

DEVELOPING A STATISTICS SYLLABUS FOR FINANCE AND ACCOUNTING

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Ideas from Modern Portfolio Theory (MPT) are suggested as a framework around which a statistics syllabus for accounting students can be built at undergraduate level. There are motivational benefits, and many opportunities for interesting project work involving use of real data. Perhaps the most compelling attraction, however, is that a core concern in MPT is the measurement of variability, the very issue that is central to statistical methodology.

STUDENT MOTIVATION

In many university statistics departments, a sizeable fraction of the undergraduate teaching comprises statistics courses delivered to non-specialists. Introductory and intermediate-level statistics courses are taken, often as a compulsory subject, by students in a very wide range of disciplines, including business, economics, accountancy, psychology, biology and education. My particular concern here is with accountancy students.

One of the principal aims of a teacher is to help motivate his/her students. Those who have been faced with the task of teaching 'service' courses in statistics know all too well the difficulties of achieving this motivational aim. Students taking statistics as an ancillary subject can be difficult to motivate. Some have fears about the mathematical aspects of statistics. Many have difficulties seeing the relevance to their own discipline. A common cry — both from students and from staff members in the 'major' discipline — is a plea to use examples tailored to that particular discipline. This can certainly help in stimulating interest amongst students. However, my own experience has been that examples need to be *very specific* to that discipline if students are to identify them as being relevant to their main interests.

ACCOUNTANCY STUDENTS

There are numerous undergraduate accounting students in universities in the U.K., and elsewhere, who take statistics courses as a compulsory part of their degrees. Many of these degree programmes are constructed so as to allow successful students exemptions from the foundation stages of professional accounting examinations. Various aspects of statistics and related quantitative methods constitute an important element in gaining

these rights to exemption. However, the statistics syllabuses recommended by the accounting bodies for their professional examinations show relatively little evidence of features peculiar to accountants or to the accounting profession.

Although accountancy is clearly a 'numerate' discipline, it is not obvious what an ideal statistics syllabus for accountancy students comprises. Accountancy as a profession sometimes gives to outsiders the impression of seeking to avoid the very characteristics statisticians see as their central concern — namely, uncertainty and variability. Accountancy students seem to be relatively poorly served for dedicated statistics text books. Their needs tend to be subsumed within the more general area of 'Statistics for Business and Economics'. For the latter market there is a plethora of texts, many originating in the U.S.A. Very few of the examples used in these texts, though, are drawn from the field of accountancy.

FINANCIAL MANAGEMENT AND MODERN PORTFOLIO THEORY

My main argument in this short paper is that Financial Management, a subject studied by most accountancy students, contains ideas that can form a coherent and motivating bridge between accounting and statistics. It is clearly not the only potential bridge. Sampling for auditing purposes is another possibility. However, with audit sampling as a starting point, there are some obstacles to developing a sufficient variety of statistical areas in a natural and coherent fashion. Moreover, the populations accountants are likely to sample typically have very skewed distributions, so elementary results from 'normal' sampling theory are of limited application.

By contrast, Modern Portfolio Theory (MPT) provides a framework around which a wealth of statistical material can be naturally assembled. Having such a stem, rooted in a subject with which accountancy students can easily identify, is potentially a great motivating tool. Perhaps the greatest attraction of using MPT as the central theme in a statistics course for accountancy and finance students is that the emphasis can be put, right from the start, on the measurement of variability, the characteristic that statistical methodology claims to address.

In this case the variability is of returns on financial investments. Looking prospectively, returns on financial investment are, for various reasons, not certain. This uncertainty gives rise to investment *risk*. Looking retrospectively, we observe that returns on investments have been variable (which is partly why we are uncertain as to what will

happen in the future). Uncertainty, variability and risk therefore inevitably become the focus of attention at the outset.

The next paragraph contains short extracts from Malkiel (1996, page 229), a book described on its back cover as ‘the newest edition of a best-selling investment guide’. The extract indicates how measurement of variability lies at the heart of MPT. Further, it points to the fact that finance theorists most frequently choose a basic statistical measure of variability — standard deviation (of percentage returns) — as their yardstick of investment risk. This is not a peculiarity of Malkiel’s very readable book. Similar statements can easily be found in other finance texts (see, e.g., Bain, 1996, page 97 or Ibbotson and Brinson, 1987, page 42).

“Risk is a most slippery and elusive concept. It’s hard for investors — let alone economists — to agree on a precise definition. ... Once academics had accepted the idea that risk for investors is related to the chance of disappointment in achieving expected security returns, a natural measure suggested itself — the probable variability or dispersion of future returns. Thus, financial risk has generally been defined as the variance or standard deviation of returns.”

The evidence for the variability is encountered daily in newspapers, and on radio and television (see, e.g., Figure 1). The variability emerges starkly when simple data sets are graphed (Figure 2).



Figure 1. Headlines from the financial pages of *The Guardian* newspaper, January 29 1998 and February 3 1998.

