RECORD OF SOCIETY OF ACTUARIES
1995 VOL. 21 NO. 1

COURSE 485 "LITE": A "LESS FILLING" OVERVIEW OF THE FELLOWSHIP EXAM ON ADVANCED PORTFOLIO MANAGEMENT

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During the past several years, the Fellowship syllabus has been strengthened by a number of exams on investment and finance topics. This teaching session will introduce Course 485 to "seasoned" actuaries who missed the opportunity to study this material on their road to Fellowship. Given the time frame, the focus of this session will be only to expose the various subjects covered, identify reading materials, and highlight a few topics. No pop quizzes, we promise!

MR. IAN G. GIBB: The material covered by Course 485 is about one-third asset management and two-thirds portfolio theory. The portfolio theory is covered in a textbook by Edwin J. Elton and Martin J. Gruber—*Modern Portfolio Theory and Investment Management* (4th ed., Somerset, NJ: John Wiley & Sons, Inc., 1991, p. 736). In my opinion, it's a good text with solid examples and many practice questions. If you can't do the practice questions, an instructor's manual is also available so that you can cheat. So, if you don't want to spend the money on writing the exam, you can still teach yourself. The other, smaller portion of the exam is on asset management. The text for this material is an anthology edited by John L. Maginn and Donald L. Tuttle titled *Managing Investment Portfolios: A Dynamic Process* (2nd ed., Boston, MA: Warren Gorham & Lamont, Inc., 1991, p. 775). Finally, the rest of the material is in about a dozen study notes, most of them written by investment professionals and published in financial journals.

Although the material is about one-third asset management and two-thirds portfolio theory, we'll spend most of our time on the asset management material. The asset management section has material that's more obviously practical than the portfolio theory section. Josephine will present that longer section as she doesn't mind public speaking and is qualified to speak on the subject. She is assistant vice-president of asset management for a large insurance company and I'll do the portfolio theory portion.

MS. JOSEPHINE E. MARKS: The asset management topic is somewhat fragmented, I'm afraid, as the exam covers a wide variety of topics. The reference material includes the Maginn and Tuttle textbook, which is also used in the Chartered Financial Analyst (CFA) program. Then there are the obligatory dozen or so study notes, also written, for the most part, by investment people. Listed below is an overview of the topics covered and I'll be touching briefly on almost all of them:

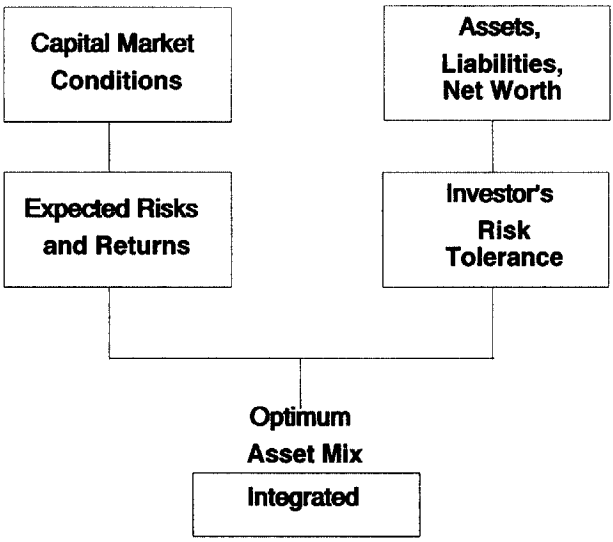
- Asset Allocation
- Attribution Analysis
- Currency Exposure
- Real Estate Portfolio Management
- Venture Capital
- Equity Duration

ASSET ALLOCATION

This part of the material looks at various approaches for making asset allocation decisions. A key point to remember is that asset allocation is considered to account for as much as 95% of the variance in actual returns in portfolios.

The asset allocation decision process, as represented in Chart 1, can consider both external and internal conditions. The external conditions include the current and historic state of the capital markets. These capital market conditions, past and present, are traditionally used to predict expected risks and returns, where risks are defined as the standard deviations of returns and take into account correlations between asset classes. This is the age-old problem of trying to use the past to predict future. Now, an interesting note presented in the material is that, as you'd expect, by using the past to predict the future for returns is not a particularly good way of doing things, but using the past to predict the future for risks, as in standard deviations or correlations, is actually fairly good. One of the key considerations is that the time period chosen for the input parameters should be consistent with the time frame for which you're making projections.

