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Takeover prediction using forecast combinations

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ABSTRACT

The ability to identify likely takeover targets at an early stage should provide investors with valuable information, enabling them to profit by investing in potential target firms. In this paper we contribute to the takeover forecasting literature by suggesting the combination of probability forecasts as an alternative method of improving the forecast accuracy in takeover prediction and realizing improved economic returns from portfolios made up of predicted targets. Forecasts from several non-linear forecasting models, such as logistic and neural network models and a combination of them, are used to determine the methodology that best reduces the out-of-sample misclassification error. We draw two general conclusions from our results. First, the forecast combination method outperforms the single models, and should therefore be used to improve the accuracy of takeover target predictions. Second, we demonstrate that an investment in a portfolio of the combined predicted targets results in significant abnormal returns being made by an investor, in the order of up to double the market benchmark return when using a portfolio of manageable size.

1. Introduction

Mergers and acquisitions have long been a major area of research in finance. Several studies have demonstrated that the target's share price increases substantially over the period leading up to the bid announcement date. It has also been observed that most of the gains in mergers and acquisition deals accrue to the shareholders of the target firm. Consequently, the ability to identify likely takeover targets at an early stage could provide investors with valuable information from which they can profit by investing in potential target firms. Assuming that abnormal returns can be achieved by trading in advance of acquisition announcements, the development of takeover prediction models based on publicly available information provides important tools for guiding investment strategies.

Even after considering the methodological improvements from several recent studies in the area of takeover prediction, the answer to the question of whether takeover targets can be predicted remains unclear. If the conclusions from a study are based on a single forecast, little information on the robustness of these predictions is available. Further, Powell (2004) advised that modelling takeovers using a binomial framework exclusively may be misleading, since takeovers may occur for many reasons which will not be present in the selected hypotheses and the corresponding predictor variables. From an investment perspective, it is crucial to be aware of the risk and stability of a takeover model. It hardly seems optimal for an investor to invest capital in a portfolio of potential target companies unless the selection process was based on robustly evaluated predictions.

Forecast combination has long been viewed as a simple and effective way to improve the robustness of forecasting performances over those offered by forecasts from just one model. The perception that model instability is an important determinant of forecasting performances, and a potential reason for combining forecasts from different models, started with Bates and Granger (1969), and was further supported by Diebold and Pauly (1987) and Pesaran and Timmermann (2007). Later, the combination of

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probability forecasts of a binary variable defined on the [0, 1] interval appeared, when Kamstra and Kennedy (1998) introduced a method of combining log-odds ratios using logit regressions. Further development in this area was carried out by Riedel and Gabrys (2004), who generated multilevel forecasts, and Clements and Harvey (2010), who compared several different methods for combining probability forecasts.

The motivation for this paper is to explore the possible economic gains accruing to a portfolio of predicted takeover target companies. The forecasts are estimated using a combination of probability forecasts generated by established takeover prediction models. It is anticipated that, by combining the forecasts from various individual models, a portfolio of targets will be created that will consistently achieve abnormal returns and lower misclassification rates. This research contributes by showing that a good and consistent forecast accuracy can be achieved when predicting potential takeover targets using forecast combinations both from a number of panel data logistic regression models and from neural network models. Its assessment of the financial gains from the proposed modelling approach is innovative, as is its observation of model consistency over time. Further, this study extends previous research by analysing a wide range of companies over a decade and including new explanatory variables for takeover prediction.

The background of takeover prediction research is summarized in the next section. In Section 3, takeover hypotheses and their corresponding explanatory variables are discussed. Section 4 outlines the data used in the study, while the design of the forecasting strategy that includes the combination of forecasts is detailed in Section 5. Section 6 contains the results, with conclusions following in Section 7.

2. Background

The theoretical background of the takeover prediction literature relies on hypotheses arising from the Market for Corporate Control. This theory assumes that takeovers can be predicted using published financial data, and includes factors which are hypothesised to increase the probability of a takeover announcement, such as inefficient management and a growth resources mismatch. Barnes (2000) explains that, although there may be many reasons for mergers, the targets are not selected arbitrarily. Instead they arise from a bidding company's desire to gather benefits from a takeover or merger. The proposed and evidenced theories explaining the reasons behind takeovers include profitability (Hogarty, 1970), economies of scale (Silbertson, 1972), market power (Sullivan, 1977; Thomadakis, 1976), information signaling (Bradley, Desai, & Kim, 1983), and management efficiency (Jensen & Ruback, 1983). In particular, researchers have found financial synergy to be a strong motive for mergers (Gahlon & Stover, 1979). However, each individual takeover has a specific rationale, and, due to its complexity, the finance literature has been unable to come up with a catch-all model to anticipate these events. It follows that an important challenge for researchers who are attempting to forecast targets is the issue of identifying the most appropriate model or models.

From a theoretical perspective, knowing the reasons behind a takeover bid should prove useful and provide a key to understanding merger and acquisition dynamics and motivations. As a consequence, the economic benefit derived from the management of a portfolio of forecasted targets depends critically on the accuracy of the predictions from the forecasting model utilized. An assortment of models has been applied in the past in an attempt to identify common characteristics of different takeover targets. They include univariate analysis by Harris, Stewart, Guilkey, and Carleton (1982), multiple discriminant analysis by Stevens (1973) and Barnes (1998), logit analysis by Meador, Church, and Rayburn (1996), and neural networks by Cheh, Randy, and Ken (1999) and Denčić-Mihajlov and Radović (2006).

Stevens (1973) defended multiple discriminant analysis as a model that was well suited to many financial problems where the dependent variable is dichotomous. However, most of the studies conducted in the 1980s and 1990s switched to logistic regression models for predicting takeover targets. Dietrich and Sorensen (1984) were the first to apply logistic regression to bankruptcy prediction following the article by Ohlson (1980). Palepu (1986) was able to formally improve both the validity and the consistency of the prediction procedure by analysing the influence of the cut-off probability on the predictability rate. Since then, the research has concentrated on the development of alternative methods, in order to determine optimal cut-off probabilities, and thus reduce the misclassification error. The end of the 1990s saw the emergence of additional methodological improvements, such as the profit maximization criterion proposed by Barnes (1999), and the use of a standard feed-forward backpropagation neural network model by Cheh et al. (1999).

The classification models reported in the literature have demonstrated varying degrees of success, with predictive accuracies of up to 90% better-than-chance in-sample, and accuracies ranging from below 50% to around 120% better-than-chance out-of-sample. For example, Powell (1995)'s best results were achieved by the use of multinomial models, with an overall reported prediction accuracy of 4.76%. The work of Powell (2004) showed an even better rate of success, with up to 12% accuracy using multinomial models. Barnes (1999) claimed an accuracy of 2.5% (or 97.33% better than chance) when using a logit regression, while Stevenson and Peat (2009) used a combined logistic model to achieve results which were up to 118% better-than-chance.

However, such abilities to generate abnormal returns have since been questioned by many authors, who have been unable to replicate the results of previous studies when applying the proposed methodologies in different markets or periods. In contrast to the classification abilities claimed by many studies, empirical applications of the models have generally failed to confirm the out-of-sample predictive expectations formed from in-sample results.