely contribution amount, and maximum and minimum status and contribution level (defined in terms of the likelihood that the maximum and minimum will be achieved).

Michaud did not attempt to incorporate the operating results of the company into his model, although one might wish to do this at the cost of making the model considerably more complicated. The simulations dealing with liabilities were handled separately and before the simulations dealing with the asset mix of the pension fund. Michaud would have preferred to integrate these, but the computing cost would have increased very substantially.

80. SOME SPECIAL ASPECTS OF ERISA (Spring, 1976)

Jack Treynor, Editor, Financial Analysts Journal, presented some original and striking thoughts on the implications of the pension reform legislation, particularly the liability insurance feature of this legislation, for pension fund planning and management. In a 1972 issue of the *Financial Analysts Journal,** Treynor had suggested that when a corporation analyzes the risk-return trade-off in the management of a pension fund, it is likely to be balancing a risk that is shared by the corporation and its pension beneficiaries against a return that benefits the corporation alone. In his remarks to the Seminar, Treynor presented a more specific description of the relationship between corporation and pension beneficiaries, and then of the relationship among corporation, Pension Benefits Guaranty Corporation and beneficiaries.

Under conditions preceding ERISA, the claim of a pension beneficiary could be considered as a weak creditor claim. The beneficiary had a direct claim on the assets of the pension fund, and an indirect claim on the corporation through the corporate contribution to the pension fund. In most cases this indirect claim did not have great legal force, since the corporation did not legally guarantee pension benefits to the extent that they could not be met from pension fund assets. But few corporations would reasonably expect to renege on promised pension benefits and remain in business. However, unlike most creditors, the pension beneficiary had no opportunity to enforce or protect his claim before his pension benefits were due. This handicap constituted the most important difference between the claim of a pension beneficiary and the claim of a creditor. The corporation could satisfy the claims of pension beneficiaries in two ways: by paying those claims at face value as they accrued, or by declaring bankruptcy and letting the beneficiaries collect what they could from the pension fund assets and the corporate assets. It is because of this that the corporation could be thought of as possessing a "put" option, entitling it to satisfy the claim of pension beneficiaries by "putting" the assets of the corporation and its pension fund to the beneficiaries in full discharge of their claim. The beneficiaries could be thought of as having given (whether they liked it or not) this "put" option to the corporation. For the corporation the "put" represented an asset, while for the beneficiaries it was a liability. As a practical

**Walter Bagehot, "Risk and Reward in Corporate Pension Funds," Financial Analysts Journal, January-February 1972, pp. 80-84.*

matter, then, the balance sheets of the employer corporation and the pension beneficiaries could have been set up as follows:

Employer Corporation		Beneficiaries	
Corporate Assets	Corporate Liabilities	Pension Claims	"Put" Option
Pension Fund Assets	Pension Liabilities		
"Put" Option	Equity		

One might regard the corporation as having a "put" option with respect to all creditor claims, but because of the relatively weak claim of the pension beneficiaries the significance of the "put" option was greater, and Treynor pointed out that this analysis (based upon conditions preceding ERISA) leads to the conclusion that a corporation might well have been motivated to run its pension fund at a very high risk level.

The immediate consequence of ERISA is to interpose the Pension Benefit Guaranty Corporation (PBGC) between the corporate employer and the pension beneficiaries. All risk of loss is transferred from the beneficiaries to the PBGC. The corporation still has a "put" option, but now it is a "put" to the PBGC rather than to the pension beneficiaries. The beneficiaries are, of course, much better off than they were before ERISA. The position of the corporation is not so clear. So long as the insurance feature of ERISA is continued, Treynor argued that corporations will have the same motivation for excessive risk taking that they had before ERISA, except that now the penalties of excessive risk will fall on the PBGC rather than on the pension beneficiaries. In this context Treynor claimed that fiduciary obligations from a corporation to its pension beneficiaries become irrelevant. He also predicted that the staggering liability carried by the PBGC would virtually force it to police the operations of all insured pension plans, and indeed the financial operations of the corporations themselves. On the other hand, if the liability insurance feature is removed from the statute, and Treynor argued that it should be removed as soon as possible, then the PBGC would have recourse to corporate assets, to a limited extent, and could act at any time to protect its position. This would put the PBGC in much the same position as any creditor of the corporation. The corporation would then find management of the pension fund assets similar to management of any corporate assets, with the rewards and penalties of high risks falling directly on the corporation itself. Once again, fiduciary responsibilities for pension beneficiaries would have little meaning; prudent investing would mean investing for the protection of the corporation and its shareholders, and corporations would be faced with the enormous visitation power of a new federal agency.

A member of the PBGC board strenuously disagreed with some of the implications of the Treynor analysis, and a lively discussion followed.

William F. Sharpe, Professor of Finance, Stanford University, commented on the inherent inconsistency in ERISA, which imposes a fiduciary obligation on the corporation towards the pension beneficiaries but simultaneously insures the beneficiaries so that they cannot suffer from irresponsible management of the company or its pension fund. If the liability insurance is abolished, and the corporation must ultimately pay for pension benefits, at least to the extent that it has assets, then the traditional risk-return trade-off is restored, and the question becomes simply one of whether the expected return to shareholders justifies the risk taken. But the taking of high risks by the corporation is harmful to the PBGC, as Treynor showed, and so we have a dilemma between the corporate strategy that will benefit the corporation and its shareholders, and the strategy that will be helpful to the PBGC.

81. OVERVIEW OF PERFORMANCE MEASUREMENT (Spring, 1980)

Peter O. Dietz, Vice President, Frank Russell Company, Inc., introduced the topic of performance measurement with a brief sketch of developments over the past twenty years or so. He suggested four sources of danger in the application of performance measurement.

His first source was the time period chosen for the measurement. Small changes in this period, shifting the period forward or backward by only one calendar quarter for example, can bring about significant changes in the performance measured. A portfolio owner should be aware of this, yet there is no clear guide to the selection of an appropriate period. The second source of danger lies in the valuation method. On the one hand, the use of book value may create the illusion of an invariant rate of return and the virtual absence of risk. On the other hand, at times the portfolio owner should not worry about fluctuation in market value. Pension plans, for example, benefit from amortization procedures that protect contributions from abrupt changes resulting from good or bad investment performance.

Inappropriate methodology is a third source of danger. Risk adjustments generally call for the use of an index, and the choice of index may or may not be appropriate. Finally, a fourth danger lies in overemphasis on market values, something that can lead to performance contests and to a preoccupation on the part of corporate treasurers with short-term results.

82. PORTFOLIO INCOME GROWTH: A THIRD DIMENSION TO PERFORMANCE MEASUREMENT (Spring, 1980)

A paper bearing this title was distributed.

Robert H. Jeffrey, President, The Jeffrey Company, suggested a number of reasons for focusing attention on growth in income from a portfolio, not as a substitute for other performance measures but as a useful addition. He described his surprise when in the course of interviewing money managers he discovered that none could tell him the long-term earnings and dividend growth of their model portfolios. So he developed his own measures.

He offered eight reasons why a portfolio's income stream deserves more attention than it presently gets from portfolio owners and managers. Although dividend income on indexes and most portfolios rises over the long term at about the same rate as market value, the volatility in dividends is much lower. This low volatility of income may suggest a lower risk than does the volatility of total returns, a sometimes useful assurance to investors prone to panic when market values drop suddenly. Second, whereas changes in market value reflect the views of investors about a company, changes in dividends reflect insider decisions and may constitute more valuable information. Third, dividends may be relatively predictable and the expected portfolio income growth rate may be a performance standard to which managers can be held more accountable than to any other. Income growth is a reasonable long-term proxy for principal growth; benefits can only be paid with income; and dividend yield must be balanced against growth. A seventh point is that although market values have not kept up with inflation, dividends have been an excellent inflation hedge. Finally, the eighth point is that portfolio owners might better understand the functioning of their portfolios if they focused more on the income output.

Jeffrey stressed the importance of distinguishing between internal growth and trading growth in income. Internal growth occurs inside the portfolio itself, as portfolio companies increase their dividends. Trading growth results from buying and selling portfolio holdings having different income yields. He used two growth stock portfolios and one high yield portfolio owned by his company as examples, to show the relationship between internal and trading growth, and the importance of understanding the sources of past income growth in a portfolio and the likely pattern of future growth.

In conclusion, while Jeffrey did not argue against the more conventional methods of measuring portfolio performance, he made a strong case for income growth as a focus that can provide investors with better perspective on what it is that they are trying to accomplish.

83. THE MEASUREMENT OF PORTFOLIO RETURNS—ART OR SCIENCE (Spring, 1980)

A paper bearing this title was distributed.

Robert C. Kavee, Manager of Institutional Applications Development, Merrill, Lynch, Pierce, Fenner & Smith, Inc., spoke on the inaccuracy in calculated rates of return and inconsistency among different suppliers of rate of return measurements. He discussed the famous BAI study and its recommended methodology for computing rates of return, with

particular reference to the criteria set up in that study. The study considered uniformity as of primary importance, precision of method as secondary, and simplicity as the least important.

Kavee dealt with three methods for calculating the return on an investment, for cases in which there are external cash flows complicating the process of identifying investment rate of return. Two of the methods, the internal (or dollar weighted) rate of return and the time weighted rate of return, were dealt with in some detail in the BAI study. A third method, simple arithmetic payback, is not a BAI recommended method but has achieved some popularity because of its computational simplicity. Kavee compared the three methods and observed that Merrill Lynch supplies all three measurements to its clients.

He next turned to problems connected with the underlying data from which the rates of return are calculated. In general, there are two sources of difficulty. First, there are often errors in the data. Some of these errors are the result of mistakes—incorrect transmission of numbers. Other errors might better be described as inevitable lack of precision. When a security is quoted with a one-eighth spread between the bid and ask prices there is inevitably some doubt about the "value" of a share of that security. Second, correct calculation of rates on a portfolio that is subject to cash inflows and outflows demands a valuation of the portfolio whenever the flows take place. Kavee observed that Merrill Lynch does not have the information available to perform valuations to accompany every cash flow. The BAI study recognized this difficulty and recommended methods for dealing with it, including approximation of portfolio values, to produce acceptable approximations of the true rates of return. Kavee showed the results of applying the recommended procedures in actual cases, and demonstrted that errors in the resulting rates of return can be significant. Abnormal cash flows are responsible for much of the error, and he described Merrill Lynch procedures for identifying the abnormal flows and dealing with them. The Merrill Lynch method of approximation seems to offer more precision than the BAI method; it provides figures that can be checked for reasonableness and it represents a simplification of the BAI method.

84. THE EXPECTED RETURN BENCHMARK AND MANAGEMENT PERFORMANCE EVALUATION (Spring, 1980)

A paper bearing this title was distributed.

Richard Roll, Professor of Finance, University of California, Los Angeles, presented a paper concerned with risk adjusted performance measurements, and specifically with the popular "alpha" measure of superior portfolio returns. He described the evaluation process as consisting essentially of establishing an expected rate of return for a portfolio, measuring the actual rate of return, and attributing any excess of the actual over the expected return to quality of management. The expected return is the return that capital market theory tells us is anticipated by the market as a whole. Management ability is demonstrated by making better forecasts of security rates of return than the forecasts of the market as a whole. He pointed out that there are two types of error in estimating the expected returns. The first is statistical error. If observations can be made over a long enough time period the statistical errors may disappear. The second type of error is more serious and lies in the benchmark used as a reference point in establishing the expected rates of return.

The procedure we use for establishing these expected returns involves the use of some benchmark—a stock market index for example—to estimate a risk-return relationship in the marketplace. The Capital Asset Pricing Model indicates that the appropriate relationship is expressed in units of expected return per unit of beta. Given this relationship, we estimate the beta coefficient for each security under consideration and calculate its expected rate of return. From these expected returns we calculate the expected return on a portfolio and it is this expected return that is compared with the actual return to arrive at a measure of quality of performance.

For purposes of illustration, Roll used security market lines to represent the benchmark risk-return relationship. He showed first how error in the estimation of beta for a security, coupled with a correct benchmark, would lead to error in the calculated expected rate of return and therefore error in the calculated measure of performance quality. Next he introduced error in the benchmark security market line itself, and showed how the combination of this error and error in estimating the beta coefficient would affect the measure of performance quality.

The theory demands that for correct estimation of expected rate of return, the benchmark relationship be derived from the expected rate of return on a perfectly diversified portfolio of all risky assets. Since we have no way of identifying such a portfolio and arriving at its expected rate of return we must fall back on substitutes, like stock market indexes. We are therefore always faced with error in the choice of the benchmark.

The combination of error in estimating beta and

error in the benchmark can lead to positive errors in the performance evaluation (error that makes the manager look better than he really is) or to negative errors (making the manager look worse). It turns out that whether the error is positive or negative depends upon whether the estimated beta is greater than or less than one, and whether a measure designated γ is greater than or less than the slope of the security market line. γ is given by:

$$\gamma = \frac{E_A - E_M}{\sigma_M(\beta_A - 1)}$$ where E_A and E_M are the expected returns on the security and on the benchmark, σ_M is the standard derivation for the benchmark return and

β_A is the security's beta coefficient.

The analysis so far suggests that it might be possible to classify securities according to the likelihood that there will be positive or negative error associated with calculation of the superiority of portfolios including those securities. Roll suggested that managers might deliberately include in their portolios securities for which they anticipate positive errors. Those employing the managers might want to make allowance for this. He described some empirical testing over the period 1959-78 which identified 86 high beta stocks and 61 low beta stocks with consistently positive errors and 63 high beta and 61 low beta stocks with consistently negative errors. The stocks had all been selected from a universe of all New York Stock Exchange listed stocks and the benchmark was the value weighted New York Stock exchange index.

In answer to a question, Roll pointed out that the lists of stocks suggested that size of company is related to evaluation error, and that smaller companies tend to be associated with positive error. That is, portfolios made up of smaller companies will tend to make the quality of portfolio management look better than it really is. Stocks with high dividend yields also tend to show positive evaluation errors. Roll suggested that this is consistent with a "yield tilt" expectation.

In answer to another question, he explained that the methodology set out in his paper was intended to facilitate an adjustment of the expected return and therefore a better measure of the quality of management. But he pointed out that there are other ways of making these adjustments. Since company size and dividend yield appear to be systematically related to errors in the expected return estimate, one might make use of these two parameters for adjustment purposes. In summary, his point was that performance evaluation depends upon a comparison between actual rate of return and expected rate of return, and whatever method we employ our objective is to make the best possible estimate of the expected rate of return.

85. WHY PORTFOLIO PERFORMANCE MEASUREMENT DOESN'T MAKE SENSE (Spring, 1980)

A paper bearing this title was distributed.

The thesis of Robert Ferguson, Vice President, College Retirement Equities Fund, was that a particular portfolio performance measurement procedure is useful only if it can enable an investor to select the portfolio most appropriate to that investor's needs. And there is no procedure that corresponds to the investment strategy than a rational investor would choose. Hence portfolio performance measurement serves no useful purpose.

Ferguson described the Security Market Line procedure that had been previously discussed by Roll and that is probably the most commonly used procedure for estimating risk adjusted rates of return. He pointed out, as Roll had, that the quality measure resulting will be a function of the benchmark chosen. Ferguson observed that a benchmark can be found to correspond to virtually any set of desired measures of performance quality. He went on to consider the possibility of agreeing on a single acceptable benchmark. The set of all investment securities would make an attractive benchmark but the necessary data are not available. A benchmark consisting of the portfolios of all managers who can be considered contestants in a performance ranking has an appeal, but Ferguson observed that it is always possible to change the quality ranking in any desired way by introducing a new contestant with an appropriate portfolio.

Abandoning the security market line methodology which he had concluded is worthless, Ferguson turned to the Treynor-Black model as a possible source of performance measurement. The Treynor-Black model presumes a mean-variance motivated investor and the existence of a riskless asset. The objective is to maximize the ratio of expected excess return on a portfolio to the portfolio's standard deviation of return. No alphas or betas are involved and there is no need for a benchmark. The model pictures an investor as holding a passive or reference portfolio, and an active portfolio. The active portfolio reflects the manager's belief that some securities are undervalued and therefore offer an appraisal premium. But the appraisal premium carries with it some risk in the

form of appraisal variability and the Treynor-Black model implies that the measure of portfolio attractiveness is the appraisal ratio, the ratio of appraisal premium to appraisal variability. All of this suggests a performance measurement criterion. Ferguson described Treynor's seven step procedure in using appraisal ratio as a measure of portfolio performance. But he pointed out that the procedure depends upon the choice of the passive or reference portfolio and we are back to the weakness of the security market line method. A reference portfolio could be found corresponding to almost any set of desired appraisal premiums. So the appraisal ratios are virtually arbitrary and the evaluation procedure is useless.

Finally, Ferguson proposed as the most reasonable investment strategy for a mean-variance investor, choosing from all available securities a portfolio that maximizes the ratio of expected excess return beyond a risk-free rate to standard deviation of return. He referred to this as maximizing the Sharpe ratio. Portfolio performance measurement cannot help in achieving this objective or in evaluating a manager's success in attempting to achieve it. But any attempt to achieve the objective depends heavily upon forecasts and therefore upon the quality of forecasts. This suggests that the best alernative to portfolio performance measurement is a forecast evaluation system, and this was Ferguson's final recommendation.

86. A CRITIQUE OF PERFORMANCE MEASUREMENT (Spring, 1980)

A paper bearing this title was distributed.

Barr M. Rosenberg, Principal, Barr Rosenberg Associates, described a series of simplifying assumptions and procedures that arise in portfolio performance measurement. Some of these give rise to "definite bias," an error in the comparison between portfolio performance and the performance of a benchmark which will be in the same direction for all managed portfolios. Others cause capricious bias, favorable for some managers and unfavorable for others. Summary performance measures can produce ambiguous results through failure to correctly attribute performance to the various elements of active management. Finally, some reporting procedures cause problems in interpretation.

Rosenberg identified three sources of definite bias. One arises when income is attributed to the date on which it is earned rather than the date on which it is received. For example, dividends are generally attributed to the ex-dividend date rather than to the date on which the payment is due. The result is to create a bias of about 6 basis points a year against the performance of the manager. Rosenberg suggested two ways of correcting for this bias. The second source of definite bias arises from the treatment of contributions to the portfolio by the owner, and withdrawals from the portfolio by the owner. There is generally a transaction cost incurred in this process, and this cost introduces a bias against the relative performance of the manager, generally on the order of 2½ basis points per year. Rosenberg suggested providing a credit to the manager to offset this bias. The third source of definite bias arises in the course of comparisons of a manager with the median of a comparison population. The comparison population is likely to be upward biased, because as money managers are dismissed the surviving portfolio population will typically have an upward-biased performance statistic. A similar bias comes from inclusion of highly selective historical data when new managers are added to the comparison population.

The first source of capricious bias arises when the comparison to a "market portfolio" is to an arbitrarily chosen benchmark. Since the benchmark is less efficient than the "true" market portfolio, there may be some tendency towards a definite bias in favor of money managers. But what is more likely is capricious bias favoring some assets and disfavoring others. The use of ex-post rather than ex-ante risk adjustments, for instance through the use of an ex-post capital market line, is another source of capricious bias and a third source arises when managers who clearly have different responsibilities are compared with the same benchmark. The answer recommended here is the use of a "normal" benchmark portfolio. The owner of funds and the managers agree on a "normal portfolio" that represents the universe against which the managers are to be compared, and includes every asset that the managers are likely to buy in the future. The differences between the managed portfolio holdings and those of the normal portfolio define the "active portfolio," whose performance is to be evaluated. A fourth source of capricious bias had to do with the mechanics of handling contributions to and withdrawals from the portfolio, and the usual assumption that both transactions occur at the mid-point of the period. A final source is incorrect valuations of the securities in the portfolio. In general, the objective is to obtain the best possible prices or estimated prices. But at times, the market value is not the correct measure of asset value, and Rosenberg discussed the special case of sinking fund bonds for which the market price is essentially controlled by a selling cartel.

Rosenberg identified three sources of ambiguity. One arises from imperfect distinction between sector timing and selectivity. Another comes from imperfect distinction between common factor and specific returns; and a third arises from imperfect distinction between transaction expense and reward from analysis. In all three cases it is difficult to identify the sources of performance and to decide whether these sources coincide with the skills that were claimed in advance by the manager. Rosenberg recommended procedures to attribute performance correctly to particular activities of the manager.

Finally, he discussed three typical problems that arise in the interpretation of performance measurement. The first involves inadequate measurement of the contribution of active management. Dealing with this problem requires using a risk adjusted alpha rather than a simple alpha. The second problem involves the use of arithmatic average rather than geometric average rates of return. And the third involves an exaggerated reliance on the predictive content of past performance. Here Rosenberg recommended that measures of performance superiority, the familiar "historical alphas," be accompanied by a measure of the variance in the alpha.

87. YOU SAID YOU WERE MEASURING PERFORMANCE? OR, THE SAGA OF TOTAL RETURN TEDDY (Spring, 1979)

In this session, Herbert F. Ayres, Vice President, J. P. Morgan & Company, Inc., and John Y. Barry, Senior Research Officer, J. P. Morgan & Company, Inc., continued with their theory of the U.S. government market on which they had spoken at the preceding (Fall 1978) Seminar and which will appear in the May-June issue of the *Financial Analysts Journal.* The purpose of the talk was to show how their theory conflicts with the Capital Asset Pricing Model (CAPM). Ayres presented two examples illustrating serious difficulties in connection with assumptions underlying CAPM. Both examples involved obligations to deliver fixed nominal dollar amounts at specified points in time. It was clear that the large volatilities in total returns of the asset pools did not present genuine risk while CAPM states that volatility is an appropriate risk measure.

Ayres argued that the treatment of real risk must examine liabilities as well as assets, and if volatility is to serve as a risk measure, then it must be the volatility of the difference between the values of assets and liabilities, not simply the volatility of asset values. He stated that this observation was not original to them; in fact the point had been made and emphasized in an *American Economic Review* article by Paul Samuelson in March, 1945.

Barry gave a quick review of the Ayres-Barry model and some of the evidence that had been presented at the preceding Seminar. Their theory rests on three invariants; all three have been tested extensively. If these invariants are correct, one may deduce from the beta equation of the CAPM both the dynamic total return and the static yield curve behavior of government bonds. The dynamic behavior is correct, robust, very strong and agrees with their theory. The R-squared of the key regression is .9991. However, the yield curve shape prediction of CAPM is very bad. It is exponential in shape as they also predict, but the parameter of the exponential is different by a factor of 6 (.0921 for CAPM to .57 for Barry-Ayres). The R-squared of the CAPM exponential yield curve is .54, on yield curve data of 3/26/79. The R-squared of the Barry-Ayres exponential yield curve is .95. Their parameter value of .57 was established from 1970-73 data and teated in the periods 1966-70, 1975-78, and various times in 1979. The t-statistic on the difference between .0921 and .57 is an enormous 644.

Barry turned next to a discussion of the assumptions of CAPM. He pointed out that all of them except two were plausible for the treasury bond market. The two were that the theory applied only to assets (investors have a mean-variance utility function for total asset returns) and that a single decision horizon is adequate. He returned to Ayres' two examples and pointed out that prudent risk-averse investors would appear to be short-term risk lovers because they would choose very volatile investments. Barry went on to say that in his and Ayres' view the utility of a portfolio of assets could not be known in the absence of knowledge of the liability cash flows or perhaps their present worth.

Ayres concluded with several points: (1) Performance measurement of pension funds should include actuarial or other forecasts of pension liabilities, (2) Much work remains to reduce this suggestion to practicality. (3) Quite independently of the Barry-Ayres theory, the CAPM and the famous expectations hypothesis are logically inconsistent. (4) A full blown government futures market might flatten the treasury yield curve, in which case he and Barry predict that the Federal Reserve and the Treasury would act against the futures market.

88. IBBOTSON AND SINQUEFIELD MADE EASY (Spring, 1979)

Steven Lauer and Alan Lewis of Analytic Investment Management, Inc., presented a simple mathematical procedure to replace the extensive simulation procedure offered by Ibbotson and Sinquefield for examining probable future performance of stock portfolios. Lauer pointed out that the Ibbotson and Sinquefield simulation model rests on the following two equations:

$$S_t = R_t + B_t$$

$$B_t = F_t - 1.1\% + e_{b,t}$$

The first equation states that the expected annual rate of return on common stocks in year t equals the sum of the risk premium for common stocks in year t and the expected annual rate of return on treasury bills in year t. The second equation says that the expected rate of return on treasury bills equals the forward rate on government bonds in year t minus a historic liquidity premium of 1.1% plus an error term. Since the expected value of the error term is zero and its variance is very small, it can be neglected.

With the error term gone, Lewis explained how the equations above can be used. First, from a U.S. government yield curve we can easily calculate a set of forward rates for as many years as we like. So we can calculate B_t, and assuming a value of 8.5% for R_t, which is its historic mean, we can calculate S_t. From the values of S_t we can calculate a set of expected wealth relatives, assuming a $1 starting value. And the table of wealth relatives presented by Lewis in fact matches very closely the wealth relatives derived by Ibbotson and Sinquefield from their simulations.

For purposes of error analysis and confidence levels, Lewis observed that the yield curve as of the end of 1975, which formed the basis for the Ibbotson and Sinquefield simulations, had been fairly flat and the stream of expected T-Bill rates was therefore fairly flat. So he approximated all of the expected T-Bill rates by their mean value, .069. It turns out that the wealth relative is lognormally distributed and confidence levels can be calculated immediately from known parameters of the normal distribution. This in turn gives maximum and minimum values for the wealth relatives and for the expected rates of return. At this point, the simplified method, involving nothing beyond the use of a pocket calculator, has essentially duplicated all of the output of the Ibbotson and Sinquefield simulation.

89. BROWNIAN MOTION OF CORPORATE EARNINGS IN A VARYING PROBABILITY FIELD (Fall, 1980)

A paper by M. F. M. Osborne and J. E. Murphy, Jr. was distributed.

Maury Osborne, Physicist, U.S. Department of Defense (Retired), described the source of his paper as an attempt to give a simple answer to a simple problem. The problem was to predict the likelihood of negative earnings next year for a given corporation.

The paper began by supposing that earnings follow a random walk, that annual changes in earnings are independent in likelihood and normally distributed. From this hypothesis, using six years of historical changes in earnings (actually annual earnings/total assets) to calculate the standard deviation of the distribution, Osborne had tabulated, for 1437 Compustat firms for the years 1973-76, the probability of negative earnings. The firms were grouped each year, into sets with a similar likelihood of negative earnings, and a graph was plotted showing for each set the actual frequency of negative earnings. The graph showed reasonable agreement between predicted likelihood and actual frequency, suggesting that the model used for the predictions was fairly good. There were, however, systematic differences between the predicted and the observed at the very high and very low ends of the scale. The model systematically overestimated the likelihood of a loss when that likelihood was large and underestimated the likelihood when it was small.

Having discovered this discrepancy between theory and observation, Osborne went on to look for other characteristics of earnings behavior that might or might not be consistent with the theory.

The distribution of net income ÷ total assets (designated P), for 1975 for 729 firms was shown to be approximately normal, at least over the middle 96% of the distribution. The mean value of P and the standard deviation of the distribution were seen to change significantly from year to year, suggesting the effect of a common factor affecting income of all or most firms.

The theory would predict that the standard deviation of earnings change over an interval of K years, ΔP_K, across the set of firms, would increase with the square root of K, unless a steady state is reached. The results for the Compustat firms indicated that the distribution of ΔP_K is not normal for all the firms, but appears normal for some industries. The increase in the standard deviation of ΔP_K was always rather below the square root of K, indicating an approach to a steady state. This in turn indicated a constraint on P itself.

The likelihood of a common factor or component affecting the income of all firms had already been detected. The sequential standard deviation of this component was calculated for a series of time intervals and it appeared that the common component had a third to a fourth the standard deviation of the average firm and contributed about 8.5% to the variance for the average firm.

Further evidence of a steady state, or a "squeeze" that tend to bring very low earnings back up and very high earnings back down, appeared in another graph, showing deviation from a 50/50 likelihood of earnings increase or decrease. It appears that the time to reach a steady state for the full set of firms is on the order of 8 to 16 years.

In response to a question with respect to measurement error at very high and very low values of P, Osborne agreed that this was possible and a participant suggested that firms with very high earnings tend to try to reduce the reported figures while these witn large losses tend to try to reduce the reported loss. Another participant questioned possible survivorship bias in the Compustat data, because as firms fail they disappear from the tape. Osborne answered that he had examined the death and birth rates of listed corporations and believed any bias would be very small.

90. A CRITIQUE OF EMPIRICAL MODELS OF BANKRUPTCY PREDICTION (Fall, 1979)

Scott's paper, "A Theoretical Critique of Empirical Models of Bankruptcy" was distributed, as was Altman's paper, "Commercial Bank Lending: Process, Credit Scoring and Lending Error Costs."

James Scott, Associate Professor, Columbia University, reviewed empirical models to predict corporate bankruptcy and various theories of bankruptcy. Most of the empirical models do not rest on an explicit theory but were derived by testing various financial ratios that might be expected to relate to likelihood of bankruptcy. Although models using single financial ratios have worked quite well, the research has moved on to models that use multiple discriminant analysis to deal with combinations of ratios. These models, too, have worked well.

Scott described three theoretical models of bankruptcy. The single-period model is the simplest. It requires a probability distribution of firm value and the Black-Scholes option pricing model will often serve to produce the distribution. A second is the gambler's ruin model, which simulates future corporate cash flows and assumes assets are sold to meet

negative flows. A third model assumes perfect access to external capital. Losses are then made up by selling securities rather than corporate assets. Empirical evidence supports both the gambler's ruin and the perfect access models. Since the former assumes no access to capital markets and the latter assumes perfect access, Scott suggested something in between—the imperfect access model.

He described the imperfect access model in some detail. The probability of bankruptcy is a function of stockholders' equity (in terms of both market and liquidation value), income of the firm, and net investment of the firm. Flotation costs become significant when the firm must resort to the capital markets because internal financing is inadequate.

Comparing the imperfect access model to the others, Scott observed that the gambler's ruin and perfect access models are special cases of the imperfect access model. He went on to compare the model to the multiple discriminant analysis models, to show that the latter are consistent with the theory of the former. The result is to add theoretical justification to empirical models that have shown some success in predicting bankruptcy.

Edward I. Altman, Professor of Finance, New York University, began by commenting on Scott's work and then discussed very briefly his own most recent work. This work deals with the process by which bank loans are made, including credit analysis, acceptance or rejection of a loan request, and the handling of "work-outs". Altman reported new empirical testing of determinants of loan losses and loss recoveries, using aggregate data from the New York Federal Reserve Bank. He also discussed results based on individual loan information obtained by way of questionnaires.

Altman believes that Scott's paper is important because it ties together the several bankruptcy theories and those empirical models developed in the last decade or so to predict bankruptcy. Scott's conclusion that the ZETA model "is the most convincing multidimensional failure prediction model" really is a testimonial to the information content implicit in many market value and financial ratio measures of firm performance. He argues, convincingly "that such ratios as (1) current ratio, (2) retained earnings/total assets, (3) market value of equity/total capital, (4) standard deviation of EBIT, (5) EBIT itself, and (6) the size of the firm, all have strong foundations in the theory of business failure. These measures typically reflect a deteriorating situation (flow concepts) and a vulnerable condition (stock concept) and Scott finds them convincing surrogates for theoretical constructs.

The bankruptcy prediction issue is currently quite controversial in portfolio management. Index funds constitute a type of passive procedure which is unconcerned with the performance of individual stocks. Yet, we rarely find that index funds invest in the *entire index*. Cost efficient techniques to help select a subset of the index would seem to present some attractive features. An obvious benefit from bankruptcy screens would be the savings (if any) that holders of potential bankrupt securities would realize by dumping those securities. Altman's own studies show that savings are in the neighborhood of 20-25% based on a comparison of the average equity price one month prior to bankruptcy vs. the average price one month after failure. Of course, savings are significantly higher if the bankruptcy recognition date is earlier.

A final point relevant to the bankruptcy issue is the role that bankruptcy prediction can play in the enormously important subject of bankruptcy costs and optimal capital structure. Many theorists believe that the question of whether or not there is an optimum rests on the trade-off between tax deductibility of interest and the increased expected value of bankruptcy costs. The latter can be more precisely estimated if we have some benchmark for determining failure probabilities and dates prior to failure to begin estimating direct and indirect costs. Scott's work will give greater validity to the empirical models attempting to estimate failure probabilities.

91. PREDICTING CORPORATE PROFIT AND LOSS (Fall, 1978)

Joseph Murphy distributed a paper entitled: "Predicting Corporate Profit or Loss."

Joseph E. Murphy, Jr., Vice President, Northwestern National Bank, described a procedure for estimating the probability that a corporation would show a profit or a loss in a given future year. He began by commenting on the usefulness of a device for forecasting losses, and noted that although techniques have been developed for predicting bankruptcies, there were no widely known methods for simply predicting reported losses. He described a series of tests begun in 1972, to examine the usefulness of 45 ratios in predicting losses among 800 companies over an 18 year period. Ten ratios were found to be useful, but one—net income dividend by total assets—had outstanding predictive power. This single ratio was equal to the ten in usefulness, and the technique makes use of this ratio alone.

Historic profit and loss data on corporations were analyzed and a standardized measure, known in statistical terms as the "z score" was calculated for each. Assuming that profits and losses for a corporation

form a normal distribution, one can calculate from the z score the probability of a corporation reporting a loss. From these probabilities it is possible to rank corporations in terms of likelihood of loss, and Murphy reported tests on the validity of these rankings. The results were positive and significant for all tests.

The model estimated with a high degree of accuracy the total number of firms that would lose money the next year. It also proved useful in identifying firms headed for bankruptcy, one year prior to the bankruptcy.