CHART 1
ASSET ALLOCATION

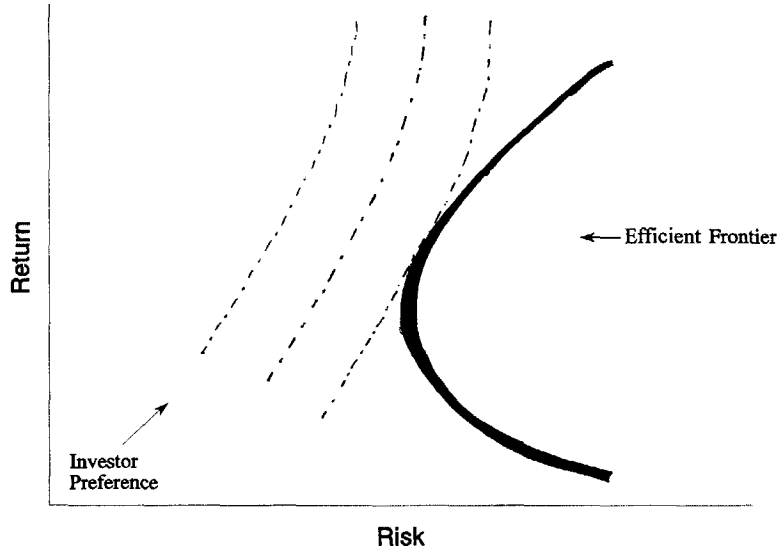


On the internal side, you've got the status of the investor. The investor would have a certain amount of assets and liabilities which, netted, is the net worth, or what we refer to as surplus. And from that, one can deduce a risk tolerance for the investor, the ability or willingness of that investor to assume risk. Part of what you might expect in looking at an insurance company or a pension fund is that their ability to assume risky investments would be a function of the surplus position in the company or in the fund.

A graphical representation of this, as shown in Chart 2, will be familiar to you from portfolio theory. The external condition can be represented by an efficient frontier, or a line of optimal portfolios. The dotted lines represent groups of portfolios to which the

investor is neutral. The top two lines would be portfolios that the investor would love to have, but of course, they don't coincide or intersect with the portfolio of assets that are actually available to this investor. So to find the optimum asset mix, we move down to the point where the two parameters—the external and the internal—meet.

CHART 2
ASSET ALLOCATION



There are several approaches that can be used for asset allocation. The first of these is strategic asset allocation. This type of asset allocation process looks at the long-run market expectations and assumes a fixed level of risk tolerance. It cuts off the feedback link between the capital market conditions and the expected risk and return, and also removes the link between the investor's net worth and the risk tolerance. It separates the long-run view from the short-run conditions and looks at it from a long-run perspective. This kind of asset allocation would only be done periodically, say every three years, and you could run through simulation procedures to come up with optimal asset mixes. But you're disassociating the top boxes from the second rung of boxes, by eliminating the feedback between current conditions and long-term expectations.

The second approach to asset allocation would be tactical asset allocation, where you would focus on the expected short-term returns. This approach would be what you'd associate with an investment manager who was actively trading in the market. Now, for this particular type of asset allocation, you would not be paying attention to the boxes on the right. You would assume that the investor's risk tolerance was unchanged. The short-term expectations for risk and return would be driving your investment decisions.

