

## Predicting Acquisitions in India

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## Abstract

This paper builds a prediction model for acquisition targets in India using logistic regression and reports typical characteristics of the target firm. Results indicate that, a typical target is inherently strong with high growth and large free cash flow, in spite of high debt levels, but encumbered by an inefficient management, who are disciplined by takeover market. Traditional determinants of US and UK studies, viz., size and growth-resource imbalance do not seem to be working in Indian context. Evidence was also found for the superiority of industry relative ratios as data, and maximization of returns method for cutoff calculation.

## 1. Introduction

The decision to acquire a company is an investment decision, similar to any capital budgeting process. Justification of this decision, therefore, will necessarily be grounded on financial forecasts. Besides, while scouting for a firm, the single largest source of information about the firm would be its audited financial reports. Thus, existing financial characteristics of the firm ought to have a strong bearing on the acquisition decision. It is with this rationale that a large body of literature has evolved, wherein attempts have been made to predict takeover targets from published financial data.

The motivation behind the endeavor to predict takeover targets is twofold. One is to test hypotheses regarding which characteristics of a firm render it attractive to a raider, and thus, susceptible to takeover attempts. These hypotheses stem from various motives that have been proposed in the literature to explain takeovers. The other motivation behind predicting takeover targets is to 'beat the market', and invest in targets which are highly probable to be acquired. Since it is commonly known that a takeover announcement leads to increase in share prices of the target, such investment before the market can result in abnormal returns.

However, most of these studies were made on the acquisition scenario of the US and UK. Prediction of takeover targets in the Indian context has been few and far between. This is both surprising and unfortunate, since M&A is a growing phenomenon in this and other developing economies, and identifying a potential target firm ought to become an area of great research interest to various stakeholders involved in acquisition activity – the acquirers, the targets themselves, investment bankers and the policy makers. The few empirical analyses with Indian takeover data have thrown up interesting observations that would warrant further investigations. For example, Pawaskar (2001) reported that target firms were smaller in size (expressed as total assets) than the industry, but so were the acquiring firms. Also, target firms had significantly lower liquidity (current ratio) than industry, as well as low growth in assets. Yet, it is well known that, if a firm has low growth prospects, a potential acquirer would be interested in it only if it is rich in resources, like high liquidity position. In another study, Panigrahi (2004) found expected returns to shareholders to be a significant factor positively related to takeover likelihood, i.e., higher the returns to shareholders, higher are the chances of takeover. But, higher returns imply a good management, and the market for corporate control is not expected to punish them. Unfortunately, there were no attempts made to explain these distinctive results, although they might contain valuable information about the Indian market for corporate control. In addition, in the few studies made on the Indian milieu, there has been no conscious attempt to include any distinctive feature that characterizes this market.

This study has three objectives. Firstly, it is intended to build a model of takeover likelihood and investigate which characteristics of Indian firms make them attractive as potential targets. These characteristics were chosen from empirical precedent and theoretical hypotheses developed in the US/UK. Given the unique results reported by previous studies on Indian takeovers, this study can add to the evidence and hopefully, provide some insights. Secondly, following Barnes (1990), this study works with both firm specific financial data and industry relative data and explores whether the latter improves the model. The reason behind the superior performance of one type of data over the other will be explored. This exercise will also help shed light on whether industry relative ratios are more preferable than regular financial data in general. Finally, this study aims to find the superiority between two methods suggested in the literature to determine the cutoff probability that is used for classification of firms into targets and non-targets.

While fulfilling the above objectives and building a prediction model in the Indian context, this study incorporates a unique feature of the Indian takeover situation. In Indian companies, average promoter holdings have declined from 50.6% in 2004, to 49.5% in 2005, to 48.5% in 2006. Even then, these figures are much higher than the 35% ownership holdings in other emerging markets, and 25% in developed markets (Businessline, Oct 15, 2006). In spite of such high promoter's holdings, takeovers abound in India. Given that high ownership concentration deters takeovers and thus, significantly affects the dynamics of the market (Jensen & Ruback, 1983), it would be logical to disconnect the effect of such an influential factor which is strongly prevalent in India. It is with this purpose in

mind that a choice based estimation sample is used in this study wherein non-targets are chosen by matching ownership structures with targets in same industry.

The results follow most of the wisdom obtained from existing literature. Industry relative ratios are found to have greater explanatory power of the likelihood model. Also, the maximization of returns method proposed by Powell (2001) to calculate cutoff probability was found to yield higher target concentrations in the predicted portfolio. However, the nature of targets differed widely from that of targets in US and UK based studies. While size did not turn out to be a strong determinant, inefficient management did emerge as significant. Also, the typical target was found to be intrinsically robust with high potential.

The rest of the paper is organized as follows: in section 2, extant literature on this topic has been discussed; in section 3, the salient features of the empirical study have been described viz., the hypotheses and the corresponding proxy variables, the sample and sample selection logic, and the methodology. Section 4 presents the modeling and prediction results, discussion, and the methods adopted for cut-off calculation. Section 5 concludes the study.

## **2. Literature overview**

The literature on this topic exhibits three distinct points of focus: (a) the methodological issues in building a robust predictive model, (b) the characteristics of target firms that are found to affect takeover considerations, and (c) the extent of abnormal returns that could have been generated with these models.

### *2.1 Methodological issues*

Palepu (1986) undertook a clean up activity in terms of correcting methodological flaws committed by previous prediction studies. While he justified the *use of non-random sampling* for model estimation because of econometric reasons, where equal number of targets and non-targets are chosen, he showed that the true acquisition probability would differ from the estimated probability by a constant amount. For prediction, he stressed the use of a sample that resembles population as closely as possible.

Some researchers questioned the logic behind taking a large *estimation period*. Bartley & Boardman (1990) argued that, takeovers considered for estimation should span three years, to avoid effects of changing macro-economy. Barnes (1990) suggested using an estimation period of one year alone, and using the next financial year as the prediction period. His logic was, distributional parameters of financial ratios vary over time, and hence, any probability of takeover obtained using such ratios would also be a function of time.

On the subject of *data attributes*, the assumption of normality is generally violated with financial data; this could be avoided using industry relative ratios, a conclusion reached by Barnes (1990) and Platt and Platt (1990). Bartley & Boardman (1990) demonstrated that predictions could be improved by replacing historical cost data with inflation adjusted data. Palepu (1986) and Ooghe et al (2006) controlled for industry trends by subtracting industry mean or median values from the firm specific data. Alleging that this method ignores the different distributional characteristics of each industry, Cudd and Duggal (2000) recommends dividing those deviations by respective industry specific standard deviations. Powell (1997; 2004) also recommended the use of industry weighted financial ratios to maintain stability across time and industries.

*Definition of targets and non-targets* vary in the literature. Most studies consider subjects of only successful takeovers as targets, and subjects of unsuccessful takeovers are classed as non-targets. Belkaoui (1978) and Barnes (1997) consider all firms that have been the subject of takeover attempts within the estimation period, irrespective of the attempt's success. However, Bartley & Boardman (1990) contend that, firms that face investment attempts exceeding 5% of ownership are targets and cannot be included as non-targets. The 5% mark stems from the 5% threshold at which disclosure norms are invoked in US as per Securities and Exchange Commission. As per the Indian regulator (Securities and Exchange Board of India), however, the corresponding

threshold is 15%, since investment below that cannot be deemed as controlling ownership interests. This might be due to the difference in shareholding patterns between US and India.

*Selection methods of non-targets* have oscillated between matched sample and choice based research designs. While the jury is still out on the selection method of non-targets (Dietrich, 1984), many researchers have randomly selected companies from the list of all non-targets (e.g., Palepu, 1986; Powell, 1997; 2001; 2004); on the other hand, Chen and Su (1997), Barnes (1990; 1998; 2000) and others have selected companies that match the assets, or sales, or market capitalization of target firms.