REAL ESTATE INVESTMENTS

92. INTRODUCTION TO INSTITUTIONAL REAL ESTATE INVESTMENT (Fall, 1981)

Blake Eagle, Vice President, Frank Russell Company, opened the discussion of real estate by sketching the history of real estate investment by pension funds. Prior to the 1970s, plan sponsors were generally satisfied that stocks and bonds could provide the rate of return necessary to achieve actuarial expectations. Apart from some mortgages and some leasebacks, pension funds showed little interest in real estate. Real estate investment was difficult to understand; it appeared to pose very high risks; and it also seemed to be dominated by tax-motivated investors. The real estate market, at the same time, appeared to have no need for pension fund money. Debt was available at low and stable interest rates from other sources.

Then the 1970s saw rapidly rising rates of inflation, and very large cash flows into pension funds. Stocks and bonds were less able to cope with unexpected high inflation. And a new view of real estate as an investment vehicle began to emerge. Real estate was no longer simply a source of tax-free cash to tax-paying investors; it held out the prospect of substantial capital appreciation. With these changes there emerged professional investment managers with real estate experience, able to present real estate opportunities to tax-exempt institutions in a sensible way. Unleveraged ownership and good management offered the prospect of much less risk than had appeared to be the case in earlier years.

The move into real estate by pension funds has been slow and cautious. At first, five percent of assets seemed a reasonable goal. Then ten percent seemed reasonable. Today a few pension funds have targets as high as 15 percent to 20 percent.

The funds have tended to invest through established quality managers, and almost always by way of commingled pools. Most use three to five managers for diversification purposes. The move into real estate is still modest, compared with the efforts by the real estate community to attract pension fund money. At the present time pension funds constitute almost the only source of capital available for real estate. This observation is significant in light of the concern expressed by many plan sponsors that pension funds may be driving up the price of real estate to excessive levels.

One participant, Bill Fouse, pointed out that while the move into direct ownership of real estate by pension funds is fairly recent, pension funds, through their common stock holdings, have for some years had substantial indirect real estate investments. And the pensioners and employees on whose behalf the money is invested are likely to have substantial personal investments in residential real estate. This observation, and its implication for whether pension funds should be investing directly in real estate, was referred to on several occasions as the seminar progressed.

Eagle closed his remarks by commenting that what pension funds now need is a good method for monitoring managers and measuring real estate performance, and some good procedures for asset allocation to include real estate.

93. PLAN SPONSORS PERSPECTIVE (Fall, 1981)

Alwyn E. Wolfarth, Assistant Treasurer, Monsanto Company, organized his presentation under three main topics: the question whether real estate is a viable investment for pension funds, what alternative real estate investments are available, and the experience of the Monsanto pension fund with real estate.

He said he believed investment in real estate is appropriate for pension funds, within the ERISA prudence standard. Prudence demands diversification, and real estate itself constitutes diversification for a fund invested predominantly in stocks and bonds. The real estate holdings themselves must be diversified, and there must be a recognition that real estate is not a liquid investment. The risk in real estate holdings depends on the type of holding, the stage of development at which the pension fund invests, and the structure of the investment position. Wolfarth felt that certain types of investment are suitable to a pension fund while others, including apartment buildings and hotels, may be too risky. Pension funds generally avoid properties that are still in the development stage and prefer to wait to buy structures that are complete and leased. A straight unleveraged equity position, or a position as mortgager, is clearly safer than that of a leveraged equity participant. Considering the risk inherent in real estate investment, Wolfarth said he would expect a rate of return lying somewhere between the expected return on common stocks and the expected return on bonds. He presented a performance record for the five years ending Dec. 31, 1980, showing rates of total return of 13.9 percent on the S&P 500, 2.4 percent on the Salomon Bond Index, and 12.8 percent on real estate. These actual performances, he said, were consistent with his expectations.

In terms of alternative ways to invest in real estate, Wolfarth commented on the diversity of investment characteristics offered by real estate. One can invest

for substantial, immediate cash returns or for appreciation. There is substantial variety in types of property and in managers. Investment can be structured as an REIT, or a closed-end or an open-end fund. Since December 1980, there is no longer a tax penalty on leveraged investment.

In describing Monsanto's experience with real estate, Wolfarth commented that Monsanto had generally favored common stocks as an investment vehicle and anticipated substantial volatility in stock prices. As a result, there was a preference for low-risk real estate, in the form of unleveraged investment producing current income. The company perceived no immediate liquidity needs, and had set a ten percent policy limit on real estate investment.

Monsanto participates in the commingled funds of five managers. Two are open end funds operated by insurance companies and two are closed end funds operated by investment advisors. The performance record so far has been acceptable, but the figures do depend upon appraisals.

In dealing with the points that had been raised by Bill Fouse, Wolfarth commented that the indirect ownership of real estate through common stocks does influence the proportion of the pension fund that can appropriately be directly invested in real estate. Monsanto currently has about eight percent of its pension fund invested directly and the policy limit is ten percent.

In answer to a question, Wolfarth said that management fees are generally one percent to 1¼ percent.

A participant raised a question for both speakers: is it not true that a tax-exempt pension fund is at a disadvantage competing with tax-motivated investors in the real estate market? The speakers and several participants commented on this question, some suggesting that tax-motivated investors are not a major force in the real estate market, others suggesting that while tax-motivated investors may dominate certain parts of the market other parts are left unaffected, and others saying that whatever the effect of taxpayer investment, real estate still looks attractive to tax-exempt pension funds when compared with stocks and bonds.

94. WHY CLOSED END FUNDS? (Fall, 1981)

Before turning to the specifics of closed-end funds, Paul Sack, Principal, The Rreef Corporation, suggested some reasons for pension fund real estate investment, in addition to those that had already been mentioned. He pointed out the difference between real estate—a hard asset—and stocks and bonds which are financial assets. Real estate appears to offer better protection against inflation, since replacement cost is closely correlated with inflation and has a lot to do with the market value of real property. He mentioned the often expressed fear that real estate prices are too high. He said whether or not they are too high really depends on inflation expectations. If inflation persists at current high rates, then real estate values will rise. If inflation declines substantially, then bonds will outperform real estate.

Sack then described the closed-end funds his firm manages and outlined the reasons why a closed-end form had been chosen. First, his firm distrusts the appraisals that are necessary for the open-end form. Even the best appraisers, given the same basic data, will disagree about value within a 15 percent range. Appraisers in general tend to be a little low, perhaps motivated by a conservative instinct. But an error on the low side is in reality no better than an error on the high side.

Second, the closed-end form brings investor money in as properties are purchased. The participant in the fund commits a certain dollar amount and then makes contributions as the money is needed for actual purchases.

Third, although each closed-end fund is less diversified than a large open-end fund, an investor with enough money can buy into several closed-end funds and achieve substantial diversification. Sack observed that some institutions participate in all of his firm's closed-end funds. He also expressed the opinion that there was reasonably good diversification even in a single closed-end fund owning eight to twelve properties. Further, he expressed a conviction that the real estate market is inefficient and that a small fund can exploit inefficiencies better than a large fund so that the small closed-end fund can be expected to outperform the large open-end fund.

Commenting on investment performance, Sack observed that the popular cash-return-on-market-value measure means very little. He prefers to track over time the cash return on the original investment as a guide to how well the purchase has performed. He said that purchase decisions are made on the basis of a discounted rate of return, using expected cash flows.

In answer to a question, Sack said his firm looks for a minimum four percent annual real return on real estate purchases, and sometimes a five percent return if the risk seems to demand it.

95. WHY OPEN END FUNDS? (Fall, 1981)

Meyer Melnikoff, Senior Vice President & Actuary, Prudential Insurance Company, began with a few comments on the background of pension fund investment in real estate. Real estate was at one time regarded as a stock and bond hybrid, one quarter common stock and three quarters bond. But in fact real estate is a different kind of investment. It offers opportunities for diversification that cannot be found in stocks and bonds.

Turning to the advantages of the open-end form, Melnikoff began by discussing diversification opportunities. Diversification by year of acquisition, he said, is especially significant for real estate. And some of the slides he showed, describing the PRISA fund, indicated substantial differences in profitability among properties acquired in different years. In addition, the open-end form affords diversification by type of property, by geographical location, by unit value of property, by age of property, and by terms of leases.

He went on to point out the opportunities that lie in the open-end form. New acquisitions can be made when these seem attractive. It is possible to expand and renovate owned properties.

The liquidity advantage of the open-end form is fairly obvious. Liquidation of units is financed by new contributions, by income, and by sales of properties.

Melnikoff's opinion was that all of these advantages strengthened the claim that real estate investment was prudent for a pension fund.

He presented a variety of slides showing aspects of the performance record of the PRISA fund. Among other things, the slides illustrated how the distribution of fund characteristics, by type of asset, unit value, age of property and duration remaining on leases, changed over the years as the fund grew in size and the mangement was able to achieve the balance desired.

In answer to a question, Melnikoff said that the PRISA funds do not create debt, but that they may continue to carry debt in place when a property is acquired. One participant asked what rate of return might be expected on a real estate investment if eight percent annual inflation were anticipated. Sack answered about thirteen percent a year, and Melnikoff agreed that this was about right.

96. THE FRC PROPERTY INDEX (Fall, 1981)

Blake Eagle, Vice President, Frank Russell Company, described the origin of the index. Plan sponsors had been looking for some benchmark measure of real estate investment performance. The Frank Russell Company responded, calling on pension funds with real estate investments to contribute data from which an index could be constructed. The result is an index limited to fiduciary investments by tax-exempt organizations and subject to outside audit. All properties have been purchased for cash and all purchases are investment motivated. All of the performance figures are based on appraisals.

Peter O. Dietz, Vice President, Frank Russell Company, continued with some details. The data have been supplied by fourteen institutions, and for twelve of these institutions include all non-leveraged real estate investments. The fact that valuations are based on appraisals clearly smooths the investment performance. Property values seem to increase with net cash flow. As of the end of 1980 the index included 496 properties valued at over two billion dollars. Dietz showed classifications of the properties by size, type and geographical location.

In reporting index rates of return, he commented that the index income has been rather stable, at around two percent per quarter of the beginning of quarter market value. For the three years 1978-1980, the weighted average annual total return was 17.8%. Figures were also available for different types of property making up the index. The three year annual averages were 20.8% for apartment investments, 10.1% for commercial properties, 64.5% for hotels, 15.4% for industrial property, and 19.9% for office buildings. Rates of return by geographical area were also available. These were 31.2% in the east, 13.5% in the south, 10.1% in the midwest and 17.5% in the west.

In pointing out some of the limitations in the index as it has been computed, Dietz discussed the fact that property valuations are not all made during the same quarter of the year. In addition, quarterly rates of return may depend upon accounting procedures that differ among pension funds.

97. RISK AND RETURN CHARACTERISTICS OF COMMERCIAL REAL ESTATE INVESTMENT (Fall, 1981)

James Hoag distributed a number of tables and charts as well as a working paper entitled "Towards Measures of Real Estate Value, Return and Risk."

James W. Hoag, Assistant Professor of Finance, University of California, Berkeley, reported on his work supported by research funds from the IQRF. He

began by discussing weaknesses in the measures that are generally available on rates of return for real estate investment. In particular, a heavy reliance on appraisals for valuation of real estate holding tends to smooth the performance results and suggests that the risk in real estate investments is quite low. He observed that the stock performance of a number of all-equity REITs does show substantial variability, indicating perhaps that the substitution of appraisals for true market value may give the illusion of low variability. A few participants objected to this interpretation, with the argument that the "true value" of a real estate portfolio is better represented by professional appraisals than by the market for common stock of a REIT.

Hoag then described in general terms what he had set out to do. He wanted to construct an index consisting of quarterly rates of total return on real estate investments. In order to avoid reliance on appraisals it was necessary for him to estimate quarterly market values of all of the properties incorporated in his index. He did this by constructing a multifactor valuation model, using about a dozen factors. The property specific factors are location, physical characteristics, lease characteristics, financing characteristics, and appraised value. Regional and national macroeconomic factors were regional growth, population, population changes, external land value and zoning, regional transportation spending, available space and vacancies, business inventories, building starts, value of new construction and construction costs, mortgage interest rates, availability, commitments and investment by major market participants. The coefficients in this valuation model were estimated using actual transaction prices. Hoag found that for individual properties his model could explain 89% of the variation in price, and he could do somewhat better for the index of all the properties.

He already had data on the cash flows for each of the properties, so he was able to combine these cash flows with the valuations from his model to arrive at quarterly rates of total return for the index. His average return for an index of industrial real estate, from the fourth quarter of 1975 through 1978, was 3.4% per quarter. This was fairly close to the average return for four pooled funds, for which performance data were based on appraisals. It was a little better than the average returns on a stock investment in any one of four all-equity REITs. What was of particular interest was that the standard deviation of quarterly returns for Hoag's index was approximately the standard deviation for the returns on the REIT stocks, but was roughly ten times the standard deviation of the reported quarterly returns on the pooled funds. The index results then provided some corroboration of the proposition that appraisals lead to reported variability in rates of return far below the variability based on actual market prices. Hoag's results also suggested that the standard deviation of quarterly returns on industrial real estate is roughly equal to the standard deviation of quarterly returns on common stocks.

But while the variability statistics suggested that real estate is not a low risk alternative to common stocks, as some studies have claimed, Hoag's correlation coefficients supported the proposition that real estate is valuable for diversification purposes. His index rates of return showed a negative correlation with rates of return on long corporate bonds and a slightly negative correlation with rates of return on common stocks.

98. RISK AND RETURN IN THE REAL ESTATE MARKET (Fall, 1981)

A paper by George W. Gau was distributed, entitled "Determinants of Return in Real Estate Investment and the Role of Real Estate Management."

George W. Gau, Assistant Professor of Urban Land Economics, University of British Columbia, reported on his analysis of a substantial sample of apartment and commercial property investments in the city of Vancouver, British Columbia. His data consisted of income figures, indebtedness and purchase and sale prices of properties sold in 1978, 1979 and 1980. About five hundred real estate properties were included. The results he presented were for properties sold in 1979.

Gau was able to estimate annual average after-tax rates of return on the properties in his sample, assuming the owner could make full use of depreciation for tax purposes. He was also able to calculate after-tax rates of return assuming, under Canadian law, only limited use of depreciation. And finally, he was able to estimate after-tax returns excluding the effect of borrowing to finance the properties. That is, he was able to estimate what the after-tax returns would have been in the absence of indebtedness.

His most interesting conclusion was that leverage dramatically increased the after-tax rate of return to the equity investor. Restrictions on the use of losses for tax sheltering did not seem to make a great deal of difference to the after-tax returns. The length of the holding period for a piece of property did not seem to have much to do with the average rate of return. Nor did the price: more expensive properties were not consistently more profitable than low

priced properties.

Gau indicated that he will continue to work with the data, analyzing the figures for properties sold in 1978 and 1980 and determining holding period returns as well. He has also begun work with a price series based on twenty-five hundred apartment and commercial building transactions dating back to 1970. First results indicate no serial correlation in apartment prices, whether these prices are expressed as price per suite, price per square foot, or price per dollar of gross income.

99. REVIEW OF DAY'S PRESENTATIONS ON REAL ESTATE (Fall, 1981)

Peter O. Dietz, Vice President, Frank Russell Company, presented a panel consisting of those who had made presentations earlier in the day. The first question presented to the panel had to do with why some types of real estate have proved much more profitable than others. The statistics that had been presented indicated that hotels and motels have produced much higher rates of return than commercial properties. The question was quickly extended to a general inquiry with respect to the level of real estate prices and rate of return expectations. Members of the panel suggested that rate of return expectations for different types of property are frequently the result of over-reaction to temporary conditions. Hoag commented that if real estate provides a good inflation hedge, one should expect to pay a price for this hedge in the form of a lower long-run average rate of return. Hoag was specifically questioned on the apparent diversification value of real estate, and just why the correlations between real estate returns and stock and bond returns are small or even negative. He had no explanation for the specific correlations, but suggested that we do not really know how real estate returns would correlate with returns on the "market for all risky assets."

SECURITIES FIRMS

100. OPTIMAL SIZE OF INVESTMENT FIRMS (Spring, 1979)

Baker distributed his paper: "Investment Performance and the Range of Choice: Ascertaining the Inherent Advantage of Moderate Size in Investment Management."

David A. Baker, Principal, M. Pescatello & Company, Inc., did not identify the ideal size of an investment firm or portfolio, but his thesis was that size limits performance, and there is an advantage in moderate size. Investors can expect to increase their portfolio rate of return when they increase the range of choices from which they select investments. More specifically the larger the ratio of stocks available for investment to stocks in the portfolio, the better off the investor is. As portfolio size goes up, the number of eligible stocks goes down. For example, if a $1 billion fund is to be in twenty-five stocks, then the positions must be $40 million in each stock. If no position is to exceed 5% of a company's capitalization, then only $800 million companies are eligible. There are a little over 200 such companies. Doubling the size of the fund will double the minimum acceptable size of companies, and there are about 90 companies with a capitalization in excess of $1.6 billion.

This means that even if the investment management firm has the ability to select superior stocks, a large number of those stocks are likely to be ineligible for inclusion in the portfolio, because their capitalizations are too small. At least a portion of the selection ability of the firm cannot benefit the portfolio.

The principle of this example was illustrated by Baker in a table showing the performance achievement for a range of information coefficients, over a range of ratios of number of stocks in the universe to number of stocks in the portfolio. For example, for an information coefficient of .10, an investor could expect to outperform the market by 3% a year with a ratio between 10 and 20. He could do only half as well with a ratio of 2. Baker suggested that a ratio of 10 to 20 corresponds to a portfolio of $850 million to $400 million, and a ratio of 2 corresponds to a portfolio of $5 billion.

If small companies outperform large companies, as some investors believe, then the disadvantage of large size becomes even more apparent, because the best investment opportunities are the most likely to be ineligible.

Baker reported some empirical testing of his proposition, based upon a comparison between the performances of common equity pools at large and medium size bank trust departments. He used average figures from the 75 largest and the next 50 bank trust departments. On average, the group of smaller banks always outperformed the larger banks by 1½ to 3% a year. The top quartile of the smaller banks outperformed the top quartile of the larger banks by 2 to 3½% a year.

In answer to a question, Baker agreed that large investment firms may have access to substantial resources, and the information coefficient may rise. But he argued that there are sources of inefficiency in large firms, and the information coefficient may simply not show up in performance. His overall conclusions were summarized in a paragraph from the abstract of his presentation: The array of available securities, the number of portfolio names, and the amount of the portfolio define the proportion of a portfolio sample to an investment universe. The mean performance of an ideally selected sample defines the upper performance limit under conditions of perfect forecasting ability. The mean performance of the universe of stocks defines the base limit under conditions of no forecasting ability. The rank correlation coefficient of forecasting ability is proportional to the probabilities of the distribution that lie between the extreme limits so defined. The probability position at any forecasting level can thus be converted to investment performance terms for any mean performance and dispersion measure of the universe.

101. NEW RESULTS ON MARKET MAKERS AND THE BID-ASK SPREAD (Fall, 1980)

A paper by Kalman J. Cohen, Steven F. Maier, Robert A. Schwartz and David K. Whitcomb was distributed.

Robert A. Schwartz, Professor of Economics, New York University School of Business, introduced the topic, stating the purpose of the research to be an investigation of how market structure affects the ease of trading and the degree to which stock prices reflect true value. He described some of the effects of cost of transactions and procedures inhibiting free trading. He went on to describe characteristics of the spread between the bid and ask price of a security, and the role of the market maker in a continuous market. He reviewed research that has been done on these topics and turned to the new ideas incorporated in the work on which he was reporting. In particular, he stressed the contribution to market liquidity of public traders placing limit orders. And he discussed what he and his fellow authors have characterized as "the gravitational pull effect."

David K. Whitcomb, Graduate School of Management, Rutgers University, picked up at this point to describe the simulation model in more detail. Market participants include individual and institutional traders, as well as market making specialists and speculator traders. The pure continuous action, with participation limited to individual and institutional traders, serves as a base line reference, against which the contribution of market makers can be judged. Three performance measures of the market, arrived at through the simulation process, were the bid-ask spread, the standard deviation of daily transaction returns, and the auto-correlation coefficient of daily transaction returns. What was of interest was the extent to which each of these three measures was reduced by the introduction of a market maker. The market maker could be a pure stabilizer, performing the function of a specialist. Or he might be a speculating stabilizer, combining the functions of a specialist with the activities of a dealer using his knowledge of the limit order book to earn trading profits for himself. Finally, the market maker might be a pure speculator.

The impact of the activities of each of these three market participants was tested under a variety of conditions. The stabilizer was required to maintain transaction-to-transaction price changes within specified inventory limits. The simulation kept track of the profitability of the activities of the market participants, since the relative profitability or unprofitability of market stabilizing activities gives some indication of the likelihood they will actually take place.

Although the research is still incomplete, some policy implications of the analysis had been arrived at. First, it was clear that ordinary investors do provide significant liquidity in the market place. The desirability of an increased flow of public limit orders was an important conclusion of the study, and indicates the value in reducing transaction costs and making the limit order book public.

Designated market makers do add liquidity and stability to the market. Stabilization as such is generally unprofitable, so that those who engage in stabilization must be compensated through some other activity.

Whitcomb reported that the research had not yet been extended to all speculative strategies, to see which are profitable and what effects they have on stabilization.

The presentation ended with a brief discussion of regulatory developments, including recent action by the SEC affecting the quality of the market place.

102. HISTORICAL VOLATILITY OF THE STOCK MARKET (Spring, 1979)

Timothy G. Dalton Jr., Vice President, Oppenheimer Capital Corp., made a presentation and Charles H. Brunie, Chairman, Oppenheimer Capital Corp., offered comments, on a study of stock and bond rates of return from the beginning of the century through 1978. Their thesis was that despite investor disappointment with stock and bond performances in recent years, and a longing for the bull market of the 1950s and 1960s, the last 13 years (1966-1978) have been a more "normal" period than the "good old days" (1949-1965). In fact the recent period has shown many similarities to the first two or three decades of the century. Total rates of return on stocks and bonds, inflation rates, variability in stock and bond rates of return, and the correlation between the performance of stocks and the performance of bonds all showed a remarkable similarity between the thirteen year period and the first three decades of the century, and were quite unlike the statistics for the 1949-1965 period. Perhaps the most interesting statistic was the correlation between the performance of stocks and bonds. This was .435 for 1966-1978, .559 for 1900-1930, and -.016 for 1949-1965.

After reviewing these statistics, Dalton turned to some of the underlying economic conditions, pointing out the close parallels between the last 13 years and the early decades of the century, and the significant differences from the 1949-1965 period. Inflation, pri-

vate and public debt as a percent of GNP, growth and volatility of the money supply, the velocity of the money supply, liquidity, and real dividends all stood out as significant economic factors. The similar periods have been characterized by high and rising inflation, and although debt as a percent of GNP has been rising over the past thirty years, Dalton noted that it is still one third below its level in 1930. A high velocity of the money supply has characterized the two similar periods, and Dalton commented that expectations of rising inflation are likely to lead to more efficient use of money balances and a higher velocity, and that asset prices are likely to become more sensitive to changes in liquidity. So a high degree of price volatility is characteristic of the two periods.

Stocks proved a poor inflation hedge over the first two decades, and during the last 13 years. Real returns on corporate equity declined from 10% in 1966 to 5% in 1978 and from 18% to less than 0 in the early years of the century.

In answer to a question, Dalton expressed general agreement with the proposition that a stable inflation rate is more important than a low inflation rate to the satisfactory performance of stocks and bonds. But he added that we have no experience with an inflation rate that is both high and stable.

Turning to the practical significance of his conclusion that "now is normal," Dalton discussed how one might expect to profit from stocks or bonds. He pointed out that between 1921 and 1928–part of the earlier period found to be so similar to the last 13 years–rates of return on stocks and bonds were substantial. The economic conditions that brought about these returns included a significant decline in inflation, very high real returns on equity (averaging 14%) and a consequent doubling of real dividends. Real interest rates averaged over 6%. His prescription for dealing with the conditions we face now consisted of 5 points: (1) while we face higher risks we also encounter greater opportunities from time to time. (2) Substantial returns can be achieved over brief time periods. (3) A buy and hold strategy does not make sense. (4) The asset mix must be varied from time to time. (5) High cash positions are normal for periods of high inflation and poor stock and bond returns.

Dalton concluded by defending the attractiveness of cash in periods of high inflation, displaying some of the Becker performance figures that show cash as a winner over the last 15 years.

In answer to a question about asset allocation techniques, Dalton said his firm has no mechanical model and does not try to pinpoint peaks and troughs. They do try to adjust risk exposure. Another question involved the likely duration of the yield inversion, that is the fact that short term interest rates exceed long term interest rates. Dalton and Brunie commented that there seems to be a consensus that the inversion will last about 9 months, but they believe it is more likely to last 20 to 30 months. Finally, in answer to a request for a prediction of long interest rates, Brunei replied that they see long rates remaining very high until March 1980, with a 10% to 11% peak on triple A obligations. But he commented that they were not as sure about this as they had been six months earlier, and were watching yield curves very carefully.

103. DEALER VERSUS AUCTION MARKETS: IMPACT OF ELIMINATING RULE 390 (Spring, 1978)

Ernest Bloch and Robert A. Schwartz distributed a paper: "On the Removal of NYSE Rule 390."

Ernest Bloch, Professor of Finance, New York University, and Robert A. Schwartz, Professor of Economics, New York University School of Business, presented a paper, with Bloch beginning the presentation by giving some background on the S.E.C. threat to remove Rule 390. He commented that for some years the S.E.C. has been dissatisfied with Rule 390, and that the dissatisfaction has been heightened by a congressional tendency to favor less regulation and more competition. At the same time, the S.E.C. has been tempted to use a threat of removal of Rule 390 as a goad to the securities industry, to bring about quicker response to the demand for a design for a National Market System. He described the handling of Rule 390 as very much a part of the process of moving towards a National Market System. Unfortunately, he said, the position of the S.E.C. does not reflect a clear understanding of the way in which competition works. We are dealing with two markets, one of them a market in broker services, and the other a market in stocks themselves. While the removal of Rule 390 may improve competition and reduce costs in the first of these markets, it is likely to do substantial harm to the second.

Schwartz then described the model he and Bloch had developed to predict the consequences of a removal of Rule 390. The model is based upon queuing theory, and pictures a queue of limit orders waiting in a marketplace for execution. Execution takes place when a market order on the other side arrives. The arrival process for these market orders is assumed to be a Poisson process, and the two critical variables in

the model are the parameter for this process, representing the frequency of arrival of market orders, and the length of the queue of limit orders. The longer the queue, the less attractive the marketplace is. But the larger the parameter of the Poisson process, the more attractive it is.

Bloch and Schwartz picture limit orders arriving at securities firms, which may choose to pass those orders to a central exchange, or to hold them themselves. Whether an individual firm can successfully compete with the central exchange itself, in offering a brokerage service to a customer, will depend upon the two key variables in the model, for the firm, and for the exchange. Schwartz demonstrated the conditions under which a firm could compete successfully with the exchange, or one firm could compete successfully with another. He suggested that a firm may find it worthwhile to retain all orders, offering a guarantee to its customers that executions will be as prompt as they would be in the central exchange.

The Bloch and Schwartz model does not predict market fragmentation, but indicates that there is a substantial likelihood that such fragmentation may take place. Schwartz indicated some of the disadvantages that would follow fragmentation. Arbitraging would probably be imperfect, and even if it were perfect, and maintained uniform prices in all markets, the market would no longer offer the time priorities that investors now enjoy. The best prices in all markets would not be known to all investors; there would be reduced ability to provide an orderly market (through specialists for example); there would be increased opportunities for over-reaching by brokers; price volatility would probably rise; and spreads could be expected to rise. Schwartz closed by observing that it would be harder to justify an open "book" in the absence of Rule 390, because of increased opportunity for brokers to take advantage of customers.

Carter T. Geyer, Vice President, Security Pacific National Bank, commented on the inadequacies of the present system for processing orders on the New York Stock Exchange. He observed that there are in fact two securities markets, one for institutions and the other a retail market. For institutions, we have had dealer, rather than broker, markets for a long time. Despite Rule 390, an institution can easily get a dealer quotation from a member of the NYSE, and if the member wants to buy or sell the entire order itself, it can easily avoid exposing the trade on the NYSE, by putting it up on a regional exchange where there is no quotation. In other words, Rule 390 is easily evaded in the case of institutional transactions. In the retail market, however, orders are automatically sent to the floor of the NYSE or American Exchange.

Geyer also explained how, under NYSE Rule 72, strict time priority is not always followed, and how institutions can "size out" other bids, to achieve priority.

He concluded by noting that there is substantial market fragmentation at the present time. He suggested that Rule 72 should be changed, but did not think that elimination of Rule 390 would lead to greatly increased dealer markets. He did expect that once a National Market System evolves, there will be a Rule analogous to Rule 390, compelling the execution in the NMS of trades in NMS stocks.

104. INSTITUTIONAL TRADING AND STOCK PRICE MOVEMENT (Fall, 1977)

David Miller distributed Parts I, II and III of a report he had prepared for submission by Morgan Guaranty Trust Co. to Senator Bentsen's Subcommittee.

David W. Miller, Professor of Statistics, Columbia University Graduate School of Business, described an analysis of the effect of institutional trading on stock prices, prepared at the request of Morgan Guaranty Trust Company for submission to Senator Lloyd Bentsen, Chairman of the Subcommittee on Private Pension Plans and Employee Fringe Benefits, of the Senate Committee on Finance. Senator Bentsen's Committee has been considering a Bill, S.285, which would limit the equity holdings of major pension fund investment managers.

Professor Ray A. Schotland of the Georgetown Law School testified in June 1977, claiming that he had found statistical evidence that institutional trading had distorted the market prices of common stocks. Miller's conclusion, based on data from Morgan Guaranty and on mutual fund data, was that Professor Schotland was wrong.

Miller began with data on Morgan Guaranty trading in stocks for which Morgan's purchases or sales exceeded 5% of the total market volume in 1975 or 1976. These included 32 stocks that were purchased in 1975, 16 that were sold in 1975, 41 that were purchased in 1976, and 33 that were sold in 1976. For each quarter of 1975 and 1976, and for the first quarter of 1977, treating buys and sells separately, Miller examined the relationship between Morgan's share of the volume of trading and the price movement of the stocks. There was evidence that in some quarters a price rise (beyond any rise in the stock market itself) accompanied heavy buying by Morgan, or a price decline accompanied heavy selling by Morgan. At this point, Miller pointed out that there are two explana-

tions for such a correlation between volume and price movement. The first has to do with an information effect. If the price of a stock moves up or down because of the dissemination of favorable or unfavorable news, and if an institution is able to anticipate this news or at least act very quickly upon its dissemination, then heavy buying by the institution can be expected to accompany a price rise, and heavy selling to accompany a price decline. In such a case, the institution is not distorting market prices through its trading. The movement in market prices is the result of a change in the fundamentals of the stocks, not a result of institutional trading.

The second explanation for a correlation between institutional volume and price movement can be termed a transaction effect. Heavy institutional volume may create a temporary imbalance between supply and demand, and lead to a temporary distortion of stock prices. It is this effect that Professor Schotland claimed to have found, and which Senator Bentsen's Bill was designed to curb. But a price distortion of this kind should be self-correcting. Once the high level of institutional buying or selling has ended, the stock prices should return to their equilibrium level. Cases of a transaction effect will be identified where there is a significant correlation between institutional volume and price movement, and where in a subsequent time period the price movement is reversed. Miller found only one instance of this phenomenon, for the third quarter of 1975. For that quarter, the buying of Morgan Guaranty may have created a temporary rise in some stock prices.

Having found some evidence that there may be a transaction effect, Miller then examined the likelihood that the Bill proposed by Senator Bentsen would deal with this effect. The Bill as proposed would apply only to institutional holdings of heavily capitalized companies, with no limits to the holdings of smaller companies. Miller's analysis, however, indicated that it was transactions in these smaller companies that accounted for the results he had found in the third quarter of 1975. The Bill as proposed, then, would not have prevented this effect.

Miller went a little further, to examine the likelihood that correlations between high volume and price change in the same quarter reflected information effects, and were the result of superior investment management at Morgan Guaranty. The point was not a trivial one, since proponents of the efficient market theory would discount the likelihood of succuessful trading. Miller tested the performance of Morgan's buys and sells, and found clear evidence that buys outperformed sells in the quarters following the trading. These conclusions were reassuring not only to those fearful of price distortions that might be caused by institutional trading, but also to those whose livelihood is bound up in the expectation that skillful analysis can lead to successful stock selection.

105. IMPLICATIONS OF THE NATIONAL MARKET SYSTEM FOR TRADING COSTS (Fall, 1976)

Donald Weeden, Chairman-of-the-Board, Weeden & Company, Inc., described the National Market System he saw developing, and its probable effects on transaction costs. First, he anticipated that three objectives will be served by any National Market System. One will be the preservation of the auction type stock market we now have, including its elements of disclosure, priority for public orders, surveillance and regulation, and preference for a central market. A second objective will be competitive market making open to any qualified firm anywhere. A third objective will be the use of electronic technology to make the operation of the National Market System as efficient as possible. Specifically, he contemplated that a quotron type terminal would enable anyone in the securities industry to call up the market on any stock, to see the book (consisting of all public limit orders on all exchanges and with all brokers), to see the bids and offers of all market makers, including both price and size, and to treat all prices as firm and able to be "hit."

With respect to commission costs, Weeden predicted that specialist commissions for limit orders would disappear and that floor brokerage would disappear in most cases, for a total cost saving to traders of perhaps $50 million a year now paid to specialists and $100 to $150 million now paid to floor brokers. He expressed the opinion that institutions have already brought their commission costs down close to a minimum, but that independent private investors may enjoy the benefits of these further savings.

With respect to market maker spreads, Weeden said those are already at a minimum. Five years ago market makers were grossing from 8 to 10¢ a share, according to the Institutional Investor Study. Weeden now earns 4¢ to 6½¢ for every share committed to. He believes further competitive pressure may lead to some reduction but not much. Apart from competition, however, the participation of many market makers will involve wider differences of opinion, differences in inventory positions and in inventory capability, so that there should be some variety of spreads among market makers and the net spread over all market makers in a particular stock should narrow. This will not be true for all stocks, but should be the case for some 100 to 200 heavily traded stocks.