The third approach to asset allocation is the insured asset allocation process, and this is the counterpart to tactical asset allocation. It focuses on the boxes on the right side of Chart 1. For example, from an insurance company's perspective, the focus might be on

maintaining surplus ratios, reflecting the investor's risk tolerance. So with this type of asset allocation, you'd be more aggressive if you have a high net worth and less aggressive when you have a low net worth. You're not focusing so much on what the markets are doing, but on what your surplus level is when setting your asset mix. A form of this is a system you've probably heard of—portfolio insurance—where, as the markets fall and your net worth is falling, you would tend to be selling out of your risky assets. This is, interestingly, exactly what happened in the stock market crash of 1987. Prior to the crash, some studies indicated that there was up to $70 billion invested using an insured asset allocation type approach, and only about $20 billion was invested using tactical asset allocation. Now ideally, in the markets, you want the two amounts to be roughly in balance, because it's the people using the tactical asset allocation who would naturally tend to trade with those using the insured asset allocation process. What happened during the 1987 crash was that as the market fell, people using insured asset allocation were selling, but there wasn't an equivalent number of people using tactical asset allocation who would be buying as the market declined in value. And, of course, the market went into a free fall; more and more portfolio insurance kicked in, more and more people were selling, and there weren't enough people buying on the tactical side.

FROM THE FLOOR: Where are we now?

MS. MARKS: I have no idea where we are in terms of dollar volumes between the two types of asset allocation policies, but I think it's safe to assume that portfolio insurance became much less popular after 1987.

ATTRIBUTION ANALYSIS

The next topic is attribution analysis. For the purpose of this presentation, I focused on one particular study note, which is a paper from the *Financial Analysts Journal* called "The Importance of the Asset Allocation Decision," by Chris R. Hensel, D. Don Ezra, and John H. Ilkiw. They wanted to see just how important the asset allocation decision was.

The first step was to establish sample benchmarks against which to measure the portfolio. The most straightforward benchmark is a risk-free portfolio, or money market, as follows:

Sample Benchmarks

- 100% Money Market
- 100% Bonds
- Average of Other Funds
- Universal Mix
- Manager-Specific

The next three benchmarks are what you might call naive portfolios—what a portfolio manager who knew absolutely nothing about this might have. Without knowing anything about it, you might just decide to set up a portfolio which was 100% bonds. Or you might get a little bit more sophisticated and look at the average of what other fund managers are doing, and just use the average of their mix as your mix. Or you might look at a mix of what's available out there in the market and create an artificial portfolio of everything that's available. This last one is obviously not very practical but was a theoretical benchmark that they considered. The last possibility shown would be to have a benchmark that was specific to the fund manager.

Table 1 shows the results, which were quite interesting, although not necessarily unexpected. These are quarterly results for a number of fund managers from the period

1984–88, so even though they are not representative of the long term, the results appear to be consistent with other published material. The top line is the return on the minimum risk portfolio of T-bills, and it averaged a 1.62% quarterly return during this period. Now, if you used the naive policy allocation approach, the average allocation of other available funds, you would be able to enhance that return by 2.13%. So according to this study, it appeared that if somebody went in and just fairly naively picked an asset allocation according to what the average manager was doing, they could achieve a return of 3.75% versus the 3.86% actually achieved, on average, by these managers.

TABLE 1

Factor	Actual Return	Potential Return
Minimum Risk (T-Bills)	1.62%	
"Naive" Allocation	2.13	4.43%
Policy Allocation	0.49	0.79
Market Timing	(0.10)	0.57
Security Selection	(0.23)	0.85
Other Interaction/Activity	(0.05)	0.15
Total	3.86	8.41

The numbers in the left column of Table 1 are the actual returns, which are the average of all returns, including negative returns where portfolios underperformed against the benchmark. For the potential returns, the authors took the average of the absolute values. They made the somewhat heroic assumption that if a factor made a negative contribution, it could just as easily have made a positive contribution of equal size. So these results tell us that the "naive allocation" could have made a contribution of as much as 4.43% more than the T-bill return.

Now, looking at the other items, these are the ones that really make your eyebrows go up. The policy allocation, the asset mix policy actually set by the fund managers, made a fairly positive contribution to the return, of 0.49% versus a potential of 0.79%. But the market timing and the security selection components made a negative contribution to return, even though if every manager had lived up to their potential as defined, they could have had a fairly substantial positive impact. You've probably heard that market timing doesn't generally contribute toward portfolio returns, and that's consistent with these results. Some other studies show that security selection does enhance returns, so presumably it depends on factors like the periods you pick and the managers you follow.