The choice of *estimating technique* ought to be based on the underlying data distributions. Dietrich (1984) writes: “Violations of the technique’s assumptions may preclude examination of the model coefficients, but may not reduce the model’s predictive ability”. Econometric models used in literature to predict acquisition probability have been linear discriminant analysis (e.g. Barnes, 1990) logistic regression (e.g., Palepu, 1986) and probit (Pastena and Ruland, 1986). Some models have also been proposed using learning based models like artificial neural networks (Cheh et al, 1999; Panigrahi, 2004) and expert systems (e.g. Lyons and Persek, 1991). Barnes (2000) investigated whether choice of estimating technique (LDA vs. Logit) and choice of data form significantly affects accuracy of takeover prediction models. He concluded that logit is preferable if data is not multivariate normal. ANN models have exhibited better predictive accuracy than regression methods (Dencic-Mihajlov and Radovik, 2006). However, the main limitation of ANN is the requirement of a large dataset for proper training and testing; in a country like India, where M&A activity is picking up in just the last five years, and much information are still unavailable, obtaining a large dataset would be an uphill task.

Three methods have been used to determine the *cutoff probability* that is expected to distinguish the targets from the non-targets. The first method is to choose the value arbitrarily, for example, 0.5. Palepu (1986) proposed a method that minimized errors while calculating the optimal cutoff probability. The underlying assumptions were, the expected costs of Type I and Type II errors are equal and the cutoff probability ought to minimize the overall sample error rate. However, the penalty for misclassification of a non-target firm ought to be smaller than the penalty for misclassification of a target firm. Recognising this, Powell (2001) suggested a cut-off such that, the concentration of targets is the highest in the portfolio. Thus his method attempted to maximize returns.

Portfolio *abnormal returns* have been calculated by event study methodology in the literature. However, Powell (2004) used BAHAR method (Barber et al, 1999) for the same.

In the present work, the suggestions by Palepu (1986) and Barnes (1990) have been incorporated. The recommendation of Powell (1997), to segregate hostile and friendly takeovers, has also been complied with to the extent that acquisitions where preferential allotments were made to the acquirer have not been considered. Following Barnes (2000), logistic regression was used to build the prediction model.

## 2.2 Significant Target Characteristics

Ever since the first works on target prediction were published by Simkowitz and Monroe (1971) and Stevens (1973), a large body of knowledge has grown on the broad characteristics that make a firm attractive to acquirers. Some of the initial studies (viz., Monroe and Simkowitz, 1971; Stevens, 1973; ) simply took a sizeable number of financial parameters on a ad-hoc basis, reduced them on the basis of multi-collinearity or redundancy, using factor analysis and other techniques, and conducted discriminant analysis to find the significant variables<sup>1</sup>.

Subsequently, based on these early findings and other theoretical analyses, certain hypotheses emerged. Common instances of these are under-valuation, free cash flow, inefficient management / profitability, size, growth, leverage, liquidity, tax advantage, and economic disturbance. However, financial ratios considered to proxy these variables varied from researcher to researcher (see Table A1 for comparison). For example, the size variable has

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<sup>1</sup> Palepu (1986) argued that, this method ‘is arbitrary and leads to statistical over-fitting of the model to the sample at hand’

been substituted by book value of assets (Palepu, 1986), logarithm of book value of assets (Bartley & Boardman, 1990; Powell, 2004), market capitalization (Barnes, 2000), and sales (Chen and Su, 1997) ! This variability in operationalisation introduces variability in results and complicates comparison. So, while Sorensen (2000) finds no hypothesis to be significant predictors of target companies, Palepu (1986) finds target firms to be characterized by low growth and low leverage. However, a comparison of their models reveals that, they worked with two mutually exclusive sets of variables to operationalise an overlapping set of hypotheses !

Thus, importance of target characteristics in light of previous research ought to be understood in the context of variables considered and variables that emerged significant on a case by case basis. Table A2 summarises the findings of various papers.

### 2.3 Abnormal Returns

It is interesting to note that, although one of the predominant motivations behind takeover prediction studies cited in the literature is to 'beat the market' and make abnormal returns, very few researchers actually attempt to find the abnormal returns of the predicted portfolio of companies. Exceptions are Wansley et al (1983), Palepu (1986), Barnes (1998; 2000) and Powell (2001; 2004). One reason could be that, ever since Palepu (1986) made methodological corrections, no researcher has obtained any significant abnormal return by predicting targets. Thus, the semi-strong form of the Efficient Markets Hypothesis has been upheld.

## 3. The empirical study

### 3.1 Hypotheses and Proxy variables

Acquisition hypotheses explored by Palepu (1986) and Powell (1997) are examined in this study. These authors have based their choice of variables on two factors:

1. Strategic motives of bidders while acquiring a firm (Palepu, 1986; Powell, 1997; Barnes, 2000)
2. Econometric justification of such random variables to follow the requisite distributions (Palepu, 1986)

A description of the hypotheses employed in this study, and the variables considered to proxy the hypotheses are given below. It may be recalled, from Palepu (1986) that, the first eight hypotheses are based on economic theory, while the last one is based on assumptions of inefficient markets. It may also be reiterated that, various researchers have used different variables to represent each of these hypotheses (Table A1). In this study, the representations that seemed most appropriate have been taken.

*Management (in)efficiency:* This premise stems from the contention put forward by Jensen and Ruback (1983) that, "takeovers serve as an external control mechanism that limits major managerial departures from maximization of stockholder wealth". In other words, if managers do not pursue shareholders' interest, they would be replaced by new management capable of delivering better results.

ROCE, i.e., the accounting return on capital employed, was taken as an index of performance by Powell (1997). In the present study, ROCE averaged over three years prior to the takeover year has been taken.

Thus the hypothesis is, takeover likelihood is negatively related to ROCE.

*Free Cash Flow:* Free cash flow implies resources which otherwise should have been paid to shareholders, but is retained by managers, presumably to escape monitoring by capital markets and/or invest in negative NPV projects. Jensen (1987) theorised that, when managers increase their financial flexibility by retaining cash, the agency cost of that cash reduces the value of the firm and makes them attractive targets.

FCF, i.e., free cash flow, was also considered by Powell (1997). In this study, FCF averaged over three years prior to the takeover year was taken, and FCF was denoted as the ratio between operating cash flow to total assets (Powell, 1997). It was computed as follows:

$$\text{FCF} = \frac{\text{Cash flow from operations} - \text{change in working capital} - \text{change in net investments}}{\text{Total Assets}}$$

Thus the hypothesis is, takeover likelihood is positively related to FCF.

*Size:* It is generally acknowledged that, larger firms are more costly to be acquired, they have the financial muscle to fight takeovers, and hence, they become less attractive as takeover targets. While this has been a significant factor in studies from US and UK, Indian studies have not found any evidence in its favour. Pawaskar (2001), for example, found both acquiring and acquired firms to be smaller than industry averages, whilst Panigrahi (2004) and Kumar and Prabina (2007) found size to be insignificant. One reason could be that, Indian markets are still quite fragmented, and consolidation through acquisitions is a very recent phenomenon here. Thus, it would not be uncommon for a smaller firm to attempt to takeover a firm slightly larger than itself. Hence, even though size is considered in this study, the effects are expected to be insignificant or at best, ambiguous.

Size is typified by book value of total assets (Palepu, 1986). Here, book value as on the financial year just prior to takeover has been considered.

The hypothesis then, is, takeover likelihood is negatively related to SIZE.

*Growth:* In the Indian context, a growing firm within one industry ought to be attractive to all acquirers, irrespective of motive. Therefore, whether the acquirer is looking for consolidation within the industry, or is attempting vertical integration, or is an MNC looking for entry into Indian markets, a growing firm signifies accomplished performance and hence ought to be 'a good buy'.

In this study, following Palepu (1986), GRO, i.e., growth is taken as the average sales growth over the three years prior to the takeover.

The hypothesis here is, takeover likelihood is positively related to GRO

*Leverage:* Several studies (Stulz 1988; Jandik and Makija, 2005) have shown that debt serves as an impediment to acquisition results since acquisition of a highly levered target would exhaust a bidder's borrowing capacity. Besides, such acquisitions tend to take a longer time to consummate, are more likely to be associated with multiple bidder auctions, and result in low gains to bidders. All these are compounded when the debt is dispersed and risky. These findings imply that, highly leveraged firm will be less appealing to potential acquirers.