Liquidity costs should decline as at least 100 to 200 stocks will have a number of market makers good for many thousands of shares each.

One participant raised the possibility that all market makers will tend to concentrate on a few heavily traded stocks. Weeden responded that initially probably too many market makers will rush to the heavily traded stocks, and then the number will decline. But he argued that for the less active stocks we are likely to find firms all over the country picking up regional stocks that so far have had only regional interest, and making national markets.

In response to questions about the services that will be available to an individual investor, Weeden expressed the opinion that the customer who prefers to deal with his broker in the traditional way will continue to do so. He may make use of the quotron information if he wishes, but he need not. So far as the individual investor is concerned, Weeden said the key service a broker can provide is advice, so we should minimize the cost of everything else.

In response to comments on block positioning and market making, Weeden expressed the hope that block positioners would become true market makers, not just making block bids for good customers but undertaking regular market making in at least some stocks. And he pointed out that it is easier to become a market maker if there are many other market makers in the same stock, offering liquidity and reduced risk. Answering another question on changes in liquidity, he said that a substantial amount of market liquidity can be provided by institutions themselves, and this liquidity can change from time to time, sometimes giving a false picture of the liquidity services of market makers.

In answer to a query as to why he was so firmly convinced of the particular future system he described, Weeden referred to a system Weeden and Company has already established through the Cincinnati Stock Exchange to provide for 23 utility stocks a prototype of the National Market System he had described.

In closing, Weeden summarized his predictions in saying that commission costs will come down a little for institutions but probably 30 to 40% for individuals; spreads will come down a little; and liquidity for institutions will improve.

STOCK LIQUIDITY MEASURES

106. LIQUIDITY AND CAPITAL ASSET PRICES (Fall, 1978)

Jack Treynor distributed a paper entitled "Liquidity, Interest Rates and Inflation."

Jack Treynor, Editor, Financial Analysts Journal, presented an analysis of the relationship between the profitability of an investment and the liquidity of the asset invested in. His final equation related rate of return and liquidity to the real rate of return and the rate of inflation, a matter of some practical importance to an investor and a guide to the proper role of monetary policy.

Treynor began with an analogy between liquidity and risk in investment assets. Just as investors prefer to avoid risk, they also prefer to avoid illiquidity. Hence assembling a portfolio involves a balance between expected return and illiquidity as well as one between expected return and risk.

He presented some statistics on liquidity ratios for stocks, in the form of the size of the purchase or sale that might be expected to move the stock price by 1%, indicating wide differences among stocks. He also referred to some Wells-Fargo exhibits demonstrating the impact of liquidity on expected rate of return.

Treynor identified a number of simplifying assumptions. He ignores risk; he assumes a single period horizon for transactors; he ignores the possibility of borrowing to meet liquidity needs; and he assumes that liquidity is valuable only for meeting unexpected needs for cash. Expected needs can be taken care of by arranging an appropriate maturity schedule.

He defined liquidity in an asset as the spread between the bid and asked prices for the asset. In meeting unexpected liquidity needs an investor could be presumed to liquidate first the asset with the smallest spread, next the asset with the next smallest spread, and so on. An expression for the expected cost of liquidation of assets in a portfolio is a function of the spread for each asset, the quantity of each asset held, and the probability of an unexpected need for cash. The derivative of the cost of liquidation with respect to the holding of an asset yields an expression for the correct amount of the asset to hold in terms of the expected return on that asset and its spread, or liquidation cost.

Treynor next moved to the combined liquidity needs of all transactors, and introduced a measure of price level, since if cash needs are measured in nominal terms these needs will be proportional to the level of prices. This leads to an expression for the trade-off between expected return and liquidity for all transactors in the market place. The difference between the expected returns on two assets in the market place is proportional to the difference in the spreads for the two assets.

Next liquidity rent was introduced, with the rent on a particular asset defined as the savings in spread costs that a transactor would experience if he were forced to raise cash, by holding one more unit of that asset. A further series of mathematical steps led to the key result, that the sum of the liquidity rent and the expected return is the same for each asset.

Inflation was brought in by way of the Fisher equation that equates the nominal interest rate to the sum of the real interest rate and the expected inflation rate. This equation was modified to:

$$\begin{matrix}\text{Pecuniary} \\ \text{Return}\end{matrix} + \begin{matrix}\text{Liquidity} \\ \text{Rent}\end{matrix} = \begin{matrix}\text{Real} \\ \text{Return}\end{matrix} + \begin{matrix}\text{Inflation} \\ \text{Premium}\end{matrix}$$

This is a particularly interesting equation when applied to the asset cash. Since the pecuniary return for cash is always zero, an increase in the inflation rate can only reduce the real rate of interest. This will in turn increase asset prices and stimulate capital formation, and will tend to increase the inflation rate further, bringing about a further reduction in the real rate. The trend can be halted only by action of the central bank to increase the liquidity rent on cash, reducing its supply. This tightening of money will not reduce the rate of inflation but it can halt the acceleration.

Treynor pointed out two further implications of the modified Fisher Equation. If a recession is severe enough to cause expectations of deflation, then the inflation term in the equation is negative and for a given monetary policy the more negative the inflation term, the higher the real rate of return. The higher the real rate, the more depressed economic conditions are likely to become. The central bank will relax monetary policy to reduce the liquidity rent on cash, but this liquidity rent cannot be made negative. So there is some critical rate of deflation below which stabilization is beyond the reach of the central bank.

A second difficulty arises if the level of private investment can be sustained only with negative real rates of return. A negative real rate can obtain if the expected inflation rate is high enough. A central bank policy to increase inflation may then be necessry and inevitable.

107. INVESTMENT IMPLICATION OF INDUSTRY STRUCTURE AND COMPETITIVE STRATEGY ALTERNATIVES (Spring, 1982)

A. Michael Spence, Graduate School of Business Administration, Harvard University, described his presentation as summarizing research in competitive strategy and industrial organization. Identifying three types of industry, he said that he would not deal with mature or declining industries, but would discuss the third type: those that are growing or emerging and in some sense "out of equilibrium." This is where the believed strategic investments are made, and this is where companies can change strategy and competitive position.

He suggested that an investor is looking for good reason to expect sustained above-average profitability of a corporation. And it is therefore worthwhile discovering the structural basis for such an expectation. He identified six sources for such a structural basis. One source is cost based advantages, which may have to do with economies of scale, the learning curve, or research and development. Competitive advantages here are usually based on relative size or share of market or being first into a market where duplication of the first firm's performance is difficult or self-destructive. The second source was the presence of irreversible investment. He suggested that the undertaking of a major advertising campaign may be an example. The third source is proprietary access to technology or resources. Sometimes this can be achieved through research and development. Sometimes it is idiosyncratic to a corporation. His fourth source was market-share-related marketing advantages. For example, the firm that has a very large market share can afford advertising expenditures that dominate the market and create barriers to entry by competitors. His fifth source had to do with intangible assets such as brand image. If buyer information is hard to come by, then a dominant reputation may be a major source of the structural basis for sustained above-average profitability. Finally, multiproduct cost advantages constitute the sixth source. Spence said that these advantages are not well understood, especially in service industries. He mentioned the financial service industry as one in which many participants appear to believe in combining every possible product, hoping that some synergies will develop.

Spence next turned to research and development. His first comment was that although one may turn up a few instances of proprietary technology that has a long life, this is the exception rather than the rule. Substantial research and development spending as a percent of sales (say 7 percent or more) means that as market share rises, costs are driven down and there is a great advantage to possessing a large share of the market. But there is what Spence called an appropriability problem. Appropriability is the extent to which a company making the research and development investment can keep the benefits. It will depend upon the value of secrecy and legal protection. In general, the chemical industry is well protected in this respect, while companies in the electronics industry are poorly protected. As a rule of thumb, he sugested that if research and development investment for the industry is greater than 10 percent of sales (which would be slightly below the standard for the computing and semiconductor industries), then if the degree of appropriability is high, there will probably not be more than three major competitors in the industry. He suggested as an example an industry in which there are three major competitors investing primarily so as to bring costs down. Appropriability is complete, through secrecy or patent protection. Each company has 33 percent of the market and is spending 12 percent of its sales on research and development. A new competitor breaking into this market and achieving 15 percent market share would have to spend about 25 percent of sales in order to stay in the game. This would be very difficult, except perhaps for a competitor coming in from a foreign market. Entry barriers would therefore be regarded as high; the survivors in the industry would be very profitable.

Now Spence suggested switching the example to assume substantial spillover of the benefits of research and development. That is, appropriability is now low. Each firm is spending 10 percent of its sales on research and development. Costs will go down very fast. Profits will be lower than in the preceding example, and entry barriers will also be lower.

Spence turned next to deal with international competition as such. He began by contrasting multinational firms with global firms. Within the United States, companies have gotten used to the idea that the U.S. market dominates the world, but this view is changing. Truly global industries, for which the United States constitutes only one significant market, are characterized by reasonable homogeneity of demand from country to country and significant advantages of scale or market share that are not truncated by national boundaries. He observed that manufacturing is not so likely to be truncated by national boundaries as is consumer marketing. Research and development is generally not truncated, nor are intangibles like trading and marketing expertise. Nor are the advantages of a learning curve. For the global industry, the level of research and development spending is likely to be dictated by corporate strategy rather than technology. Japanese companies have provided an example in raising

research and development expenditures so that a competitor must spend substantial amounts just to stay in the game.

Finally, Spence turned to the competitive implications of the learning curve. He observed that the learning curve is in some respects similar to expenditures on research and development. The learning curve can be represented by the following equation:

$$\text{Logarithm of Unit Cost} = a + b \times (\text{Accumulated Volume for the Firm}) + g \times (\text{Accumulated Volume for the Industry}).$$

Where all participants in the industry share the benefits of experience, the coefficient b will be zero and the last term of the equation will explain all of the reduction in cost through accumulated learning. Where the benefits of learning are strictly proprietary, then the coefficient g will be zero and the second term to the right of the equality sign will represent the entire cost reduction for the firm due to accumulated learning. A steep learning curve will be represented by a b or a g of .-0.3 to -0.4. In such a case, a 10-percent increase in accumulated volume will lead to a 3- to 4-percent reduction in unit cost. In general, it is very difficult to separate the effects of learning at the firm level and learning at the industry level. It is also difficult to identify expenditures that are actually an investment in achieving reduced unit cost by way of learning. Spence commented that research and development expenditures are generally clearly identified to the firm itself and to outsiders, and accounting procedures may call for capitalizing these costs so that a firm can simultaneously make heavy research and development expenditures and show a profit. But an investment in learning is not likely to be identified through accounting rules, so that during the learning period prices may actually appear to be below unit costs, and the firm may appear to be operating unprofitably with no obvious prospect of becoming profitable. During this period, it may be very difficult to achieve the financing necessary to complete the learning that will bring unit costs down and make the firm profitable.

Spence concluded his presentation with the following equation and table illustrating the great sensitivity of the rate of cost reduction to the slope of the learning curve and to demand elasticity.

$$\text{Growth Rate in Unit Sales} = \frac{\text{Natural Growth of Demand}}{1 - \left\{\text{Slope of Learning Curve}\right\} \times \left\{\text{Demand Elasticity}\right\}}$$

$$\text{Rate of Cost Reduction} = \text{Growth Rate in Unit Sales} \times \text{Slope of Learning Curve}$$

		Slope of Learning Curve				
		.1	.2	.3	.4	
Demand Elasticity	.5	2.63	2.78	2.94	3.13	Rates of Cost Reduction at 5% Natural Growth Rate
	1.0	5.56	6.25	7.14	8.33	
	2.0	12.50	16.67	25.00	50.00	
	2.5	16.67	25.00	50.00	–	

(Cont'd)

108. COMPARISON OF OPTIMAL VS. STATIONARY MULTI-PERIOD INVESTMENT POLICIES (Spring, 1981)

A paper entitled Comparisons of Optimal Versus Stationary Investment Policies Over Time, by Richard O. Michaud and James P. Monahan, was distributed.

Richard O. Michaud, Vice President, Director for Quantitative Research, Bache Halsey Stuart Shields, introduced his subject by suggesting that the easiest way to picture investment decision making is in terms of what fraction of one's assets to bet on each play of a game. The single period horizon manner of thinking that characterized the original mean-variance portfolio models of Markowitz would suggest selecting a "best" fraction and sticking with it play after play. But the mean-variance approach has been criticized as inappropriate in a multi-period world, where it is geometric mean return over many periods that really matters, not expected or arithmetic return. Hakansson's geometric mean criterion was intended to deal with the multi-period case, and in Michaud's illustration would lead to a different fraction of assets being committed in each play of the game.

What Michaud and James P. Monahan, Associate Professor, University of Lowell, Massachusetts, set out to do was to compare the results of the single period strategy (the "stationary beta policy") to those of the Hakansson strategy (the "variable multi-period beta policy"). They imagined an investor working with two assets—one risk free and one risky—with beta representing the commitment to the risky asset. They assumed a two period investment horizon, with two possible performances for the risky asset. For example, in each period the return on the risky asset could be +30% or –10% with a .5 probability of each. For a stationary beta of 1.0, the possible outcomes are –.19%, +17% and +69%. They then determiined, using dynamic programming, the first period and second period beta that gave the same two-period geometric mean return standard deviation. In this example, the initial beta was 1.063, and the second was .776 following a +30% or 1.318 following a –10%. The variable beta policy resulted in both a larger wealth outcome and a smaller variance in the wealth outcome.

The testing covered three pairs of outcomes: +30% or −10%, +20% or 0%, and +40% or −20%. The mean or expected return is the same for each pair, but the variance is not. The probability of a favorable outcome was set at 0.5, 0.45 and 0.55. And three values of the stationary beta were tried: 0.5, 1.0 and 1.5. In each case, three "variable beta policy" betas were determined: the initial beta, the beta following a positive return and the beta following a negative return.

When all of the results were tabulated, these conclusions could be drawn: (1) The optimal initial beta was always greater than the stationary beta; in other words, take higher than normal risk early in the game. (2) The optimal second period beta was lower than the initial beta when first period results were favorable; reduce risk after a successful period. (3) The optimal second period beta was higher than the original when first period results were unfavorable: increase risk after an unsuccessful period. (4) The variable beta policy outperformed the stationary beta policy, increasing the median terminal wealth, but it also reduced the largest and smallest terminal wealth possibilities. (5) The benefits of the variable beta policy were greatest at high levels of expected return and low levels of variance (e.g. 20% or 0% rather than 40% or −20% outcome pairs).

Michaud expressed the opinion that these results were consistent with intuitive risk adjustment practices of managers.

109. STOCHASTIC PORTFOLIO THEORY AND STOCK MARKET EQUILIBRIUM (Spring, 1981)

A paper by Robert Fernholz and Brian Shay, entitled Stochastic Portfolio Theory and Stock Market Equilibrium, was distributed.

Like Michaud in the preceding presentation, E. Robert Fernholz, Director of Research, Arbitrage Management Company, pointed out that over the long-term the performance of a portfolio is represented by the growth rate or geometric average return rather than the expected or arithmetic average return. Where α is the expected single period return and σ is the standard deviation of expected return, the long run growth rate is given by $\alpha - \sigma^2/2$.

The principal purpose of the Fernholz and Shay paper was to show that when judged by growth rate, dynamically rebalanced portfolios outperform passive portfolios. A dynamically rebalanced portfolio is one for which the proportion invested in each stock is kept constant. For example, 2% of the portfolio value is always invested in a particular stock. A passive portfolio is one that holds a constant number of shares of each stock. For example, the portfolio always includes 1,000 shares of a particular stock. The "market" portfolio, of course, is made up of a constant number of shares of each stock and is not rebalanced.

It turns out that assuming lognormally distributed stock returns, the long-run growth rate γ for a stock is equal to $\alpha - \sigma^2/2$ as indicated above, and assuming γ equals the riskless rate r the long-run growth rate of a portfolio invested π in a stock and $(1 - \pi)$ in cash earning r is given by $r + (\pi - \pi^2)\,\sigma^2/2$. The term $(\pi - \pi^2)\,\sigma^2/2$ is the excess growth rate—the excess over the growth rate in the stock and the cash. The maximum excess growth rate is $\sigma^2/8$.

Fernholz described the origin of this excess growth in a balanced portfolio as generated by other investors who cause the random movement of stock prices. The greater the random movement the greater σ and the greater the excess growth. In effect what a dynamically balanced portfolio does is to buy on a falling market and sell on a rising market, so that constant fluctuation leads to excess growth.

Since for the market as a whole there can be no excess growth, the phenomenon of excess growth in balanced portfolios requires only limited use of these portfolios, and Fernholz said there are probably few balanced portfolios.

Following the presentation, a number of questions were asked about transactions costs. Rebalancing means trading, and in theory the dynamically rebalanced portfolio involves infinite turnover. Fernholz replied that a reasonable level of rebalancing at an assumed cost of 10¢ per share traded could lead to 3% annual excess growth with about 10% of the excess lost to commissions.

In closing, he pointed out that rebalancing is not offered as an alternative to active management, but as better than a passive strategy for a core portfolio.

110. SYSTEMATIC PORTFOLIO MANAGEMENT IN AN INEFFICIENT MARKET (FALL, 1980)

A paper by Robert D. Arnott was distributed.

Robert D. Arnott Vice President, The Boston Co., argued that whatever claims theoreticians may make about the efficiencies of the stock market, there is substantial evidence that the market is in fact inefficient. Extra market performance is by definition a zero sum game so that what one wins another must lose. Profiting from any inefficient market is a matter of competing successfully in this game.

He described the process at The Boston Company as consisting of three key components: Projections of security returns, estimates of security risk characteristics, and optimizing techniques to select portfolios to produce superior returns at acceptable risks. He stressed the point that the process is only as good as the estimates and the forecasts that are supplied to it.

The Boston Company system makes use of five models: a dividend discount valuation model, an earnings momentum model, a technical model, an earnings retention model, and a dividend yield model. Each model provides ratings for each stock studied, and the ratings are then combined in a composite rating system. Arnott described the process by which one would select a model to be included in the set to be used to produce the combined ratings. First the model must be tested to see whether it is effective and consistent in the way it assigns ratings to stocks. If the model passes this test it must be further tested to see whether its results are correlated with the results of models already within the system. No matter how successful a model may be standing alone, it adds no value to the composite ratings if its results are highly correlated with a model already being used to produce those ratings.

In discussing the five models in use, Arnott indicated that some perform best in the short run and some in the long run, that none are perfect but that the combination of five has been unusually successful. He reviewed performance results for each of the five models and for the company, presenting results in terms of total returns and of risk adjusted rates of return.

In answer to a question with respect to turnover, Arnott said that he runs the optimizer monthly and assumes a 5% transaction cost, so that the optimizer will indicate portfolio changes only when these can justify the transactions costs. He said turnover has averaged 5% a month and the reported performance figures are after transactions costs.

111. REDUCING MODELS OF COVARIANCE TO WEIGHTED SUMS OF SQUARES: A PROCEDURE FOR THE FAST DETERMINATION OF EFFICIENT PORTFOLIOS (Spring, 1980)

A paper bearing this title was distributed.

Harry M. Markowitz, Manager, Entity-Set Programming Systems, International Business Machines and Andre F. Perold, Graduate School of Business Administration, Harvard University, described the development and testing of a mathematical technique for portfolio selection and revision, making use of a covariance matrix but dramatically reducing the computation time and computer storage requirement.

Markowitz began by discussing the need for the model. Portfolio managers using a scenario approach, and estimating expected rates of return for securities for various economic scenarios, had encountered serious computational difficulties with existing portfolio models that make use of a full covariance matrix. Perold referred to a number of simplified models that eliminate or approximate the covariance matrix, commenting that these models all make some sacrifices in terms of realism or generality of application.

Tracing through the expressions for the expected rate of return and variance of a portfolio of securities, Markowitz showed that the variance can be expressed as the sum of two terms. The first of these, the "within scenario variance," is:

$$\sum_{i=1}^{N} X_i^2 \sigma_i^2$$ where X_i = proportion of the portfolio invested in securitiy i

and

$$\sigma_i^2 = \sum_{s=1}^{S} P_s \sigma_{is}^2$$ where P_s is the probablity of economic scenarios s,

there are S scenarios contemplated, and σ_{is}^2 is the variance in the return of security i corresponding to scenario s.

The second term in the porfolio variance, the "between scenario variance" is:

$$\sum_{s=1}^{S} P_s \left[\sum_{i=i}^{N} X_i (\mu_{is} - \nu_i) \right]^2$$ where μ_{is} is the expected rate of return

on security i if scenario s occurs and $\nu_i = \sum_{s=1}^{S} P_s \mu$ is,

the expected return on security i over all scenarios.

The first term is a weighted sum of the variance of the security returns. The second is the variance of the portfolio return across all scenarios. The derivation of these expressions assumes along the way that given a particular scenario, the deviation of the return on a security from its expected return for that scenario is independent of the deviation of every other security return from its expected return.

Computation of the variance of the portfolio rate of return would require the specification of the probabilities of the economic scenarios, the expected rates of return on the securities for each scenario, and the variance in return for each security for each scenario.

Perold described how the particular formulation of the portfolio variance in this new model leads to rapid calculation of the full set of efficient portfolios on a computer with a relatively small storage capacity.

He also discussed the incorporation of transaction costs, a minimum expected rate of return for the portfolio, upper and lower bounds for the proportions invested in each security, corresponding sector bounds, a constraint on the total investment, and the incorporation of attributes like an acceptable range for beta. It is also possible to incorporate a number of factors in addition to scenarios, on which the security rates of return depend. The end result is a procedure for selecting efficient portfolios from hundreds of securities at a modest cost.

112. AN ACTIVE PORTFOLIO ASSET ALLOCATION MODEL (Spring, 1980)

W. Scott Bauman, The Financial Analysts Research Foundation, introduced the topic with a commentary on the history of pension fund asset allocations that suggested these allocations had been perverse. There had been a tendency for allocations to follow performance, so that moves from bonds to stocks had come at high points in the stock market's history and moves back to bonds had come at low points. To illustrate, he showed a table reflecting 21 years experience from 1958 through 1978. The 21 years were broken into three groups of 7 years in two ways. One way identified the seven years during which pension funds had the lowest commitment to common stocks, the seven years of highest commitment, and the seven intermediate years. The other way grouped the seven years during which the stock market showed its highest returns, the seven years of lowest returns, and the seven intermediate years. Successful allocation would have paired the years of high returns with the years of high stock commitments and the years of low returns with those of low stock commitment. In fact, almost the opposite had taken place.

The purpose of the project reported on was to develop a model to produce more reliable forecasts of the stock market and to make the allocations of assets more productive.

Constance H. McLaren, Associate Professor, Department of Management/Finance, Indiana State University, described the development and testing of the forecasting model. Eleven variables had been tried out as possibilities for explaining the rate of return on the stock market. The model that fitted the 1948-75 test period best made use of 3 independent variables. The first was an average earnings to price ratio, incorporating earnings in the current year, the preceding year, and the next year. This variable of course incorporated an earnings forecast and for purposes of testing the model the actual earnings for the next year were used. In other words, the model assumed perfect forecasting ability. McLaren commented on this, pointing out that if the model worked well then it was obviously worth spending time and effort to improve earnings forecasting.

The second independent variable chosen was the geometric mean rate of return on the stock market over the three preceding years. The third independent variable was the rate of inflation in the current year, which again constituted a forecast and again a perfect forecast was assumed.

Over the test period, the regression coefficients for the independent variables had the expected signs. Rate of return was positively related to the earnings to price ratio. It was negatively related to the mean rate of return over the three preceding years. This implied a four year stock market cycle, and McLaren explained that this cycle had been suggested by the autocorrelation in the return variable and that she had done some testing to see whether a different cycle would provide more explanatory power. The coefficient for the third independent variable, the inflation rate, had a negative sign.

The regression model was fitted to ten years of historic data, initially to 1948 through 1957, and then used to forecast the stock market rate of return for the 11th year, 1958 for the initial application. The model was then moved forward one year and fitted to the years 1949 through 1958 and used to forecast the market return in 1959. This process was continued through 1978, producing 21 years of forecasts. McLaren showed a table that included the regression coefficients for each of the 21 forecasts, the forecasted returns and the actual return. She then showed a matrix displaying the seven years forecasted to be the best, the seven forecasted to be the worst, and the seven intermediate years, together with the seven years that were actually the best, the seven that were actually the worst, and the seven intermediate years. This time, the forecasted high return years matched quite well with the actual high return years, and the forecasted low return years matched quite well with the actual low return years.

Next, the predicted stock market returns were compared with bond yields available at the beginning of the test year and the portfolio was allocated to stocks or to bonds depending upon this decision rule: stocks were held when the expected market return exceeded the bond yield by at least 3 percentage points. Otherwise, the portfolio would hold either treasury bills or long-term corporate bonds. A table showing the results of this strategy demonstrated that it outperformed a passive strategy that simply held stocks. This was true whether the alternative to stocks was bonds or treasury bills, but the treasury bill alternative proved somewhat more profitable than the bond alternative.

In about three quarters of the years the model allocation proved more profitable than a passive strategy. These results were confirmed by examination of risk adjusted returns, using a standard deviation and a beta coefficient.

In closing, Bauman recommended the model approach as encouraging a disciplined and systematic strategy, one likely to restrain overreaction to recent performance. Its success appeared to justify research efforts in forecasting earnings and inflation.

113. OPTIMAL PORTFOLIO COMPOSITION (Fall, 1979)

A paper entitled "Portfolio Composition Using Forecasted Alphas" was distributed.

Robert Vandell, Financial Analysts Research Foundation, reported on the first stages of a research project on stock selection models. Out of the Capital Asset Pricing Model (CAPM) have emerged a number of portfolio optimization models designed for managers who believe the market is not efficient and that they have the skill to exploit the inefficiencies. (On the preceding day Keith Ambachtsheer had discussed use of this sort of model in selecting international stock portfolios.) Vandell's research questioned the usefulness of models based on CAPM, and set out to find alternative models for active stock managers.

The objectives of a stock selection model were seen as:

(1) achieving higher returns than a stock index or a given universe of stocks, with lower risk (i.e. a high "alpha")
(2) consistently over a 5 year period,
(3) with an undiversified stock portfolio

The research methodology involved definition of a strategy (the strategies tested were quite simple, in the absence of actual analysts' forecasts), addition of constraints and optimizing objectives, construction of portfolios at semiannual intervals over the 26 year period 1952 to 1977, measurement of the performance for each portfolio over the succeeding half year and for each strategy over the 26 year period, and evaluation of the relative performances of the different strategies.

The selection strategies were applied to 15 industry indices, each made up from about 9 firms and similar to industries as perceived by investment practitioners. The optimization model formed portfolios from the indices, with no more than 25% in any one index.

Vandell reported first the results of strategies based on alphas and betas for the 15 indices calculated from five years of monthly returns (1947-1951). The strategies consisted of aiming at particular portfolio alphas and betas. Aiming at a high alpha without constraining beta led to higher returns with reduced variability, and Vandell saw this as evidence that a CAPM-based optimization, stressing control of beta for risk reduction purposes, is not appropriate. It also appeared that risk reduction does not require broad diversification. Some of the low risk portfolios were highly concentrated. Industry historic alphas seemed to have modest information content, and are useful in portfolio selection. But the covariances between the residual errors of the indices seemed to have greater value. Historic betas, on the other hand, seemed of little value.

A second set of strategies were based on a slightly diffferent CAPM regression model, designed to correct for misspecification of the original model. Somewhat higher returns were obtained, with somewhat lower variability.

Next, two strategies without optimization were tested. The first simply selected the six indices with the highest alphas at the beginning of each period and the second invested equally in all indices. Both strategies were profitable but produced high variability.

At this point it began to appear that the betas and alphas might be more stable than their measurements indicated, and exponentially "smoothed" alphas and betas were calculated for the indices. Strategies were then tested, controlling the smoothed beta and aiming at a high smoothed alpha.

Four forecasting models were tested next. The first made use of a regression equation to forecast the future alpha for each index, working from smoothed alphas and changes in smoothed alphas. Aiming at a high alpha gave fairly good results. A second model imposed a beta constraint of unity or higher and aimed at an alpha a little lower than the target for the first model. Results were not as satisfactory. A third model aimed at high values of alphas defined a little differently, in terms of incremental wealth rather than return. Results were again disappointing. Finally, a fourth forecasting model made use of exponential smoothing of forecasting errors, to revise alpha forecasts. Returns for this model were very high except at market turning points.

114. ETHICS, GIMMICKS, AND MODERN PORTFOLIO THEORY (Spring, 1979)

Robert G. Kirby, Chairman, Capital Guardian Trust Co., opened the Seminar with some comments on investment practices and portfolio theory. He began with the theoretical proposition that money managers in the aggregate cannot beat the stock market and indeed will underperform the market by at least

the transactions costs they incur. He agreed with this proposition, observing that in the aggregate managers cannot beat the market because they *are* the market. But he contended that there are good and bad managers and investors are better off entrusting their funds to professional managers than undertaking investments on their own.

He disagreed completely with the theoretical proposition that almost all available information on publicly held stocks is built into the current prices of those stocks. While analysts may indeed make good use of available information and prepare reports based on this information, many portfolio managers make little use of the analysts' work and their purchase and sale decisions are based on nothing more than fear and greed.

His principal criticism of modern portfolio theory had to do with the definition of risk. He said risk cannot be perceived in the historical pattern of stock prices. Real risk can be defined as the likelihood that a company will not perform as the analyst has predicted. Risk can be divided into three types. The first is the risk of buying a company and discovering there is simply nothing there. Examples are National Student Marketing and Equity Funding. The second consists of paying too high a multiple for a basically sound company. Examples have been Polaroid and Xerox. The third type of risk, and the hardest to deal with, arises from holding supposedly "blue chip" stocks and failing to notice that the companies have lost their quality. Examples are Sherwin Williams, A&P, and National Fruit. He added that inflation today presents a major risk and clearly calls for a heavy emphasis on equities, although the growth of money market funds and recent investment policies of corporate pension funds seem to reflect an ignorance of this fact.

His second major criticism of modern theory had to do with selection of the S&P 500 Index as the standard by which to judge diversification of common stock portfolios. The proper objectives of investment management have nothing to do with tracking the S&P 500, but are related to long-term absolute performance. If some portfolio is to be established as a peformance standard, that portfolio should be less risky and better diversified than the S&P 500.

Finally, Kirby argued that price volatility should not concern investment managers. What matters is the income stream and the corporate characteristics that influence that stream.

In answer to a question how long it should take to determine whether or not a portfolio manager is doing a good job, Kirby answered that extremely poor management may show up very quickly, but it may take eight or ten years to develop a suitable relationship between client and portfolio manager and therefore it may take this long to decide whether there is an appropriate fit between client and manager.

115. PORTFOLIO THEORY IN PRACTICE: EMPIRICAL INVESTIGATION (Spring, 1979)

Ahler's talk was based on his book, A New Look at Portfolio Management, which reflects his experience at Bankers Trust.

David M. Ahlers, Associate Professor of Management, Graduate School of Business, Cornell University, began with a brief review of a presentation he had made to the Q Group ten years before, describing a restructuring of the investment process at Bankers Trust Company. The structured Decision Making System (SDM) was actually implemented at Bankers Trust and was the formal investment decision making system of the bank for three years following that Q Group meeting. The system, however, is no longer in use and Ahlers went on to describe the analysis that led to its abandonment, one that sheds light on the usefulness of modern portfolio theory in a professional management organization.

The system asked security analysts for subjective forecasts of future equity returns, in the form of triangular distributions. For each of three market scenarios–a poor, medium and good stock market–the analyst was asked to provide three forecasted rates of return for each stock–a low, most likely, and high expectation. The forecasts were run through an optimizing process, in the course of which allowance was made for the apparent biases of the analyst. The question Ahlers undertook to answer in his exhaustive evaluation was whether the system, which incorporated the best portfolio theory available at the time, actually improved investment performance.

The complete record of the analysis fills an entire book, and Ahlers presentation could only touch on the highlights. Briefly, he concluded that there was significant value to the analysts' forecasts, but that the coupling of these forecasts with the portfolio theory methodology was quite ineffective. Part of the failure may lie in inadequacies of the methodology itself, particularly in the way in which it dealt with analysts' biases. But part of the difficulty appeared to lie in the fact that the analysts' forecasts, while valuable, were not good enough for the high powered techniques that were applied to them.

Ahlers discovered that applying the analysts' forecasts one stock at a time gave much better results than random selection of portfolios from the universe

of stocks followed at the bank. So the analysts did have valuable insights. At the same time, he found that applying the analysis one stock at a time also gave significantly better results than running the forecasts through the portfolio optimizing process. These results indicated that the bank's best course of action was to apply a simple methodology, something far short of the portfolio optimization suggested by modern portfolio theory, to the work of the analysts. At the same time, it suggested that it might be worth strengthening the quality of the security analysis itself.

Ahlers had expected that reducing the risk level of portfolios selected by his optimizing methodology would have lowered the rate of return. But the risk reduction actually raised the rate of return. It appeared that what had happened when the risk level was reduced was that the more speculative stocks, those about which the analysts' forecast were the least reliable, were simply dropped from consideration. The result was that only well researched stocks were included and portfolio performance improved.

Ahlers also found that the procedure by which analysts' biases were allowed for were generally not successful. This may have been due to inconsistencies in the biases themselves, or to shortcomings in the methodology that was applied to identifying and correcting for them.

The overall conclusion indicated that in this particular case the application of modern portfolio methodology had not been successful. While it did not demonstrate that portfolio theory cannot be useful, it did demonstrate that implementation of portfolio theory should be done slowly, one step at a time, with evaluation of each step. In this way an institution can stop short when the applications cease to improve performance, can try to find out what went wrong, and can take appropriate remedial action instead of moving on to further unsuccessful applications.