CURRENCY EXPOSURE

The next section deals with hedging currency exposure. In Canada, and I believe in the U.S. as well, there's a great deal of interest these days in international investment and diversification. In 1994, for example, foreign investors were purchasing Canadian assets, but hedging out of the Canadian dollars. They liked the market, but they didn't like the dollar. First, though, let's look at reasons why you would choose *not* to hedge the currency exposure in your portfolio. The first reason is a very practical one. It may simply be that the cost of hedging outweighs the amount of risk that you're hedging against, that the risk is fairly low relative to the cost of putting on a hedge. But there may be other reasons. You may decide that your ability, or your manager's ability, to

forecast currency movement is, in fact, expected to add return to your portfolio, in which case you have no desire to hedge out of that enhanced return. Another reason may be that your investment is supporting a liability which has an exposure to the foreign currency, whether it be direct or through imports in that currency. So, it may be that having the currency exposure on the asset side is consistent with the exposure on the liability side.

Now, if you do decide to hedge, there are some different ways that currency exposure can be hedged. The first one is a full hedge, or an exact hedge on the portfolio. In this instance, you would sell forwards exactly equal to the exposure on your portfolio. Of course, you don't have an exact fix on what the level of exposure is, because your value is going to be fluctuating over time. So you would need to continually rebalance your hedge to have a perfect, exact hedge against your exposure.

The second approach is called minimum variance hedging. It involves forecasting the volatilities and the correlations between the foreign assets and the foreign currencies. Based on the volatilities, you determine an optimal hedging ratio, taking into account the correlations between the foreign currencies and the foreign assets in your portfolio. What you're doing is managing the asset risk and the currency risk as one bucket, rather than just looking at the currency risk in isolation.

The last approach is called option-based hedging. If you want to retain the exposure to favorable currency movements, then you could purchase put options. These give you the right, but not the obligation, to sell the currency forward at a given exchange rate in the future. So, if the currency movement had gone on side for you, you would just let the option expire. But if the currency had moved against you, you would have the right to protect yourself against that currency movement. The option-based hedging could be set up as an exact hedge on the portfolio, or as a minimum variance hedge to reflect the correlations between the assets and the currencies.

REAL ESTATE PORTFOLIO MANAGEMENT

The next section on the exam is real estate, which of course is a fairly unique asset class. This exam is a bit of a catch-all exam for many topics that haven't been covered on earlier exams. The first topic in this section is the real estate appraisal process. The market value of real estate can be defined as the most probable price for a property in a competitive and open market in a fair sale. The further assumption is that buyers act with full information, and in a rational, logical manner. But of course, in practice, the real estate market valuation process has parameters that are somewhat unique.

The first point to consider is the well-known axiom: location, location, location. But, beyond that, there are a number of key factors that enter into the appraisal process for real estate. One would be to look at the effect of leases, and leases may enhance or detract from the value of the property. You're going to look at the extent to which a property is leased, the quality of the tenant, the term of the lease, and the rates on the lease, but things aren't always as they appear. For instance, if you have a long-term lease at lower-than-market rates, that might be less attractive than a lease that was due to expire soon, which you would then be able to renegotiate at current market rates. On the other hand, if you have a firm lease with a good credit tenant, at a time when leasing is particularly difficult, then that's obviously an enhancement.

The second point to consider is the investment value, which is defined as the value from the perspective of a typical investor for that property. And appraisers have to "blue sky it" in that they have to define who would be the typical investor for this property, and what would they pay for it. Another consideration is the assessed value that can be very controversial. This is the value that's used for the calculation of property taxes. And a fourth point to consider is the value to a user, or the value with respect to a particular project for that property, which may be fairly unique.

Now given these issues to consider, the appraisal process can follow a number of different approaches. The first one is to look at the property with respect to its cost, which is the value of the land plus the replacement cost for the building. Note that generally the value of the land is taken to be a fixed amount. It may be that the property has less value than it might have had because it's not the best use for that land. But this is factored into the value of the replacement cost of the property, and the land value is not reduced. In other words, the land still has the same basic value to it, even if it's been misused or used less efficiently than it might have been.