Here, LEV, i.e., leverage is denoted by debt – equity ratio, and is averaged over the three years prior to the takeover.

The hypothesis implied by earlier work is, takeover likelihood is negatively related to LEV.

*Liquidity:* Powell (1997) found that, lower the target firm's liquidity, greater is the chance of it facing a hostile takeover. The logic behind this may be derived from the empirical fact that, takeovers financed with cash and debt create larger benefits than those accomplished through exchange of stock" (Wansley et al., 1987; Wansley and Fayez, 1986, cited in Jensen, 1987). The indication is, acquirers have unutilized

liquid assets, with no better investment options, and so, pursue firms that are less liquid. This effect might be more pronounced in the Indian scenario, where reports have repeatedly pointed out that, large Indian companies are riding high on a booming economy and sitting on cash mountains, with very few investment opportunities. Foremost among these are IT companies, banks, mid-cap and small cap fund management firms, and conglomerates.

In this study, LIQ, i.e., liquidity is expressed by quick ratio, which is averaged over the three years prior to the takeover.

The hypothesis thus is, takeover likelihood is negatively related to LIQ.

*Growth-Resource Imbalance:* A firm that has growth opportunities, but is strapped for resources should seem attractive to an acquirer with the reverse features. Conversely, this acquirer, with resources but no growth opportunities should also seem attractive to the first firm. Thus, the crux of this hypothesis is that, any firm with incompatible growth and resource potential would be a good target (Palepu, 1986).

Palepu (1986) depicted this hypothesis with a dummy variable, GRD, that was equated to 1 when a firm was seen to have high growth and low resources, or low growth and high resources. In other situations, it was equated to zero. High or low was defined in terms of industry averages. In this study, too, the same depiction has been adopted. Resources are operationalised by both liquidity and leverage. Thus, high (low) resource implies both high (low) liquidity and high (low) leverage. The definitions of growth, liquidity and leverage have been kept the same as above.

Therefore, the hypothesis is, takeover likelihood increases when GRD is equal to 1.

*Real Property:* Ambrose and Megginson (1992) advanced the notion that, a firm with greater proportion of tangible fixed assets in its asset structure is likely to be sought-after. The reasoning advanced by them was that, tangible fixed asset could be used as security for debt financing, thus reducing direct costs of acquisition to the bidder.

In this study, TNG, i.e., tangible fixed asset is specified by the ratio of tangible fixed assets to total assets of the firm, and is averaged over the three years prior to the takeover.

The hypothesis thus is, takeover likelihood is positively related to TNG

*Firm undervaluation:* It is popularly believed that, firms whose market values are lower than their book values are undervalued and hence, a 'good buy'. The idea is that, it is cheaper for the acquirer to 'buy' this firm, rather than build one from scratch. However, Palepu's (1986) caveat may be recalled here: "Since the book value of a firm need not reflect the replacement value of its assets, the economic validity of this assumption is suspect".

Here, MTB, i.e., market to book ratio, is taken as the ratio of market value of common equity to its book value, and is taken at the financial year-end just prior to the takeover.

The hypothesis thus is, takeover likelihood is negatively related to MTB.

The above hypotheses, their representative variables, and expected signs are summarized in Table 1.

→ Insert Table 1 here

### 3.2 Sample and Data

Following Bartley and Boardman's (1990) procedure, two sets of firms were chosen for this study: one set for estimation, spanning a three year period from April 2002 to March 2005, and another set for prediction, spanning the financial year 2005-06. For inclusion into either sample, the data requirements were:

- Have data for all above variables in Prowess module of CMIE<sup>2</sup> database for 4 years prior to acquisition
- Listed in Bombay Stock Exchange

*Choice of targets:* All targets in the estimation and prediction sets were obtained from three sources: the M&A module of CMIE database, the website<sup>3</sup> of SEBI<sup>4</sup> where all open offers are listed, and the Indian Business Insight Database<sup>5</sup>. In each of these databases, only those deals were chosen where

- initial stake of the acquirer was less than 15%,
- targeted acquisition of shares was greater than 20%, and
- mode of acquisition is through non-preferential allotment of shares.

The initial stake of 15% is chosen because of the provisions of Takeover Regulations of SEBI. Regulation 12 deems that, in order to gain control over a target company, all acquirers have to make a public announcement to acquire shares, where various disclosures are mandated, including the object and purpose of acquisition of shares. However, Regulation 10 allows a prospective acquirer to build up a holding of upto 15% without making any public announcement to acquire shares. What emerges from these Regulations is that, upto acquisitions of 15% of the voting capital, it is difficult to differentiate whether the intention behind buying an initial holding is takeover, or simply investment. But initial holdings more than 15% clearly signal that, the firm has already been identified as a target, and the intention is to gain substantial control of the firm. Hence the choice of maximum initial holding of 15%.

At any point of initial shareholding, the acquirer has two options: one, to make a substantial acquisition alongwith a public announcement, or two, to make a creeping acquisition. Regulation 11 allows creeping acquisition of 5% every year upto 55% holding without invoking the requirement of public announcement to acquire shares. On the other hand, if the acquirer wants to make a substantial acquisition, he has to make public offer to the shareholders of the target company for a minimum twenty per cent of the voting capital of the company (Regulation 21). In this study, we consider only substantial acquisitions, and hence require that, actual acquisition be greater than 20%.

In addition, the object of this study was to eliminate friendly acquisitions. Since in India there is no specific database that mentions whether an acquisition is friendly or hostile, it was decided that, it would be logical to ignore deals where acquisitions of shares have taken place through preferential allotment. Hence, only non-preferential allotment of shares was considered for the purposes of this study. Finally, following Bartley and Boardman (1990), any takeover that had been attempted was included in the sample, irrespective of the final outcome.

*Choice of non-targets:* In this study, non-targets were chosen by matching. Matched samples are justified when the matching factor is likely to have a large effect on the likelihood of takeover, but itself is not of primary research interest. Thus, the matched sample design helps to focus on variables of primary interest while applying control over the 'nuisance' variables (Cram et al., 2007). In earlier literature, this matching was done with respect to one of the variables of primary interest, like size, or market capitalization, thus reducing the information content of the data. In this study, the variables to be matched were taken as percentage shareholding of promoters in the company, and the industry. It is worthwhile to mention here that, the first criterion for matching is unprecedented in the literature. There were two reasons behind the choice of using promoters' holdings as the matching variable in this study – one was derived from economic theory that showed that this is a critical factor in

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<sup>2</sup> Centre for Monitoring Indian Economy

<sup>3</sup> <http://www.sebi.gov.in/Index.jsp?contentDisp=DataTakeOver>

<sup>4</sup> Securities and Exchange Board of India

<sup>5</sup> [ibid.informindia.co.in](http://ibid.informindia.co.in)

takeovers and the other was to focus on variables representing important hypotheses explaining takeovers without losing information.

Economic theory has suggested that, irrespective of the financial characteristics of firms, it is the shareholding pattern that defines takeover dynamics. In an influential article, Grossman and Hart (1980) argued that, no raider will ever find it profitable to take over a company with completely dispersed shareholding. Shleifer and Vishny (1986) showed that the presence of a large shareholder can actually facilitate takeovers. Subsequent theoretical development (Baron, 1983; Giammarino and Heinkel, 1986; Khanna, 1997) justified resistance and delaying tactics, to increase the gains to the target shareholders, at the cost of the bidders. These theoretical works also received empirical support; Jennings and Mazzeo (1993) informed that target management resistance seemed to increase shareholder wealth from the time between the initial takeover announcement to its outcome for both successful and unsuccessful offers. Betton and Eckbo (2000) also found that management resistance did push up initial bid premia from 45% to 84%. Thus, it was established that, the presence of large shareholders could have considerable influence on different parameters of the takeover outcome. At the very least, it signals positive gains to the target, and negative gains to the acquirer. It follows that, even if the financial characteristics of a firm were highly attractive, raiders might still prefer a lesser attractive firm, with lesser ownership concentration, simply because the net gain from the latter would be higher. This intuition was established by Bebchuk (1999); he showed that, raiders could gain control of companies with dispersed ownership at low prices and extract benefits of control. Hence, by matching a target with a non-target on the basis of promoters' holdings in the companies, the effect of such an influential parameter was sought to be removed.