116. NEW TECHNIQUES FOR PORTFOLIO CONSTRUCTION AND REVISION (Fall, 1978)

William F. Sharpe distributed a paper: "An Algorithm for Portfolio Management."

William Sharpe, Professor of Finance, Graduate School of Business, Stanford University, began with a review of the familiar portfolio optimization problem, which consists of seeking the efficient frontier representing the best possible trade-off between expected return and risk. He suggested that portfolio improvement is actually more relevant than portfolio selection, since most users of portfolio models begin with an existing stock portfolio.

Sharpe commented that previous models had had great difficulty dealing with a complete covariance matrix, including the covariance between every pair of securities eligible for inclusion in a portfolio. The result had generally been some simplification of the covariance matrix, and imposition of a number of constraints so that the simplification was not damaging. The model he presented made use of a general covariance matrix, with no restrictions. The model operates by starting with a feasible solution, that is a portfolio that satisfies constraints imposed by the user such as maximum and minimum limits on each holding, and then goes through a number of iterations each of which improves the portfolio. Improvement results from reducing the holding of one security and adding another security. The model calculates the marginal benefit of increasing the holding of every eligible security. Improving the portfolio involves adding some of the best security and dropping some of the worst. The substitution continues until it is no longer beneficial. Transactions costs are taken into account, so that a substitution is beneficial only if the portfolio improvement justifies the transaction costs.

Sharpe showed an example in which the model was used to test improvements in the Tricontinental Portfolio. The portfolio initially held 103 securities and it was assumed that transactions costs were 1% on the buy side and on the sell side. Making use of Wells-Fargo security analysis, the model called for portfolio revisions involving turnover of about 45%. The computer cost of running the model in this case was $15.00 at nighttime rates or $30.00 at daytime rates. This cost did not include establishing the covariance matrix for the stocks under consideration. Responding to a question from a participant, Sharpe commented that it is not satisfactory to rely upon historic covariances exclusively. Any aberrations in the historic covariances will seriously distort the use of the model. The covariances must be predictive.

Polly Shouse, Investment Officer, Wells Fargo Investment Advisors, described the practical use of the portfolio optimizer. She began by showing efficient combinations of 3 stocks, meeting the risk preferences of various classes of investor. She introduced transaction costs, to show how the appropriate portfolio revisions for each of these classes would change. She explained what information was required by the model, and why actual results may vary from expected results. She pointed specifically to the effect of transaction costs as a limit to achieving an ideal portfolio. Finally, she presented some evaluation of

the success of Wells-Fargo in identifying over-and under-valued stocks.

Larry Tint, Vice President,Wells Fargo Investment Advisors, concluded the presentation with a comparison between what he called traditional portfolio management and the use of the Wells-Fargo optimizing model. He focused in particular on Wells-Fargo identification of undervalued stocks, and the length of time it has taken for the stock prices to adjust and deliver unusual profits to investors. There was evidence that prices responded fairly quickly, producing extra returns in the very short run.

117. SIMULATIONS OF EQUILIBRIUM IN THE CAPITAL MARKET (Spring, 1977)

Two papers were distributed: R.C. Stapleton and M.G. Subrahmanyam, "Simulations of Capital Market Equilibrium," and "Market Imperfections, Capital Market Equilibrium and Corporation Finance."

Richard Stapleton, Professor, Manchester Business School, began with a brief discussion of the capital asset pricing model of Sharpe, Linter and Mossin. This is an equilibrium model, based upon the proposition that investors prefer high expected rates of return on their portfolios but also prefer a high degree of certainty with respect to those returns and are willing to trade off one for the other. This so-called "mean variance" model, given a set of expected rates of return, variances, and covariances for all available securities, will deliver a set of optimal portfolios for all return-risk preferences. The model, however, has nothing to say about the process by which investors make their choices, and how security prices adjust to equilibrium levels. Stapleton's work attempts to simulate this process and also to illustrate the consequences of changing a number of restrictive assumptions in the original model.

The simulations began by assuming an economy with four stocks and 20 investors. One thousand shares of each stock were available, investors expected that those 1,000 shares would be worth $100,000 at the end of one time period, a standard deviation of $25,000 was associated with that expectation, and the correlations of expected returns on the four stocks varied, ranging from .1 to .9. The 20 investors were assumed to have differing degrees of risk aversion, but the same initial wealth. The simulation was begun with a price of $80 per share for all four stocks. On the basis of all these data, the demand for each stock by the 20 investors was calculated, demand was found to exceed supply, the prices of all four stocks were assumed to be reset at a higher level, demand was recalculated, and these iterations were continued until final prices were arrived at for all four stocks such that demand exactly equaled supply. These prices were the equilibrium prices for the four stocks. For the particular simulation reported by Stapleton, the equilibrium prices for the four stocks were 89.40, 89.00, 92.67, and 89.00.

The simulations continued, to test what happened when investors no longer had identical expectations with respect to the performance of the four stocks, when they had different personal tax rates, and when they owned some non-marketable assets. In all cases the equilibrium prices resulting from the simulations were as one would have predicted from theory.

Further simulations tested the results of changing the number of investors, of segmenting markets so that some investors were precluded from owning some securities, and of assuming nationalization of some firms so that the returns on the corresponding stocks were arbitrarily allocated among the investors. The results reached here were not always intuitively obvious.

A second paper presented by Stapleton extended the model to an economy of 8 stocks rather than 4, with the expected returns remaining equal for all stocks but with the variance expectations differing among the stocks. The simulations now tested the consequences of merging two companies into a single company, of varying dividend policies so that the returns on different stocks were composed of different proportions of dividends and appreciation, and of differential investor tax rates and fixed transactions costs. Once again, the resulting portfolios held by the 20 investors seemed in most cases to fit intuitive expectations.

118. PORTFOLIO STRATEGY IN AN EFFICIENT MARKET (Spring, 1977)

Edwin J. Elton, Professor of Finance, New York University and Martin J. Gruber, Professor of Finance, New York University, spoke on this topic. Elton began with a short digression, to provide an update on portfolio selection models. A year earlier, at the IQRF Seminar in the Spring of 1976, Elton and Gruber had described a simple mathematical model for portfolio selection. That model had come in two versions, one a so-called "single index model," which assumes the joint movement between stocks comes about because of a common response to a market index. The second model was even simpler, and assumed that the correlation coefficients be-

tween the returns on all pairs of securities are equal, or alternatively that correlations for stocks within an industry are equal, or alternatively that correlations for stocks within an industry are equal.

Elton pointed out that within the last year or so there have been a number of improvements in techniques for estimating beta coefficients, a critical element in many simple portfolio models. He also noted that these models are generally now able to cope with constraints that make them more practical. One can insist that there be no short sales, that there be limits to the percentage of the portfolio invested in any one security, and that investment in a "riskless" asset be precluded. Elton and Gruber also provided a list of seven papers of theirs dealing with portfolio selection. The first was identified as a non-technical introduction, with the other six dealing with more or less technical details. Copies of all seven papers are to be sent to the Sponsors of the Institute.

Turning back to the main topic, Gruber described it as essentially "Index Funds Revisited." He reviewed the rationale for index fund investing, and then turned to some of the problems. Because of transactions costs, one cannot hope to exactly duplicate the performance of a stock index. Furthermore, it is not obvious which index is the one to emulate. But the major problem, as seen by Elton and Gruber, has to do with taxes. Logic tells us that since dividends are taxed at ordinary tax rates while long-term capital gains are taxed to many investors at lower rates and may be deferred for several years, for a tax-paying investor there is probably an advantage to owning securities whose returns come mostly in the form of appreciation rather than dividends. One might expect that tax-paying investors, particularly those with large differences between capital gains and ordinary income tax rates, would bid up the prices of low yielding stocks relative to the prices of high yielding stocks. And so it would pay low or zero tax bracket investors to buy high yielding stocks.

Gruber referred to a technical appendix to his presentation, setting out the mathematics that relate the portfolio selection process to the tax rate for the investor relative to the average tax rate for all investors. This tax rate is actually a differential rate: the difference between the ordinary income rate and the long-term capital gain rate. Knowing his own differential and the average differential for all investors, the investor can in principle modify the mathematical portfolio selection models to account for this tax factor.

The theory then is relatively clear. What remains is the question whether investors actually behave as the theory says they should, and whether the average tax rate differential for all investors in the market really does influence stock prices and therefore stock rates of return. This is an empirical question, one that Elton and Gruber propose to investigate.

Elton reviewed briefly some of the empirical work that has already been done. The study most quoted is one by Black and Scholes, that found no statistical significance to tax rate differences in tests of the Capital Asset Pricing Model. Another study, by Mark Rubenstein, showed some significance.

Gruber described two more tests that have been performed in the past. One, by himself and Elton, examined the ex-dividend behavior of common stocks. This research found that as one would expect, low tax investors were better off with high dividend stocks and high tax investors were better off with low dividend stocks.

One participant pointed out that the capital gains tax is paid only when a stock is sold, and that the impact of capital gains tax on an investor therefore depend upon his holding period. Elton and Gruber acknowledged that this would have to be taken into consideration in the proposed research. Another participant questioned the data base that would be available, pointed out that tax conditions have changed over time and may well change in the future, so that results obtained from the past may not apply to future periods. The answer to this was that the research would be checking the impact of changes in tax laws, so that the results would not simply describe the appropriate portfolio selection process at some time in the past but would show the appropriate change for a change in tax laws.

Another participant pointed out that although the logic previously expressed would suggest that pension funds should probably be invested in high yielding stocks, just the contrary seems to be the case. There was speculation as to why this might be so, but no clear answer emerged.

119. TWO SIMPLE MODELS FOR ASSET ALLOCATION (Spring, 1976)

This presentation was one of three under the heading "The Bond-Stock Asset Mix." The other two were "A Complex Simulation Model," and "Some Special Aspects of ERISA."

Peter O. Dietz, Associate Professor of Finance, University of Oregon and Vice President for Economics Research, Frank Russell Associates, and Roger Smith, Vice President, Investments, Allis-Chalmers Financial Corp., presented somewhat similar methods for establishing appropriate ranges of stock-bond ratios (and short-term instrument ratios in

the case of Smith) for a pension fund. There is a substantial literature on the subject of the risk-return trade-off, but virtually none of this literature will help a corporation to determine just what point in the risk-return spectrum is appropriate for its pension fund. Dietz and Smith argued that the final decision must rest on a number of characteristics of the capital markets, and they therefore offered no single "correct" asset allocation for all pension funds. But they did present an analysis of the capital markets leading to a reasonable range of asset allocation, one that could be defended as meeting the fiduciary requirements of ERISA, within which the corporation and the investment manager could make a final choice. The Dietz model* is designed to identify the minimum percentage in bonds and the minimum percentage in stocks that can be identified as theoretically sound, defensible in court, and easily understood and used by a corporate pension fund committee. The analysis begins by assuming that the performance of the stock and bond markets over the seventy-five years 1900-1975 is a reasonable basis against which to test the portfolio. (Some modifications of historical performance are introduced later in the analysis.) Dietz examined all of the decades within these seventy-five years (1900-1910, 1901-1911, etc.) and for each decade calculated the rate of return corresponding to an all-stock portfolio, an all-bond portfolio, and a variety of combinations of stocks and bonds. From these calculations he was able to answer the question, for any stock-bond mix: How frequently was the ten-year rate of return above or below any given rate? When the given rate is the actuarial rate for a pension fund, this question becomes: What is the likelihood of the value of the pension fund falling below the actuarial target level, at various time horizons for different bond-stock mixes?

The Dietz model assumes the corporation has established a satisfactory actuarial rate, or target rate of return for the pension fund assets. This in turn gives a target fund value for any particular future year. With this target value, the model can establish the likelihood of the fund exceeding or falling below that target for any bond-stock asset mix. Some experimenting with the model has shown that for very short time horizons, a high percentage of stocks leads to a substantial likelihood of falling below target, but for longer time horizons (ten years and over), the model may indicate that there is some combination of stocks and bonds offering a *minimum* likelihood of a fund value below target. That is, it turns out that excessive reliance on either bonds or stocks leads to excessive risk, to the fund beneficiaries as well as to the corporation.

In presenting the model, Dietz included an example based not only upon the performance of the capital markets, but also on the particular forecasted cash flows for a corporate pension fund, and on its own actuarial assumptions. The model was tested over a range of plausible actuarial rates, and over a range of possible inflation rates with corresponding capital market performances. This involved making some adjustments to the historic performances of stocks and bonds, to allow for inflation rates different from historic rates and for possible changes in the superiority of the average rate of return on stocks over the bond rate of return. The tests always assumed, however, consistency among the rates of inflation and salary progression, actuarial assumptions and capital market performances. In this particular example, the testing led to the conclusion that the minimum percentage of the portfolio invested in stocks should be about 40%, while the minimum in bonds should be about 35%. These numbers provided a useful guideline over a fair range of possible performances of the capital markets, and established a range for the asset mix that the consultant and the company believed could be defended as appropriate within the fiduciary obligations under ERISA.

The model described by Smith,* like the Dietz model, accepted the actuarial rate as given, and made use of capital market analysis to establish a reasonable range for the asset mix, in this case a mix of stocks, bonds, and money market instruments. But Smith stressed the importance of elements other than the performance of capital markets in establishing the final asset mix. He suggested that pension fund planning in the past has tended to begin with consideration of the equity portion of a pension fund and to work back to the overall strategy, objectives and policy for the entire pension plan. He stressed the influence of ERISA in demanding the reverse of this: a planning process that begins with the policy and objectives for the entire pension plan and works down to asset allocation and management of each asset sector.

Smith expressed the opinion that ERISA demands the setting of quantitative standards in the asset allocation process. The assets that are significant today, he felt, include stocks, long-term bonds, short-term instruments and real estate. The examples he presented made use of the first three of

*The paper distributed was "The Debt/Equity Dilemma (Integrated Pension Planning: A Capital Market Approach)," by Peter O. Dietz and H. Russell Folger.

*The paper distributed was "Setting Objectives and Allocating Assets: The Pension Manager's Dilemma."

these asset types, but he suggested that in the future the set of possible assets would probably include options and increased emphasis on foreign equities.

The characteristics of the capital markets that formed the base for the Smith model differed a little from those that went into the Dietz model. The Dietz model was built on actual ten-year rates of return for stocks and bonds over the period 1900-1975. The Smith model made use of the well-known Ibbotson and Sinquefield data for stocks, bonds and treasury bills over the period 1926-1975.* For each of the three assets, four numbers were derived from the Ibbotson and Sinquefield data: an average rate of return, a volatility (measured by the standard deviation over time in rate of return) and the correlation between the return on that asset and the rates of return on each of the other two assets. The fact that there is less than perfect correlation among the performances of stocks, bonds and money market instruments, that is, the fact that they do not all move up and down together, offers opportunities for putting together diversified portfolios making use of all three assets that offer the prospect of a higher rate of return at a lower level of variability than one could expect to find in any one of these three assets alone. And, in fact, the Smith model made use of the portfolio selection techniques described in the preceding section to identify a set of "efficient" portfolios, consisting of various proportions of stocks, bonds and money market instruments, over a range of expected rates of return. These portfolios then were the ones offering the minimum expected variation in performance for various levels of expected return: For example, if the target rate of return is 10%, then the characteristics of stocks, bonds and short-term instruments drawn from the Ibbotson and Sinquefield study indicate that a portfolio invested 31.5% in stocks, 19.9% in bonds, and 48.6% in short-term instruments is the best.

Once this set of "efficient" portfolios has been established, the analysis described by Smith confronts the company with three possible choices. It could decide what level of risk or expected variability is appropriate and then take the corresponding efficient portfolio, or it could begin with a rate of return and take the efficient portfolio corresponding to that target, or it could establish a minimum rate of return target and find the efficient portfolio offering the minimum risk of falling below that target. This last approach is, of course, essentially the approach of the Dietz model, and was chosen by Smith as the most appropriate to pursue.

As in the case of the Dietz model, then, the procedure was to experiment with a number of target rates of return (which might be thought of as possible actuarial assumptions) and to find for each of the efficient portfolios the likelihood of underperforming the target. And, as in the case of the Dietz approach, the end product is not a "correct" portfolio, but a reasonable range of asset mixes that could be justified as prudent and would offer enough flexibility to the company and its investment manager.

During the discussion period following the presentation of both these models, a number of observations were made by participants. One was that it is probably better to work with "real" rates of return throughout, to avoid concern over consistency of inflation assumptions underlying actuarial rates and capital market estimates. It was also suggested that a starting point for the stock-bond ratio might be the ratio of the value of all stocks outstanding to the value of all bonds outstanding, which is, after all, the average stock-bond ratio for all investor portfolios, and that the question to be addressed might be the degree to which a company wishes its pension fund to deviate from this average.

Although the Dietz model will appeal to many companies because it makes use directly of the actual performance of bond and stock markets in the past, one participant pointed out a danger in this approach. Any particular historical period is simply one sample from the much longer time period over which pension funds have existed and will exist, and we probably have little assurance that any particular time period is a representative sample. Using this period to represent what the future may bring may therefore be more dangerous than deducing from a long historical period some characteristics of the long-run capital market and using these characteristics to simulate the future, as is done in the Smith model.

Another suggestion concerned the measurement of risk in a bond portfolio. Both the Smith and Dietz models made use of year-to-year variation in bond prices and rates of return. In some cases this will be appropriate: For example, if termination of a pension plan is a matter of concern, therefore the market value of the bond portfolio at any particular year-end is a matter of concern. On the other hand, if concern focuses on the ability of the pension fund to deliver benefits over future years, the fact that bonds (apart from a small credit risk) can be counted on to pay off at face value on redemption may make the year-to-year fluctuation in value a matter of little importance. In this case, both the Dietz and Smith models may have exaggerated the riskiness of bonds, and

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*Ibbotson and Sinquefield, "Stocks, Bonds, Bills and Inflation: Year-by-Year Historical Returns (1926-1975)," The Journal of Business of The University of Chicago, Vol. 49, No. 1, January 1976, pp. 11-47.

substituting a performance record based on amortized book value rather than market value may be preferable. Finally, it was pointed out by one participant that the focus in the Smith and Dietz models is on a particular time horizon, although the models can, of course, be used to test a variety of time horizons. But in the process of considering, for example, a ten-year horizon, the models do not explore the possible impact of a particular asset mix on the annual contributions for the preceding nine years. All of the effects of fluctuation in the capital markets are shown as impacting the state of the pension fund at the ten-year time horizon. There were no suggestions as to how this issue could adequately be dealt with.

120. PORTFOLIO SELECTION TECHNIQUES: SIMPLE CRITERIA FOR OPTIMAL PORTFOLIO SELECTION (Spring, 1976)

A second approach (the first is described in "Portfolio Selection Techniques: The complex Model") consists of modifying the theoretical concept behind the original Markowitz model, to develop a model that is readily comprehensible to professional investment managers. The attractions of this approach are obvious. A manager with no mathematical expertise can understand these models and implement them himself. Critics of this approach, however, point out that there may have been a sacrifice of theoretical integrity, and that perhaps no one, least of all the investment manager, really knows just how much has been sacrificed and therefore how faulty these models may be in principle. A model following this second approach, one that has been tested against more complex models and found by its authors to be superior to some of them, was presented by Edwin J. Elton, Professor of Finance, New York University, and Martin Gruber, Professor of Finance, New York University, and their presentation is described below.

In this presentation Edwin J. Elton and Martin J. Gruber offered a very simple model for portfolio selection.* Gruber began by pointing out that very little practical use has ever been made of mathematical portfolio selection models, despite the substantial progress that has been made in simplifying the data input problems and reducing the computational time and costs. The diagonal model, proposed by Sharpe, has been a helpful development, and the model has in fact worked quite well (Gruber referred to some tests comparing it with the full Markowitz model). But the model presented here is very much simpler even than the diagonal model.

Gruber described the model as not only substantially reducing the quantity of data required of an analyst or of a manager, but replacing the difficult mathematics of most portfolio models with calculations that can be done with pencil and paper. This model ranks securities in order of their desirability, even before the portfolio selection process begins. This means that the manager can examine a ranked list of the securities and compare it intuitively with his own preferences, before he begins the process of assembling a portfolio or revising a portfolio. The ranking is not a function of the optimum portfolio, but solely a function of each stock's own characteristics. The model will rank securities, establish a cutoff point separating the securities attractive for purchase from those unattractive for purchase, and will establish the proportions in which the attractive securities should be combined in a portfolio. All in all, Gruber felt this simplified model has great intuitive appeal to a portfolio manager who is naturally suspicious of extraordinarily complex mathematical models he cannot hope to completely understand.

Elton described the first of two versions of the model. This one is based upon the Sharpe diagonal model, which assumes that the only joint movement between securities comes about because of a common response to a market index. The calculation of the fraction of the portfolio which should be invested in any stock is easily done with a hand calculator.

Gruber went on to describe the second version of the model, which, instead of making the assumptions of the Sharpe diagonal model, assumes that the correlation coefficients between the returns for all pairs of securities are equal. Gruber noted that he and Elton had already shown that this assumption produces better estimates of future correlation coefficients than historical correlation coefficients or those produced from the diagonal model approximation.

Gruber commented that he did not think one could expect analysts to come up with correlation coefficients on the basis of intuition, so that it is desirable to avoid subjective estimates of these coefficients in a portfolio model.

**The paper was: Edwin J. Elton, Martin J. Gruber, and Manfred W. Padberg, "Simple Criteria for Optimal Portfolio Selection."*

One participant asked about tests that had been performed to compare the effectiveness of various portfolio selection models, and a reference was given to Elton and Gruber, "Estimating the Dependence Structure of Share Prices–Implications for Portfolio Selection," *Journal of Finance,* Vol. 27, No. 5 (December 1973), pp. 1203-33.

Some surprise was expressed that the full Markowitz model had not outperformed some simpler models, and one answer given was that there is too much random fluctuation reflected in a full covariance model or even a multiple index model, and this leads to results that are poorer than those that can be obtained from theoretically less defensible models.

A question was raised as to the sensitivity of the portfolio to the estimate of risk-free interest rate in the Elton and Gruber model. The answer was that the portfolio is quite sensitive to the risk-free rate, and one will get quite different sets of securities depending upon that rate. Gruber suggested that one might assume a series of risk-free rates and calculate the "corner" or efficient portfolio for each rate.

In answer to a question about costs of portfolio revisions, Elton and Gruber answered that their model does not at present deal with revision costs, although they have dealt with some simple cases, but that the model will eventually be modified to incorporate costs.

In answer to a question about implementation of the model in the institutional portfolio management process, Elton and Gruber conceded that they have avoided two issues: how best to obtain estimates of the data needed by the models and how best to fit use of the model into a professional organization. As in the case of the Rosenberg-Rudd model, a question was asked about the quality of data input estimates, and whether some uncertainties about these inputs could be dealt with in the model. The answer was that the models did not explicitly deal with this uncertainty, but one could look for errors in input data that would drop a security below a cut-off rate. Elton and Gruber suggested that some sensitivity analysis based on trial and error might be helpful.

121. PORTFOLIO SELECTION TECHNIQUES: THE COMPLEX MODEL (Spring, 1976)

The paper given was: Barr Rosenberg and Andrew Rudd, "Portfolio Optimization Algorithms: A Progress Report."

Mathematical portfolio selection models were introduced with the work of Harry Markowitz in 1959. For a variety of reasons the conceptual approach of Markowitz, although it was of enormous theoretical importance, has generally not proved of much use to investment managers. Efforts to overcome the practical limitations of the original Markowitz model have generally followed either of two directions. One preserves the theoretical integrity of the model, but embellishes it with a number of features to deal with the practical limitations and constraints faced by a professional manager. This approach is apt to lead to very complex models, ones that are difficult to understand for anyone not trained in mathematics. And for this reason, one might anticipate considerable resistance to use of the models by professional investment managers. At the same time, supporters of this approach will argue that the models have retained their theoretical soundness, and that if those who use them will only acquire the mathematical expertise that is needed or else rely on those who have this expertise, they can achieve practical problem solving and know that their models are "correct." The model presented by Barr Rosenberg and Andrew Rudd, described below, followed this first approach. It is a model that is almost ready for use and one that appears able to cope with a wide variety of practical constraints under which a portfolio manager must work.

Barr Rosenberg, Associate Professor of Finance, University of California, provided a general introduction to portfolio selection models. He described the original Markowitz concept as theoretically sound and still the best base on which to build a portfolio selection model.

The Markowitz model, in its original form, was accompanied by a number of practical problems. The information that had to be supplied by analysts or managers to the model, for any reasonably-sized universe of investment opportunities, was excessively large and indeed beyond the capacity of most organizations. The computational costs for processing the data to produce the "efficient set" of portfolios was excessive when Markowitz first presented his model. Both of these problems, Rosenberg said, have now been solved. The Markowitz model provided no advice as to which portfolio out of the "efficient set" might be most appropriate to a particular investor. The model did not take account of the cost of revising a portfolio, which includes commissions, the effects of trading on the price of a security, taxes that might have to be paid by an investor, and the importance of accounting profits and losses to the investor. The original model did not deal with a dividend yield goal or constraint which faces many professional managers. And, finally, the original model did not deal with standards of required diversification and

limits on the holding of any particular security that might be included in a portfolio. Rosenberg reported that all of these limitations had been dealt with or were about to be dealt with in the model described in his paper. Although the risk measure used in the Markowitz portfolio model (and in the Rosenberg model) is the variance in the rate of return on the portfolio, Rosenberg pointed out that this risk consists of two parts: systematic or undiversifiable risk, and residual or diversifiable risk. According to the theory of capital asset pricing, investors can generally expect increased returns for bearing systematic risk but not for bearing residual risk. This principle, coupled with the quadratic utility function usually assumed for the portfolio model, leads to the proposition that there probably is, for any investor, a "best" level of systematic portfolio risk.

Since an investor cannot generally expect to be rewarded with extra return for bearing extra diversifiable risk, as he contemplates revisions to a portfolio he will generally want to add or remove stocks, or change the proportions of stocks, so as to reduce and not increase residual risk. That is, he will generally be trying to increase the diversification of the portfolio. However, there is sometimes justification for modifying a portfolio so that its residual risk is not minimal. The justification will lie in the belief that certain stocks offer unusually high rates of return. The trade-off now is between the so-called "appraisal premium" attached by the analyst to what he believes is an unusually good buy, and the residual risk added by this stock to the portfolio. Rosenberg described this trade-off as the essence of the portfolio revision problem, and stressed the sensitivity of the decision whether or not to add a recommended stock to a portfolio, to the contribution the stock makes to the residual risk of the portfolio. This sensitivity demands a very accurate model of portfolio risk. It also turns out that this trade-off, while it is affected by transaction costs, is much more sensitive to the analyst's appraisal of the stock. In other words, for purposes of portfolio revision, transaction costs are much less important than the analyst's assessment of "good" or "bad" stocks. Rosenberg discussed the popular "diagonal" portfolio model proposed by William F. Sharpe, which enormously simplifies the computational problems in portfolio selection and also simplifies data required for the model, by assuming that the residual risk added by a stock to a portfolio is unrelated to the residual risk added by other stocks. He pointed out that this assumption may be incorrect, and that it can lead to incorrect decisions when the appraisal premium-residual risk trade-off is being made in the course of a portfolio revision.

Andrew Rudd, University of California, concluded the presentation, to describe in general how the Rosenberg-Rudd model achieved a close to optimum solution using very little computer time.

122. PORTFOLIO REVISION BASED UPON IMPLIED RETURNS (Spring, 1976)

Lawrence Fisher, Professor of Finance, University of Chicago, discussed portfolio revision, essentially in terms of a comparison between the rates of return analysts might estimate for individual securities and the rates of return implied by the inclusion of those securities in existing portfolios. Fisher's presentation was based in large part on a 1975 article of his,* and he referred to a somewhat similar article by William F. Sharpe.**

Fisher described the following approach: Begin by assuming that the portfolio currently held is efficient. Assume a risk level for each security and see what the implied expected return is for that security. This implied return can be deduced from the assumption that the portfolio is efficient and the assumptions of individual security risks. Then review these expected returns to see if they appear reasonable. If some appear unreasonable in the light of current security analysis, then some changes may be worthwile. But the changes are worthwhile only if they justify transaction costs. And while one may know the cost of buying and selling a security, one might not know for how long the portfolio revision will be valid, and therefore one might not know over what time period to amortize the transaction cost in determining whether the revision is worthwhile. He reported some tests run on data from the CRISP file, for 1926-1972. For portfolios consisting of 64 randomly selected stocks, the ratio of portfolio residual variance to initial residual variance (a measure of how undiversified the portfolio has become over time) increased almost linearly over time. In four or five years the portfolio had added residual risk worth 5 basis points. A portfolio of only 32 stocks would have added risk worth about 10 basis points.

**"Using Modern Portfolio Theory to Maintain An Efficiently Diversified Portfolio," Financial Analysts Journal (May-June 1975), pp. 73-85.*

***"Imputing Expected Security Returns From Portfolio Composition," Journal of Financial and Quantitative Analysis, June 1974, pp. 463-472.*

123. ECONOMIC SOURCES OF REAL RETURN AND VARIABILITY IN COMMON STOCK INVESTMENTS (Spring, 1982)

A paper entitled "Sources of Value and Risk in Common Stocks," by Tony Estep, Nick Hanson, and Cal Johnson was distributed.

Tony Estep, Special Consultant, Salomon Brothers, described his work as an attempt to present a conceptual framework that may help resolve a paradox that has arisen with respect to risk and return. One expects high anticipated rates of return to be accompanied by perceptions of high risk, and yet this is often not the case if risk is represented by some conventional measures such as beta. Estep expressed a belief that investors really do perceive high risk in high-return opportunities, and the paradox appears to exist only because our popular risk measures are inadequate.

The research reported was based on the commonly used three-period dividend discount model (the three periods being those of significant growth, transition to steady-state growth, and steady-state growth itself). Estimates of dividends and earnings growth rates for 250 of the largest stocks in the S&P 500 Index were taken from Value Line. The model was used to derive a discount rate, or expected rate of return, for each stock. Each year from 1973 through 1981 the stocks were ranked by expected rate of return, and divided into quintiles. The *ex post* rate of return for each quintile was calculated, and Estep showed that the performances over the nine-year period validated the usefulness of the model. The forecasted top quintile achieved an average annual rate of return of 14.5 percent, while the bottom quintile achieved a rate of -.9 percent, and the other quintiles were arrayed in the appropriate order between these two rates. Estep presented further analysis to confirm that this configuration was very unlikely to have resulted by pure chance.

He next compared the results of his work with those of Sanjoy Basu, who had reported the results of a valuation model based on P/E ratios. Both models had been about equally successful in correctly ranking stocks, at least by quintiles. And for both models, the quintile compound rates of return were clearly negatively correlated with the beta coefficients of those quintiles. A popular measure of risk was then negatively correlated with both expected and achieved rates of return. Estep's conviction was that investors did actually perceive a high risk in the high-return stocks, despite the lower betas. And the risk is associated with uncertainty about the growth in earnings and dividends. His proposition was that: (1) Investors recognize uncertainty in the future growth rate; (2) They are averse to this uncertainty because it leads to uncertainty in the future rate of return; (3) Errors in estimates of the growth rate will be unbiased; (4) In the short run, changes in the expected growth rate will produce changes in the stock price proportional to the derivative of the logarithm of the price with respect to the growth rate; that is, proportional to the duration of the stock.

If this proposition is correct, then variability of stock price will be correlated with duration, the expected rate of return will be correlated with the variability of earnings growth rate, and estimates of the expected rate of return will usually be negatively correlated with short-term price variability. Each of these conclusions can be shown mathematically.

Having identified uncertainty about the growth rate as the source of risk to investors, Estep went on to relate that uncertainty to two systematic sources: inflation and all other sources. He restated the dividend discount model in terms of real rates and inflation, introducing a new variable for each stock: the flowthrough, or the fraction of the inflation rate that passes through to growth in earnings. This variable will have a value of 1.0 for a company that is able to pass on inflation completely and a value of 0 for a company that is unable to pass on any inflation. A little mathematics shows that low flowthrough companies, such as utilities, banks, and paper companies, do poorly as inflation expectations rise, and well as inflation expectations fall.

Estep went on to consider stock price sensitivity to other factors, including real growth in GNP, oil prices, defense spending and real interest rates. And he reported on the deliberate construction of portfolios that were sensitive to some of these factors and insensitive to others. In other words, one could design a portfolio to bet on defense spending but hedge against unexpected changes in interest rates. His argument was that the sensitivities of stock prices to these factors should be used as risk measures. He referred here to the earlier discussion by Bill Sharpe of a thirteen-factor model to explain security returns, observing that if we knew all of the factors and all of the sensitivities to these factors, as well as the covariances among them, we would have a complete picture of the risk in the stock.

In answer to a question, he commented that the model he had used to deal with several factors was the simplified one-period dividend discount model, but he observed that one can convert the more realistic three-period model to this simplified version, without losing the benefit of the three-period model. There was some discussion of the independence of particular factors Estep had chosen, and he observed

that one can convert the more realistic three-period model to this simplified version, without losing the benefit of the three-period model. There was some discussion of the independence of the particular factors Estep had chosen, and he observed that the correlations among them appear to be essentially random. It was largely on this basis that he believed them to be independent.

124. PREDICTING BETAS AND RETURNS USING COMMERCIALLY AVAILABLE BETA FORECASTS (Spring, 1982)

A paper was distributed by Diana R. Harrington entitled "Predicting Returns Using Commercially Available Beta Forecasts."

Diana Harrington, Associate Professor of Business Administration, Darden School, University of Virginia, presented the results of a research project funded by the IQRF. She began with a general discussion of beta coefficients and their use. In the course of establishing rates to be charged by public utilities, it is necessary to estimate cost of capital, and in a number of states beta coefficients are being used as risk measures for comparison purposes and also in direct estimations of cost of common equity. Beyond the utility field, corporate financial officers are increasingly turning to beta coefficients in estimating cost of capital for a corporation and frequently for decisions within the corporation. In the investment world, of course, the beta concept has become fairly well established. Indeed, it turned up in a number of the preceding presentations at this seminar, as an obvious measure of investment risk.