The second approach that can be used is very simple in theory, but can be tricky in application. This would be a sales comparison technique to compare against other properties with, in theory at least, identical characteristics. The difficulty with this approach is that there will never be any other property with identical characteristics, if for no other reason than any other property cannot possibly have the exact same location.

The last approach is more rigorous and looks at income potential. The market value is defined as the net operating income divided by the discount rate less the growth rate—the discount rate being the nominal discount rate, and the growth rate being an inflation-based rate.

$$\text{Market Value} = \frac{\text{Net Operating Income}}{\text{Discount Rate} - \text{Growth Rate}}$$

This denominator is referred to as the capitalization rate. It reflects the expectations of future income or growth for the property. Solving back, the capitalization rate works out to be equal to the net operating income divided by the market value. Or from another perspective, it's equivalent to the earnings over price ratio for stocks, or *E/P*.

Much has been done in terms of looking at real estate from the same perspective as other types of assets. One example of this is looking at it with respect to risk and return, or measures at risk. One type of risk is systematic risk which is risk that cannot be diversified away. One of the study notes looks at the factors that affect systematic risk in real estate. For example, unanticipated inflation, which is actual inflation less expected inflation, shows a weak positive link, with a lag, to real estate prices. The reason it is weak is because it's probably partially hedged, because there would be lease escalation provisions that protect the property against unanticipated inflation.

A second factor is investor confidence, and there seems to be a negative link between real estate values and investor confidence. The rationale for this is that when investor confidence is low, in troubled times, there is a tendency to revert towards hard assets. And when confidence is booming, the real estate market tends to suffer a little bit. Investor

confidence, for this purpose, was defined as the spread between corporate bonds and government bonds.

A third factor is the expected inflation, which is defined as being the difference in rates between long government bonds and Treasury bills. And again, this seems to have a negative link with respect to real estate values. The theory here is that the long-term nature of leases prevents the flow-through of the higher income; therefore, as inflation is increasing, the real estate value suffers.

For business cycles, there are mixed results. Some indicators, like rising industrial production, seem to lower the value of real estate. Increased consumption seems to increase the value of real estate. So there's much work to be done in trying to understand the linkages between some of these external economic factors and the real estate market.

The other type of risk is unsystematic risk, which is defined as the risk that can be diversified away. And the two obvious methods that are traditionally used to reduce unsystematic risk in real estate are diversifying the portfolio by property type and by location, whether it be geographic or regional. There has also been talk recently about diversifying internationally, although there are differences of opinion as to whether international diversification reduces unsystematic risk. Other types of diversification that you could look at for a real estate portfolio would be diversification by tenant or diversification of leases. So, there are a number of ways in which you can reduce your unsystematic risk.

EQUITY DURATION PARADOX

The last topic is the equity duration paradox that I referred to, which is discussed in a paper called "Resolving the Equity Duration Paradox" by Martin L. Leibowitz and Stanley Kogelman, was published in the *Financial Analysts Journal*, January 1993. The paradox they refer to is that if you look at equity from the point of view of the dividend discount model, which is what is traditionally done, it seems to have a duration of about 20, or as much as 50 years. However, if you look at it in practice, it seems to have a duration that's considerably shorter than that. The authors are using a model called the franchise factor model to see if they can resolve this paradox. The franchise factor model looks at business as having two components. It defines it as having a tangible value, which is the value of its current business, and a franchise value, which is the value of its future business. They use this model to support a shorter duration for equity.

First they looked at duration from the perspective of the dividend discount model. The dividend discount model defines the price of a stock as the initial dividend, D, divided by k minus g, where k is the nominal rate and g is the dividend growth rate.

$$\text{Price} = \frac{D}{k-g}$$

So you're essentially setting up a perpetuity of future dividends, discounting them at the real rate. Recall that duration is the derivative of price, with respect to changes in interest rate. If we set D at 8, k at 12% and g at 8%, the current price would be $200. If you move the interest rate by 0.01%, the new price would be $200.50.

$$\text{Price} = \frac{8}{0.1199 - 0.08} = \$200.50$$

Duration equals the change in price ($0.50) divided by the price ($200) divided by the change in interest rate (0.0001) which is 25.

$$\text{Duration} = \frac{0.50/200}{0.0001} = 25$$

So under these assumptions, the dividend discount model does indeed give a duration in excess of 20.