The fact that ownership concentrations matter, assumes greater importance when the context is India. Porta et al (1999) examined 20 richest countries and found that, in countries where there was poor shareholder protection, even the largest firms tended to have large controlling shareholders. They found that more often these shareholders belonged to a family, either the founder or his descendants<sup>6</sup>. This is especially true of India. Most of the large corporations are predominantly owned by their promoters who also manage the company. In fact, SEBI defines<sup>7</sup> 'promoters' as "any person who is in control of the target company" and clarifies that, "Financial Institutions, Scheduled Banks, Foreign Institutional Investors (FIIs) and Mutual Funds shall not be deemed to be a promoter or promoter group merely by virtue of their shareholding". Also, a director or an officer need not be a promoter, if (s)he is merely acting in a professional capacity. The trend in India shows that, many of these owners, including some of India's giant private sector groups, viz., Reliance group, Tata group and Aditya Birla group are hiking their stakes in their respective companies over the last couple of years to ward off hostile takeovers. Thus, promoters' stake in firms is an Indian characteristic that cannot be ignored, but is of not much interest when the research objective is to predict takeover targets based on financial data – a classic example of 'nuisance' variable !

Similarly, the industry effect is a dominant factor as propounded in extant literature. In this study, industry effects are not being studied, and so, its effects are also sought to be removed. Thus, non-targets were selected by taking each target, and finding a non-target till that date which was in the same industry and having the same promoters' stake. Industry was defined upto the fourth subset of classifications as per prowess database.

*The final dataset:* For the estimation sample, a total of 122 target firms were identified with complete data availability. Another 122 non-target firms were then selected from the list of non-targets with data existence, by matching industry and promoters' holdings. For prediction, 66 target firms were obtained that fulfilled data requirements. Finally, as suggested by Palepu (1986), all firms listed in CMIE Prowess database, that were not taken over till March 2006, were included as non-targets for prediction. Out of a total of 9955 such firms, 6429 fulfilled data requirements.

The survivorship bias pointed out by Powell (1997) was not factored in here.

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<sup>6</sup> India did not enter their list. But they commented that, including poorer countries would only have increased the incidence of state and family controlled enterprises.

<sup>7</sup> [http://www.sebi.gov.in/Index.jsp?contentDisp=SubSection&sec\\_id=5&sub\\_sec\\_id=5](http://www.sebi.gov.in/Index.jsp?contentDisp=SubSection&sec_id=5&sub_sec_id=5)

### 3.3 Methodology

In this study, a two step analysis is done (Sorensen, 2000). First, a univariate analysis of variance is performed to test for differences between the averages of target company data and the non-target company data. This would give a preliminary idea of the significant characteristics that are markedly different between a target firm and a non-target firm. In the next step, the procedure outlined by Palepu (1986) is adopted. Thus, a binomial logistic regression is employed to measure takeover likelihood as a function of financial characteristics, and is given by the equation:

$$p(i) = 1/[1 + e^{-\beta x(i)}]$$

where,  $p(i)$  : probability that firm  $i$  will be acquired,  
 $x(i)$ : vector of attributes of the firm  
 $\beta$ : unknown parameters to be estimated

As pointed out by Palepu (1986), the model estimated does not reflect the true population acquisition probability, but estimates  $p'$  given by the following formula:

$$p' = \frac{P(i \text{ target}) \times P(i \text{ sampled} \mid i \text{ target})}{P(i \text{ target}) \times P(i \text{ sampled} \mid i \text{ target}) + P(i \text{ non-target}) \times P(i \text{ sampled} \mid i \text{ non-target})}$$

$$= P(i \text{ target} \mid i \text{ sampled})$$

In this study,

$P(i \text{ sampled} \mid i \text{ target}) = 1$ , since all targets available in the population were selected

$P(i \text{ sampled} \mid i \text{ non-target}) = 1$ , since non-target was decided a priori to be that firm which had equal proportion of promoter's holding as the target, within the same industry

Then,

$$p' = \frac{p \cdot 1}{p \cdot 1 + (1 - p) \cdot 1} = p$$

$$\Rightarrow \frac{p'}{1 - p'} = e^{\beta x}$$

$$\Rightarrow L_i = \ln\left(\frac{p'}{1 - p'}\right) = \beta x$$

Thus, in this case, the logistic regression does yield an unbiased estimate of the population acquisition probability.

In this study, two versions of the attribute  $x(i)$  were used – one with firm specific financial data, called “raw data” and other with the industry weighted data. Thus, in the version with raw data, the financial ratios of target and matched firms were used directly as instances of the independent variables. In the model version with industry

weighted data, industry relative ratios suggested by Platt and Platt (1990) have been used: each financial ratio of any year was divided by the average ratio of all the firms in the same industry in the same year.

Four logistic regressions were run for building the takeover likelihood model. Model 1 used raw financial data, and included promoters' holdings as one of the explanatory variables. Model 2 also used raw financial data, but did not include promoters' holdings as one of the explanatory variables. Models 3 and 4 were like models 1 and 2, respectively, but with industry relative data instead of raw financial data.

Finally, for prediction purposes, two methods were used: one, the minimization of errors method suggested by Palepu (1986) and two, the maximization of returns method suggested by Powell (2001).

## **4. Results and Discussion**

### *4.1 Modeling Results*

Step 1: First the results of the ANOVA test are examined. Table 2 shows the variables, the means for each variable, the ANOVA F ratio, and significance levels for each group.

→ Insert Table 2 here

It can be seen that, only a few ratios vary significantly between the target and matched groups. Another observation is that, more ratios vary significantly when industry weighted data is used. Thus, from this preliminary analysis, it seems that, firm undervaluation, inefficient management, growth and leverage are statistically distinct parameters found in target firms, not found in non-target firms.

Step 2: The next step is to analyse the results of logistic regression which are presented in Table 3. McFadden  $R^2$  and likelihood ratio statistic are also included to examine the overall explanatory power of each model, and test the statistical significance of the same.

→ Insert Table 3 here

By comparing the McFadden  $R^2$  values of Models 1 and 2, vis-à-vis those of Models 3 and 4, it is clear that, the explanatory power of the latter are greater. Also, the likelihood ratio statistic of Models 3 and 4 are significant at 1% level, while those of Models 1 and 2 are significant at only 25%. Therefore, it can be concluded from the above results that, the models which were constructed using industry relative data provide a more significant explanation of acquisition probability. This is consistent with the findings of many researchers, viz., Barnes (1990), Powell (1997), Akhigbe and Madura (1999), etc. Only Palepu (1986) found no difference between using raw financial data and industry relative data. Of course, his definition of industry relative data was different; he used deviations from the average industry values. As pointed out by Cudd and Duggal (2000), this approach incorrectly assumed that, the standard deviations of the industry values were same. By capturing those industry specific dispersions, they also obtained significant additional information from industry relative ratios.

However, although it is found that industry relative data provides greater explanatory power, the extent of this explanation is pretty small, about 11.3% only, of the total variation. The models built by Palepu (1986) also had similar small explanatory amount (12.45%), Powell (1997; 2001; 2004) obtained McFadden  $R^2$  values ranging from 3% to 13%, Cudd and Duggal (2000) achieved 11% maximum. Thus, although the explanatory power of the model is low here, it corresponds to comparable results in the literature.

In order to explore why models with industry weighted data performed better than those with raw data, a Jarque-Bera test is conducted on the variables used for the study. Table 4 lists the Skewness, Kurtosis and JB statistic for both sets of data. It is obvious that, both sets of data clearly violate the normality assumption. However, some of

the variables do exhibit reduced significance with industry weighted data, like SIZE, TNG, MTB and LIQ. And FCF actually worsens, while ROCE and LEV do not change appreciably. These dynamics are reflected in the logit estimates also.