This rather widespread use of betas seems to make sense. As several presentations had already demonstrated, security returns appear to arise from a variety of factors and the returns of almost all securities are sensitive to some set of macroeconomic factors. One would intuitively expect to find a measure of this sensitivity for each stock, and the beta coefficient can be thought of as this measure.

Given that betas are being used and are indeed useful, and that a variety of sources of beta coefficients exists, it is worth asking whether the betas from these sources are different, and if so, which ones are best. Harrington showed quickly that betas from different sources are indeed different. The research reported in the paper undertook to investigate these differences. The testing covered twelve different betas. Of these, eight came from commercial sources: The Merrill Lynch beta, the Merrill Lynch adjusted beta, the Rosenberg historical beta, the Rosenberg short-term fundamental beta, the Rosenberg long-term fundamental beta, the Value Line beta, the Drexel market cycle beta, and the Wilshire fundamental beta. In addition, for testing purposes, Harrington had added an ordinary least squares beta, one that anyone could easily calculate, an ordinary least squares adjusted beta, a naive beta (simply assuming the beta for every stock is 1.0) and a second naive beta (assuming the beta for a stock is the mean value of the betas for a sample of stocks).

The testing was performed on monthly rates of return for fifty-two utility stocks and thirty-six industrial stocks. She commented that it would have been preferable to make use of larger samples, but she was restricted to what was available from all of the commercial sources. These eighty-eight stocks were used to compare the twelve different kinds of beta. Larger sets of stocks were used for comparisons among subjects of the twelve sources, and did not lead to any differences in rankings.

Harrington's study was aimed essentially at testing each of the twelve beta sources for accuracy of prediction. The sources included adjusted and unadjusted betas, betas based on the New York Stock Exchange Index (Value Line), and betas based on the S&P 500 Index. Some were based on wealth relatives and some on price relatives. Some were based on fundamentals and other simply on stock market regressions. Her point was that the user of a source of betas is interested in the quality of the betas in terms of their predictive ability. Some want to predict the beta itself for a future period; others want to predict a rate of return for a future period. So the testing undertaken involved the prediction of betas and the prediction of rates of return. The quality of prediction one year, two years, three years and four years into the future was examined. The measure of quality was the mean square error, and Harrington referred to the discussion Elton and Gruber had offered at a previous session on the components of the mean square error and their uses. In addition to the mean square error, her testing included mean differences (to distinguish positive and negative biases), and percentage of over- or under-forecasts (another measure of the direction of the actual to forecast errors).

Harrington presented several tables of results, summarizing from the paper. As might have been expected, the prediction errors for industrials were greater than those for utilities. The errors for short horizons were greater than the errors for long horizons. And forecasts for portfolios of stocks are more accurate than forecasts for individual stocks. The larger the portfolio, the lower the mean square error. What was perhaps more surprising was the ranking by quality of

the different sources of beta. Generally speaking, the second best source was almost as good as the best. Harrington observed that in almost all of the tests, three or four of the betas offered rather similar quality, with the other betas falling some distance behind.

After reviewing the tests of beta predicting beta, she turned to the tests of beta predicting rate of return. She made use of the capital asset pricing model, using both short and long U.S. Government interest rates and a short-and long-run average stock returns from the Ibbotson and Sinquefield tabulations. She also used a market line prepared by the Wells Fargo Bank, and finally she used a market line based on assumed perfect foresight of interest rates and returns on the stock market.

Overall, she commented, the prediction results were not very encouraging. Even for the best beta sources, the mean square errors were quite substantial, at least for individual securities. What the tests had revealed, however, was a measure of just how serious the inaccuracies are, how they vary with type of security and with time horizon, and whether there are any significant differences in the quality of beta sources available.

125;. MULTI-FACTOR RISK MODELS (Fall, 1979)

Arnott's paper "Discussion of Cluster Analysis Project" was distributed.

Robert Arnott, The Boston Company, described a methodology for applying a cluster analysis to the comovement of common stocks. The result is a set of 5 comovement classes–quality growth, utilities, oil and related, basic industries and consumer cyclical–and 5 "betas" for each stock, relating the stock's movement to each of the classes. Portfolios can then be constructed to limit or control exposure to movement in any of the classes. A specific example might be reduction of a pension fund's comovement with the class to which the plan sponsor belongs.

The price movement of a common stock can be divided into market-related and non-market-related, or "extra market" movement. The extra market movement can be further divided into movement that is related to different factors, or industries or sectors of the market, and movement that is "issue-specific". James Farrell published in 1974 the results of this kind of analysis of the price movements of 100 stocks. He identified 4 sectors–growth, stable, cyclical and oil.

Arnott described a methodology differing somewhat from Farrell's. First, he included almost 600 stocks and second, the clustering process–the statistical process by which the stocks were sorted into sectors–was not carried to the point where the stocks were all sorted but was halted before the sectors became diluted by only weakly related stocks.

Once the 5 sectors had been identified, a price index was computed for each, to serve as a factor and help explain the price movement of the 600 stocks. For each stock a beta was calculated relating the stock's price movement to each factor. For IBM the traditional beta, relating price performance to the stock market (as of Sept. 12, 1979) was .93. The betas for the factors were: .45 for growth, -.24 for utilities, -.24 for oils, -.33 for basic industries and -.26 for cyclical. Arnott explained that the growth beta of .45 means that for every percent that the growth cluster rises relative to the market as a whole IBM can be expected to rise .45 percent relative to the market. (The negative utility beta classes IBM as "anti-utility,"a stock that moves counter to utilities.) Since the average of the growth betas for the 600 stocks is zero, it is possible to construct a portfolio with zero growth beta (or with a small or negative growth beta) and the same is true for the other 4 factor betas. Arnott provided tables showing the betas for many of the stocks.

A last step in the analysis was classification of all 600 stocks into the 5 sectors and a sixth class containing the stocks for which no one of the 5 factors was dominant. Very few stocks fell into this sixth class; almost all showed a primary factor relationship placing it in one of the 5 sectors. Arnott's tables listed the stocks in each of the 5 sectors, and his paper concluded with the following description of the patterns that emerged in the secondary factor relationships:

1. Retailing companies, airlines, automotive companies, and broadcasters were consistently cyclical and anti-oil in their behavior.
2. Utilities and oil companies were consistently anti-growth in their price behavior.
3. Computing and high technology companies (IBM, AMH, CDA, DEC, INTC, HWP, etc.) were consistently growth and anti-utility.
4. Banks had no consistent primary factor, ranging across all categories, while savings and loans were consistently cyclical (with substantial pro-utility and anti-growth secondary factors). Savings and loans moved similarly to building and very unlike banks.
5. Insurance companies consistently moved as pro-cyclical, pro-utility companies. The primary factor could be either of the two.
6. Drug stocks tended to be growth with no secondary factors.

7. Many of the most popular cyclical issues, which have performed like growth stocks for several years, actually have neutral or negative growth betas.

126. SECURITY MARKET PLANE (Spring, 1979)

Jeffrey Fulmer, Vice President and Kelly Haughton, Investment Officer, Wells Fargo Bank, described the Wells Fargo Security Market Plane, a three dimensional representation of yield, risk and expected rate of return on common stocks.

Fulmer described the Wells Fargo procedure by which analysts estimate expected rates of return on common stocks and the expected returns for the stocks in the Wells Fargo universe are plotted against the beta coefficients of the stocks to permit estimation of a Security Market Line. Such a line gives a relationship between expected return and risk. Now if the stocks are further identified by dividend yield, a series of market lines can be constructed, one market line for each dividend yield level. These lines lie in a plane, the Security Market Plane. From the Plane one can derive lines relating expected return to risk at different levels of yield or lines relating expected return to yield at different levels of risk. It turns out that expected return is positively related to dividend yield as well as to risk. The explanation appears to lie in the fact that 80% of common stocks are owned by tax paying investors, to whom dividend income is less valuable than capital gains because it is generally more heavily taxed.

Haughton reported on the success of the Security Market Plane in identifying over-and-under priced stocks. The mispricing alphas for the stocks were ranked, the universe of stocks was divided into deciles, and the performances of the deciles were compared. Most of the time the first decile, containing the apparently most underpriced stocks, performed very well. There were some months, however, during which this decile underperformed all the others.

Results at the other end of the scale, for the ninth and tenth deciles, were less consistent. The ninth decile generally showed negative returns, confirming the value of the Plane, but the tenth decile showed quite mixed results. Haughton discussed possible reasons for the erratic behavior of the tenth decile, and observed that the model had not worked as well as in 1978 and the second half of 1977 as it had in earlier years. In answer to a question, he said the Security Market Plane had not always proved a better guide than the simple Security Market Line.

127. DISCOUNT RATES AND STOCK PRICE CHANGES (Spring, 1978)

Frank Block and Jack Treynor distributed a paper: "The Influence of Yield on Beta."

Frank E. Block, Vice President, Bache Halsey Stuart Shields, Inc., and Jack L. Treynor, Editor, Financial Analysts Journal, suggested that beta coefficients might usefully be calculated from the yields of common stocks, instead of from historic performances.

Block pointed out that the familiar Gordon and Shapiro stock valuation model calculates the total return on a stock as the sum of yield and growth. A change in the market discount rate will change stock prices, and may have much more effect on prices than changes in expected dividends or growth rate. He showed in tabular form the effect on a stock price of a change in the discount rate, assuming that expectations with respect to dividends and growth in dividends remain unchanged. The impact of the change in discount rate on the stock price varies according to the relative importance of yield and growth for that stock. The relative sensitivity of the price of a stock to a change in the discount rate suggests something like a beta coefficient, and the relationship between this sensitivity and the importance of dividend yield suggests a relationship between the beta and the yield.

Treynor derived an equivalence between the beta of a stock and the ratio of the yield on the market to the yield on the stock, from the Gordon and Shapiro equation. This equation relates the price of a stock to four variables: current normalized earnings, dividend payout ratio, the discount rate, and the expected growth rate in earnings. Treynor divided both the discount rate and the expected growth rate into two components—an extrinsic and an intrinsic component. His reasoning was that the discount rate reflects money market conditions (extrinsic) as well as risk and other characteristics (intrinsic) of the company itself. Similarly, the expected growth rate reflects trends in the economy (extrinsic) and the peculiarities of the company itself (intrinsic). Having rewritten the Gordon and Shapiro expression in terms of intrinsic and extrinsic factors, Treynor showed that the elasticity of the stock price with respect to extrinsic forces is the reciprocal of the yield of the stock. Since the beta of a stock is the ratio of the elasticity of the stock price to the elasticity of the market, the beta is equal to the market yield divided by the stock yield.

Block presented graphs showing the relationship between the discount rate and the elasticity of stock price (the reciprocal of the yield), and the relationship

between the discount rate and the beta. What was of principal interest was the shift in beta that accompanies a change in the discount rate. Block went further, to show two market lines, reflecting different discount rates, and the positions of two stocks with rather different yields, on those two lines. It was clear from this graph that a failure to understand how betas may shift with discount rates could lead to serious mistakes in identifying undervalued and overvalued stocks.

Block reported the results of some regressions that were aimed at identifying an explicit relationship between beta and yield. The regressions all suffered from the fact that the betas used were historical betas, while the yields were taken at a single point in time. The relationship showing the best statistical "fit," did not confirm the use of the reciprocal of yield as a measure of beta. A second regression, of the historical beta against the ratio of market yield to stock yield at a point in time, and limited to stocks with yields of at least half the market yield, showed a significant relationship.

Questions directed to Block and Treynor, and their answers, made it clear that any tests of their proposition were very much tests of whether the Gordon and Shapiro model explains the way in which the market places a value on stocks. It was also suggested that the beta, derived as Block and Treynor had derived it, was essentially a measure of duration. Treynor noted that for the Gordon and Shapiro model, duration is equal to the reciprocal of yield. It was also pointed out that the Block and Treynor analysis makes a number of assumptions about independency among discount rate, yield and expected growth, that may or may not be justified.

128. USING ANALYST INPUTS IN PROJECTING BETAS (Spring, 1978)

William Jahnke, Vice President, Wells Fargo Bank, discussed the procedures used at the Wells Fargo Bank for establishing the input data to computerized portfolio selection models. The Markowitz portfolio optimization model requires, as Gruber had pointed out, forecasts of a mean rate of return and variance of each security to be considered, as well as covariances for each pair of securities. Analysts might be asked to predict the mean rates of return directly, but the belief at Wells Fargo is that indirect forecasts are more efficient. The Gordon and Shapiro valuation model which has already been discussed, gives the following:

$P = \frac{D}{\mu_i - G}$, where P is the price, D the normalized dividend,

μ_i the expected rate of return, and G the expected growth rate in dividends. This expression can be rewritten as:

$$\frac{P}{\text{Book Value}} = \frac{\text{ROE x Payout}}{\mu_i - (1 - \text{Payout})\ \Delta\text{ROE}},$$

where ROE is the return on book equity, and ΔROE the marginal return on equity.
The analyst is asked to forecast ROE, ΔROE and the payout, from which μ_i can be calculated.

The Capital Asset Pricing Model gives the following formula:

$\mu_i = RF + \beta_i(\mu_m - RF)$, where RF is a risk free rate, and μ_m is the expected return on the market.

With good forecasts of beta, and the calculated values of μ_i for each stock, one can run a regression of μ_i against beta, to obtain a market line. The companies for which μ_i plots above the line are the undervalued companies. Jahnke reported tests on the value of this method of analysis, in the form of the following table, showing price performance over the three years 1975 through 1977, of stocks ranked by degree of undervaluation:

Top 10%	231% Appreciation
15%	116%
25%	75%
30%	42%
20%	16%

Jahnke pointed out that there are different ways to obtain beta coefficients. The beta coefficient can be defined as

$$\beta_i = \frac{\sigma_{i_{ROA}}\ L_i\ P_{im}}{\sigma_{m_{ROA}}\ L_m}$$

In this expression, $\sigma_{i_{ROA}}$ is the standard deviation in the return on the company's assets, which can be thought of as business risk, and $\sigma_{m_{ROA}}$ is the business risk in all stocks in the market. L_i is the leverage, or financial risk in the stock, while L_m is the leverage in the market. The analyst focuses on the variables in the numerator of the expression on the right hand side of the equation, which are related to a single stock, while the policy group focuses on the denominator, where the variables are related to the market as a whole.

Still another way to obtain a beta coefficient is through regression analysis, assuming that the beta is a function of the historical beta, the variability in return on assets, leverage, duration, size of the company, and its industry. Analysts can forecast these variables, and a regression analysis can be used to estimate the betas.

In summary, the analysts are asked to supply values of return on equity, payout ratio, standard deviation of return on assets, leverage, and the correlation between the stock return and the market return. A computer can derive from these variables the parameters required for a portfolio optimization model, and can specify efficient portfolios.

When asked about the estimation of beta coefficients, Jahnke replied that this process had evolved over time. At first, analysts were simply asked to adjust historical betas. Later, analysts were asked to adjust betas that had been computed by Barr Rosenberg. Now, a multiple regression is used, as described above, with variables predicted by analysts.

Asked about the tests of the process for identifying undervalued stocks, Jahnke commented that the rates of return tabulated above were not adjusted for transactions costs, and that turnover might be as high as five times per year. However, even after allowing for transaction costs the performances were impressive. He said the selection process has worked consistently well except during the second half of 1977, when it was not unprofitable. For the early months of 1978, it has been very successful.

129. USING BETA ESTIMATES TO FORECAST THE CORRELATION STRUCTURE (Spring, 1978)

Edwin Elton and Martin Gruber distributed a paper: "Are Betas Best?"

Edwin J. Elton and Martin J. Gruber, Professors of Finance, New York University, School of Business, presented the latest in a series of papers on alternative models for the correlation structure. Gruber began with a brief review of their work since 1971. Models for selecting optimal portfolios generally demand estimates of the expected return on each security to be considered for inclusion, and of the variance in the return on that security, as well as the covariances between the return on that security and the returns on all other securities to be considered. The covariances present a special problem, because although analysts may be able to supply the expected returns and variances, they cannot be expected to supply the covariances. In earlier papers, Elton and Gruber had proposed a number of models for estimating the covariances or correlations. Gruber indicated the relative success of the models they had considered, measuring success in terms of the ability of the models to predict correlations. Of five models tested, the worst was one that simply predicted future correlations to be the same as past correlations. The best had grouped stocks, and made use of historical correlation coefficients among groups, assuming for predictive purposes that correlations from group to group would remain the same and that all stocks within a group would display among each other the average correlation coefficient for the group. Three other methods had ranked in second, third, and fourth place. These were the overall mean correlation model, which assumes the same correlation between all pairs of securities, the single index model, which makes use of beta coefficients, and multi-index models.

Elton introduced the present paper, which reports a comparison between the full historical model, the overall mean model, and four variations of the single index model. The four variations included unadjusted historic beta coefficients, beta coefficients adjusted by a method proposed by Vasicek, historical betas adjusted by a method proposed by Blume, and a variation that simply assumes the beta of all stocks is 1. Elton described the Blume and Vasicek adjustments which reflect the observation that over time extreme values of beta, both high and low, tend to shift towards 1.

The predictive ability of each of the three methods (with four variations on the single index method) were tested over two five-year periods, for two samples of 100 stocks each. The first five-year period was used to predict the second, and the tests were directed at ranking the methods in terms of prediction accuracy. One test of prediction accuracy was concerned with the average error between the forecast correlation coefficient and the actual correlation coefficient. A second test was concerned with the probability of a forecast error of any particular size.

In presenting the results of the tests in tabular form, Elton observed that the overall mean method was clearly the best, with the Blume beta method in second place. He went on to explain why the Blume method tends to overestimate correlations and why the Vasicek method tends to underestimate.

Gruber continued with a detailed explanation of how the Blume and Vasicek adjustments work, and the effect of these adjustments can be expected to have on the forecasted mean correlation. He suggested that it may be useful to focus on the forecasted mean correlation, and attempt to correct this for bias. Once this is done, it is possible to apply the various techniques once again, forcing them to produce a corrected mean correlation. Gruber described

two possible adjustments, one assuming that the average correlation coefficent will remain unchanged, and the other making use of hindsight and forecasting the average with perfect accuracy. In both cases, the overall mean method remained the best, but the Blume method became worse and the Vasicek method became better.

Gruber went on to describe research that he and Elton will continue, on multi-index models and mixed models, making use of traditional and pseudo-industry groupings of stocks.

130. THE DIVIDEND YIELD – RESIDUAL RISK TRADE-OFF (Fall, 1977)

Rosenberg and Rudd presented a paper: "The Yield/Beta/Residual Risk Trade-Off" (Preliminary Version).

Barr M. Rosenberg, Associate Professor of Finance, University of California, Berkeley, and Andrew Rudd, Assistant Professor, School of Management, Cornell University, described the results of an analysis showing the residual risk that an investor must undertake if he demands a stock portfolio delivering a beta or a dividend yield differing significantly from the beta or the yield of the market as a whole. A perfectly diversified portfolio, and one therefore that has no residual risk, would be one embracing the entire market. As one shifts the composition of a portfolio to drive either the beta or the yield further away from the beta or yield of the market as a whole, there is a steady loss of diversification, and therefore an increase in residual risk.

Yields or betas which are very different from those of the overall market may be attractive for a number of investors. For tax exempt investors, for example, high yields may offer some advantage, because one might expect tax paying investors to shun high yield stocks in favor of those offering less heavily taxed appreciation.

The portfolio model used by Rosenberg and Rudd was designed to select portfolios with minimum residual risk, meeting the beta or yield targets of an investor. The model selected portfolios from 552 assets. 400 of these assets were stocks of actual companies. The remaining 152 assets were actually miniature portfolios among which the stocks of another 3,200 companies were allocated. Each miniature portfolio was limited to a single industry, and was further characterized by either a high or low yield and either a high or low beta.

Rudd discussed the results of the analysis, presented in graphical form. The graphs are essentially three dimensional, since two variables – yield and beta – are to be specified by the investor, and for each set of these variables the model is to report the minimum achievable residual risk. The graphical results also identified, of course, the minimum achievable residual risk for an investor with a particular beta target but no concern for yield level, and for the investor with a particular yield target but no concern about beta level.

Results were presented for investors holding only stocks, and for investors able to hold combinations of stocks and cash (a yield of 4.37% was assumed on the cash holdings, while a yield of 4.36% was assumed for the stock market as a whole).

The model is able to deal with constraints imposed on holdings, in the form of limits to the permissible investment in any one stock. These constraints become significant to an investor seeking extreme levels of yield or beta, and Rudd described some tests of the significance of such constraints on the minimum achievable residual risk.

Rosenberg next discussed the Capital Asset Pricing Model and the risk-return trade-off, in a world where income taxes are important. In its standard version, the model draws no distinction between the attractiveness of dividends and the attractiveness of appreciation to an investor. All are embraced in "total return," and the excess total return anticipated from an investment, over the risk-free rate, is hypothesized to be proportional to the riskiness of the investment. But clearly, $1.00 of dividends does not have the same after-tax value as a $1.00 of appreciation, to most tax paying investors. Rosenberg discussed modification of the traditional model to allow for this fact, and reported his own estimate of the numerical adjustments necessary to reflect the average effect of taxes. Returning to the analysis described by Rudd, it is now clear that minimizing residual variance for a particular yield and beta target requires consideration of the investor's tax rates. Rosenberg displayed a graphical representation of this analysis.

131. DURATION AND COMMON STOCK BETAS (Fall, 1977)

John Boquist, Professor of Finance, Indiana University, began with the mathematical expression for the duration of a bond. He then introduced the Capital Asset Pricing Model, which related the expected return on any asset to the expected return on the market. This relationship contains the familiar beta coefficient. He then combined the two relation-

ships, to express the beta for a bond in terms of its duration.

$$\text{Beta} = \frac{-D\rho(dr, R_m)\sigma(dr)}{\sigma^2(R_m)}$$

where D is duration, ρ is the correlation between changes in bond yield and the market rate of return, $\sigma(dr)$ is the standard deviation in yield changes and $\sigma(R_m)$ is the standard deviation of market rates of return. This expression will be valid only for a default-free bond, like a U.S. Government bond. This is because we are assuming that the bond is exposed only to the risk of changes in interest rates. Further, because of the limitations in duration that we have already seen, the risk measured is specifically the risk of changes in the yield for the maturity of the particular bond under consideration. We are not considering exposure to the risk of changes in interest rates generally. Boquist pointed out that the beta for the bond will be positive, if the correlation between changes in the bond's yield and returns on the market is negative, and he observed that this is probably the case. That is, increases in interest rates are probably accompanied by declines in the market. He did not, however, attempt to define the market that is represented in this expression. He explained, as his presentation continued, the difficulty one experiences in trying to identify an appropriate market index to which to relate bond betas.

Boquist next developed a measure of duration for stocks. In the case of stocks, the maturity becomes infinity and the coupon is replaced by a dividend, in most cases a dividend that can be expected to grow over time. The expression for duration requires two modifications then, extension of maturity to infinity, and the introduction of a growth rate in the periodic payments to be received. The end result is the following expression:

$$\text{Duration of stock} = \frac{1}{k - g}$$

where k is the discount rate applicable to the stock (the expected rate of turn to stockholders) and g is the expected growth rate in dividends. And this expression further simplifies to

$$\text{Duration} = 1/\text{dividend yield}$$

Once again, Boquist combined the equation for duration with the equation for beta, to deduce an expression for the beta of a stock in terms of its duration.

$$\text{Beta} = \frac{D[\text{cov}(dg, R_m) - \text{cov}(dk, R_m)]}{\sigma(R_m)}$$

where D is again duration, the covariances are those of changes in the growth rate and the market rate of return and of changes in the discount rate and the market rate, and the denominator is the variance of the market rate.

132. THE APPLICATION OF UTILITY THEORY TO RISK ANALYSIS DECISION-MAKING (Spring, 1977)

Irwin Kabus, Senior Research Officer, Morgan Guaranty Trust Company of New York, had discussed at the preceding Seminar, in the Fall of 1976, the quantification of uncertainty, and techniques used at Morgan Guaranty Trust Company to train senior executives in this activity. He described decision analysis as a critical process beginning with the quantification of uncertainty, proceeding to the quantification of risk, to derive the likelihood of unfavorable outcomes, and ending with the quantification of risk preferences of decision-makers so that choices can be made from probability distributions.

His talk was primarily concerned with the third element, the quantification of risk preferences, but he included some discussion of the second stage.

This second stage was illustrated by Kabus with his Petroleum Risk Analysis Model, for evaluating loans to companies with proven oil reserves. Both geological and economic data were supplied to the model, to forecast year-by-year production and net cash flow up to the year in which reserves were depleted or recovery ceased to be economical. A discount factor was applied to the net cash flow to arrive at a net present value. The net present value divided by a coverage factor gave the loanable amount. Probabilities incorporated in the input data led to probability distributions for the net present value, which made it possible to attach confidence ratings to the net present value, to the coverage factor, and to the chance of loan default.

Turning to the quantification of risk preferences, Kabus described a probability game that can be used to familiarize an executive with the concept of probability distributions, and to prepare him to deal with distributions of probable outcomes of business decisions. Kabus showed a foreign exchange currency swapping model demonstrating the likelihood of different rates of return for different currency swaps.

Once we have established a means of deriving probability distributions for the results of decisions or choices, we face the problem of choosing the most attractive of a number of such distributions. Confronted with a choice between two actions, one of which offers a higher expected value but a chance of greater loss than the other, the executive can appreciate that expected value is not the sole criterion to be used. Kabus recommended the derivation of a Certainty Equivalent for each distribution, to make comparisons and ranking possible. The methodology for establishing risk preferences, and hence Certainty Equivalents, is rather complicated. One approach makes use of a derivation model, in which pairs of choices between which an executive is indifferent are used to identify the key parameters of the executive's utility function. Another method–the construction approach–makes use of the executive's suggested certainty equivalents to derive his utility function. The former is the preferred method at Morgan.

In answer to a question, Kabus agreed that risk preferences of executives change over time and that it is necessary to monitor these preferences and insure that the preferences built into the computer models are currently valid. Responding to another question, Kabus explained that the risk preferences used in the decision analyses are primarily those of the most senior officers of the bank.

133. INCORPORATING THE QUANTIFICATION OF UNCERTAINTY INTO ASSET/LIABILITY AND FOREIGN EXCHANGE DECISION-MAKING (Fall, 1976)

This presentation was one of three offered under the heading, "Organizing for Performance." The other two were "Security Analysis: The Changing Dimension" and "Optimal Use of Security Analysis in Managing Common Stock Portfolios."

Irwin Kabus, Senior Research Officer, Morgan Guaranty Trust Company of New York, described the use of histograms for the top management at Morgan Guaranty Trust in helping management committees to reach decisions involving uncertainty. He described the process as the quantification of uncertainty, the presentation of this quantified uncertainty through histograms (although other devices could be used), and the use of the histograms by bank officers to incorporate their risk preferences and attitudes in decision-making.

He showed a series of slides explaining risk and uncertainty and the use of histograms to picture them. Then he turned to a specific example, the decision by the Morgan Sources and Uses Committee with respect to the quantity and maturity of CDs to issue. A group of seven executives developed a histogram of expected interest rates on CDs 90 days in the future, a histogram that can be used by the Sources and Uses Committee in its decision-making. Each of the 7 executives is asked to construct his own histogram, indicating the likelihood of every possible CD rate at the 90 day horizon. The seven histograms are combined into a single average histogram, representing the collective forecast of the group. The 7 executives, furnished with copies of all of these histograms, then discuss their forecasts and possibly revise them. The revised histograms are combined into a single average histogram and this goes forward to the Sources and Uses Committee.

The histogram can be used by the Committee in a number of ways, but the simplest way is generally to infer from the histogram whether the issue of long CDs is likely to be more expensive than the rolling over of short CDs. Kabus and his staff have tabulated forecasted and actual interest rates, and the cost that the bank would have incurred by going consistently long on CDs, going consistently short, predicting interest rates accurately and acting accordingly, and using the histogram in the simple way discussed above. Using the histogram in this simple way would have led to costs of money only seven basis points above the costs that would have accompanied perfect forecasting. Kabus concluded that the use of the histograms had been very valuable.

He described one further example, a foreign exchange currency swapping model. This model was developed to help customers of the bank make the choice between investing in one currency short term, or swapping that currency for another, investing the second currency short term, and swapping back to the first. The choice depends upon the prediction of a future spot exchange rate, and on the uncertainties surrounding that rate. Just as the Sources and Uses Committee was able to use the CD histograms to reach decisions under uncertainty, the customer corporation could use histograms of future spot rates to assess the likely profitability and risk in the swap program.

134. REFLECTIONS ON MARKET INEFFICIENCIES (Fall, 1982)

Dean LeBaron, President, Batterymarch opened the Seminar with some observations on sources of market inefficiencies. He began with the comment that inefficiencies must be identified with respect to some reference point, and that reference point is highly subjective. A pricing mechanism is "inefficient" if it produces prices that in our judgment, or someone's judgment, are incorrect. Further, we believe that the market will ultimately recognize the correctness of our view, and that the inefficiency will disappear.

These comments led him to a phenomenon underlying much of what we call inefficiency in the market place. This is the fact that institutional managers are for the most part acting as agents to invest other people's money. They are not motivated toward the maximization of invested assets, as economic theory might have us to believe; they are in fact motivated towards preservation and enhancement of their jobs. Managers are judged not so much by what they actually deliver for their clients as by what clients perceive them to be delivering. So it is better to make only a little money conventionally than to run even a small risk of losing a lot of money unconventionally. Long run payoffs are presumably what matter most to clients, yet short run volatility determines jobs and careers.

LaBaron illustrated his point with an example. In April, 1982, Batterymarch introduced a contrary investment strategy that involved buying portfolios of illiquid companies at a time when illiquidity was described as a front page peril. A number of clients complained that although the strategy might make perfect sense for a businessman investing on his own account, it was inappropriate for an agent. The comment suggested that some forms of money making are simply out of bounds for agents, and the losers, of course, are the ultimate owners of the fund assets.

Small capitalization companies seem to have represented an inefficiency in the recent past. Stocks of these companies have produced risk adjusted excess returns. But it appears that the academic research that clearly identified this imperfection may have come forth just as the imperfection was disappearing.

Costs of management seem much higher than they have to be. Batterymarch has developed methods for substantial reductions in transactions costs and management fees, yet there seems to be relatively little interest on the part of clients in minimizing these investment costs.

Different investors appear to be seeking different payoffs, and over time the payoff preferences of individual investors may change. If prices are set at any point in time by the single investor whose payoff preferences at that time are best served, then what may appear to us to be inefficiencies may be nothing more than shifts of preferences and of influence from one group to another.

Similarly, investors have different time horizons and the same investors change their time horizons. Again, the appearance of an inefficiency may rest on no more than a shift in time horizon.

Finally, LeBaron proposed that instead of attempting to arrive at correct prices through inefficiently arrived at economic forecasts, we might do better to derive from known actual prices, good economic forecasts that could be used for business planning and corporate stragegy.

135. SIZE RELATED ANOMALIES, THE YIELD EFFECT, AND STOCK RETURN SEASONALITY (Fall, 1982)

A paper was distributed to Seminar participants, entitled "Further Evidence on Size Effects and Yield Effects: the implications of Stock Return Seasonality." A more compact version of this paper, by Donald B. Keim, will be made available at a later date.

Donald B. Keim, Assistant Professor, The Wharton School, University of Pennsylvania, presented a summary of the key conclusions from a very substantial piece of research described at length in his doctoral dissertation at the University of Chicago. Specifically, he discussed his investigation of "yield effect," "size effect," and "January effect" on stock returns. His work was based on data for firms listed on the New York Stock Exchange, for the period 1926 through 1978.

First, he demonstrated the relationship between average daily abnormal returns for ten portfolios, ranging from smallest to largest market capitalization. For the months of February through December, there was evidence that abnormal returns are inversely related to capitalization, but the effect was much more pronounced in January. An examination of subperiods of the total 1931-1978 period indicated some instability over time of the inverse relationship between size and excess return, but the dominant effect of the January results was consistent in every year from 1931 through 1978. On average, the January monthly size effect was 8.8%, while the effect for all months was only 1.3%.

Next, Keim turned to the yield effect. Previous research has produced conflicting results, with respect to the influence of the level of dividend yield

on excess stock returns. Some of this, Keim discovered, resulted from a failure to isolate zero dividend stocks and analyze them separately from stocks paying at least some dividends. Keim's results consistently produced a U shaped relationship, with high excess returns on the non-dividend paying stocks, low excess returns on the lowest dividend stocks, and increasing excess returns on higher dividend stocks. Once again, the January effect was quite pronounced. In fact, almost all of the yield effect for the entire year seemed to come from January results.

Next, he reported his efforts to separately identify the yield and size effects. He ranked his stocks by capitalization, and assigned them to five quintiles. He then ranked the stocks in each quintile by yield, and divided the quintile into six yield groups. He found that for each of the yield categories there was a distinct size effect, but there was a strong yield effect only for the quintile containing the smallest firms.

Keim had pursued the yield effect a little further, to explore different definitions of dividend yield. in all cases he defined the yield as dividend divided by price, and the dividend as the twelve month average. The price, however, could be taken at different points over the twelve months. He found the dividend yield effect quite sensitive to the manner in which the price was chosen for the yield calculation. He went on to substitute for his yield simply the reciprocal of the price, and found effects very similar to the yield effects.

There was an extended discussion following Keim's presentation, during which a number of issues were raised. Several questions were asked about the source of the January effect, but neither Keim nor any participant was able to offer a satisfactory rationale. In answer to a question about the practical application of his findings, Keim commented that he was not sure whether an institution could make use of the effects he had found to achieve access returns. For one thing, the most pronounced yield effect was to be found in small capitalization stocks. In addition, his work was based on CRISP data, and one could not be sure that transactions could actually have been made at these prices.

136. SURVEY OF MARKET INEFFICIENCIES: METHODOLOGY AND RESULTS (Fall, 1982)

A set of exhibits for this presentation, by Barr Rosenberg, Ron Lanstein, and Ken Reid, was distributed.