Now the authors look at duration from the point of view of the franchise factor model. They defined the price as being the sum of two parts—the tangible value and the future value. The tangible value is based on the earnings from the current business, and the future value, or the franchise value, is based on the prospective earnings on new businesses. The tangible value is defined as the annual earnings divided by the nominal discount rate. This excludes the impact of any new business or any growth.

Tangible Value

$$TV = \frac{E}{k} = \$133.33$$

Franchise Value

$$FV = FF \times G \times E$$
$$= \frac{r - k}{rk} \times \frac{g}{k - g} \times E$$
$$= \$66.67$$

E (annual earnings) = 16
k (nominal discount rate) = 12%
r (return on equity) = 16%
g (dividend growth rate) = 8%

The franchise value is defined as the product of FF, G, and E where FF is the franchise factor, which represents the P/E producing power of new investments, G, a growth factor for the earnings, and E, earnings. By using assumptions consistent with those used for the dividend discount model, the tangible value works out to be $66.67. So the tangible value and franchise value do indeed equal the price of $200.

The next step is to look at the duration of the equity, from the perspective of the price being the sum of the tangible value and the franchise value. Recall that the duration equals the derivatives of the prices with respect to a change in i. I've just shown the results if you'll trust the math. For the tangible value, the duration is 1 divided by k or 8.33, and for the franchise value it works out that the duration is 58.33. And indeed, if you weight these durations according to the values, where the duration of the tangible value is weighted by 133 divided by 200 and the duration of the franchise value is weighted by 67 divided by 200, we come back to the same result for the duration as for the dividend discount model, a value of 25.

$$D_{TV} = 8.33$$
$$D_{FV} = 58.33$$
$$D_P = \left[\frac{133}{200} \times 8.33)+(\frac{67}{200} \times 58.33\right]$$
$$= 25$$

Now, what the authors propose is that if the duration of the franchise value is zero, and if you substitute zero in your formula here, you obtain a duration of 5.56. Alternately put, if the franchise value is not sensitive to changes in the interest rate, then a duration of 5.56 might be the observed outcome.

To support this theory, they make the assumption that interest rates are linked to changes in inflation. If you make the assumption that costs are going to rise with inflation, then the growth factor is no longer sensitive to inflation. It has 100% inflation flow-through, and *G* has a duration of zero. Likewise, if the franchise factor only depends on the level of real returns, or it has 100% inflation flow-through, then it also has a duration of zero. An alternative way to look at this is if management is avoiding new investments whose earnings could be eroded by inflation, and if it is avoiding new businesses that are sensitive to inflation, that would imply that the duration of the franchise value is zero. And if we apply this assumption to the previous equation for the duration, a shorter duration is obtained for equity which is consistent with observed values.

Ian Gibb will now talk about the portfolio theory part of the syllabus.

MR. GIBB: As I said before, the portfolio theory section is theory, and it's not going to be obvious—well, it wasn't obvious to me—exactly how to apply this, but we'll plow into it. Portfolio theory is all about the trade-off between risk and return. The first few chapters of the Elton & Gruber text examine how to determine where the efficient frontier is (Chart 2). They look at various conditions, for example, whether lending or borrowing is allowed and whether short sales are allowed. If short sales are allowed, what are the conditions for short sales? Does the investor need to deposit collateral? Several formulae are developed to find the efficient frontier.

One of the conclusions of all this is the two-mutual-fund theorem, which you may have learned when you were taking the old part seven or part eight investment exam. That theorem states that if investors all have the same expectations, then they should all buy the same portfolios of risky assets, regardless of their individual aversions to risk. We have R_f, which is the risk-free rate available for borrowing and for lending. Because returns are linear, you can draw a tangent from the risk-free rate to the efficient frontier, and if you have the same appetite for risk as the market, you would buy this portfolio. If you're more risk-averse, you can buy T-bills and avoid risk all together, or you can do some combination of the two, and place yourself somewhere along this line.

