

THE TRADE-OFF DECISION

IS MPT THE ACTUARY'S ANSWER?



by ROHAN PROWSE

Modern Portfolio Theory is all about risk management. The challenge for actuaries and investment managers is in deciding how and to what extent to use the methodology of MPT.

Recent events with which we are all very well acquainted have highlighted the trade-off between risk and return in investment. Modern Portfolio Theory (MPT) is concerned with risk management and this trade-off between risk and return.

MPT is a generic term including the Markowitz Mean-Variance approach, the Capital Asset Pricing Model (CAPM) and the Efficient Market Hypothesis (EMH). The three pivotal ideas of MPT are:

Portfolio selection. Portfolio selection is a different subject from security analysis. Security analysis is designed to indicate the likely or possible outcomes to do with the selection and surveillance of a bundle of securities that match the aspirations, fortitude and tax status of the beneficiary.

Capital asset pricing. The relative prices of securities are determined by the expected returns to the investor and also by the uncertainty investors feel over the outcome of their investments. Modern theory and empirical work have taught us something about the way in which the market determines the premium for enduring uncertainty or risk.

Efficiency. Capital markets are highly efficient, meaning that current prices reflect in an unbiased way what is knowable about the companies whose securities are traded.

MPT explicitly quantifies risk, by assuming that risk is measured by the standard deviation of return. Total risk is made up of two components: the risk

related to movements in the market as a whole (that is, market risk); and the risk which is specific to an individual security (the specific or non-market-related risk).

The **assumptions** underlying the development of the theory are:

- Investors base their portfolio decisions on just two parameters of a probability distribution of returns — the expected return and variance of return.
- Investors may borrow and lend without limit at a risk-free rate of interest (e.g. a government bond rate).
- Investors have homogeneous expectations about future outcomes over a one-period time horizon.
- Capital markets are in equilibrium.
- There are no market imperfections; investments are infinitely divisible; information is costless; there are no taxes, transaction costs or interest rate changes; and there is no inflation.

Elements of the theory

The **Markowitz Mean-Variance Approach** shows the risk-return trade-off in portfolio selection. It can be shown that the standard deviation of return of a portfolio is less than the standard deviation of the return on the individual assets making up the portfolio. Thus diversification within a portfolio provides substantial risk reduction by reducing the specific risk.

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The **Capital Asset Pricing Model (CAPM)** is a simple yet powerful description of the equilibrium relationship between risk and return in an efficient market. Equilibrium prices are obtained for each security and portfolio, given just one attribute — Beta. The Beta coefficient of risk measures the sensitivity of the underlying assets' prospects (and investors' assessments thereof) to those of the economy as a whole.

The CAPM obtains equilibrium results for an efficient market. However:

■ What about movement to this equilibrium position? ■ Are capital markets efficient?

The **Efficient Market Hypothesis (EMH)** answers these questions. The EMH states that the market adjusts so rapidly to public information that for most purposes the possibility of disequilibrium can be ignored.

Empirical evidence suggests that share prices fully reflect all publicly available information (including past price data), adjusting instantaneously to any new information; but that market professionals may be able to achieve excess returns (above the market) through the use of fundamental analysis.

Factors assisting the efficiency of the market include the general availability of information, increasing computerisation, the well-developed institutional character of the market, increasing competition and the general trend in deregulation.

This is great theory about an ideal world; but we live in a very real world. So does the theory have any practical use? And what are the implications of using the theory?

Validity of the Capital Asset Pricing Model

Most of the major assumptions which underlie the CAPM violate real-world conditions. The CAPM may be extended by relaxing the assumptions and so determining the effect of more realistic assumptions.

A study by Jensen (1972) ¹ has shown that the CAPM theory is reasonably robust with regard to violations of the major assumptions, as many of the latter are not essential for the derivation of the important results of the CAPM. He found that when relaxing assumptions, in every case, the CAPM implies a positive linear relationship between expected return and systematic risk. Thus, *the CAPM is likely to be a reasonable approximation of the manner in*

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This is supported by empirical evidence demonstrating that securities with high Beta values tend to yield correspondingly high expected rates of return; and furthermore, that the relationship between expected return and Beta is linear. ²

Criticisms of Modern Portfolio Theory

The main criticism levelled at MPT relates to the validity of the crucial assumption of the use of variance of return of a security as a measure of risk.

Other criticisms relate to the use of a risk-free rate of interest (this being described as unrealistic); the use of a normal distribution for the distribution of returns; the validity of using the past as a guide to the future; and the failure of MPT to identify over-priced securities.

One of the main critics of MPT is R.S. Clarkson (1983) ³, who has derived a Market Equilibrium Model for the Management of Ordinary Share Portfolios. He criticised MPT conceptually, focusing largely on the inappropriateness of the definition of risk, saying that *it takes no account of the fund manager's understanding of the price formation process and therefore cannot be accepted as a suitable yardstick*. . .

I believe that it is appropriate to use the standard deviation of return as a measure of risk, because the future is uncertain, so we can talk only in terms of expected returns. The return achieved is what matters, and this measure of risk gives estimates of likely divergences of actual outcomes from the expected outcome.

I do not wish to discuss Clarkson's model; however, suffice it to say that his model is subjective, whereas MPT presents an objective approach to portfolio management. ⁴

At the 22nd International Congress of Actuaries in 1984, P.G. Moore ⁵ made the following points in favour of MPT: ■ MPT is primarily based on past performances (and hence is very much allied to past experience of investment behaviour). It is not, as is commonly asserted, theoretical in the sense that it aims to describe how a market ought to behave — it looks at how a market has actually behaved in the past and uses that information as a guide to the future.