Barr M. Rosenberg, Principal, Barr Rosenberg Associates, began with a discussion of the studies that had been carried out by a number of researchers on the relationship of rate of return, or excess rate of return, to various stock characteristics. What was significant about this work was the fact that each piece of research tended to focus on one or two characteristics, and to ignore the others. For the most part, in exploring the relationship between return and a particular characteristic, those who had done the research had not controlled for characteristics that others had found to be significant. So much of what purported to test a single characteristic was actually testing a bundle of characteristics that might be expected to affect stock returns. Rosenberg commented that what Keim had just reported involved the separation of size and yield effects, so that each could be examined in isolation.

He turned next to describe in some detail a methodology developed to systematically capture the separate effects on rate of return of many characteristics. He made use of a "factor portfolio" for a characteristic and a "factor portfolio" for a group. The former is a pure hedge portfolio with an initial zero net value, set up to provide unit exposure to a particular characteristic. If the characteristic is positively related to return, then the portfolio will have a positive value at the end of the holding period. This value will be the factor of return for the particular characteristic.

The "factor portfolio" for a group has a unit net investment, spread across the securities in the group. The factor of return to the characteristic is the rate of return on the portfolio.

The work Rosenberg reported made use of a "simple factor portfolio," and a multiple factor portfolio." The first is constructed to capture a particular characteristic, with no concern for whether the factor portfolio is also exposed to other characteristics. This would correspond to most of the previous research Rosenberg had described. The "multiple factor portfolio" for a particular characteristic is made "orthogonal" to the other characteristics by having zero exposure to each of those other characteristics. Rosenberg listed a number of characteristics to which the portfolio model has been applied, and indicated which multiple factors had led to significant results. He illustrated the importance of the multiple factor analysis in a demonstration of the relationship among excess return, yield, and beta. Because yield and beta are inversely correlated, the simple factor analysis would lead one to believe that return is inversely correlated with yield. The multiple factor analysis, which separates the yield effect from the equity risk effect, demonstrates that the yield effect alone produces high returns for high yield. The multiple factor analysis makes it possible to identify the advantages or disadvantages of a pure bet on one characteristic, or an incremental advantage from adding exposure to a single characteristic on top of a neutral portfolio.

Ron Lanstein, Partner, Barr Rosenberg Associates, next described a specific test of the market-to-book-value effect. Essentially, high returns are associated with stocks purchased at a low market-to-book ratio. A strategy of purchasing low ratio stocks would have worked consistently from 1973 through 1982, and would also have worked for the period April through August 1982.

Kenneth Reid, Consultant, Barr Rosenberg Associates, concluded the presentation by discussing his work undertaken as part of a doctoral dissertation. His research had covered a number of characteristics; the ones he addressed in his presentation were historic beta, reciprocal of price, standard deviation of residual returns from the historic beta regressions, a distinction between large and small capitalization companies, an indicator variable defined to be one if the most recent residual return is negative and zero otherwise, and relative strength over the last twelve months. He discussed the use of the simple and multiple factor analyses, and indicated his surprise that the technical characteristics – low prices and reversals – dominated the results. They proved to have much more statistically significant effects than the beta and variability measures.

137. IMPACT OF PRICE EARNINGS RATIOS ON PORTFOLIO RETURNS (Fall, 1982)

John W. Peavy, III and David A. Goodman distributed a set of exhibits to accompany this presentation. A paper will be available at a future date.

John W. Peavy, III, Assistant Professor of Finance, Southern Methodist University, began with the observation that on average, over long time periods, low price-earnings multiple stocks have delivered higher rates of return than would be expected from the Capital Asset Pricing Model. And at the same time, stocks of small capitalization firms have tended to outperform stocks of larger firms. He reviewed some studies of both phenomena, and commented that it is difficult to separate the price earnings multiple and capitalization size effects.

Peavy described the purpose of their work as confirming the price earnings effect and the size effect independently, and investigating whether one is a proxy for the other and which one is dominant. The tables he displayed demonstrated quickly a confirmation of the price earnings multiple effect and the size effect over the period 1970-1980.

David A. Goodman, Associate Professor of Management Science, Southern Methodist University, next described an analysis somewhat similar to the one Don Keim had discussed earlier in the day. Stocks were ranked and divided into quintiles by market value and the stocks within each quintile were ranked by price-earnings ratio and divided into further quintiles. The sequence was then reversed, with quintiles ranked by price earnings ratio subdivided into quintiles by size. Both a price earnings multiple effect and a capitalization effect were observable. Goodman compared their results with the previous work of Reinganum, who had not adjusted for risk in computing his returns. The result of adding the risk adjustment was as had been predicted. The size effect appeared less powerful and the price earnings multiple effect more powerful.

Next, he described a procedure by which the multiple and the capitalization were standardized to compensate for very substantial variation over the time period of the study. With this adjustment, the size effect was no longer statistically significant, although it did appear to show up for the small companies. The price earnings multiple effect was still quite significant.

John Peavy closed with some comments on industry effects, and the result of standardizing size and multiple by industry. With this adjustment, the price earnings multiple effect was quite clear. He also noted that the more rapidly the portfolio is rebalanced, the greater the effect.

In the discussion following the presentation, a number of questions were asked concerning the underlying economic source of the price earnings multiple effect. It was suggested by some of the participants that the beta coefficient adjustment used by Peavy and Goodman may not be capturing all of the risk perceived by investors.

138. PANEL DISCUSSION: CAPITALIZING ON MARKET INEFFICIENCIES (Fall, 1982)

Eugene E. Record, Vice President, Thorndike, Doran, Paine and Lewis, Inc., introduced the panel, and described its purpose as adding to the academic reports on the existence of inefficiencies a consideration of practical exploitation of these inefficiencies in portfolio management.

Thomas F. Loeb, Vice President, Wells Fargo Bank, N.A., presented a study of transaction costs, and discussed the impact of these costs on a portfolio strategy seeking to exploit the small capitalization effect. The investment strategy he described consisted of ranking stocks by capitalization, dividing them into deciles, and combining deciles. The investment choices were then to work with the smallest 10%, the smallest 20%, 30%, 40%, 50%, or 60%. Over the fif-

teen year period 1967 through 1981, it was clear that the rates of return before adjustment for transaction costs declined from the smallest 10% to the smallest 60%. The portfolio turnover, with annual rebalancing, also declined from 44% per year down to 12% per year. It was clear then that the higher rates of return were gained at the cost of higher turnover.

Next Loeb presented the net returns, after allowing for transaction costs. For quite small blocks (five thousand dollars) it still appeared that the strategy using the smallest 10% was the most attractive. But for a twenty-five thousand dollar block, the smallest decile was no longer the most attractive, and for a seventy-five thousand dollar block it was clearly better to go to the larger stocks.

Steven Einhorn, Vice Chairman, Investment Program Committee, Goldman Sachs, began by putting the small capitalization effect in perspective, showing that it is principally a phenomenon of the 1975 to 1981 period. For the period 1925 through 1964, large companies out-performed small companies almost half of the time. Over the years 1965 through 1972, small companies had an edge. But over the period 1972 through 1974, the large companies generally outperformed the small. He then turned to four reasons why the small company effect had been strong from 1975 through 1981, and concluded with an observation that none of the four factors is present in today's market, and one therefore has no reason to expect that the small size effect will persist in the near future.

John Nagorniak, President, Franklin Portfolio Associates, discussed a conceptual approach to the exploitation of market inefficiencies. He suggested a sequence of questions to be asked: Does the opportunity for exploitation exist? How can it be expolited? Is there any proprietary niche in bringing about the exploitation? And what is the risk/reward relationship? He discussed a number of examples to illustrate cases where the opportunity may exist but the method of exploitation may not be clear, or where the method of exploitation is clear but there is no proprietary niche so the advantage to an investment manager may be small. And he observed that the quantitative analytic approaches that have generally been used to reveal inefficiencies are likely to miss some risk, so that the risk/reward relation may be less attractive than it at first appears.

STOCK VALUATION – METHODOLOGY AND PRINCIPLES

139. EQUITY SECURITY VALUATION: PRACTICAL APPLICATIONS AND PROBLEMS (Spring, 1982)

Nunzio Tartaglia, First Vice President and Director of Quantitative Investment, Drexel Burnham Lambert, described his presentation as essentially human engineering: How to take a valuation model and present it in such a way that it is likely to be understood and used. He referred to problems of language and terminology, and to the need for ease of application. A fine performance record alone will not sell a valuation model. The model must "fit the shop."

George M. Douglas, Senior Quantitative Analyst, Drexel Burnham Lambert, ran through a number of steps he and Nunzio have used to present the essence of the dividend discount model to analysts. The presentation relies on concepts and terminology that are clear to analysts, and adds to familiar data and calculations those that are peculiar to the dividend discount model.

Tartaglia continued, with a discussion of how to press analysts for the forecasts necessary as inputs to the model, and how to control the tendency of analysts to modify their growth forecasts as a means of protecting their own professional position. One step taken has been to publicize rather fully the forecasts and recommendations of the analysts.

Douglas reviewed the one-page valuation summary that displays the work of an analyst on a particular company. The single page includes the essence of the recommendations, a summary of assumptions, and an analysis of the sensitivity of the forecast to the assumptions. Tartaglia pointed out that it is critical to know where the sensitivities lie and to assure that the important assumptions and forecasts are well made. He added that risk measures are difficult to deal with, because analysts are generally not much interested in risk. Betas are not used directly as risk measures, because they establish a bias against growth stocks. A market cycle beta is combined with a duration for each stock to arrive at a growth rate sensitivity, which serves as a risk rating. He concluded by presenting valuation and statistical summary pages, combining company, industry and stock market projections. One purpose of this final summary is to provide a check on whether the forecast made by an analyst for a stock is consistent with the economic forecast. The projection of earnings as a percent of industry earnings and a percent of earnings for the S&P 500 Index also helps to provide a check on the reasonableness of an individual company forecast.

In answer to a question regarding the performance record of the firm and its analysts, Tartaglia responded that he had no simple way of measuring the effectiveness of the system he had described Douglas presented statistics suggesting that the analysts' forecasts had led to correct rankings of stocks

140. WHAT INVESTMENT TOOLS THE COMING GENERATION OF INVESTMENT MANAGERS WILL BE USING (Spring, 1978)

William F. Sharpe, Professor of Finance, Graduat School of Business, Stanford University, opened th Spring Seminar, speaking, as he said, not so much o specific investment tools as on the principles unde lying the tools. He dealt with seven principles, and fo each of them suggested tools or analytic methods.

First, he noted that the same investment result can often be obtained in different ways, and if ther are cost differences among these ways, then a astute investor will find opportunities to mak money. For example, simultaneously buying a ca option and selling a put option is equivalent to bu ing stock on margin. So the relationship among th interest rate and the prices of the put and call optio and the stock, should be such that the two inves ments offer the same return. The relationship can i deed be expressed as the put and call parity theorer If the relationship is not met, then there exists profit opportunity. Similarly, there is a relationsh among the spot and forward exchange rates betwe two currencies, and interest rates in the two countrie such that when an equality does not exist, there a opportunities for making a profit.

The second principle is to the effect that t securities market is made up of investors with d ferent characteristics and needs, in particular with d ferent tax rates and risk tolerances. This is importa in the context of indexing and theories of mark efficiency. Holding a portfolio that is representati of the entire market for risky assets will be approp ate only for an investor whose tax rate and wh risk aversion coincide with the average tax rate a average risk aversion for all investors. In general, cause tax rates and risk preferences vary, a portfo that is representative of the total market will not appropriate for any particular investor.

Measurement of investment risk is extremely co plicated, because it involves correlations among assets that can be included in a portfolio. Sharp third principle is that coping with risk measures, a choosing an optimal portfolio, demand the use o computer. In addition, however, it is no longer sa factory to think of risk as consisting of two eleme – market risk and unique risk. We know there other risk characteristics, and we require the servi of analysts to deal with them.

Principle four has to do with transaction costs. As long as transactions are not free, the weighted average performance of actively managed portfolios will always be below the weighted average performance of passively managed portfolios.

From this we arrive at principle five: passively managed portfolios will tend to outperform actively managed portfolios, on average, and gradually clients will transfer actively managed portfolios to passive managers. The process will be slow, because there is enough randomness in investment performance to make it difficult to identify superior and inferior performances.

Sharpe's sixth principle, and perhaps the basic principle underlying all the others, is the powerful force of competition. We have seen the effects of competition in brokerage rates over the past three years. Similar competition for investment performance, coupled with easy entry into the investment management business, makes it extraordinarily difficult to achieve consistently above average rates of return. The concept of an efficient market is really not very new.

The seventh principle recites a favorite maxim of economists, that there is "no free lunch." It is incumbent on investment managers to discover for themselves as many as possible of the illustrations of these seven principles, but not at the expense of their clients.

A number of questions were raised by participants, concerning a lack of consistency between modern capital market theory and Sharpe's seven principles on the one hand, and the realities of performance measurement and competition among money managers, on the other. Sharpe agreed that these inconsistencies do exist, and that some of the legal framework governing pension funds may inspire objectives and behavior that do not make good overall economic sense.

A question was raised concerning the most difficult aspects of running an index fund. Sharpe replied that he believed in market funds rather than index funds, and predicted that when some logistical problems are solved and a better understanding is reached among clients and managers with respect to objectives and control, then index funds may give way to market funds.

141. INVESTMENT DECISION MAKING AND THE SCENARIO APPROACH (Fall, 1977)

Michael Edesess, Partner, Syrus Associates, suggested that study of the future is the proper business of investors. He pointed out the difference between attempting to forecast truly random events, and attempting to forecast future events in general. In the first case, we are safe in assuming that although random events cannot be predicted with certainty, they follow a constant probability distribution, and history will allow us to establish with certainty at least the form of that distribution. But in the second case, not only are the future events uncertain, their probability distribution is also changing. We can no longer use the past as a safe guide even to the distribution.

Edesess observed that the average Becker Equity Fund experienced turnover of 20% a year, suggesting the average holding period of a stock is about five years. Anyone selecting a stock for a five year hold will be concerned about the price/earnings ratio five years in the future, and must therefore be looking ahead to the prospects for the stock for something beyond five years. It would appear absurd to buy a stock on the basis of a single year's earnings estimate. Some will argue that it is difficult to predict beyond five years. It may well be difficult, yet purchases are being made on the basis of implicit forecasts beyond five years, and what is called for is not a precise forecast for a particular stock beyond five years, but a forecast that differentiates among alternative investments.

Edesess proposed that, in deciding how to invest, one should begin with the future and work backwards. One should ask:

1. What might potentially be the characteristics of the future?
2. What processes of societal organization would create such a future?
3. How can my investments participate in its creation, if it is a desirable future, or avoid participating in its creation if it is undesirable?

Since there are numerous possible futures, the best way of marshalling the possibilities is with the scenario approach. The scenario approach seeks, first, to stimulate creative thinking about future possibilities. Second, it seeks to impose a structure and a discipline on that creative thinking and ultimately to represent it quantitatively. The result of constructing scenarios is a quantitative framework for decision-making, and one also derives from the process an improved understanding of how investment conditions might develop as time goes on.

In introducing a scenario approach, Edesess suggested that one must first construct the scenarios, then estimate the results, then assign probabilities to those scenarios and their results, and finally determine investment objectives and set policy.

Turning next to the matter of constructing scenarios, he discussed a variety of methods for aggregating the myriad possible futures into a tractably small

number of scenarios with varying investment implications. Then he showed how the subjective probability distribution of future investment results is constructed from these scenarios.

Investment objectives are then stated in terms of the desired probabilities of achieving certain investment goals, such as rates of return. These objectives can be merged with the projected probability distributions which have been established through the use of scenarios. The result is a mix of investments which meets the objectives – or a demonstration that the objectives as currently stated are too ambitious and cannot be met.

142. TOWARD A THEORY OF INVESTMENT VALUE (Spring, 1977)

Jack Treynor distributed a paper: "Toward a Theory of Investment Value."

Jack L. Treynor, Editor, Financial Analysts Journal, began with a brief review of techniques for stock valuation, and then turned to the issue Beaver had been concerned with: the use of accountants' earnings and earnings growth figures for security valuation.

On what Treynor called level 1 are the stock valuation models based on empirical data, chiefly economic data. The models of Ben Graham are a good example. These models have never been justified by rigorous economic testing. On level 2 are valuation formulas like those of Gordon and Shapiro, Holt, and Miller and Modigliani. There are significant differences among these models, but all are based on earnings growth and it is assumed that this growth has economic meaning, without any rigorous testing.

The models of level 2 present a problem to an investment organization, because earnings growth forecasts for a company assume forecasts of the economy and the models make no separation between the two, while investment organizations generally assign to different people forecasts of the economy and analyses of individual companies and industries.

On level 3 the valuation models emphasize the market environment and focus on relative value as this environment changes. This is in sharp contrast to the "intrinsic" value approach of levels 1 and 2. But the level 3 models are still based upon accounting numbers.

The Hagaman and Jensen model, the Fouse model, the Value Line Approach, the Stock Grouping approach of Jim Farrell, and the Fischer Black two-factor model all belong in level 3.

With his level 4, Treynor turned to the meaning of "earnings" and "earnings growth." Treynor agreed with Beaver in concluding that what the earnings represent, if they represent anything at all, is the increase in the value of the net assets of the enterprise.

A major element in calculating earnings is the charge for depreciation. Treynor argued that depreciation is based upon the proposition that assets wear out and have to be replaced and the wearing out takes place in a smooth and orderly way. But, he said, assets generally do not wear out and rarely have to be replaced. New assets are purchased not simply to replace old assets but because those new assets offer the prospect of recovering their costs and returning a profit. Old assets are discarded because competition has driven down their revenues to the point where revenue no longer exceeds operating costs. Not only is the useful economic life of an asset difficult to forecast, but that life usually ends abruptly, as the result of competition, rather than smoothly, as the result of wearing out. Depreciation conventions followed by accountants are not likely to be helpful to security valuation.

143 . STOCK VALUATION: ITS ROLE FOR INVESTORS (Spring, 1982)

Stanford Calderwood distributed copies of a paper entitled "22.8 Million Buy/Hold/Sell Signals: Any Usable Insights?"

The theme of the opening presentation at this Spring Seminar was the usefulness of stock valuation models. Although Stanford Calderwood, President Trinity Investment Management Corporation, manages money and serves a clientele through a valuation model, his point was not so much the value of that particular model as the value of models generally. Throughout his talk, he pointed out the performance superiority of a variety of stock valuation models over the performances of stock indexes and actual portfolios. Even the least effective models, because they embrace a consistent and disciplined approach, are likely to outperform most portfolio managers. In the course of his discussion, Calderwood dealt with some of the reasons for this disparity.

He began with a review of an enormous amount of quantitative testing of a wide range of stock valuation models, undertaken by himself and his partner Eric Levin. In the course of the testing, they learned a great deal about the strengths and weaknesses of the models themselves. They also learned a lot about appropriate sources of input data for the models, and appropriate adjustments to make to the data. But at the same time it appeared that simply using a model, any model, was likely to produce significantly better performance than an index.

From the back-testing of a variety of models, Calderwood moved on to his organization's record with the real-time use of its own model service. The value added, over an index, was substantial. A review of real-time recommendations of competing valuation model services indicated that they, too, provided significant value to their clients.

Calderwood identified seven valuable insights gained from all of this model testing. The first was that there is such wide dispersion in the performances of stocks over any given time period, with so many stocks performing far above the average, that it does not seem unreasonable to expect that a valuation model can identify enough of these high performers to beat the indexes by a significant margin. The second insight was that traditional portfolio management may serve to get in its own way, to be inconsistent, to involve management for the sake of management, so as to seriously impede performance. The third insight was that consistent normalized inputs to a model are better than the raw estimates that come from analysts. The fourth was that while no particular valuation model works well in every year, sticking with a model for a long time pays off. A fifth and related insight is that in some periods no model will perform in a superior fashion. The sixth insight was that different models may achieve approximately equal performance over long periods of time, while recommending quite different stocks along the way. Finally, the seventh insight was that the year-to-year volatility in the performance of a single model is generally quite substantial, and argues against consistent use of a single model over a long period of time. The answer to this volatility problem, Calderwood suggested, is a device like his Multiplex model, that combines a variety of sub-models to significantly reduce volatility and deliver a superior long-term performance.

144. SOME FACTORS IN NYSE SECURITY RETURNS: 1931-1979 (Spring , 1982)

William F. Sharpe distributed a paper entitled "Some Factors in New York Stock Exchange Security Returns, 1931-1979."

William F. Sharpe, Timkin Professor of Finance, Graduate School of Business, Stanford University, introduced his paper as an expository piece intended to describe the technology of factor models. The basic idea is to decompose rates of return on individual securities and for portfolios into a number of elements or "effects." Each effect is the product of an "attribute" like the dividend yield on a stock, and the corresponding "factor," like the normal increase in excess rate of return per unit of yield. There are different ways to select an appropriate set of factors to explain the rate of return of a security or portfolio. He described his own selection as consisting essentially of an intuitive choice of what were likely to be appropriate factors followed by statistical testing to verify that they were indeed significant. The factors he had chosen were historic beta, yield, size, bond beta, alpha, and membership in one of eight industry segments: Basic industries, capital goods, construction, consumer goods, energy, finance, transportation and utilities.

In discussing the value of factor analysis, Sharpe offered three general uses. One has to do with analysis of performance. Factor analysis helps in performance comparisons and diagnosis of the causes of good and bad performance. Another use is for estimation of risk in a stock or portfolio, in terms of the exposure of the future performance of the stock or portfolio to factors that may change. The third use is similar, and is for estimation of future returns on stocks and portfolios.

The analysis presented was based on data for all New York Stock Exchange stocks for the years 1931 through 1979. Sharpe reviewed the average values and standard deviations of his thirteen attributes, and the evidence that the thirteen factors were significant. He then turned to the interesting results of his work. First, it turned out that all thirteen factors could explain only 10.4 percent of the variation in returns among the stocks examined for the average month. The beta factor alone explained 3.7 percent, the common factors added 4.2 percent, and the sector factors added another 2.5 percent. The results were more encouraging in explaining the variation in rate of return on a particular stock over the full time period. Here, the thirteen factors together explained 40.3 percent of the variation, and the beta alone explained 33.9 percent.

Sharpe next turned to a series of graphs illustrating what has happened to the relationship between rate of return and his factors over the years 1931 to 1979. While the excess return of the S&P 500 Index over the Treasury bill rate had averaged better than 8 percent per year for the full time period, this average reflected a significant superiority over the bill rate up about 1965, and an average zero superiority since that time. What was perhaps more surprising was that the standard deviation in the S&P 500 excess return has been far below its 21 percent long-term average for the past three decades. At the same time, the standard deviation of excess returns on long-term government bonds has been well above average in recent years.

In the final portion of his presentation, Sharpe presented a series of slides identifying the "January effect" in the size and yield factors. It turns out that if one ignores rates of return in the month of January, and performs the factor analysis for the 1931-1979 period, using only data for February through December, rate of return shows little relationship to company size. The January data alone show size to be very important. Over the full time period, it turned out that large companies under-performed small companies by approximately 560 basis points per year, and 320 basis points of this difference lay in the January results. It seems clear that the purchase of small company stocks in December and perhaps January, should be an attractive strategy. Similarly, on average high-yielding stocks outperformed low-yielding stocks by 23 basis points, but 10 basis points of this difference was achieved in the month of January. It would appear that high-yielding stocks should be purchased in December or early January.

One participant asked whether there was not something contradictory about high-yielding stocks outperforming low-yielding stocks, while small companies outperformed large companies, when one would expect large companies to offer higher yields than small companies. Sharpe pointed out that he was reporting the results of a multiple regression, so that the size factor results apply when the yield is held constant, and the yield factor results apply when size is held constant.

145. VALUATION MODEL BIAS AND THE SCALE STRUCTURE OF DIVIDEND DISCOUNT RETURNS (Spring, 1982)

A paper was distributed entitled "Valuation Model Bias and the Scale Structure of dividend Discount Returns," by Richard O. Michaud and Paul L. Davis.

This presentation, like the one preceding (see "Economic Sources of Real Return and Variability in Common Stock Investment"), dealt with the dividend discount model. While Estep had been generally satisfied with the ability of the model to deliver useful recommendations, Richard O. Michaud, Vice President, Bache Halsey Stuart Shields, Inc. was not and had undertaken to produce a variation of the model with a distinctivley different structure. He proposed that the standard dividend discount model is frequently rejected by a portfolio manager and for good reason. The model, because of its structure and not because of the particular data fed into it, contains biases that may be quite inconsistent with the market view of a manager who might otherwise be willing to use the model.

Michaud's research was based on four data bases, two of them being in-house analysts' forecasts and two consisting of forecasts from a widely available external source. Applying the model to these sets of data, Michaud demonstrated that the *ex ante* returns are positively correlated with dividend yield and E/P ratios. In other words, the model is strongly biased toward high dividend yield, low P/E stocks. This bias can also be seen as an anti-growth stock bias. The results also showed, somewhat as Estep's results had showed, that the *ex ante* returns were not positively correlated with beta.

Michaud went on to show the result of a test of the similarity of the forecast performance of the standard dividend discount model with models based simply on dividend yield or P/E ratio. It turned out that the forecasting performances of all three models were very similar. Michaud's conclusion was that the standard dividend discount model does not deliver any positive statistically significant forecasting information beyond what is contained in the P/E measure. His question then was whether the model could be restructed in such a way that it would.

By means of a simple example, he demonstrated the yield bias that is a part of the standard dividend discount model, and proposed a method for restructuring the model in order to remove this bias. Essentially his process was to decompose the expected rate of return into a yield and growth component, to rescale the growth component, to add the dividend component to the rescaled component and arrive at a restructured dividend discount model. The rescaling is the interesting aspect of the process, and Michaud described in general terms how the rescaling can be adapted to fit the market outlook of the manager using the model. Specifically, he demonstrated a "passive" dividend discount model to reflect an *ex ante* risk premium of 6 percent and a risk-free rate of 15 percent. This represents structuring the dividend discount model to serve the needs of a manager who anticipates a market performance characterized by the 6-percent and 15-percent parameters. These assumptions take the place of the biases that would otherwise automatically show up in the standard model. The results of the passive model showed that its return structure was more closely related to beta and less strongly positively related to yield and E/P ratio than had been the standard model. The forecast performance of the passive model was a little better than that of the standard model. And the passive model did not behave like the E/P model, as had the standard model.

In summarizing the advantages and disadvantages of his restructured model, Michaud stressed that it is important to know just what the biases of the model are, and to set these biases deliberately, on the basis of a market outlook. This is preferable to simply taking the built-in biases of the standard model as they happen to come. In response to a question, he commented that while the results of a run of the standard model had proved totally unacceptable to a growth stock manager, the passive model had delivered more acceptable results and a model restructured to reflect a high-growth market expectation was even more helpful.

146 . THE DIVIDEND DISCOUNT MODEL AND LONG-TERM EARNINGS FORECAST (Spring, 1982)

A paper was distributed titled "The Dividend Discount Model and Long-Term Earnings Forecasts: A Decade of Experience," by William L. Fouse and Charles F. Pohl.

William Fouse, Senior Vice President, Wells Fargo Bank, N.A., began by describing work of his at the Mellon Bank in 1969, linking the single index market model with the dividend discount model to derive implied dividend growth rates for a sample of companies. Although these derived rates were not particularly good forecasts of actual growth rates, they correlated very closely with growth rates estimated by security analysts. He went on to show that improving the accuracy of forecasted growth rates could achieve substantial stock market returns.

This work led to the Wells Fargo dividend discount model combined with a security market line to identify under- and overvalued stocks. Fouse showed a summary of performance results for the year 1974 through 1981.

Charles Pohl, Manager, Security Analysis Group System, Wells Fargo Bank, N.A., picked up the discussion at this point, and described the liquidity adjustment and the yield adjustment to the Wells Fargo model. He then described the results of some analysis to see how the performance of the model in the years before Wells Fargo introduced adjustments for the yield effect might have been explained by that yield effect. In other words, it now seemed likely that at least a portion of the performance which Wells Fargo had attributed to its identification of mispricing might in fact have been due to an as yet unidentified yield effect. It turns out that the yield effect in the early 1970s was indeed substantial, and once that effect was accounted for, the ability of the model to select stocks on the basis of mispricing was actually quite limited. A repetition of the study over a more recent time period also suggested that the return to mispricing was small and not significant. Pohl suggested that even if the returns to mispricing are small, the model may still be valuable if the *ex ante* risk and yield lines are good predictors of the *ex post* risk and yield lines. In other words, the model may still provide useful guidance as to whether it is worth taking risk and seeking high yield. But for both the 1972-1976 and 1976-1980 periods tested, this did not seem to be the case. Pohl's conclusion at this point was that the model by itself would not generate excess returns, but that it is a valuable tool for anyone who can supply truly superior long-term forecasts.

He turned next to the forecasts supplied by analysts at Wells Fargo. An examination of the accuracy of these forecasts of dividend and earnings growth rates showed that ability to forecast deteriorates quite rapidly through time. This is important to the particular version of the dividend discount model used by Wells Fargo. This version depends heavily upon the forecast earnings growth rate five years out, and it appears unlikely that the analysts' five-year earnings growth forecasts have much validity. Pohl

closed by observing that Wells Fargo is currently investigating ways to alter the form of the model to stress those inputs that can most accurately be forecasted, and to find ways of improving the inputs themselves. In the meantime, the model may still be useful in indicating when yield, risk or liquidity may be expected to pay off, and it may still be useful in providing expected returns, even if these cannot be regarded as excess returns over those explained by the factors.

147. COMMON STOCK VOLATILITY AND THE REAL RATES OF INTEREST (Spring, 1981)

A paper by Robert J. Shiller was distributed, entitled "Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends?"

The phenomenon that Robert J. Shiller, Research Associate, National Bureau of Economic Research, set out to investigate is that while a widely accepted explanation of common stock prices equates those prices to the discounted present value of expected dividends, movements in stock price indexes seem much too large to be attributable to changes in expectations with respect to dividends. Shiller demonstrated graphically that a Standard and Poor's Composite Index that discounted at a constant rate an accurate forecast of dividends would have been remarkably stable over the period 1928 to 1980, and the same would have been true for a Dow Jones Industrial Average that accurately discounted dividends. The very wide swings in the actual values of the indexes compared to the rather stable present value of dividend stream raises the question whether the actual index values could have represented present values of anticipated dividends. Shiller's research indicates that this is very unlikely.

He began with a series of mathematical relations between the variance in actual stock prices (working always with stock indexes and not individual stocks) and the variance in the "correct" stock price level, the level representing the present value of the true dividend stream. The former must be less than the latter, yet the graphical presentation had demonstrated the opposite. Immediately then there appears to be a contradiction of the model that relates stock prices to the present value of expected dividends.

Shiller went on to derive mathematically a relation between the variance in stock price changes and the variance in dividends. The conclusion at this point was that observed variance in stock prices is much higher than it should be, given the proposition that stock prices are the discounted present value of expected dividends.

So far the analysis had been based on the assumption that the discount rate is constant in real terms. Shiller now introduced uncertainty in the discount rate itself and derived mathematically the maximum contribution of variance in this discount rate to the variance in changes in the index. At this point it was possible to turn to empirical evidence.

The empirical results yielded standard deviations in the index ranging from five to thirteen times the values given by the mathematical relationship, with the discount rate, which cannot be observed directly, estimated from average dividend and price levels. Alternatively, the empirical data indicated that the standard deviation of the real discount rate would have to be at least 5.3 percentage points to explain the variance in the Standard and Poors Composite Index and at least 7.2 percentage points to explain the variance in the Dow Jones Industrial Average. Shiller's opinion was that these are unrealistically large numbers. His overall conclusion then was that the variance in stock prices over the past century is much too high to be attributed to new information about expected dividends. It appears then that the rational dividend expectations, or "efficient markets" model is a quite unsatisfactory explanation of stock price movements.

148. THE NET EFFECTS OF DEBT AND TAXES: A SYSTEMATIC APPROACH TO THE FINANCIAL ANALYSIS OF ELECTRIC UTILITIES (Fall, 1980)

A paper entitled "A Systematic Approach to the Financial Analysis of Electric Utilities," by Guilford C. Babcock, was distributed.

Guilford C. Babcock, Department of Finance and Business Administration, University of Southern California, described his method for decomposing growth in corporate earnings per share, for purposes of identifying more precisely the sources of growth and the sources of instability in growth, using electric utilities as a specific example.

First, he decomposed growth in earnings per share into two multiplicative components, sustainable growth and non sustainable growth. These components were further divided into two multiplicative components each, return on common equity and retention rate, which multiply to sustainable growth, and new stock contributions and change in return on common equity, which multiply to give non sustainable growth. For the Standard and Poor's Industrial Index, 1969-78, the components appeared as follows:

S&P Industrial Index, 1969-78, Annual Rates

Return on Common Equity	Retention Rate	New Stock Contribution	Change in Return on Common Equity
12.9%	.55	0	2.5%

Sustainable Growth	Non Sustainable Growth
8.2%	2.5%

Growth in Earnings Per Share
10.9%

Babcock presented a comparison of investor owned electric utilities with the figures above for the Industrial Index, and then he decomposed for the utilities the first element, the return on common equity, into six further sub-components and presented data for each. The sub-components were return on total assets, the effect of allowance for funds used in construction, the leverage effect of unfunded liabilities, the leverage effect of funded debt, the effect of income tax, and the leverage effect of preferred stock. For each sub-component, he showed the mean value over the years 1970-1978, and the trend over the nine years. For each he also showed a measure of the variation around the mean and the variation around the trend line.

