Applications of Statistics in Accountancy

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1.   Introduction

Most undergraduate programmes in business contain a one-year course in basic statistics. Two common problems in teaching such a course are, first, developing students' understanding of the basic concepts of statistics, many of which are counter-intuitive and difficult to understand, and, second, convincing them of the relevance of statistics to their specific field.

To deal with the first problem, Horgan (1985) recommends an empirical approach to basic statistics teaching using simulation procedures to illustrate statistical concepts. With the increased access to interactive computing and the increasing computer literacy of students from all disciplines, this approach is certainly feasible. It makes it possible to de-emphasise algebraic proofs and enhances the understanding of statistical concepts.

The second problem, that of the relevance of statistics to the particular discipline, may be partially addressed in the basic course by using real data sets, as far as is possible, and avoiding the artificial examples frequently given in standard textbooks. It is our opinion, however, that there is a strong case for a further one-term course dealing specifically with statistical applications in specific disciplines. This paper deals with such a course. It is given to final-year business students specialising in accounting and finance. It is given for one term of the Financial Statement Analysis course.

2.   The course

The ideas for this course came from our joint research and we thought that students could benefit from our experiences of collecting and modelling accounting data from Irish companies. The objective of the course is to increase the motivation and understanding of statistics by dealing in depth with problems directly related to accounting and by using data collected from Irish companies. Students have already completed a one-year basic statistics course.

Two one-hour lectures and a seminar are held each week. The course concentrates on three areas, namely collection and handling of accounting data, regression, and time series. The first half of the course is devoted to data collection and analysis for regression models, and the second half to time series. In an approach somewhat similar to that suggested by Hawkes (1980), students are given a set of papers to read at the beginning of the course. Each student is asked to review one paper at the weekly seminar. They are familiar with the accounting terminology and concepts from their core subjects and the statistics material is dealt with at lectures. Students are also encouraged to follow up the references given in the papers. In addition, each student is given four or five Irish companies and collects data on these with a view to doing a similar type of analysis. Problems with data collection, variable definition, and modelling are also considered at the weekly seminar. Both of us sit in on the seminar - the accountant to give guidance on the accountancy aspects and the statistician to discuss the statistics problems.

The students use a statistics package to do the analysis and are given a choice between MINITAB and Statgraphics. In the modelling, emphasis is placed more on obtaining the correct model than on details of parameter estimation. At the end of the course, each student submits a written report on the work done and compares the results with published results. Assessment is based on this.

2.1 *Published papers and background reading*

The papers studied are mostly from the *Journal of Accounting Research* and the *Journal of Business, Finance and Accounting*. McDonald and Morris (1984) and Whittington (1980) are used to give guidance on variable definition. For the regression section the students read Brown and Ball (1967), Gonedes (1973), Lev (1980), and Magee (1974). In addition, Foster (1986), Rees (1990), and Draper and Smith (1981) are used as reference texts. Studies which fit time series models to the annual earnings of individual firms include Albrecht, Lookabill and McKeown (1977), Ball and Watts (1972), Beaver (1970), Caird and Emanuel (1981), and Watts and Leftwich (1977). O'Donovan's text (1983) is used to aid in the modelling. Irish companies do not release quarterly earnings information. Papers which report the results of fitting time series models to quarterly earnings (e.g. Hillison, Hopwood and Lorek, 1983; Kodde and Schreuder, 1984) are reviewed but students cannot collect data or model the behaviour of quarterly earnings of Irish public companies. At the weekly seminar each student gives a summary of one of the papers. The objectives of the seminar are to assess critically the paper, to evaluate the data collection methods, to understand the methods and models used, and to decide if similar analysis may be applied to the data on Irish companies.

2.2 *Data collection*

Each student is allocated a number of Irish public companies and collects data on these with a view to doing analyses similar to those in the published articles. The companies allocated to each student are carefully selected to include some whose data is readily available on computer databases (e.g. Datastream) and others whose data have to be collected from primary sources such as the Office of the Registrar of Companies. Data are collected on annual earnings, total assets, and shareholder's equity. Return on

shareholder's funds and return on total assets are calculated from the collected data. Gross National Product and Industrial Output Statistics obtained from the Central Statistics Office are also used. The idea is to give the students a feel for different sources of data collection.