→ Insert Table 4 here

#### 4.2 Discussion of Results

The ANOVA tests showed that, ROCE, GRO and MTB differ significantly between target and non-target firms when raw financial data is used. Logit estimates (Models 1 and 2) also show that ROCE, GRO and MTB are significant at 10% level. But, the sign of MTB is not consistent with the firm undervaluation hypothesis; that is, the model predicts that, takeover likelihood increases as the market value of firm assets scores above its book value. Bearing in mind Palepu's (1986) suspicion of the economic validity of this measure, the significance of the firm undervaluation hypothesis should be received with caution. When industry weighted data is used, the ANOVA tests pointed to significant differences in ROCE, FCF, GRO, LEV and MTB between target and non-target firms. Logit estimates of Model 4 also yielded GRO, LEV and MTB to be significant at 5% level, while ROCE and FCF were significant at 10% and 11% levels respectively. Here again, MTB and LEV are opposite of their hypothesized signs.

Thus, what these Logit estimates are telling about the typical target firm is that, it has high growth potential, high levels of free cash, highly leveraged, low returns to capital employed, and a market value higher than its book value. Seen in totality, this does make eminent sense. High growth potential and high level of free cash flow implies a profitable and efficient organization. High levels of free cash flow, *in spite of* high levels of debt, reinforces the inherent superiority of the target firm, not only in terms of profitability and efficiency, but also in alleviating the usual costs of debt, viz., bankruptcy costs, diminished borrowing capacity, etc. Recalling Jensen's (1987) argument about the 'control effects of debt' wherein he posited that debt reduces agency costs of free cash flow by reducing the cash available for spending at the discretion of managers, it may be inferred that high levels of cash flow in conjunction with high levels of debt moderates the costs of both, thus increasing value. Unsurprisingly then, high growth potential, high levels of free cash and high leverage would tend to boost shareholder confidence in the capabilities of the firm, thus increasing market values, despite the fact that, returns to capital employed are low. However, low returns to capital employed, in the face of high levels of cash flow would signify management inefficiency. As predicted by Jensen (1987), such a state of affairs would inevitably attract hostile takeovers.

Thus, the typical Indian target seems to be an essentially valuable and promising company, which is acknowledged by the market, but is saddled with inept management. In a way, this finding is consistent not only with the predictions of Jensen (1987) but also with Powell (1997) who found that hostile takeovers are targeted at firms with inefficient management and high levels of free cash flow. In this study, attempt was made to filter out only hostile takeovers, and the conclusion tallies with that of Powell (1997).

The insignificant variables are also worth a mention, here. The foremost notable observation is that, unlike most US and UK based studies, size is found to be irrelevant. India's financial market is extremely well developed with high yields and can be accessed to finance large deals. Therefore, size should not pose to be a deterrent, if a large company is found to be attractive. A number of leveraged buyouts have been achieved by Indian companies where their targets were three to four times in size. In addition, given that the target is a growing company with free cash in spite of high debt obligations, financing such an acquisition should not be very difficult. It is also worth noting here that, other studies based on Indian takeovers also found no support for the size hypothesis.

Another oft significant variable that has turned out insignificant in this study is the growth resource dummy. This is logical given that, out of its three component variables, growth is significant with consistent sign, leverage is significant with opposite sign and liquidity is insignificant. The growth – resource imbalance hypothesis does not

seem to work here; the implication is that, rather than intrinsic firm characteristics, the problem seems to lie with management.

#### 4.3 Cutoff Calculation for Prediction

As mentioned earlier, two methods were used to conduct prediction tests. Each of these methods was applied on Models 2 and 4, since it is worthwhile to capture the effects of using raw financial ratios vis-à-vis industry relative ratios on the predictive accuracy of the models.

*Minimisation of Errors Method:* Adhering to the procedure laid out by Palepu (1986), the logit model is used to compute predicted probabilities of takeover of all firms in the estimation sample. These probabilities are then grouped into ten equal intervals. The number of target (non-target) firms in each interval is expressed as a percentage of the total number of target (non-target) firms. In Figure 1, the midpoint of each probability interval is plotted against the percentage of target (non-target) firms in that interval; here, probabilities are computed from estimates of Model 2. Figure 2 corresponds to a similar plot, but the probabilities are computed from estimates of Model 4.

Thus, in each figure, two plots are obtained, one for the target firms and another for non-target firms, and their intersection is noted. This represents the cut-off point where probability of being a target equals the probability of not being a target. Therefore logically, at probabilities less than these cutoffs, a firm can be classified as a non-target, and at probabilities greater than these cutoffs, a firm can be classified as a target.

From Figure 1 (Model 2) it can be seen that, the plot for targets cross the plot for non-targets at 0.51 (approximately). Thus for Model 2, the cutoff probability for classification of targets in prediction set is taken as 0.51. The corresponding point in case of Figure 2 (Model 4) is at 0.43 (approximately). So for Model 4, the cutoff probability for classification of targets in prediction set is taken as 0.43.

→ Insert Figure 1 here

→ Insert Figure 2 here

*Maximisation of Returns Method:* Following Powell (2001), the logit models are used to compute predicted probabilities of all firms in estimation sample. These firms are then sorted in ascending order of probabilities. Ten portfolios are constructed by dividing this ranked list equally. The portfolios are then examined for target concentration, which is computed as number of targets in each portfolio divided by the number of firms in that portfolio. The portfolio for which the target concentration is highest is then the critical portfolio. The first acquisition probability of this portfolio becomes the cutoff probability.

Table 5 shows the calculations for concentration and cutoff probabilities. The values for Model 2 are worked out in Panel A. As can be seen, the ninth portfolio has the largest concentration of targets, and the corresponding cutoff is 0.56. This is adopted as the cutoff for Model 2. Similarly, the cutoff for Model 4, from Panel B of table 5, is 0.75, corresponding to the tenth portfolio which has the maximum target concentration of 0.79.

→ Insert Table 5 here

As has been suggested in the literature, these cutoff probabilities are indeed greater than those obtained from Palepu's (1986) method.

#### 4.4 Prediction Results

The above cutoffs are now used in prediction tests. Acquisition probabilities of all firms in the prediction set are calculated using estimates of Models 2 and 4. Based on the relevant cutoffs, the firms are classified as target and

non-target. Table 6 presents the summary of the prediction tests for both models, including the prediction accuracy.

→ Insert Table 6 here

Model 2, which is based on raw financial data, produces a prediction accuracy of 70.62% when the cutoff from Minimisation of Errors method is applied. On the other hand, when the cutoff from maximization of returns method is used, Model 2 yields a significantly higher prediction accuracy of 77.91%<sup>8</sup>. The reason is that, the criteria for cutoff is higher in the latter method and hence, the number of targets correctly predicted as targets reduced marginally whereas, the number of non-targets correctly predicted as non-targets increases substantially. The portfolio size also reduces by a large amount.

Similar observations may be made for Model 4. With maximization of returns method, the cutoff was 0.75 vis-à-vis a cutoff of 0.43 with minimisation of errors method. Again, the number of targets correctly predicted was lesser in the former method by only 17 firms, while the number of correctly predicted non-targets increased by 838 firms. Hence the net increase in correct prediction increased by 838-17=831 firms ! This resulted in a total prediction accuracy of 91.99%.

Thus, it can be concluded that, as claimed by Powell (2001), the prediction accuracy resulting from maximization of returns method is driven by its ability to peg the cutoff at higher levels so that, the number of non-targets in the target portfolio reduces drastically, thereby reducing misclassification error. However, the percent of misclassified non-targets in the portfolio is still too high (96.48% for Model 4 and 97.46% for Model 2) to provide any scope of abnormal returns.

Another point worth observing here is that, when accuracies within models are compared, irrespective of the method for cutoff being employed, Model 4, with industry weighted financial ratios performed significantly<sup>8</sup> better than Model 2, which employed raw financial data.