The mean return on total assets was only 7.5%, with a trend of plus 1.8% per year. Allowance for funds used in construction added 1.14% to the mean and .6% to the trend, increasing the variability of the mean somewhat but decreasing the variability in the trend. The leverage effect of unfunded liabilities added another 1.17% to the mean rate of return and .7% to the trend, increasing the variability of the mean but again decreasing the variability of the trend. The leverage effect of funded debt added another 1.37% to the mean rate of return but subtracted 1.6% from the trend. Babcock pointed out that this has been the result of significant increases in interest rates paid on long term debt. This leverage effect substantially reduced the variability in the mean, and added slightly to the variability in the trend. Income taxes eliminated 30% of the mean rate of return, bringing it down to 9.7%, and reduced the trend by 1.2% a year, bringing it down to .2%. At the same time, tax effects significantly reduced the variability of the mean rate of return and also reduced the variability in the trend. The stabilizing effect of income tax was an interesting feature of the analysis. Finally, the leverage effect of preferred stock added 1.11% to the mean return, bringing it to 10.8%, and reduced the trend by .8%, bringing it to -.5%. This leverage effect increased slightly the variability in the rate of return and the trend.

Babcock's final observation was that the return on total assets for electric utilities is clearly inadequate and the trend is downward, while the contribution of funded debt and preferred stock leverage is declining.

In answer to a question with respect to the purpose of his measures of variability, Babcock referred to his article in the *Financial Analysts Journal* of January-February 1980, entitled "The Roots of Risk and Return". He suggested that these measures will help to tell a security analyst where time can be most usefully spent and the measure should also be helpful in making projections. In answer to another question, he indicated that he has not yet attempted any comparisons of individual companies or regional groups of companies using his analytical framework.

149. HOW TO MAKE THE DIVIDEND DISCOUNT MODEL REFLECT THE REAL WORLD (Fall, 1982)

A paper by James D. McWilliams was distributed.

James D. McWilliams, Vice President, Continental Bank, described the purpose of his paper as showing how the familiar dividend discount model can be modified to deal with the peculiar financial needs and preferences of an individual investor. His analysis was built around five hypothetical investors. The first, Mr. Young, anticipated a need for income and no income tax obligation for about 10 years, followed by a reduced need for income and a rising marginal tax rate. The second investor, Mr. Middle, was already in a medium tax bracket and anticipated an increase. Mr. High was at a high marginal tax rate but anticipated retirement in 10 years with a declining tax rate. The fourth investor was a pension fund with a preference for current income and the fifth was a pension fund with a preference for growth. To these investors, McWilliams offered a choice between two companies, Yieldco and Growco. Each stock was selling at $20.00, but as the names suggest the first offered a high current dividend with modest anticipated growth and the second offered a modest current dividend with high expected growth. Although the pattern of expected dividends differed between the two companies, both offered the same expected total return of 15.4%. That is, the expected dividend stream for each company when discounted at 15.4%, gave a present value equal to the $20.00 price per share. On an expected total return basis, then, the stocks appeared equally attractive.

Next, McWilliams adjusted the expected dividends for each stock for income taxes. For the two pension funds, with no taxes to pay, the expected rate of

total return remained at 15.4%. For each of the three individuals, the after-tax dividends were smaller than the before tax dividends and the after tax expected rate of total return was below 15.4%. But for all three investors, the after tax expected rate of total return was higher for Growco than for Yieldco.

McWilliams next introduced the proposition that the projected dividends might be considered uncertain, and that the uncertainty might change as one looked further into the future. He proposed a scenario in which hard times occur in years 3, 4 and 5 and good times in years 6 through 15. The model therefore should be forced to favor securities having near term cash distributions. His method of adjusting the model was to increase the discount rate for years 3, 4 and 5 and to decrease the discount rate for years 6 through 15. He presented in tabular form a picture of the effect of this adjustment that altered the anticipated total return from 15.4% to 19.4% for Yieldco and to 18.5% for Growco. Since the concept of the expected total return rate had been somewhat altered by the adjustment process, McWilliams preferred not to call the 19.4% and the 18.5% expected total returns, but to think of them in terms of utility measures or UTILS.

Having adjusted the discount rates to deal with the uncertainty profile of the expected dividends, McWilliams used the same technique to adjust for the consumption preference profile of a particular investor. During a year when dividend income was neither needed nor desired, he discounted the dividend at a high rate. During a year when the dividend was badly needed, he discounted at a low rate. The adjustment process to reflect the consumption preference profile is somewhat more complicated than the adjustment process to reflect the profile of uncertainty in the dividend receipts, and McWilliams described the mathematics. He then presented measures for each of the two stocks, now expressed in UTILS, for each of the five hypothetical investors. As one might have expected, the pension fund with a preference for current income would find Yieldco the more attractive stock while the pension fund preferring deferred income would find Growco the more attractive. And as one might have expected, Mr. Young would prefer Yieldco, while Mr. High would prefer Growco. Mr. Middle was a less obvious case, but after adjusting for both uncertainty and consumption preference, it turned out that Yieldco was somewhat more attractive than Growco.

Finally, McWilliams applied his evaluation model to a set of 48 stocks, using historical averages to estimate current dividend yields and growth rates in years 6 through 15 for each stock. He then applied the model, using the uncertainty and consumption preference adjustments for each of the 5 investors, to arrive at a set of attractive stocks and a set of unattractive stocks for each investor. The results were consistent with intuitive expectations.

150. DETERMINING THE PROFITABILITY OF AN ACQUISITION (Fall, 1978)

James McTaggart, President, Marakon Associates, described the methodology he had used at the Wells-Fargo Bank for analyzing corporate acquisitions. His talk dealt first with a structure for analyzing acquisitions, next with the question whether the acquisition boom of 1977-8 makes economic sense, and finally with a case study of a pending merger.

Two equivalent criteria for the profitability of an acquisition are: (1) that the present value of the seller (the company to be acquired) exceeds the purchase price, and (2) that the expected rate of return on the acquisition exceeds the risk-adjusted cost of equity capital. Although he was not explicit on the point, he seemed to imply that the cost of capital to be used was the cost of the seller rather than that of the buyer. In order to apply the criteria, one must first define the cash flows from the acquisition, next estimate these cash flows over time, out to an infinite horizon, and finally determine the appropriate discount rate to apply to the cash flow. The following equation describes the calculation:

$$\text{Present Value} = \sum_{t=1}^{\infty} \frac{cf_t}{(1 + k_e)^t}$$

The equation represents the sum of the present value of the cash flows (cf_t is the cash flow in the year t) discounted at the cost of equity capital k_e from the present time to infinity.

Cash flow is defined as what is left of earnings after a necessary equity plowback, and is essentially equivalent to dividends that can be taken from the acquisition.

The cost of equity capital is given by the Capital Asset Pricing Model as:

$$k_e = k_f + \beta\ (k_m - k_f)$$

Where k_f is the risk free rate, k_m is the market rate (the rate of return to be expected from stocks in general) and β is the familiar beta coefficient for the company to be acquired. The beta coefficient will be an ex ante coefficient (forward looking coefficient) if possible, otherwise it will be determined from a regression analysis of historic data.

Having described the technique of analysis, McTaggart turned to the question why it may be possible to purchase a company at less than the present value of the cash flows to be derived from that company. He suggested four reasons. The first has to do with forecasts. The buyer may simply believe that the consensus forecast of the cash flow is too low. The second reason has to do with mismanagement. The buyer may believe that improved operating or financial management will improve the cash flow. This will be particularly true when the acquisition is debt free, and the purchase can be financed with debt. A third reason may be that combining the buyer and the acquisition will lead to operating economy. Finally, a possible fourth reason has to do with the cost of capital. The buyer may believe that the risk of the acquisition will be reduced once it becomes a part of the buyer, while the risk in the buyer will not be significantly increased. It is not at all clear, however, that this fourth reason is a valid one.

Finally, McTaggart turned to a specific case, the offering of $61 dollars per share for Hanes Corporation by Consolidated Foods. Before the offer was made the stock of Hanes was selling at $37 a share, with a book value of $32.

He showed a table of historical data, Value Line Forecasts, and a second set of more optimistic forecasts that were used in projecting cash flows. From a beta of 1.05, the cost of equity capital for Hanes was established at 14%. A second table showed the present value per share of Hanes calculated for the two sets of forecasts, using 3 discount rates: 14%, 14.5%, and 15%. The acquisition appeared to be profitable only if the appropriate discount rate were as low as 14% and if the second (and optimistic) set of forecasts were the appropriate one. In this case the profit would be the difference between the calculated present value of $63.25 and the offering price of $61.00 per share, on 4.3 million shares, or $9.7 million which is about 32¢ per share of Consolidated Foods. Presumably the reason for the acquisition lay in the cash flow forecasts. There was apparently no intention to change management, no expectation of operating savings, no expectation of changes in capital structure and no reason to expect that there would be a reduction in cost of capital.

One participant pointed out that if the profitability of the acquisition is based upon superior cash flow forecasts, the profit will be realized only when investors accept the forecasts of the buyer, and discard the old consensus forecasts. McTaggart agreed, and suggested that the chief value of his analytical structure probably lies in screening out acquisitions that will not prove profitable even if investors do accept revised forecasts. Another participant asked what proportion of acquisitions examined by Wells-Fargo appeared to be profitable. McTaggart responded that probably two thirds appeared to be unprofitable.

151. PANEL DISCUSSION: ON-LINE SECURITY VALUATION MODELS (Spring, 1977)

The panelists were Arnold Bernhard, President, Arnold Bernhard & Co., Inc., and Samuel Eisenstadt, Vice President, Arnold Bernhard & Co., Inc., describing the valuation methods of The Value Line Investment Survey, William Jahnke, Vice President, Wells Fargo Bank, describing the valuation approach of Wells Fargo Bank, and William Gillard, Vice President, Kidder Peabody & Company, Inc., describing the valuation model of Kidder Peabody and Company.

Bernhard began by disputing the efficient market concept and arguing that the Value Line results contradict the contention that one cannot expect to outperform the market. He conceded that there is evidence of some degree of efficiency in the marketplace but he argued that the long-term trend of the stock market is one that the ordinary analyst can forecast. Gross National Product is a good proxy for corporate sales, so that a forecast of GNP can serve as a sales forecast. A forecast of margins will then lead to a forecast of profits.

The ability of corporations to pay dividends is an important element in the market forecast, and ability to pay dividends depends very much on inflation. Payout ratios were very low in 1976, because of the reinvestment demands exaggerated by inflation. But once earnings and dividends are adjusted for the impact of inflation, the payout ratio appears to have been fairly stable over the years at about 55%. Value Line expects 1977 adjusted earnings to break out of a 10 year plateau and therefore to carry dividends upward. So the expectation is for stock prices to rise, with the Dow Jones Industrial Index perhaps reaching 1,400. The forecast for the end of the decade is an index of 1,500 to 2,000. The Value Line portfolios are aimed at a high beta (over 1.15).

Eisenstadt continued the discussion of Value Line, with a description of the ranking of individual stocks. Four criteria go into the ranking. First is a non-parametric relative value, ranking the 1,600 stocks on the basis of relative price performance. The second criterion is earnings momentum, a function of relative growth in quarterly earnings. Third is an earnings surprise factor, based upon the difference between actual earnings and forecast earnings. And fourth, a criterion added in 1976, is an analyst judgment factor. Stocks are rated average or above or below average in

terms of expected relative price performance. The four criteria are equally weighted and rankings according to each of the four are added to give an overall ranking.

Eisenstadt referred to tabulations of the performance of the ranking system included in the January 31, 1977 Value Line Report. Assuming portfolio adjustments had been made each time ranking changes had been recorded for stocks monitored, the 1976 results showed a clear value to the ranking procedure.

Jahnke described the Wells Fargo valuation model as based essentially on two ideas: the capital asset pricing model and a dividend discount model. The first step in the valuation process is to estimate the security market line, the graph of expected return against beta for all securities. As of March 31, 1977, for example, this line was plotted as a rather flat line with an intercept (corresponding to a beta of 0) at about 10.5%, and a return of about 13% at a beta of 1.

The dividend discount model sets the current price of a stock equal to the present value of the expected stream of dividends. Analysts are asked to provide four years of forecasted dividends and an estimated growth in dividends from the fifth year in perpetuity. Dividend forecasts are based on fundamental analysis, and these, together with the current price, are used to calculate the expected rate of return. The beta coefficients are those provided by Barr Rosenberg, with a number of adjustments. A plot of expected returns and betas for individual stocks around the market line identifies the over-and undervalued stocks.

Sensitivity of over and under valuation to stock price and to projected growth rates is calculated, and a further adjustment is made to allow for liquidity differences among stocks.

The valuation model has proved successful in recent years in separating overvalued from undervalued stocks, and provides the raw material for a portfolio optimization process that was discussed later in the day by Ronald Lanstein.

Gillard described the Kidder Peabody model as one that computes a present value by discounting expected cash flows to investors. The model is applied to the market as a whole to see whether stock investments are justified. And then it is applied to individual stocks.

The model requires an estimate of normalized base earnings and an estimated growth rate in earnings per share. Gillard suggested that in a few years the use of earnings per share may disappear in stock valuation models, but that for the time being this element forms an important part of the Kidder Peabody model. The model also requires a forecast of the dividend payout rate, and all of these forecasts are extended for ten years. The analyst then selects one of three p/e multiples for the end of the ten year period, and one of three discount rates, depending on the risk perceived in the stock.

The model differs from the Wells Fargo model in that the discount rate is not derived from other forecasted variables and the current price. A discount rate is specified by an analyst as the rate required on a particular stock given the risk seen in that stock. The risk premium is a matter of judgment and changes from time to time. The rate of inflation is important in estimating this premium, as are accounting choices with respect to replacement cost and inventory profit adjustments.

The performance results of the model have been good, with the stocks consistently overvalued trailing the market from late 1974 to early 1977 by about 50%, and the stocks consistently undervalued beating the market by about 50%.

During a question period, Gillard reiterated his expectation that there will be a shift away from concern with stated earnings per share in the use of valuation models. Jahnke conceded that it is difficult to evaluate analysts' forecasts, saying that Wells Fargo does not have an evaluation system but that a committee of senior analysts does examine analyst's forecasts carefully. Eisenstadt said that the Value Line model seems to have correctly ranked stocks through both bull and bear markets, but that the data are not available to prove that the model copes satisfactorily with market swings. He said Value Line does not have evidence on the performances achieved by clients, although simulated portfolio performances indicate returns of 8 to 10% above the market rate of return, after allowing for commissions.

152. ANALYZING GROWTH STOCK MODELS (Spring, 1977)

David Fewings distributed a paper: "Growth Models of Investment Value: Review and Extensions."

David R. Fewings, Assistant Professor of Finance, McGill University, described a growth model following the work of Gordon, and Miller and Modigliani, derived essentially from early proposals of John Burr Williams.

He turned next to the relationship between corporate growth and risk to investors. After describing the theory, he reported the results of empirical testing, relating beta, as a measure of market risk, to

other variables. For a sample of 325 firms for 1966-75, he regressed market beta on earnings betas, debt/equity ratios, proportion of retained earnings to total equity financing, average return on common equity, expected growth in dividends and earnings, and historical growth in both equity value and total assets. The market beta was found to be positively correlated with the earnings beta and with the debt/equity ratio, and negatively correlated with the retained earnings portion of equity financing. All of these results were to be expected. A negative correlation with average return on common equity was harder to understand. Fewings' explanation was that industries with restricted entry may be demonstrating simultaneously a low beta and a high return on common equity.

The correlation with expected growth in dividends, and historic growth in equity and in total assets was positive, which was to be expected.

Next, Robert Hamada, Associate Professor of Finance, University of Chicago, dealt with the concept "growth stock," and established precise definitions of growth firms and growth stocks.

He defined a growth firm as one expected to earn on new projects, sometime in the future, a rate of return greater than the discount rate demanded by investors in its common stock. Put another way, the firm is expected to take on investments in real assets with positive net present values. This expectation in turn demands a belief in the inefficiency in the market in real assets. Hamada suggested that it would be unrealistic to expect such inefficiencies to persist indefinitely.

Expected growth in earnings does not necessarily indicate a growth stock. A firm may cause earnings to grow by investing in projects with a zero net present value. As Hamada's equations showed, the value of the earnings growth to the stockholders would be zero. He also demonstrated that growth in earnings per share need not provide any opportunity to shareholders. This growth can be achieved through manipulation of dividends that is of no value to shareholders. Similarly, stockholders may be fooled by an increase in the proportion of debt in the firm's capital structure, or by investment in higher risk projects to increase the firm's rate of return and lead to a higher expected rate of return on the part of shareholders, accompanied, however, by a corresponding increase in risk. The price/earnings ratio alone may be misleading without a careful check on the dividend policy, the debt ratio, and the riskiness of investments made by the firm.

153. PANEL DISCUSSION: INTEGRATING VALUATION MODEL OUTPUT INTO THE INVESTMENT PROCESS (Spring, 1977)

Charles Blood distributed a paper: "Maintaining Portfolio Manager Motivation Within a System of Quantitative Controls" and Ronald Lanstein distributed "Portfolio Composition–History at Wells Fargo."

The panelists were Charles Blood, Assistant Vice President, Marine Midland Bank, Ronald Lanstein, Vice President, Wells Fargo Bank, and John Nagorniak, Director of Computer Applications, John Hancock Mutual Life Insurance Company, discussing the implementation of valuation mdels in the portfolio management operations at Marine Midland Bank, Wells Fargo Bank, and John Hancock Mutual Life Insurance Company.

Blood described portfolio management at Marine Midland as differing somewhat from portfolio management at Wells Fargo in that at Marine Midland the portfolio manager serves essentially as both analyst and forecaster, whereas at Wells Fargo portfolio managers rely on analysts to do stock valuation.

Managers at Marine Midland have gradually but willingly accepted the Capital Asset Pricing Model, and generally agree with the concept of an efficient market. The security universe consists of about 250 companies classified into about 40 industries. The industries are scored on a scale from 1 to 5 based on expected 12 month returns relative to the general market. Each company is then scored on a scale of 1 to 5 based on its expected 12 month return within its own industry. The scoring is based upon a model developed by Canavest House Limited.

There are currently five equity portfolio managers making use of these ratings. Marine Midland faced a choice of three alternative procedures. The managers could be left to use the rating model independently and manage their portfolios accordingly, or one manager could be designated to use the model and provide scores for the other managers to use in running their portfolios, or the managers might produce a group consensus which would be used for all of the portfolios. The principal value of the third alternative, which Marine Midland has adopted, is that there is consistent performance among portfolios–something that appeals to clients–and a high degree of job satisfaction among the managers.

Prior to a group session each manager does his own scoring and these scores are preserved. Blood commented that having to review the entire list of 250

stocks is good discipline for a manager, who would otherwise probably restrict himself to a private list of 50 to 100 names.

Lanstein described the portfolio management operation at Wells Fargo as beginning with the security valuation model described earlier by William Jahnke. Analysts are responsible for ranking 343 stocks, and provide expected rates of return and betas for each stock. The portfolio manager is responsible for identifying client goals and risk tolerance. He works with the results of the valuation models and with a policy guidance statement. For each class of portfolios a beta target is specified, which depends upon the perceived slope in the capital market line. If this slope is small, the target betas will tend to be low since the reward for taking greater beta risk appears to be small.

Diversification among industry groups is established in the policy guidance statement as are limits on the holdings of any individual security, and limits on transaction sizes and transaction costs.

A quadratic programming code, reflecting essentially the Markowitz Portfolio Selection Model, has been found useful for major portfolio changes, especially those involved in taking over a portfolio from another manager. The model includes constraints reflecting the directives in the policy guidance statement.

Nagorniak began with some history on the use of portfolio optimization techniques at John Hancock. In September 1974 a Markowitz Portfolio Selection Model was first put in use, operating on a universe made up of all stocks held. The initial objective was to closely track the S & P 500 index. The portfolio beta was to equal 1, and residual variance was to be minimized. At the same time, a number of quantitative security valuation systems were being developed and tested, and this activity continues today. The valuation systems that seemed successful were used to provide quantitative computerized input to the portfolio optimization model.

Nagorniak closed with a suggestion that the use of valuation and portfolio models requires a definition of both objectives and results in quantitative terms, and careful measurement of the success of the input estimates. He commented that most of the problems encountered have to do with human engineering.

During the discussion Nagorniak was asked how an institution might decide between equal dollar weighting and market value weighting. He answered that if illiquid stocks seem to offer very high rates of return, then equal dollar weighting will be appropriate. In answer to a question about valuation methods that had been found inadequate and discarded, Nagorniak answered that no valuation method seemed to work at all times. He recommended the use of several valuation models, no one of which will always be satisfactory but which in the aggregate will provide satisfactory results over time. Blood added the comment that different sources of information are of value at different times. For example, sometimes insider transactions prove helpful and at other times relative strength estimates are useful. Nagorniak was asked whether John Hancock had adopted models that were particularly hard to explain to the users. He answered that no problems had been encountered, but that some possible models had not been introduced simply because they were very technical and hard to understand.

STOCK VALUATION–SECURITY ANALYSIS

154. EARNINGS EXPECTATIONS: ACCURACY AND DIAGNOSIS OF ERRORS (Spring, 1982)

A paper was distributed, entitled "Professional Expectations: Accuracy and Diagnosis of Errors," by Edwin J. Elton, Martin J. Gruber, and Mustafa Gultekin.

To begin their presentation, Edwin J. Elton, Professor of Finance and Martin J. Gruber, Professor of Finance, Graduate School of Business Administration, New York University, distributed a short questionnaire designed to test the intuition of the conference participants on the subject of the nature and extent of analysts' errors in forecasting earnings per share and growth rates in earnings per share. In the course of their presentation, they referred back to this questionnaire and revealed the extent to which the conclusions of their research coincided with the judgments the participants had reached.

Gruber reviewed briefly an earlier paper he and Elton had presented at the Spring, 1979, seminar of the Q Group, dealing with the value of consensus earnings forecasts by analysts. That presentation, which had been supported by a grant from the IQRF, was published in *Management Science*, September, 1981, under the title "Expectations and Share Prices." In that earlier work Elton and Gruber had found that consensus forecasts are already impounded in stock prices, so that one cannot achieve superior investment performance by basing a portfolio on consensus earnings forecasts. The possession of accurate forecasts, as contrasted with consensus forecasts, would have led to superior performance. But an accurate forecast of the consensus itself, at some future point, would have led to even better performance.

Having established the value and proper use of consensus forecasts, Elton and Gruber had then turned to examine some of the properties of a consensus earnings forecast, and their conclusions were the subject of this presentation. The practical benefits of this most recent research lie to some extent in guidance for the better use of consensus forecasts in stock selection, and to some extent in guidance toward better management of a staff of security analysts.

The presentation was divided into four topics, and Elton began with the first: The Size and Time Pattern of Analysts' Earnings Forecasting Errors. He described the IBES database that had been used, covering earnings forecasts for 1976, 1977 and 1978, and reduction of the sample to a set of data for 414 corporations, for thirty-six months of forecasts. He went on to describe the measures of errors the two authors had chosen for the consensus forecast, and then turned to the first clearly interesting result. The average absolute dollar error in the forecasted earnings per share was predictably greater twelve months before the beginning of the year in question than only one month before, but what was perhaps surprising was that this error dropped at a fairly uniform rate over the intervening months, and that this rate was very nearly the same for all three years studied. In answer to a question from a participant, Elron commented that the release of quarterly earnings figures by the corporations in question did not seem to have any impact on the steady improvement in earnings forecasts through the year.

Martin Gruber picked up with the second topic: The Components of Earnings Estimate Errors. Errors had been decomposed into those due to faulty forecasting of the economy, those due to faulty industry forecasting, and those due to errors peculiar to company factors. It turned out that the economy component was very small, on the order of 2 to 3 percent of the total error. The industry component of the error constituted some 25 to 35 percent of the total. Gruber next introduced a different form of decomposition: into bias, inefficiency and random error. After explaining the methodology of this decomposition, he pointed out that they had found very little bias error, and very little inefficiency error with respect to the forecasts of dollar earnings, but a little more inefficiency error with respect to growth forecasts. It appeared that analysts in general tend to overestimate growth in high-growth situations and to underestimate it in low-growth cases.

Gruber turned next to the third topic: Persistence of Errors in Estimating the Earnings of a Particular Company, over Time. The point here was to uncover evidence of persistent errors over the three years. The conclusion reached was that firms for which analysts prepare poor forecasts in one year tend to be the same firms for which they deliver poor forecasts in the subsequent year.

Finally, Gruber discussed the fourth topic: Divergence of Analyst Opinion. Divergence was measured by the standard deviation across the individual earnings forecasts for a particular company in a particular month. The two authors found that the degree of divergence was consistently related to industry classification. They also found that a high divergence of analysts' estimates accompanied large errors in the accuracy of the consensus forecast. Unfortunately, the coefficient relating forecast error to analysts' divergence were quite unstable, so that one cannot easily translate the known degree of divergence into a measure of the forecast error.

Ned Elton concluded the presentation with a brief

discussion of what the two authors proposed to do next. They will be investigating the matter of identifying the companies for which the earnings forecast errors will be largest, and they will be trying to predict changes in analyst estimates, and therefore changes in the consensus.

In answer to questions from two participants, the speakers agreed that their finding that errors in forecasts of the economy were quite small might be related to the particular years of data they had chosen. In answer to another question, they said they had not attempted to determine whether forecast errors for a company in one year might be a predictor of error in the next year. This is something they may undertake in their next research.

155. CONSENSUS ANALYST OPINION: AN INITIAL REVIEW (Spring, 1982)

Lawrence G. Tint distributed a paper entitled "Consensus Analyst Opinions: An Initial Review."

Lawrence G. Tint, Vice President and Director of the Fundamental Research Division, Wilshire Associates, described a research recommendation monitoring system that was first offered to clients of Wilshire Associates in early 1981. Fourteen charter subscribers provided (generally weekly) analysts' recommendations on common stocks. The subscribers, all "buy side" organizations, were given an analysis of the effectiveness of their analysts' opinions, a consensus opinion for each security based on the recommendations of all fourteen subscribers, and a comparison of the performances of the subscribers' recommendations with consensus recommendations. Tint's paper reported an analysis of the consensus forecasts for 1981.

The analyst recommendations were supplied to Wilshire Associates in a variety of forms. Wilshire converted these recommendations to a one-to-five rating, with one characterizing a strong buy, and five characterizing a strong sell recommendation. For each of the 253 trading days in 1981, the average ratings for approximately four hundred stocks were calculated. The stocks were ranked by this average rating, and divided into deciles. For each decile, for each trading day, the average return for the stocks in the decile was calculated and from it was subtracted the average return for all of the stocks on that day. The result was a measure of the excess of the return for the decile above the average for the entire group of stocks. This excess return was calculated for each trading day in the year. Next, a cumulative excess performance index was calculated, which displayed the cumulative return pattern for stocks in a particular decile, for all of the trading days before and after the registering of the opinion which placed them in that decile. This cumulative performance was then displaved in graphical form.

Tint began with a graph for the tenth decile, the strongest sell recommendations, including only ratings based on six or more observations. The performance record for the 126 days preceding the opinion date showed a steadily rising cumulative excess return, while the record for the 126 days following the opinion day showed a fairly steadily declining cumulative excess return. The picture then was one of stocks being classified as sell candidates after they had shown extraordinary excess returns, following which they significantly underperformed the average. This was consistent with accurate classification of the stock by the subscriber analysts. In fact all five negatively rated deciles showed negative excess returns for six months after the opinion date, and all of the top five deciles showed positive excess returns over the next six months. The first and second deciles, however, showed less impressive performances than the third and fourth. Indeed, the third and fourth, and the seventh and eighth deciles gave the strongest indication of accurate analyst ratings. Tint suggested that the first and second, and ninth and tenth deciles probably contained stocks with fewer opinions that stocks in the middle decile, and that extreme ratings by only a few organizations will have less market impact than moderate ratings by more organizations. Tint reported that an equal weighted portfolio, constructed from the stocks ranked in the top half as of January 1, 1981, would have returned 4.8 percent during 1981, while an equally-weighted portfolio of the bottom stocks would have returned –8.7 percent. This 13.5 percent spread would have increased to 19.8 percent with a rebalancing at midyear. The evidence so far then was that the recommendations of the participating analysts had substantial predictive value.

Next, Tint reported analysis based not on absolute ratings of stocks on a daily basis, but on changes of ratings. As one might have predicted, high excess returns generally led to a downward change in a stock's rating, and substantial negative excess returns generally led to an increase in rating. But there was no distinct pattern in price performance following the date on which the ratings changed. Rating changes simply did not have the predictive value that the level of ratings had shown.

Tint's overall conclusion was that what his research had disclosed was not simply predictive ability on the part of the analysts, but a market impact resulting

from the recommendations. In other words, he concluded that analysts were influencing the movement in stock prices, rather than merely predicting that movement.

In answer to a question, he commented that the average rating for a stock changed infrequently. His best estimate was that probably 80 percent to 90 percent of the stocks in a decile are still there after three months.

156. EXPECTATION DATA AND STOCK RETURNS (Spring, 1979)

Edwin J. Elton and Martin J. Gruber, Professors of Finance, Graduate School of Business Administration, New York University, presented a paper dealing with earnings forecasts, and the use of forecasting ability to beat the market. The study on which their conclusions were based was unusual because it made use of actual earnings forecasts. The data came from a computer data base constructed by Lynch Jones and Ryan containing one and two year average earnings estimates on all corporations followed by one or more analysts representing virtually all major brokerage firms. Elton and Gruber made use of one year forecasts for 1973, 1974, and 1975, and two year forecasts for 1974, 1975, and 1976. They used only average earnings forecasts based upon the estimates of three or more analysts and referred to these averages as "consensus" forecasts. And they used only March and September forecasts for each year. Their reasoning was that the March forecast probably represents the first forecast for a year after the previous year's results have been published, and the September revised forecast for the year is probably in most cases based on published six month results. Their procedure then was to treat the March forecast as the initial forecast and the September forecast as the revised forecast.

First they tested the proposition that market prices incorporate consensus earnings forecasts, and that investment strategy based upon the consensus forecast can only achieve average results. They ranked all of the stocks by consensus forecasted earning growth. They then divided the stocks into ten deciles, formed portfolios of each decile, and calculated the rate of return for each of these portfolios for each of the twenty-four months following the forecast month. These rates of return were the "actual returns". "Normal returns" were calculated from the market return and the average betas for the portfolios. The difference between the actual and normal return for a decile is the "excess return". If consensus forecasts of earnings growth were a guide to stock market profits, the highest growth decile would have produced an excess return, and the lowest growth decile would have produced a negative excess return. It turned out that the calculated excess returns showed no discernible pattern. Apparently the consensus earnings growth forecasts were fully incorporated in the stock prices, and these consensus forecasts could not be used to achieve excess returns.

Next the stocks were ranked by actual earnings growth, rather than forecasted earnings growth, and the preceding procedure was repeated. This time there was a clear pattern and the stocks with high actual earnings growth achieved excess returns. An investor who had correctly predicted earnings growth, rather than relying on consensus forecasts, could have beaten the market.

A third ranking used the error in the consensus forecasts, that is the difference between actual growth and consensus forecast growth, for ranking the stocks. This time the excess returns pattern was even more evident. In other words, an investor who could have accurately predicted the error in the consensus forecast (which would have required both accurate forecasting and a knowledge of the consensus forecasts) would have done better than an investor who was simply able to make accurate forecasts.

Finally, a fourth ranking was done, this time based upon the revision in the earnings forecasts in September. The revision in the earnings forecast for a particular company was the difference between the September forecast and the forecast of the previous March. This time the excess returns were even greater. An investor who could have accurately predicted the revision in the earnings forecasts would have done even better than the investor who accurately predicted the original forecast error.

Elton and Gruber discussed the implications of these findings, and drew the following conclusions:

(1) The study gives support to a belief that expectations determine market prices. It is more important to anticipate changes in expectations with respect to earnings than it is to accurately forecast earnings.

(2) Forecasts must be judged relative to consensus expectations. In order to decide the value of an analyst's work, we must judge his forecasts against the consensus, not simply against actual earnings.

(3) Performance can be improved through forecasts that are more accurate than the consensus. But profits cannot be made by simply following the consensus.

In answer to a question, Gruber said they had not

made use of the variation of analysts' forecasts around the average, but hoped in future work to do something with it.

157. INSIDER TRADING INFORMATION AND SUPERIOR PORTFOLIO PERFORMANCE (Spring, 1978)

Charles H. DuBois, Manager, Management Information Systems, R. H. Macy & Company, described the results of a stock selection technique based upon analysis of insider trading reports filed with the Securities and Exchange Commission. He provided a list of seven other studies on the use of insider trading reports, and noted that all seven had found that insider trading information led to improved investment performance. He tabulated the characteristics of those other studies, and compared them with his own. His analysis covered the years 1972 through 1977. He worked with a universe of 260 common stocks, all of them appropriate for institutional portfolios. His procedure was to rank the stocks in order of their attractiveness, on the basis of the insider trading record. Each ranking made use of six months history of insider trading, reflected in the reports that would actually have been available to an investor when the ranking was done. The test then, was on the value of insider trading reports to investors, not on the success of the insider trading itself.

From each report, DuBois tabulated for each of his stocks the number of insiders who had bought, and the number who had sold. He then doubled the number who had bought, because he believed purchases to be more indicative than sales, of the use of inside information. In order to adjust for risk and the movement of the market as a whole, DuBois divided his stocks among the four groups that had been suggested by earlier research of Jim Farrell–growth, cyclical, stable, and oil stocks. He examined the growth and cyclical stocks separately, and also tested a 60 stock portfolio within which each group was weighted just as it is weighted in the S&P 500 index.

The analysis included 100 growth stocks. These were ranked from 0 to 100 ("best buy" to "worst buy" on the basis of the insider reports), and split into five sub-groups containing the top ten, the next 20, the middle 40, the next 20, and the bottom 10. The performance of each of these sub-groups was tracked for one year. The analysis was conducted for 11 starting points, at quarterly intervals from January 1973 through July 1975. In general, each subgroup outperformed the succeeding sub-groups, and the combination of sub-groups 1 and 2 almost always outperformed the combination of sub-groups 4 and 5. That is, the top rated 30% of the group almost always outperformed the bottom rated 30%.

