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The identification of U.K. takeover targets using published historical cost accounting data Some empirical evidence comparing logit with linear discriminant analysis and raw financial ratios with industry-relative ratios

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Abstract

This study examines whether multivariate models using published financial data have predictive accuracy to successfully identify targets, thereby earning excess stock market returns. Although it was found that in the estimation period the important factors affecting the likelihood of a bid were stockholder profitability combined with poor sales growth, these variables were unable to successfully identify targets in the holdout sample. The empirical study also investigated whether the predictions are affected by the choice of statistical estimating technique and data form. It found that they were and that the choice depended upon the statistical assumptions of the models. The results also showed that raw financial ratios and IRRs based on the same underlying data generated significantly different forecasts using the same statistical technique. © 2000 Elsevier Science Inc. All rights reserved.

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1. Introduction

The literature on corporate control presumes that, like financial failure, mergers may be forecast using published financial data. That is, factors increasing the probability of (or vulnerability to) takeover include inefficient management (as represented by declining profitability, for example) and a poor growth resources mismatch. This seems eminently reasonable because although there may be many reasons for mergers,

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targets are not selected arbitrarily but arise from a desire by a bidding company to reap benefits from merger. The problem for the analyst who attempts to forecast them is simply a matter of identifying the best explanatory/predictive variables.

However, Palepu (1986) showed that most of the previous studies that had boasted high predictive accuracy (between 60% and 90%) did so largely because of statistical error. If they had been estimated correctly, their conclusions would have been very different. However, subsequent studies suggest that, while Palepu's methodological points are clearly correct, his conclusions may not be the final word on the subject. For instance, Walter (1994), using Palepu's methodological revisions, showed that current cost accounting (cca) information in the U.S. has quite a high predictive accuracy. Unfortunately, because of the losses sustained on a few of the incorrect forecasts, his model only earned modest excess returns overall.¹

Despite his criticism of the statistical methodology of previous studies, Palepu did not address the choice of statistical technique. Most used linear discriminant analysis (lda), whereas Palepu (and subsequent studies) preferred logit, probably because it was generally considered to have "theoretical superiority." But this may not necessarily be the case. As the statistical literature demonstrates (Ladd, 1966; Efron, 1975; Press and Wilson, 1978; Lo, 1986; Sharma, 1996, pp. 263–264), the arguments for and against the two competing methods are more finely balanced in which the statistical nature (or form) of the data plays an important part.² While lda strictly assumes that the explanatory variables are jointly normal with equal covariance matrices, logit is not restricted by these assumptions; the restriction is merely that the explanatory variables are independent.³ The case for lda, therefore, is that logit estimators are between one half and two thirds as efficient as lda estimators (Efron, 1975).⁴

On the other hand:

- (a) When the two lda assumptions do not hold, the discriminant function estimators of the slope coefficients will not be consistent (Halperin et al., 1971).
- (b) lda estimation can give misleading results regarding the significance of the coefficients when the normality condition is violated. That is, under non-normality of the explanatory variables, a slope coefficient that is really zero will tend to be estimated as zero by logistic regression in large samples but not necessarily so by lda. Thus, where normality is violated, meaningless variables may be erroneously included in discriminant functions (Press and Wilson, 1978).
- (c) The maximum likelihood method of estimation in logistic regression usually gives under non-normal distribution conditions (and possibly even normal conditions as well) slightly better fits to the model, as evaluated from observed and expected numbers of cases per decile (Halperin et al., 1971).
- (d) lda estimators may also mask troublesome data. Press and Wilson (1978) show how, for the same data, lda estimators may provide a perfect fit, while a logistic regression shows the slope and intercept coefficients as non-existent and no relationship between the hypothesised variables. Their concern is that lda "provides no warning signal whatsoever and quite incautiously suggests [in their numerical illustration] a slope coefficient estimate of $b = 4$."

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