## 5. Conclusion

The objective of the study was to build a takeover likelihood model in the Indian context employing logistic regression on nine variables that represent nine theories commonly cited as takeover strategies. The method used in this study to select non-targets was by matching targets, rather than randomly selecting non-targets. However, unlike previous literature, where matching was done with respect to one of the hypothesized variables, leading to loss of information, in this study matching was done with respect to promoters' holdings in the firm. Irrespective of the attractiveness of a firm, promoters' holdings have been shown to affect actual takeover dynamics in the literature. By selecting non-target firms with similar ownership structures as the targets, the effect of such an important factor was isolated, without reducing the information content of the model.

Following previous literature, two types of data were used – raw financial data of each firm, and the same data scaled by industry averages. It was found that, the explanatory ability of industry scaled data is much higher than that of raw data. This finding has implications on other areas of financial research as well.

The model that resulted from the logit analysis using industry weighted data gave credence to the hypothesis that, in the Indian context, the typical target is one which has high growth potential along with high levels of free cash

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<sup>8</sup> Significance is tested by applying the one tailed test for differences between proportions.

So, here,  $p_1 = 0.7062$ ,  $p_2 = 0.7791$ ,  $n_1 = n_2 = n = 6429$

$H_0 : p_1 = p_2$ ;  $H_1 : p_1 < p_2$

Then, overall proportion of success,  $p = \frac{1}{2} (p_1 + p_2) = 0.7425$

Also, estimated standard error of the difference between two proportions  $= \sigma_{p_1-p_2} = \sqrt{2 p q / n} = 0.0077$

$Z_{1-2} = (p_1 - p_2) / \sigma_{p_1-p_2} = -9.42 \Rightarrow$  evidence to accept the alternate hypothesis

flow in spite of high leverage, that is, an inherently strong company valued highly in the market, but saddled with inefficient management. Size, which has been found to be significant in studies based on US and UK, was found to be trivial here.

For prediction, the cutoff probability to be used for classification was derived from two methods, the minimization of errors method proposed by Palepu (1986) and the maximization of returns method put forward by Powell (2001). It was found that the second method produced significantly greater accuracies of prediction. Thus, the combined effect of using industry weighted financial ratios and cutoff calculation with maximization of returns method can improve prediction accuracies significantly, implying that these should be incorporated in future acquisition studies. However, the target concentration in the predicted portfolio was still found to be very small.

## References:

- Akhigbe, A. and J. Madura, 1999, The Industry Effects Regarding the Probability of Takeovers, *Financial Review* 34, 1-18
- Ambrose, B. W. and W. L. Megginson, 1992, The Role of Asset Structure, Ownership Structure, and Takeover Defenses in Determining Acquisition Likelihood, *Journal of Financial & Quantitative Analysis* 27, 575-590
- Barber, B., J. Lyon and C. Tsai, 1999, Improved methods for tests of Long run Abnormal Stock Returns, *Journal of Finance* 54, 165-201
- Barnes, P., 1990, The Prediction of Takeover Targets in the U.K. by Means of Multiple Discriminant Analysis, *Journal of Business Finance & Accounting* 17, 73-84
- Barnes, P., 1998, Can Takeover Targets be Identified by Statistical Techniques?: Some UK Evidence, *Journal of the Royal Statistical Society: Series D (The Statistician)* 47, 573-591
- Barnes, P., 2000, 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, *International Review of Financial Analysis* 9, 147-162
- Baron, D., 1983, Tender Offers and Management Resistance, *Journal of Finance* 38, 331-343
- Bartley, J. W. and C. M. Boardman, 1990, The relevance of inflation adjusted accounting data to the prediction of corporate takeovers, *Journal of Business Finance & Accounting* 17, 53-72
- Bebchuk, L. A., 1999, A Rent-Protection Theory of Corporate Ownership and Control, Harvard Law and Economics Discussion Paper No. 260, available from [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=168990](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=168990)
- Belkaoui, A., 1978, Financial Ratios as Predictors of Canadian Takeovers, *Journal of Business Finance & Accounting* 5, 93-108
- Betton, S. and B.E. Eckbo, 2000, Toeholds, bid jumps, and expected payoffs in takeovers, *Review of Financial Studies* 13, 841-882
- Cheh, J., R. Weinberg, and K. Yook, 1999, An Application of an Artificial Neural Network Investment System to Predict Takeover Targets, *The Journal of Applied Business Research* 15, 33-45
- Chen, C. and R. Su, 1997, Do cross-border acquisitions of U.S. targets differ from U.S. domestic takeover targets? *Global Finance Journal* 8, 71-82
- Cram, D. P., I. Stuart, and V. Karan, 2007, Review of Choice based and Matched Sample Studies in Auditing Research, available at <http://www.nhh.no/for/seminars/accounting-management-science/2007-spring/140307.pdf>

- Cudd, M. and R. Duggal, 2000, Industry Distributional Characteristics of Financial Ratios: An Acquisition Theory Application, *Financial Review* 35, 105-119
- Dencic-Mihajlov, K. and O. Radovik, 2006, Problems in Predicting Target Firms at the Undeveloped Capital Markets, *Economics and Organisation* 3, 59-68
- Dietrich, J. R., 1984, Discussion of Methodological Issues Related to the Estimation of Financial Distress Prediction Models, *Journal of Accounting Research* 22, 83-86
- Giammarino, R.M. and R.L. Heimkel, 1986, A Model of Dynamic Takeover Behavior, *Journal of Finance* 41, 465-480
- Grossman, S. and O. Hart, 1980. Takeover bids, the free-rider problem, and the theory of the corporation, *Bell Journal of Economics* 11, 42-64
- Jandik, T. and A. K. Makija, 2005, Leverage and the Complexity of Takeovers, *The Financial Review* 40, 95-112
- Jennings, R.H. and M. A.Mazeo, 1993, Competing bids, target management resistance, and the structure of takeover bids, *Review of Financial Studies* 6, 883-909
- Jensen, M.C., 1987, The free cash flow theory of takeovers: A financial perspective on mergers and acquisitions and the economy, available from <http://papers.ssrn.com/ABSTRACT=350422>
- Jensen, M.C., and R.S. Ruback, 1983, The market for corporate control: The scientific evidence, *Journal of Financial Economics* 11, 5-50
- Khanna, N., 1997, Optimal Bidding for Tender Offers, *Journal of Financial Research* 20, 323-342
- Kumar, R. and R. Prabina, 2007, Characteristics of Merging Firms in India: An Empirical Examination, *Vikalpa* 32, 27-44
- Lyons, P. J. and S. C. Persek, 1991, Integrating Neural Networks and Expert Systems for Merger and Acquisition Analysis, *IEEE Proceedings of the First International Conference on Artificial Intelligence on Wall Street*, 200-205, available from <http://ieeexplore.ieee.org/xpl/tocresult.jsp?isnumber=6074&isYear=1991&count=52&page=1&ResultStart=25>
- Ooghe, H., T.De Langhe, and J.Camerlynck, 2006, Profile of multiple versus single acquirers and their targets: a research note, *Applied Economics* 38, 725-733
- Palepu, K. G., 1986, Predicting takeover targets: a methodological and empirical analysis, *Journal of Accounting & Economics* 8, 3-35
- Pastena, V. and W.Ruland, 1986, The Merger/Bankruptcy Alternative, *Accounting Review* 61, 288-301
- Pawaskar, V., 2001, Effect of mergers on corporate Performance in India, *Vikalpa* 26, 19-32
- Panigrahi, P. K., 2004, An alternative predicting model for corporate mergers and acquisitions, *Vilakshan – XIMB Journal of Management* 1, 12-21
- Powell, R. G., 1997, Modelling takeover likelihood, *Journal of Business Finance & Accounting* 24, 1009-1030
- Powell, R. G., 2001, Takeover Prediction and Portfolio Performance: A Note, *Journal of Business Finance & Accounting* 28, 993-1011
- Powell, R. G., 2004, Takeover Prediction Models and Portfolio Strategies: A Multinomial Approach, *Multinational Finance Journal* 8, 35-72
- Platt, H. D. and M. D.Platt, 1990, Development of a class of stable predictive variables: the case of bankruptcy prediction, *Journal of Business Finance and Accounting* 17, 31-51