The same analysis was performed on 80 cyclical stocks, and the results were similar. The results for both the growth and cyclical stocks were confirmed by the calculation of 12 month "alphas," using as a reference "market" the 100 stocks for the growth group, and the 80 stocks for the cyclical group.

Finally, DuBois reported the results of a simulated "insider" portfolio. This portfolio consisted of 60 stocks, 21 of them growth, 16 of them cyclical, 15 stable and 8 oil. These weights corresponded to the weights of the groups in the S&P 500 index. The portfolio was established as of September 1973, and was rebalanced at quarterly intervals, reflecting the most recent six months of insider trading history at each rebalancing date. Over a three-year period, this "insider" portfolio, after allowance for a management fee, and a transaction cost of 1.5% (one way), would have significantly outperformed the S&P 500 index.

DuBois went on to consider insider trading as a guide to "group" selection rather than stock selection. As of September 1973, for example, the insider reports ranked cyclical stocks highest, with stable stocks next, oil stocks next, and growth stocks last. By September 1977, stable stocks ranked highest, with growth and cyclical stocks tied for second place, and oil stocks last.

Some questions were asked about the average statistics DuBois had calculated and the use of unweighted and market value weighted comparisons. Jim Farrell commented that the 260 stock universe with which DuBois had worked, both equal weighted and market value weighted, had underperformed the S&P 500 index over the time period for the analysis. In response to other questions, DuBois suggested some further refinements that could be tested. For example, it might be worth trying to pick up changes over time in the pattern of insider trading in a company, basing an investment decision not on the relative number of buys and sells but on changes in the relationship.

158. OPTIMAL USE OF LOW QUALITY INFORMATION (Fall, 1977)

Keith Ambachtsheer distributed a paper: "On the Optimal Use of Limited Quality Predictions."

Keith Ambachtsheer, Vice President for Research, Canavest House Limited, had discussed this topic briefly at the IQRF meeting in the Spring of 1976, at

the meeting in the Fall, at West Point. Those earlier presentations had dealt with proposed techniques for using small but positive ability to select superior stocks, and had illustrated the techniques through simulations. At this session, Ambachtsheer reported tests of the technique, using actual stock evaluations.

He began with a review of the choice the owner of a portfolio faces, between active and passive management. Passive management generally offers low management fees, low transactions costs, and low specific risk (that is, a high degree of diversification). Active management can only be justified on the grounds that its superior investment results will more than offset the advantages of passive management. In prior presentations, Ambachtsheer had introduced his information coefficient, a measure of the success of an analyst or an organization in selecting superior stocks. A coefficient of 0 represents no ability, while a coefficient of 1.0 represents perfect forecasting ability. James L. Farrell, Jr., Vice President, Citibank, N.A., who had worked with Ambachtsheer in applications of the technique, commented that there had been evidence for some time of institutions for which the IC (information coefficient) was on the order of .15. Brealey and Hodges had demonstrated that appropriate portfolio selection techniques can convert an IC of .15 into an extra 2% investment return a year.

Ambachtsheer explained that if one could combine security analysis from two sources, each of which has an IC greater than 0, and if these two sources are independent, then the IC for the combination is given by

$$IC_{combination} = \sqrt{IC_1^2 + IC_2^2}$$

This expression requires that the advice from the two sources be weighted in proportion to the ICs themselves. In the specific example reported by Ambachtsheer, one source of advice was Wells Fargo (following essentially a dividend discount approach), and the other source was Value Line (following essentially a relative value-momentum approach). The IC for each source had been measured for six half-years. The average for Wells Fargo was .135, and the average for Value Line was .067. So recommendations from the two sources were combined, weighting the Wells Fargo recommendations twice as heavily as the Value Line recommendations. It turned out that on this basis, the IC for the combination, for the six half-year period, was almost exactly the figure given by the equation above.

For the test, portfolios were constructed using the Dividend Discount approach, the Relative Value method, and the combined judgments. Portfolios were selected on the assumption that the ICs for the three were respectively, .15, and .075, and .17. Each portfolio contained 60 stocks, drawn from a universe of 200 stocks. Each portfolio was constrained to have a beta of 1.0. The portfolios were set up in September 1973, with four sectors–growth, cyclical, stable, and oil–weighted as these sectors are weighted in the S&P 500 Index. Within each sector, stocks were equally weighted. No stock was allowed to carry more than a 3% overall weight.

The portfolios were carried through three years, with the sector weightings unchanged, but with revisions within each sector, based upon the Dividend Discount, Relative Value, and combined judgments. The performance results, with comparative statistics, are shown in the following table, from Ambachtsheer's paper:

Three Year Results

	Annualized ROR (after TA cost, Mgt. fee)
Top Becker Fund	11.9%
DD + RVM Fund	11.0%
DD Fund	10.0%
RVM Fund	4.4%
SP500 Index	3.8%
Starting "Neutral" Fund	2.7%
20th Percentile Becker Fund	0.8%
50th Percentile Becker Fund	-2.9%
80th percentile Becker Fund	-5.6%
Bottom Becker Fund	-16.1%

In calculating the performances of the three portfolios, management fees of 2/3% per year were deducted. In fact, this may bias the comparison against the three portfolios, since in general the reported results for Becker Funds are not net of management fees. All buy-sell transactions for the three portfolios were assumed to carry a 3% round trip transaction cost. Turnover was in the range of 30% to 50% per year, with about 7% of this accounted for by semi-annual rebalancing.

The performance results looked quite impressive. Ambachtsheer commented that they were the result of positive ability to select superior performing stocks, and it is here that the "slippage" so often occurs, that leads to inferior portfolio performances, despite superior analysis. Ambachtsheer suggested that slippage is not a technical, but an organizational problem, and that future seminars of the Institute might explore organizational problems.

Farrell concluded the presentation, pointing out that what had been tested was a combination of three

simple concepts. valuation models, the idea of the information coefficient and combining information coefficients, and construction of portfolios with homogeneous stock groups, with unchanging weights for the groups. He said that although the performance record looked very encouraging, and the degree of diversification of the portfolios was very high, some further testing was necessary, using monthly data, to be quite sure about the risk levels of the three portfolios.

159. DOES THE FASB'S CONCEPTUAL FRAMEWORK MEET THE NEEDS OF THE OUTSIDE USER? (Spring, 1977)

William A. Beaver, Professor of Accounting, Graduate School of Business, Stanford University, opened the Seminar with a discussion of the Conceptual Framework Project of the Financial Accounting Standards Board. His theme was essentially the future of acrrual accounting and the reporting of "true" earnings.

Beaver identified the three most important aspects of the Conceptual Framework Project as first, establishing the objectives to be served by financial statements, second, endorsing accrual accounting, and third, giving explicit recognition to research on efficient securities markets, portfolio theory and capital asset pricing theory.

With respect to the objectives of financial statements, the FASB has taken the position that these should serve the needs of present and future investors in a company, as well as present and future creditors. This position goes a good deal beyond the traditional professional accountant's concept of financial statements serving essentially as a report on management's stewardship. Implicit in the FASB Statement is a suggestion that the financial statements should include future oriented information and current value information.

With respect to the second point, endorsement of accrual accounting and correct earnings measurement, it is not clear how the FASB reached its conclusions. Why is the measurement of net income important? So far as investors are concerned, if the net earnings figure is useful, it is useful as a measure of the change in the value of an enterprise. But the financial analyst's discounted cash flow model can be applied to projected future flows to compute a present value. The change in present value from year to year would then provide a net income figure. The discounted cash flow approach gives the investor and creditor all the information needed, without accountants worrying about the development of net income figures.

On the third issue, modern financial theory, Beaver began by noting that there is a strong paternalistic element in the FASB position that seems to say disclosure alone is not enough: the average investor needs to be assisted in interpreting what is disclosed. But there are 16 thousand analysts whose profession includes performing this interpretation. If the investor decides not to use the services of analysts, Beaver questioned why he was entitled to the services of accountants, probably financed by all investors, including those who do make use of analysts. And in any case, if the securities market is efficient, even the investor who does not make direct use of analysts' services gets the benefits of their analysis.

In summary, Beaver expressed the opinion that the FASB had failed to reconcile contradictions among the three aspects of its Conceptual Framework, and to identify the social choice process implicit in its recommendations: the choice as to whom the accountant is to serve.

Turning to the role of security analysts, Beaver suggested that this group was seeing its traditional activities taken over by accountants through the process of income determination. The analyst profession is ultimately at the mercy of the SEC, which could put analysts out of business by strict regulation of corporate disclosure, including a prohibition on private discussions between management and analysts. Analysts could seek to persuade the SEC to improve public disclosure and give analysts more to work with. But if performing a valuable service to clients requires the analyst to uncover information that is not publicly available, then analysts may have good reason to oppose greater public disclosure.

David Baker, of Drexel Burnham, urged analysts to assist the three-man subcommittee that has been appointed to address the FASB Project, and to pass on to him their suggestions. He saw the key issue as the question whether the social choice issues would be resolved by a public or a private agency. And he hoped that the issues could be settled within the Conceptual Framework Project.

John Barry suggested that the interests of investors are not the same as the interests of creditors, and Beaver agreed, saying that once again we were back to a matter of social choice, and a reconciliation of different costs and benefits to the two parties in the accounting analysis of specific items.

160. PANEL DISCUSSION: VALUING THE GENERAL MARKET (Spring, 1977)

David Nicholson distributed a paper: "Adaptive Stock Market Forecasting in a Dynamic Non-Stationary Capital Asset Environment," Richard Katz distributed "Time Quartile Analysis: A Forecasting Technique," reprinted from the Journal of Portfolio Management; and Timothy Dalton distributed "Liquidity and Stock Prices."

The three participants on this panel, David J.S. Nicholson, Executive Vice President and Director, MacKay-Shields Financial Corporation, Richard C. Katz, Senior Vice President, The Boston Company and Timothy Dalton, Jr., Vice President, Oppenheimer Capital Corporation, discussed the approaches of their firms to the problem of stock market timing. All three made use to some extent of economic indicators.

Nicholson made the point that it is not so much objective economic or market conditions that matter, but rather the perceptions, correct or not, of investors, and particularly investors' perceptions of what other investors perceive. So the objective at MacKay-Shields is to try to identify the basis for a model that will forecast perceived values.

Nicholson identified a number of economic indicators generally used as the basis for a stock market forecast. One is a forecast of GNP, a variable that unfortunately lags the stock market. Leading economic indicators also lag the stock market. The money supply does not seem to account for market swings, and reported profits before tax constitute a coincident rather than a leading indicator of the market. Stock prices and profits, price/earnings ratios for the Dow Jones Industrials and the S&P 500, and inflation and stock market trends are further variables that do not seem to have high predictive value. Bond yields and short term interest rates do have value, and a downward sloping yield curve has proved to be a signal for the sale of stocks. A comparison of stock earnings yields with bond yields, the percentage of market activity for individuals and institutional investors on the New York Stock Exchange, net purchases of common stocks by financial institutions and foreigners, net institutional purchases of stocks and bonds, corporate sources and uses of funds, the movement of the Dow Jones Industrial average, the S&P 500 index, and the Value Line unweighted average, and price/earnings ratios for market indexes, including indexes for individual industries, are other indicators used in the forecasting process.

Katz described forecasting at the Boston Company as narrower in scope than what Nicholson had described for MacKay-Shields. The Boston Company forecasts are aimed primarily at identifying the cyclical position of the market. Not much effort is made to forecast long-term and short-term changes. The analysis divides bull markets into quartiles and attempts to identify economic indicators that will tell us in which quartile of a bull market we find ourselves. Since 1953, the average duration of bull markets has been 31 months, so that quartiles have been almost 8 months long, ranging from 3½ months to 11 months. Identification of quartiles is valuable, since nearly half of the total gain that takes place in a bull market tends to occur before the end of the first time quartile, about the time the cyclical economic trough is reached. The percentage gain from the peak reached in the third quartile until the cyclical market peak has always been less than 10%.

Katz referred to the quit rate in manufacturing—the rate at which employees voluntarily leave their jobs—as a useful indicator in identifying quartiles of the market cycle. This rate appears to turn in the first quartile of a bull market, and reaches the level of the preceding year in the third or perhaps the fourth quartile. The peak rate of increase usually occurs in the fourth quartile or after the market has peaked. So a single economic time series can be used in different ways to identify stock market quartiles.

The Boston Company makes use of other indicators, including interest rates and liquidity measures, but most offer very imprecise signals. And some, including peaks in economic growth, give their signals much too late to be of value in market forecasting.

Dalton described the forecasting by Oppenheimer Capital Corporation as based primarily on financial liquidity as an indicator. Earnings and profits, while important to the long-run movement of stock prices seem to have little to do with the cyclical behavior of prices and are quite misleading as indicators of the stock market cycle.

The single best measure of liquidity is M2 (currency plus demand deposits plus time deposits) as a percent of GNP. A time series of this measure has worked quite well in signaling market changes.

An alternative measure useful in evaluating liquidity is the change in cash balances deduced from sources and uses of funds in the economy. The money supply and the sources and uses analysis used together make a particularly useful combination of signals.

In answer to a question about the quartile approach, Katz conceded that assuming the business cycle trough coincides with the end of the first quartile of a bull market, and multiplying by 3 to

find the end of the bull market, would have led to an error of 6 to 8 months in estimating the end of the last bull market. Nicholson was asked whether short-term fluctuations in the market, which are very difficult to predict, cause difficulties while one is waiting for an intermediate term forecast to be realized. Nicholson agreed that short-term forecasting is generally not successful but said that short-term fluctuations were not a problem and did not interfere with intermediate term forecasting. A question was asked about the article by Bill Sharpe in the Financial Analysts Journal, indicating that very high accuracy in market forecasting is necessary to make the forecasting worthwhile. Jim Farrell reminded the group that Keith Ambachtsheer had dealt with this issue at two previous seminars, and had shown that if properly used, market forecasts of much lesser quality could be valuable. A question was raised whether practice at market forecasting and improvements in skill may lead to a decline in the advantages accruing to those who are successful and to smaller swings in the market. Both Katz and Dalton expressed the opinion that this was not likely to happen. Dalton said that market timers are using different techniques and those with the same techniques tend to read the data differently. Arnold Bernhard commented on the observation by Dalton that earnings and profits are a misleading cyclical indicator. He agreed that earnings are not a useful indicator, but argued that when they are adjusted for inflation effects, the real earnings are quite well correlated with stock prices.

161. SECURITY ANALYSIS: THE CHANGING DIMENSIONS (Fall, 1976)

This presentation was one of three offered under the heading, "Organizing for Performance." The other two were "Optimal Use of Security Analysis in Managing Stock Portfolios" and "Incorporating the Quantification of Uncertainty into Asset/Liability and Foreign Exchange Decision Making."

Sidney Cottle, Managing Director, Financial Research and Systems Associates, began with the proposition that security analysis will assume a more important role in the future than it has had in the past. To the extent that securities markets are indeed efficient, then the task of achieving superior performance will demand more then ever from the security analyst. He proposed three major changes in the way in which security analysis is carried out. One will be increased tailoring of security analysis to the investment policy or decision-making process of an institution. Another change will call for greater emphasis on forecasting long term growth rates in earnings and dividends. And a third change will lead to estimates of uncertainty to accompany the traditional point forecast made by analysts.

The purpose of security analysis is to serve portfolio management, as one of three parts of fundamental analysis. The other two are economic analysis and capital market analysis. The process of making investment decisions must begin with the setting of long term objectives and a strategy to translate these objectives into a portfolio. (The strategy will include an asset allocation decision and a decision as to quality of security holdings.) Until these two steps have been completed analytic work cannot begin, because they determine the form the analysis should take.

The purpose of the security analysis is to help implement the investment strategy, and to help achieve the appropriate level of risk. The analyst's job is to try to help the portfolio manager assemble the securities that will achieve predetermined objectives for the portfolio. Cottle suggested that the discussion of the case on the preceding afternoon had emphasized the need for orderly disciplined decision making. And he pointed out that the samples of analytic work that appeared in that case demonstrated a failure on the part of the analyst to help achieve a set of portfolio objectives.

Once the objectives and strategy have been set, and economic projections made, then it is time to make earnings, multiplier and valuation estimates, to examine industries and companies, and to select particular issues for a portfolio.

While short-term earnings forecasts have a value, the market is sensitive to long-term growth expectations and both the expectations themselves and the degree to which investors rely on these expectations will change. Analysts will have to give increasing emphasis to these long-run forecasts.

Modern portfolio theory leads to the setting of investment objectives in terms of return and risk. And risk management will probably become more important in the future. This calls for estimates on the part of security analysts of market and unique risk, as well as returns for individual stocks. Forecasts of unique risks seem to present great difficulty. Some organizations have become discouraged with their attempts at it, and a good many analysts still do not like attaching uncertainty to their forecasts. This will have to change.

Part of the discussion among the participants concerned the question which aspects of security analysis offer the greatest payoff, and which offer the least. One suggestion was that there is little payoff in attempting to achieve earnings forecasts that are

better than consensus forecasts. If the expenditure of time and effort cannot significantly improve on the consensus forecast, we may be better off concentrating on the mechanism by which earnings forecasts are translated into prices. There was some disagreement about the value of attempting to improve on earnings forecasts, and it was argued that in some cases long run forecasts are almost impossible to make because they are highly dependent on unpredictable technological changes. Cottle conceded that high technology companies present serious problems, but argued that we cannot avoid a valuation decision that must at least imply a forecast of the level, the growth rate, and the stability of earnings. It was also argued that the only way we can avoid disastrous mistakes is by improving on consensus forecasts.

Cottle agreed that an organization must decide what it can do best in the world of security analysis.

One participant pointed out that analysts do not always follow the economic guidelines given them, and Cottle agreed that this can be a source of trouble.

The question was raised whether the judgments coming out of security analysis today, in terms of identification of under-and over-valued securities, have any value. The promise was made that the discussion on the following day would demonstrate that they do have some value.

162. OPTIMAL USE OF SECURITY ANALYSIS IN MANAGING COMMON STOCK PORTFOLIOS (Fall, 1976)

This presentation was one of three offered under the heading "Organizing for Performance." The other two were "Security Analysis: The Changing Dimension," and "Incorporating the Quantification of Uncertainty into Asset/Liability and Foreign Exchange Decision Making."

Keith Ambachtsheer, Vice President for Research, Canavest House, Inc., introduced his presentation as "making the case for active management for stock portfolios." The presentation was to some extent an outgrowth of Ambachtsheer's presentation at the Spring 1976 IQRF Seminar, where he described a simple model for implementing and testing ability to time the market, incorporating not only a market forecast but a measure of the reliability of that forecast. This presentation went beyond market timing to deal with security analysis as a whole.

Ambachtsheer referred to the choice between actively and passively managed portfolios. He proposed dealing with the issue by considering from the point of view of an institution the process by which: analysts make forecasts, the forecasts are translated through some carefully established procedure to build portfolios, and these actively managed portfolios establish a performance record. The question then is whether the performance record justifies the process, or in other words whether security analysis and its implementation can add value to a portfolio. His answer was yes providing two conditions are met. The forecasting ability of the security analysis must exceed some minimum level, and there must be a satisfactory method of translating the forecasts into portfolios. Harking back to the discussion of the preceding day, Ambachtsheer suggested that an institution seeking to demonstrate that it has managed a portfolio prudently using security analysis and active management, should be prepared to show that its analysis does exceed this minimum level of quality and that it knows how to use the analysis efficiently in building portfolios.

Ambachtsheer provided a bibliography on the measurement of forecasting ability, and discussed specifically the work of Hodges and Brealey that found significant investment performance gains could be achieved from apparently low levels of ability to forecast individual stock performances. But success depended critically on an understanding of the quality level of the forecast and its proper implementation.

Ambachtsheer described the form in which analysts might be asked to provide forecasts, so that these forecasts can be conveniently processed to make portfolio decisions. He suggested there is value in trying more than one form of presentation, but proposed in particular the value of a particular rating scheme that could be used for all stocks studies by analysts.

Comparing the rating assigned by an analyst with the subsequent performance of stocks in a group leads to a correlation coefficient referred to by Ambachtsheer as the "information coefficient," that will serve as a measure of the analyst's forecasting ability. Historical performance records can be used as a guide to what one might expect of the top rated, second rated, and so on of the stocks in a group in terms of appreciation. Finally, the analyst's rating, his information coefficient, and the expected appreciation for each rating can be used to assemble a portfolio.

Ambachtsheer presented six sets of statistics recording measurements of analysts. The range of coefficients, for different analysts and different time horizons, was from about 0 to about .3. A coefficient of around .15 seemed fairly typical for a good deal of security analysis. Some of the coefficients came from relative ratings of stocks within an indus-

try, and some from relative ratings within a very large universe of stocks. And the results covered organizations with very different methodologies for security analysis.

The information coefficients reported were not standardized for risk, and some of the participants suggested that this might be appropriate. Others suggested exploring the stability of the information coefficients and of the time horizon for which these coefficients seemed to reach a maximum.

Having presented the six sets of quality measures of security analysis, Ambachtsheer turned to the process by which the analysis can be efficiently translated into portfolio selection. The objective is to maximize the extra rate of return on a portfolio, adjusted for risk, subject to various constraints involving such things as diversification. Achieving this objective, Ambachtsheer explained, is essentially the solution to a mathematical problem.

Ambachtsheer turned next to measures of "value added" when security analysis of known quality is appropriately processed to select portfolios. Simulated results reported by Hodges and Brealey showed that an information coefficient of .15 could lead to value added of about 2% per year for a portfolio. Regressions run by Ambachtsheer on the results of 16 money management groups confirmed the Hodges and Brealey results. Ambachtsheer had already reported at the Spring 1976 Seminar the value added by market timing at various quality levels. In addition to these previously reported results Ambachtsheer presented some statistics derived from studies of Canavest House clients and from Wells Fargo ratings.

Ambachtsheer closed with a reference to standards of prudence. He pointed out that an Index or Market Fund should display no independent risk, but that active management will add independent risk to a portfolio. Prudence demands that a client institution understand the choice between active and passive management. This involves understanding the independent risk that must be taken with active management, and having some basis for concluding that the extra return that can be expected from the active management, net of all transaction costs, will justify this extra risk.

Some participants asked whether Ambachtsheer had tested any simple mechanical rating strategies for an information coefficient. This would help to confirm the value of security analysis to an organization, as offering forecasting quality beyond what might be obtained, for example, by simply extrapolating historical returns. Ambachtsheer had not done this, but agreed that it might make sense. One participant, emphasizing the importance of efficient processing of the results of security analysis into portfolio selection, observed that the exercise of discretion by portfolio managers may lead to performance records that have little to do with the quality of the analysis. He pointed out that it is critical to evaluate the quality of the analysts on the basis of their own ratings of securities, and not on the basis of portfolio performances.

TRANSACTION COSTS

163. PANEL DISCUSSIION ON TRANSACTION COSTS (Spring, 1979)

Evan Schulman distributed a summary of transaction costs from Batterymarch Financial Management Corporation.

Peter O. Dietz, Vice President, Frank Russell Company, Inc., moderated a panel made up of Kathleen Condon, Gilbert Beebower, Evan Schulman, and John Greeley.

Kathleen A. Condon, Vice President, Bankers Trust Company, began by describing a study of transaction costs at Bankers Trust, covering six months in 1977 and 1978. In the absence of any generally accepted definition of transaction costs, the definition used for this study was commissions plus taxes plus SEC fees plus market impact. And market impact was defined as the price change from the time the order was received at the trading desk until the time of execution, adjusted for market movement. The market adjustment was based on Wilshire beta coefficients and hourly values of the S&P 500 Index.

For purchases, the average transaction cost was 1.27%, consisting of .35% commission cost and .92% market impact. The standard deviation was 2.9%. For sales, the average transaction cost was .57%, consisting of .28% commission, .11% tax and SEC fee, and .18% market impact. For both purchases and sales 25% of the transactions showed a negative cost.

Some analysis was also done on the change in price from the time of execution to the close for the day, and over the succeeding ten days. In general, the stocks purchased continued to move up slightly during this succeeding period, while the prices of stocks sold moved up from the transaction to the close for the day, and declined a little in succeeding days.

In an effort to find some explanation for transaction costs, correlations were run on twelve factors. In the case of purchases, six factors proved to be significantly related to transaction costs. The most significant was the number of days over which a complete transaction "package" extended. The correlation between transaction cost and the elapsed time was strongly positive. Transaction cost was also positively correlated with volume on the New York Stock Exchange on the day of the transaction, but was negatively correlated with the price of the stock purchased, the number of shares in the trade, the market capitalization of the company purchased, and the Amvest Liquidity ratio. For sales, only one factor showed a high correlation. Transaction cost was strongly positively correlated with the ratio of the volume of the days transactions in the stock to the average daily volume in that stock.

Condon closed by commenting that if another study were done she would prefer to use a multi-index model for making market adjustments, and would like to check more closely on the form in which orders come to the trader. The study had encountered almost no limit orders, which may mean that limits were expressed verbally to the traders and never put in writing.

Gilbert L. Beebower, Vice President, A.G. Becker, Inc., described a study undertaken by BEA and A.G. Becker, and a continuing study involving BEA and ten other organizations. The definition of transaction costs differed from that used at Bankers. It consisted of three elements. The first was the explicit cost—commission tax and SEC fee. The second was a so-called "opportunity cost," measured up to the time of the transaction. And the third was the "execution cost," measured after the transaction. The opportunity cost attempts to identify what the cost would have been of completing a trade immediately. The execution cost captures the information value in the trade and any market impact of the trade.

Beebower illustrated the analysis of a single transaction or transaction "package" by means of a graph. On the graph were plotted the total rate of return on the stock in question, day by day, along with the return on a broad market index, and the "trade specific group return," which is the daily return on a group of stocks with volatilities close to the volatility of the stock traded. From the plot it is possible to see how the trade related to prior movement in the market, in similar stocks, and in the particular stock traded. These observations can be used in a discussion of the investment process with the portfolio manager.

The opportunity cost is calculated as the change from the closing price the day before the trade to the price of the trade. This cost approximates the price change between the decision to trade and the transaction itself. The execution cost is estimated from the movement of the stock price after the transaction, relative to the trade specific group. If the stock moved along with the trade specific group, then there was no execution cost. Finally, it is possible to track over a longer period, for example twenty days following the transaction, the price movement in the stock relative to the trade specific group and to the market index. This movement will indicate whether the transaction was based upon valuable information.

Evan Schulman, Senior Vice President, Batterymarch Financial Management Corporation, discussed primarily differences between the approach to transaction costs taken by Batterymarch and the method described by Beebower. The Batterymarch method, like the Bankers Trust method, is essentially a "striking price" method. That is, it com-

pares the striking price–the price at the time the decision was made to trade–with the price of the transaction itself. The focus is then on what happens between the time of the decision and the time of the transaction. The Becker method focuses on what happens after the time of the transaction. Schulman suggested that there are problems connected with both methods, but commented that the striking price method can help keep costs down, since both the striking price and the transaction price are known as soon as a trade is completed and a series of trades can be stopped as soon as the value of the information that triggered the transaction is exhausted. Measurements made following the transaction, however, involve an arbitrary time period to be measured, and the cost cannot be measured at all until the trading has ceased.

John Greeley discussed the components of transaction costs in terms of the portion attributable to brokers and dealers and the portion represented by one trader's loss to another trader. He commented on the importance of liquidity and offered some suggestions to institutions for reducing trading costs. He also suggested that it might be appropriate to monitor the performance of trading desks more closely.

In answer to questions, both Beebower and Schulman commented that any transaction cost measurement method may be open to "gaming" by brokers or by those who place the orders. Probably no method is entirely foolproof but one can try to minimize the problem.

164. ECONOMIC FACTORS IMPACTING TRADING COSTS (Fall, 1976)

A paper by this title was distributed.

Dennis Logue, Professor of Finance, Amos Tuck School of Business Administration, Dartmouth College, began by referring to three elements in the cost of trading a large block of stock on an organized exchange–the commission, the bid-ask spread, and the cost of the trading impact–and commented that the last of these may run from 2.8 to 4% for a round trip. For a 100 million dollar fund with a portfolio turnover of 25% per year, cost would be from 600 thousand to one million dollars per year, a substantial amount. Logue's paper was concerned with the possibilities for reducing or eliminating this cost.

He dealt first with the theory that might describe the behavior of a market maker, then went on to describe empirical studies of market maker's spreads and inventory, and concluded with a discussion of market organization and its impact on trading cost.

The first theory, the "liquidity theory," was developed by Demsetz, and attributes the bid-ask spread of a specialist to a number of factors of which the chief one is the extent of competition the specialist faces. Risk was not considered to be a significant factor. The second theory was proposed by Walter Bagehot and assumes that the specialist profits from liquidity transactions and loses money to inside information transactions. Risk will play a role in determining the bid-ask spread, and there will be two components of risk in the inventory position of the specialist. One type is related to new information, and is the risk that information motivated transactions will come from persons who have inside information and can take advantage of the specialist. The other kind will be marketability risk, affecting the specialist's ability to make inventory adjustments.

A third theory is the "dynamic price/inventory adjustment theory," developed by Smidt and extended by Logue. This theory goes beyond the specialist's spread to consider the equilibrium price and his inventory changes as well. Risk in a stock will lead not simply to a larger spread but to fluctuation in the specialist's inventory position and changes in the equilibrium price.

Empirical work suffers from the fact that we do not know the levels and changes in specialist inventories and probably will not know. And work so far has not involved the equilibrium price level. However, the results of all of the empirical testing are remarkably similar. The consensus is that spread varies inversely with volume and competition. In general, higher risk increases spreads, but the risk that is relevant here seems to have more to do with inside information than with price variability. Unsystematic, rather than systematic risk seems to be the critical element.

It might seem that since independent risk and the apparent fear of inside information lead to increased specialist spreads, then more stringent disclosure requirements would help reduce these spreads. But empirical studies have suggested that expanded disclosure requirements in the past have not reduced unsystematic risk and therefore could not be expected to reduce spreads.

Market makers other than specialists are free to search for customers to take the other side of a proposed transaction. Exchange specialists are not allowed to do this, and it seems reasonable to suppose that if they were allowed to do so they could reduce their risk and hence their spreads. There would also appear to be some advantages in increasing the competition faced by specialists.

165. MINIMIZING TRANSACTION COSTS (Fall, 1976)

Evan Schulman, Vice President, Batterymarch Financial Management Corp., described the rationale for swap programs, permitting the instantaneous substitution of one long list of common stocks for another long list, with no market impact and very low commission costs. Transactions of this sort are common when the management of an institutional portfolio changes hands, or when the policy changes substantially, as when an actively managed portfolio is converted to a market fund. If the performance record is a matter of concern, then so is the cost of restructuring. An index fund has introduced a special concern for transaction costs, which represent the difference between the performance of the fund and the performance of the corresponding index. The unfixing of commission rates has made it possible to develop swap programs to meet these needs.

For an actively managed portfolio the cost of institutional trading has been estimated at 2 to 4½% one way, or 4 to 9% for a round trip. But a swap trade is not really an information based trade, and should justify lower rates. Giving a substantial amount of business to one broker-dealer should achieve a quantity discount, but a swap program can do even better. It is probable that the list of stocks to be sold and the list to be bought involve a fair amount of diversification, so that a broker who goes short one list and long the other will be reasonably protected against individual risks in the stocks. And probably the market risk of the buy and sell portfolios will be about equal, so the broker will be hedged against market risk.

To illustrate the attractiveness of swap trades to a broker-dealer, Schulman described a simulation using actual portfolios and actual market prices for the stocks in these portfolios over a period of time, and another simulation based upon a Markow process with an absorbing barrier.

For the simulation, we take two institutional portfolios of about the same size and the same market risk level. As a broker-dealer, we use a set of actual prices to go short one portfolio and long the other. At the closing prices on the following day we unwind the long and short positions, in equal dollar amounts, with the greatest profit. Then we unwind the long and short positions, again in equal dollar amounts, with the second largest profit. We go on to exhaust all profits in excess of 7.5%. We repeat the process the next day, and continue for perhaps ten days. At the end of this time we close out the balance of the short and long positions. Throughout the period we have remained hedged, with at least roughly matching long and short positions. When the positions have been completely unwound, we can anticipate a rate of return of something like one percent, achieved over approximately ten days. The swap program then appears very attractive to a broker-dealer.

For the Markow process with absorbing barrier, we simply assume that common stock rates of return are log normally distributed, and use a random number generator to simulate the performance of the stocks in our two portfolios over five days. In Schulman's illustration, an absorbing barrier was set at 5%, which simply means that any long and short positions showing a profit of 5% or more in any day were liquidated, again in equal dollar amounts so that the remaining holdings were fully hedged. At the end of five days the positions were closed out, and again the profit to the broker dealer was about 1%.

Schulman indicated that there are a few problems with these simulations, so that the results might not be quite as attractive as they indicate. For one thing, it may not be possible to close out long and short positions as described above if the market supply will not absorb sufficient volume of stock without some price effect. Remaining fully hedged also puts some limitations on closing out positions, and there is a loss of diversification as the long and short positions are reduced, and perhaps some shift in market risk as well.

In the discussion that ensued, Schulman pointed out the advantages of negotiating a swap program with a broker-dealer without disclosing the names of the particular stocks. The broker would agree to undertake the entire program, at, for example, the next day's closing prices, for a specified fee. The names would not be disclosed until after the close on the following day. This means that the client can be assured that the broker-dealer has done nothing to affect the prices against his interests. Some broker-dealers, however, will offer a lower transaction fee if the names are disclosed in advance. A variation on this swap program involves a broker guarantee of prices without an immediate transfer. The broker-dealer will then work out both the buys and sells, avoiding a series of transactions between himself and the client, and hence avoiding a stock transfer tax. This process creates difficulties when it comes time to print the trade originally agreed on, if prices have changed significantly before the workout is completed.

Schulman referred to swaps of from 30 to 70 stocks into 150 to 200 stocks, and commented that the commission charged is apt to vary from time to time, depending upon how busy the broker is. Bids of commissions up to .5% he described as high bids. Another participant had seen bids as high as 1.2%.

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