■ MPT is principally concerned with portfolios, and the effects of diversification, rather than individual securities.

■ MPT is very much simpler to handle than models based on regression analyses performed on subjective assessments of future performance of individual earnings and dividends, and requires fewer inputs.

■ It is quite possible to graft on to MPT particular pieces of strong subjective information. Hence it seems to be playing with words to describe MPT as being "purely theoretical" and traditional methods as being practical (and therefore more worthwhile).

■ MPT should be seen as being based on the principle that the past is the best guide to the future unless there is strong evidence to the contrary, while many of the so-called traditional methods of portfolio management rely heavily on subjective inputs.

Present use of MPT in Australia

It would appear that, unlike in the United States where it is growing in popularity, MPT has little relevance in Australia at present as an explicit investment tool, being used by only a handful of companies. However, as competition increases, some investment managers may seriously consider such an approach to portfolio management.

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Implications of MPT

The basic tenets of Modern Portfolio Theory are that expected return is related to risk, as measured by Beta, in a linear fashion in an efficient market; diversification reduces specific risk; and the optimal portfolio is related to an investor's risk-return preference, and is attained through holding both the market portfolio and risk-free securities.

The implication of such a model, if it holds, is that there are no bargains in the market-place. Shrewd investors may be able to take advantage of the small amount of disequilibrium which exists, because the market is not perfectly efficient — but it is efficient to a large degree.

If superior returns cannot be achieved through stock picking, then the optimum strategy is to diversify as fully as possible in order to eliminate non-market-related risk.

This is happening largely in the US, but the concept of an indexed fund is starting to take root in Australia. One advantage of such a strategy is that transaction costs are kept to a minimum.

With the growth in investment-linked life insurance policies, and market-related contracts generally across the financial community, investment managers must give serious thought to their level of risk. If they opt to take on more than the market level of risk, either through leverage or chancing their arm, they must realise that while the expected return on their portfolio may be increased (only when using leverage, not when chancing one's arm), they are increasing the variability of their return. An adverse degree of fluctuation in the performance will not encourage investors — especially those who like to see their return, and not be told that in the long run they will average a higher return.

Rather than go for a situation of full indexing, an approach which may be adopted is to invest a significant proportion of a fund in a passively

managed, indexed fund — say, 70 per cent to 80 per cent — and then actively manage the remainder. Such an approach might be used where some stability is wanted in the fund, but there is still some scope to try for increased returns, as a result of: ■ forecasting ability on either individual securities or on the market; ■ inside information; or ■ luck.

Modern Portfolio Theory, in the sense of applying mathematical and statistical concepts to the processes of investment management, is clearly here to stay. The extent to which an individual uses it or believes in it is obviously a matter for personal judgment.

Most fund managers implicitly consider risk management, but they may never actually measure the risk-return trade-off. For example, a fund manager adopting a top-down approach to investment policy regularly analyses each sector of the economy and the various investment opportunities. In this appraisal, he considers the perceived risk in each alternative, particularly in relation to other risks. Having done so, he seeks to maximise his return given the risks which he is prepared to take on.

FOOTNOTES

1. Jensen, M.C., *Capital Markets: Theory and Evidence*, "Bell Journal of Economic and Management Science", Autumn, 1972.
2. Black, F., Jensen, M.C., and Scholes, M., *The Capital Asset Pricing Model: Some Empirical Tests*, in Jensen, M.C. (ed.), "Studies in the Theory of Capital Markets", Praeger, New York, 1972.; Blume, M. and Friend, I., *A New Look at The Capital Asset Pricing Model*, "Journal of Finance", March, 1973.; and Fama, E.F. and MacBeth, J.D., *Risk, Return and Equilibrium: Empirical Tests*, "Journal of Political Economy", May — June, 1973.
3. Clarkson, R.S., *A Market Equilibrium Model for the Management of Ordinary*

Such a process would come alive if the risk and return could subsequently be measured, and considered, using the results of the CAPM as a benchmark for comparing portfolios of different risks. While there are practical difficulties associated herewith, such an exercise might show whether the fund would be better invested using an indexed fund, following the CAPM.

I believe that Modern Portfolio Theory will be used more and more, especially when increased sophistication of computers allows valid comparisons to be made between actual and expected results, based on a realistic model such as the CAPM. The trade-off between risk and return will be increasingly emphasised by investors, and there will be a growth in the use of funds which are substantially indexed to some measure of the economy. Pressure for such changes will come largely from increasing competition, and the corresponding need to perform.

The whole concept of risk management is a fundamental issue for modern investors. The challenge of defining and quantifying risk is met head-on by Modern Portfolio Theory.

The implications of Modern Portfolio Theory are that there are no bargains in the market-place, and the maximum return for a given level of risk can be obtained by taking on the market portfolio, the risk being varied by borrowing or lending.

There is much evidence to support the validity of Modern Portfolio Theory. I believe that the full impact of its results has not yet been felt, but it will become increasingly important in the years to come.

Share Portfolios, "Journal of the Institute of Actuaries" (JIA), 110, 1983, p.17.

4. J.M. Ryder, in a paper to the Institute of Actuaries entitled *Subjectivism — A Reply in Defence of Classical Actuarial Methods*, (JIA, 103, 1976, p.59.), argued strongly that actuaries should not pursue subjective or "degree of belief" approaches to actuarial problems, but should use what he called "Classical Actuarial Methods". MPT uses objective data, and so is a methodology which falls squarley within the purview of Ryder's definition. Clarkson's paper, on the other hand, does not.
5. Moore, P.G., *Modern Portfolio Theory and the Measurement of Risk*, 22nd International Congress of Actuaries, 1984, Vol. 5, p. 241. □