Porta, R. L., F. Lope-de-Silanes, and A. Shleifer, 1999, Corporate Ownership around the world, *Journal of Finance* 54, 471-517

Schleifer, A. and R. W. Vishny, 1986, Large Shareholders and Corporate Control, *Journal of Political Economy* 94, 461-488

Simkowitz, M. and R. J. Monroe, 1971, A Discriminant Analysis Function for Conglomerate Targets, *Southern Journal of Business*, 1-16

Sorensen, D. E., 2000, Characteristics of Merging Firms, *Journal of Economics & Business* 52, 423-433

Stevens, D., 1973, Financial Characteristics of merged firms: A multivariate analysis, *Journal of Financial & Quantitative Analysis* 8, 149-158

Stulz, R.M., 1988, Managerial control of voting rights: Financing policies and the market for corporate control, *Journal of Financial Economics* 20, 25-54

Walter, R. M., 1994, The Usefulness of Current Cost Information for Identifying Takeover Targets and Earning Above-Average Stock Returns, *Journal of Accounting, Auditing & Finance* 9, 349-377

Wansley, J. W. and A. Fayez, 1986, Determinants of Return to Security Holders from Mergers, Manuscript (Louisiana State University)

Wansley, J. W., R. L. Roenfeldt, and P. L. Cooley, 1983, Abnormal Returns from Merger Profiles, *Journal of Financial & Quantitative Analysis* 18, 149-162

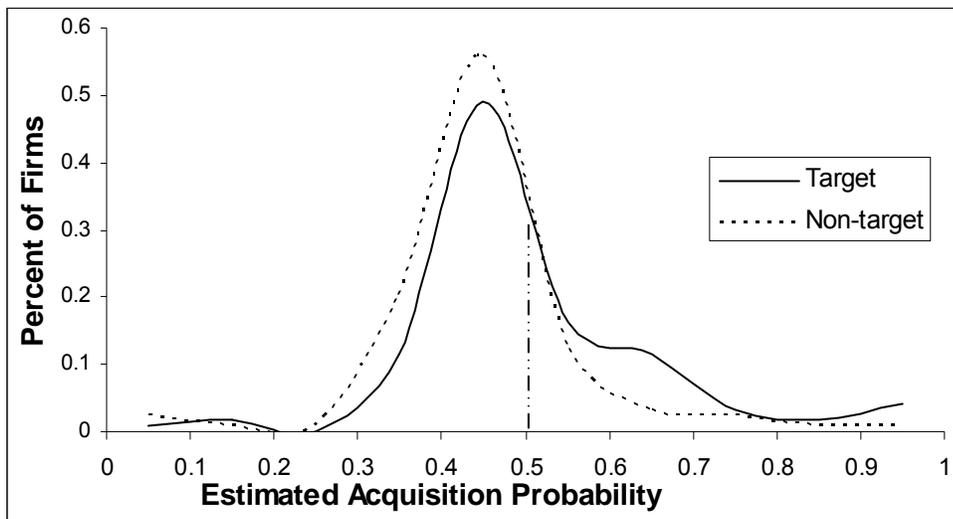


Figure 1: Cutoff Probability Estimation - Model 2, Raw data

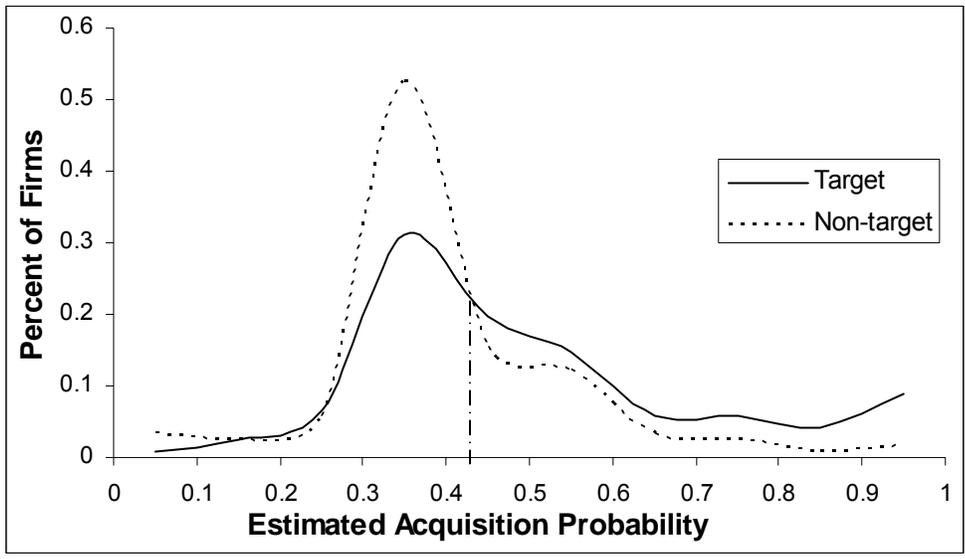


Figure 2: Cutoff Probability Estimation – Model 4

Table 1: List of variables included in study

Sl	Hypothesis	Variable	Definition	Expected sign
1	Inefficient management	ROCE	Accounting return on Capital	-
2	Free Cash Flow	FCF	Operating Cash Flow to total assets	+
3	Firm size	SIZE	Total Assets	-
4	Growth	GR	Average Growth in Sales	+
5	Leverage	LEV	Long term debt / Total Share Capital and reserves	-
6	Liquidity	LIQ	Quick Assets / Total Assets	-
7	Growth – resources imbalance	GRD	Growth resource dummy	
8	Real property	TNG	Tangible fixed assets / Total assets	+
9	Firm undervaluation	MTB	Market to book value ratio	-

Table 2: ANOVA test of differences in the ratio means between the groups

Hypotheses	Variables	Raw data			Industry Weighted Data		
		Target	Matched	F-ratio	Target	Matched	F-ratio
Inefficient management	ROCE	11.22	32.80	2.11*	0.91	2.12	1.37*
Free Cash Flow	FCF	0.13	0.07	0.60	20.43	3.33	1.93*
Firm size	SIZE	540.93	452.61	0.10	0.03	0.04	0.008
Growth	GR	0.81	0.29	2.13*	0.47	0.14	1.48*
Leverage	LEV	2.06	1.43	0.93	2.54	0.94	3.00*
Liquidity	LIQ	1.86	2.38	0.13	4.14	4.22	0.00
Grth– Res imbalance	GRD	0.28	0.26	0.17	0.28	0.26	0.17
Real property	TNG	0.35	0.39	0.70	1.00	1.10	0.70
Firm undervaluation	MTB	0.92	0.41	3.24*	3.77	2.07	5.05*

\* denotes significance at 1% level

Table 3: Estimates of Logistic Acquisition Likelihood Models

Hypotheses	Variable	Exp Sign	Model 1	Model 2	Model 3	Model 4
Constant	Const		-0.031	-0.289	-0.684	-0.659
	sig		94.8%	39.4%	16.7%	5.1%
Inefficient management	ROCE	-	-0.014	-0.014	-0.12	-0.12
	sig		8.7%	8.8%	7.9%	7.9%
Free Cash Flow	FCF	+	0.218	0.203	0.015	0.015
	sig		66.4%	68.6%	10.9%	11.0%
Firm Size	SIZE	-	0	0	-0.124	-0.12
	sig		28.1%	29.2%	93.2%	93.4%
Growth	GR	+	0.128	0.127	0.187	0.187
	sig		6.2%	6.5%	3.5%	3.5%
Leverage	LEV	-	0.053	0.053	0.203	0.202
	sig		25.2%	25.0%	3.2%	3.2%
Liquidity	LIQ	-	-0.001	-0.001	-0.012	-0.012
	sig		97.1%	96.4%	43.6%	43.8%
Growth-Res Imbalance	GRD		0.107	0.124	0.178	0.175
	sig		74.8%	70.8%	63.0%	63.3%
Real Property	TNG	+	-0.317	-0.285	-0.168	-0.168
	sig		61.3%	64.7%	36.8%	36.8%
Firm Undervaluation	MTB	-	0.594	0.572	0.188	0.188
	sig		3.2%	3.7%	0.9%	0.9%
Promoters' Holdings	PH	-	-0.005		0	
	sig		45.4%		94.4%	
Mcfadden R <sup>2</sup>			0.059	0.057	0.113	0.113
Likelihood Ratio Statistic			12.724	12.161	23.854	23.849
sig			24.00%	20.40%	0.80%	0.50%