If you are willing to assume more risk, you can borrow money, and buy more risky assets, increasing your risk but also increasing your expected return. Now, if your rate of lending and borrowing are different, then you might actually have possibilities somewhere along two lines. People who prefer less risk will situate themselves along the tangent from the

risk free rate for lending to the efficient frontier. More aggressive people will situate themselves along the tangent from the (higher) borrowing rate to the efficient frontier. But essentially, the choice of risky assets that should be used is limited.

When we talk about a trade-off between return and risk, let's consider how you measure risk. Well, Elton and Gruber discuss possibilities other than the variance of return, but that's not, in fact, in the readings for this exam. So we're working with the variance of return. The calculation of the expected return on a portfolio is fairly easy because expectations are linear. The return of any portfolio is simply the weighted average of the expected return of all the assets, where the weights are the portion of the portfolio invested in that asset. The variance, though, is a more complicated formula, and here it is.

$$\text{Variance} = \sum W_i^2 \times \sigma_i^2 + \sum \sum X_j X_k \times \sigma_{jk}$$

Here the covariances of various assets affect the variance of the total portfolio. Now with N assets, you'd have $N(N-1)/2$ correlations. So, for 250 stocks, you'd have about 31,000 estimates of correlations. That's a lot—and these would be very difficult to obtain sometimes. If you're relying strictly on historical data, you can get that from published stock performance. Sometimes you won't have historical data if, for example, it's a new issue or, for some reason if there has been a change to the fundamentals of the asset. So, you have to come to people for advice. In an investment department, it's rare to find expertise across many sectors. So that's a problem, too.

To solve this, the single-index model was developed, where the return of a particular asset is seen to be a constant, plus a factor related to an index, which we call R_m (it might be I_m, but the book uses R_m) times the coefficient and a random-error term. The model is constructed so that the expectation of the error term is zero. It's assumed that the error term is unrelated to the index. Also the error terms between different assets are uncorrelated here. The implications of that, and I'm sure this is all vaguely familiar to you, is that any correlation between assets is fully explained by the responsiveness of the asset to the index, and also, that the risk of any asset can be viewed in two parts: one that's related to the variation of the index, (beta), and another that's independent of the index. From that, you come to the conclusion that some risk is diversifiable, the part that is unrelated from one asset to another, and then there's systematic risk, related to the index, which can't be diversified away. The other conclusion from this is that you can cut down significantly on the number of inputs required to calculate the variance of a portfolio. Instead of some 30,000 correlations, you can get by with estimating just these betas. For a 250 asset portfolio, there are 250 betas. That's much fewer estimates than 31,000 correlations.

How are betas calculated? Well, they can be calculated strictly from historic data, although as I said before, there can be problems with using regression analysis. People have looked at the accuracy of these betas: are they constant over time? They tend not to be. Historically, people observed that an asset with a high beta will generally, in the forecast term, turn out to have a beta lower than expected—the observed beta will be closer to the average beta than it was in the historic period used to predict it. This is an example of regression to the mean. So there have been adjustments to historic beta.

One of them, Blume's adjustment, is done by looking at two historic terms for the present, and fitting a regression line to see how the betas from the first historic term can best

predict the betas in the second historic term. The same adjustment is then used for the future. The problem with that is if there's any variation from one historic term to the other in average beta, then it will be projected through to the future. And this is undesirable, unless there's some reason to expect a trend.

The other adjustment is Vasicek's adjustment. It calculates beta as a weighted average between the average betas for a whole group of stocks examined, and the beta for the individual stock examined. The more variable the estimate for either of those two elements, the less weight it is given. It's a sort of credibility formula. It's Bayesian we're told, but don't ask me for the prior distribution.

Another approach is to come up with a fundamental beta that is related to the economy. It really doesn't make sense, if you know that something fundamentally has changed, to stick stubbornly to historic patterns. And so, people have created models based on characteristics of the firm that can be changed and as these characteristics change, so will the resulting beta. Generally, the index is the market, and it doesn't necessarily have to be, but in most of the single-index models, it is. It could be hemlines or sunspots or whatever. But in this case, we're talking about the market. For example you could have beta for a market index negatively correlated to dividend payout. If dividends are paid out, it's considered a somewhat less risky investment. Growth is viewed as a positive. Leverage is viewed as a positive. If it's a highly leveraged stock, then the risk should increase, but so should expected return. If liquidity is high, then risk is reduced.