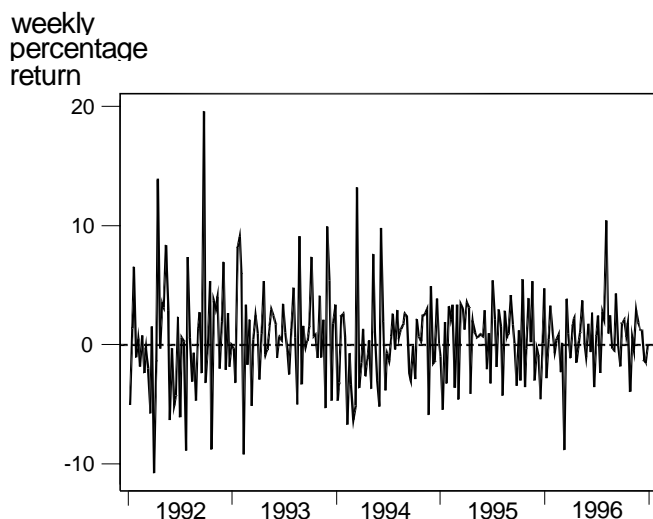


Figure 2. Time series plot showing the weekly percentage returns on an investment in Barclays Bank shares, January 1992 to December 1996. Source of data: Datastream.

A course based around ideas from MPT can begin at a very elementary (though non-trivial) level: examining basic statistical measures including mean and standard deviation, and simple statistical diagrams. From these elementary beginnings, a variety of directions can be pursued, including the investigation of important probabilistic notions, in particular dependence and independence, and of methods for time series analysis. One attractive path is to work towards a discussion of the Capital Asset Pricing Model (CAPM). A central notion in the CAPM, as in statistical methodology more generally, is the partitioning of variance — and, in this context, of ‘risk’. Discussion of the CAPM highlights the role played by theory and modelling. Application of the theory involves regression and correlation, two of the most commonly used statistical tools.

THE CAPITAL ASSET PRICING MODEL

The CAPM is a pricing theory for the expected return on a risky asset. Because the CAPM sometimes rates a mention in the financial pages of the ‘quality’ press, I have been able to hand out to students copies of newspaper articles (e.g. O’Connor, 1996) giving an intelligent layman’s explanation of the CAPM. It is clearly a theory finance experts treat seriously. The London Business School runs a *Risk Measurement Service* providing subscribers with a quarterly bulletin listing the latest estimates of risk for companies listed on the U.K. Stock Exchange, and for various portfolios made up from

these companies. The bulletin contains brief but good explanations of CAPM concepts. I have encouraged my students to study the risk ratings and use them in assignment work.

Because the CAPM is so seldom referred to in existing statistics texts, and appears to have been neglected even as a basis for relevant examples, a very brief overview follows. In a straw poll of introductory statistics texts on the shelves of my own University's library, I have examined around twenty introductory texts written for business and economics students. Some of their titles promise statistical techniques 'for modern business decisions' or 'for management'. None, though, contain any reference to the CAPM, nor more generally to measurement of investment risk using statistical tools.

According to the CAPM, the risk involved in holding a particular asset consists of systematic risk (from general market movements) and unsystematic risk (from variation specific to that asset). All investors are assumed to hold a suitably weighted portfolio of all risky assets, known as the market portfolio. Any particular risky investment in this portfolio will provide a return in the form of a risk premium. Investors are rewarded, however, only for taking systematic (undiversifiable) risk. The security market line expresses the expected percentage return on a risky asset as a linear function of the expected percentage return on the market portfolio.

An important element in this relationship is the beta coefficient of the asset, which measures the sensitivity of the asset's returns to general market movements. Assets with beta coefficients greater than 1 (i.e. which tend to show more variability than the market portfolio) are known as aggressive assets. Assets with beta coefficients less than 1 (i.e. which tend to show less variability than the market portfolio) are known as defensive assets. The beta coefficient of an asset can be estimated by running a linear regression of the asset's percentage returns against the percentage returns from the market portfolio. A broadly based index such as the FT-SE All Share Index is commonly used as a proxy for the latter. The coefficient of determination for this linear regression represents the estimated proportion of the variability in the asset's returns that is 'in common' with market variability, i.e. the proportion of the variability that represents systematic (undiversifiable) risk.

The beta coefficients are the focus of the London Business School's *Risk Measurement Service*. The quarterly bulletins list estimated betas, together with associated statistics from the regressions. The London Business School no doubt incorporates some sophistications in the statistical techniques it uses to estimate the beta

coefficients (the quarterly bulletin refers to 'Bayesian predictions', but gives no further explanation). However, in my experience, and those of my students, it is possible to get beta estimates using naïve least squares estimates that closely match those given in the London Business School quarterly bulletins. This is a useful point, suggesting to students that the techniques they are learning and practising give results with a commercial value!

DATA SETS AND PRACTICAL WORK

As my brief outline of the CAPM indicates, there are great opportunities for practical work and for 'real-life' examples and projects. Newspapers carry day by day listings of share prices. Though this is a very cheap source of data, the amount of work involved in incorporating the raw figures into a useful database is high. Additionally, a long lead time is needed if a satisfactory run of past data is to be created.

An alternative is to use a commercial databank. In the U.K., two possible options are Datastream International Ltd and FT EXTEL. Datastream offers an impressive amount of on-line business, financial and economic data, and generous discounts to academic organisations. For large institutions, a subscription can provide considerable amounts of data at modest cost. The pricing structure is less attractive for smaller institutions with a relatively small number of users.

REFERENCES

- Bain, W. G. (1996). *Investment Performance Measurement*. Woodhead Publishing Limited, Cambridge, England.
- Ibbotson, R. G. and Brinson, G. P. (1987). *Investment Markets*. McGraw Hill Book Company, New York.
- Malkiel, B. G. (1996). *A Random Walk Down Wall Street*. W W Norton and Company, New York and London.
- O'Connor, G. (1996). A sense of balance helps reduce your risks. *Financial Times*.