Problems that occur at this stage arise mainly because Irish firms are smaller than those studied in the papers reviewed and, usually, the time series are shorter. For example, Irish public companies were first required to publish financial information in 1963. Therefore, data for the time series models are only available from then, while in the papers being reviewed (e.g. Albrecht, 1977) data goes back as far as 1947. Furthermore, because industrialisation in Ireland took place much later than in other western economies, a larger proportion of Irish public companies were founded only in the 1970s. As a result, collecting even twenty years' earnings data of Irish public companies for use in regression studies similar to those discussed in Foster (1986) can be difficult. Discrepancies such as these and national differences in disclosure requirements, company and market size, and accounting variable definitions, prevent the students plagiarising and blindly following the published analyses.

2.3   *The regression models*

The published papers report results which show that in the USA and elsewhere the annual earnings of companies are influenced by industry and economy factors. Regression models for accounting earnings on economy and industry factors are found. Our students attempt to carry out similar studies with data from Irish companies. Economy and industry factors may be defined in various ways, for example:

(i)   GNP for the economy index and Industrial Output Statistics for the industrial index;

(ii)   simple and weighted average earnings for all companies in the sample for economy indices, and simple and weighted average earnings for all companies in the industry for the industry indices.

Foster (1986, pp.197-200) considers 315 companies over 15 industrial sectors and includes only sectors that have 10 or more firms. In the Irish situation, students identify a large number of separate industrial sectors (as defined by standard classification systems such as that of the Institute of Actuaries and the Faculty of Actuaries) and often the number of companies per sector is small. This forces the students to consider alternative definitions of industrial sectors and, where necessary, to combine sectors.

Simple linear differenced models of accounting earnings on the economy index and the industry index are fitted. Multiple regression models of earnings on both indices are also considered. Reasons for differencing are discussed. The models are tested for autocorrelation. The residuals are examined and transformations and quadratic terms are considered. Outliers are examined and considered for rejection. The impact of change in the industrial sector classification is compared with published results. At a final seminar on regression, the models are presented by each student and criticised by the participants. Students defend their approach.

2.4   *Time series*

Our approach to time series is similar to that of regression. Results from studies of the time series models on annual earnings of American, Australian, and British companies indicate that deflated and undeflated earnings appear to be well described by a random walk model and a random walk model with drift respectively, and that company-specific models cannot outperform the random walk for forecasting.

Data are collected on the undeflated and deflated annual accounting earnings series of public companies for which accounting information is available from 1963. Any series shorter than this is deemed to be too short (O'Donovan, 1983, p.32) and hence not included. The undeflated and deflated variables are drawn from the same set as for the regression models. Again, uniquely Irish issues are encountered. For example, the deflator in the variable "return on shareholders funds" is often found to be negative, which makes the variable uninterpretable and forces students to examine alternatives.

Students use Box-Jenkins procedures to obtain suitable models. Predictions are obtained from the company-specific model, random walk model, and random walk model with drift, and prediction accuracies are compared.

At a final seminar students present their findings, expound their models using ACFs and PACFs, and compare the predictions obtained from the company-specific models with those obtained using random walk and random walk with drift.

3.   Summary

This course deals with collecting and modelling accounting data. It is given as part of a Financial Statement Analysis course to business students specialising in accounting and finance. They have already taken a basic course in statistics. Practical statistics are used in a realistic context and a limited range of practical problems are studied in depth. Students realise the need for discussion and exploration rather than thoughtless application of standard techniques. They discover that real data do not always fit textbook examples and they learn to deal with these situations. At the analysis stage, they become adept at using statistical packages and often discover their limitations. They gain experience at putting together a statistical report, orally presenting results, reading journals, and following up references.

Finally, it is hoped that this course helps to combat the negative attitude towards statistics often encountered in undergraduate courses on statistics - a subject usually relegated to the ranks of an irrelevant extra, necessary to know only for examination purposes and quickly forgotten thereafter. This practical approach should help to raise the "status" of statistics. The fact that it is part of an accounting course helps to establish the connection between the two subjects.

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