So, how does this technique of using a single index work, compared to the apparently more sophisticated technique of calculating thousands of correlations between individual assets? Well, in fact, it works out very well, as long as the index makes sense. If it's sunspots, it might not work very well. But if the index is the return on the market, it works very well. It not only cuts down on the amount of work, but you actually get better results. The book also shows that the adjustments of Blume and Vasicek help a lot.

The text also discusses multiindex models. Here there are several indices. Again, there's an error term, and the error terms are unrelated from one asset to another. The error term is assumed to have an expected value of zero. And the indices are chosen to have zero covariances. It's also assumed that the error terms are independent and that the error terms and the indices are uncorrelated. The result of this is that you have to make more estimates than for a single index model but not all that many more. For 250 stocks, you'd have to make approximately 3,000 estimates, and that's still far short of the original 31,000 covariances. I suppose if it actually helped make better predictions of variability, it would be worth pursuing. But it doesn't seem, so far, that these multiindex models are particularly good at forecasting, though they're great at explaining things.

So, what kind of indices have been used? Well, one obvious index for a multiindex model would be the industry. It can be fair to assume that stocks in a common industry will be highly correlated. That has been done. One of the problems with that is that the standard industry classifications are either too broad or too narrow for many organizations. The example the text gives is that General Motors and American Motors were in the same standard industry classification, but they behave quite differently. So, one of the techniques is to create pseudoindustries, and this is done through a factor analysis, and somehow these pseudoindustries are independent of each other. Another technique is a

fundamental multiindex model, a model that depends on fundamental facts about the economy.

Chen, Roll, and Ross have worked on the idea that the value of a share is the present value of future cash flows. They also suggested that the current price of any share must incorporate current beliefs. Any variations should be coming from changes in belief. They looked at various indices. The first was based on the variation in spread between government and corporate bonds, a reflection of consumer confidence. The second index was the difference between long-term and short-term interest rates, which has to do with the term structure of interest rates. The theory is that if people are demanding a premium for long-term bonds, then they probably will do the same for a long-term investment in stocks. These first two indices have to do with the discount in the present value. The third index, inflation shock, affects both the cash flows and the discounts that people would apply. The fourth index is called sales surprise, and it has to do with changes in expected prospects for growth. Finally, there's a fifth index which includes everything in Standard & Poor's returns that's not explained by the first four indices.

That's all I'm going to say about multi-index models. However, I will mention some of the other things that are covered in the course. One is a discussion of the capital asset pricing model and the assumptions behind it. Then the text studies a relaxation of some of those assumptions, what happens if short sales aren't allowed, or if there is no riskless lending or borrowing. What are the effects of personal taxes, or the fact that some assets are not marketable? The text also discusses international diversification and how to bring currency risk into the equation.

I'll now turn the podium back to Josephine for the "test."

MS. MARKS: Actually, what we have is a sample exam question. I'm sure you're probably thinking that the students these days have it pretty easy. And, I wouldn't want to dispel you of that notion so what I'll do is give you a sample question they had, and a sample answer. And, by virtue of having the answer, even if you couldn't have figured it out, and I'm sure you could have, you can convince yourself that the students have it pretty easy these days. I chose a sample question about the equity duration paradox. Here it is: you're being told that the chief financial officer wants to switch to a new stock portfolio, which appears to have a longer duration. And you're being asked to use the inflation-adjusted franchise factor model to demonstrate whether or not this is, in fact, achieving the goal of extending the duration of the portfolio. Now when you look at duration from a dividend-discount model perspective, the financial officer's results are exactly right. But if you look at it using the study material, looking at the franchise factor model, if you assume that the franchise value is not sensitive to interest changes, the duration comes from the tangible value only, and the proposed portfolio has a much lower duration than the current one.