Table 4: Jarque Bera Test of variables

Vars	N	Raw data			Industry Weighted Data		
		Skewness	Kurtosis	JB	Skewness	Kurtosis	JB
ROCE	238	11.032	134.07	175192.1	11.949	165.71	151101.3
FCF	239	4.046	67.319	41849.04	12.258	169.94	79858.09
SIZE	244	6.795	49.473	23835.02	4.665	24.508	1133.02
GR	227	8.192	78.565	56546.69	9.261	102.96	33832.27
LEV	222	8.864	97.806	86047.75	11.407	146.73	86314.73
LIQ	242	3.01	44.569	17789.24	5.778	54.61	5194.393
GRD	209	1.056	-0.895	170.9582			
TNG	244	2.446	11.587	992.9604	2.48	9.674	33.38209
MTB	244	8.822	90.537	81069.38	5.821	40.915	5934.26
PH	244	-0.18	-0.563	130.3831			

Table 6: Correct Prediction of targets and non-targets

	# firms classified as T	# firms classified as NT	Actual T classified as T	Actual T classified as NT	Actual NT classified as T	Actual NT classified as NT	Prediction accuracy
Actual	66	6363					
Minimisation of Errors Method (Palepu, 1986)							
Model 2	1889	4540	33	33	1856	4507	70.62%
Model 4	1338	5091	34	32	1304	5059	79.22%
Maximisation of Returns Method (Powell, 2001)							
Model 2	1412	5017	29	37	1383	4980	77.91%
Model 4	483	5946	17	49	466	5897	91.99%

## Appendix

Table A1: Hypotheses vs variables assumed by various researchers

Paper	Hypothesis	Variables used
Stevens (1973)	NIL	NWC/TA, NWC/Sales, EBIT/TA, GP/Sales, EBIT/Sales, NI/Sales, EBT/sales, NI/Eq, NI/TA, LTD/MV(Eq), LTD/TA, LTD/Eq, LTL/TA, TL/TA, Sales/TA, COGS/Inv, Sales/(CA-Inv), Div/NI, PE, Int/(Cash+mktable sec); After factor analysis: EBIT/Sales, NWC/TA, Sales/TA, LTL/Assets, Dividend Payout, PE
Belkaoui (1978)	NIL	Assets (CF/NW, CF/TA, NI/NW, NI/NA, LTD+Pref Sh/TA), liquidity (CA/TA, Cash/TA, WC/TA, QA/TA, CA/CL, QA/CL, Cash/CL), turnover (CA/sales, QA/sales, WC/sales, Cash/sales)
Wansley et al (1983)	NIL	PER, ln(net sales), BV(L.T.Debt)/TA, CAGR(net sales), MV(Equity)/TA
Palepu (1986)	Inefficient Mgmt	Avg Excess Return on stocks, accounting ROE
	Growth Resource Mismatch	Dummy based on Sales Growth, (Cash+Mktable Sec-CL)/TA, LTD/(Sh & Pref Eq)
	Industry Disturbance	Dummy based acquisition in same industry
	Size	BV(Assets)
	Undervaluation	MTB
	Price- Earnings	PER
Bartley & Boardman (1990)	Performance	EPS, CAGR(Sales), Div/Eq, Div/FCE, Sales/TA, COGS/Inv, Sales/AR
	Earning Power	Sales/FA, FCE/BV(Eq), FCE/MV(Eq), EBIT/Eq, CF/MV(Eq)
	Long term Solvency	(TL-CL) /MV(Eq), Interest/EBIT, Total Liab/Eq
	Short term Solvency	CA/CL, WC/TA, Cash/MV(Eq), Cash Equiv / MV(Eq)
	Other	LOG[MV(Eq)], Net Op Loss/MV(Eq), Pension costs / MV(Eq), R&D/Sales, Shares outstanding/#Shares
Barnes (1990)	NIL	CA/CL, (Loan+S.T.Debt)/(Eq+def tax-intangibles), QA/CL, Loan/Eq&Res, Cash/CL, Sales/Assets, ROE, PBT, net profit margin
Ambrose & Megginson (1992)	Inefficient Mgmt	Avg excess Return, Avg Adj return
	Growth Resource Mismatch	Dummy based on Sales growth, liquid asset/TA, L.T.Debt / Eq
	Size	BV(Asset)
	Undervaluation	MTB
	Price- Earnings	PER
	Real Property	Fixed Assets / Total Assets
	Ownership Structure	# Instt Mgrs, % Instt Shareholding, Change in Instt Shareholding, %Mgr Sh
	Takeover defenses	Poison pill, Anti-takeover Charter Amendments, Voting Right, etc
Walter (1994)	Undervaluation, Price Earnings, Size, Leverage, Liquidity, Profitability, Asset Turnover, Dividend Payout, Inflationary Tax Loss, Tax Savings, Industry Effects	MTB, PER, LOG(Total Asets), QA/TL, TL/TA, Opn Inc/TA, Sales/TA, Opn Income per share/DPS, Current cost(TA)/Historical cost(TA), Tax savings dummy, Industry dummy
Chen & Su (1997)	Technology Transfer	R&D exp/sales
	Undervaluation	MTB

	Co-insurance effect	Total Liab/Common Eq
	Liquidity	CA/CL, QA/CL
	Size	Total Asset, Total Sales
	Growth Potential	Average Sales and Asset Growth over 5 year period
	Inefficient Mgmt	ROE, ROA
	Economic Disturbance	(Highest Share price-Lowest Sh price)/EPS
	Tax Advantage	Operating Loss Carry Fwd/Total Asset
Barnes (1998; 2000)	Inefficient Mgmt	PBT/sales, PBT/Equity, PBT growth, PE, avg dividend/Equity, dividend growth, mkt cap/equity
	Growth Resource Mismatch	Sales/TA, total remuneration/sales, sales growth, CA/CL, (CA-CL)/TA, LTD/TA, (PBT+Int Paid)/Int paid, LTD/Eq
	Size	Market Capitalisation
	Anticipated returns	Cum Avg Return 2 months before bid
Sorensen (2000)	Profitability	EBIT/Sales, EBIT/TA, CF/TA, EBIT/Eq, $\Delta$ CF/Eq
	Liquidity	CA/CL, (CA-Inv)/CL, Cash/TA, WC/TA, CA/TA, (CA-Inv)/CA
	Leverage	Debt/CA, Debt/TA, CL/Debt, EBIT/Int, CF/Int
	Turnover	Sales/TA, Sales/CA, Sales/Inv, Sales/P&M, Sales/Accts Recv
	Growth	5Yr Sales growth
Cudd & Duggal (2000)	Inefficient Mgmt	ROE
	Growth Resource Mismatch	Dummy based on Sales Growth, (Cash+Mktable Sec-CL)/TA, LTD/(Sh & Pref Eq)
	Industry Disturbance	Dummy based acquisition in same industry
	Size	BV(Assets)
	Undervaluation	MTB
	Price- Earnings	PER
Powell (1997; 2001; 2004)	Inefficient Mgmt	Operating Profit/Cap Employed
	Undervaluation	MTB
	Free Cash Flow	Operating CF/TA
	Size	Log(Total Assets)
	Real Property	Fixed Assets / Total Assets
	Growth Resource Mismatch	Dummy based on Sales Growth, Cash&Mktable Sec/TA, Debt/Sh Capital & Reserves
Ooghe, Langhe, Camerlynck (2006)	Profitability	NOI/Sales, EBIT/TA, PAT/Equity, CFAT/Equity
	Liquidity	Equity/(Liab+Equity), CFAT/Liab
	Leverage	Cash& S.T Inv/CA, CA/CL
	Value Added	Gross Value Added / # employees, Personnel Exp / #employees

Table 5: Cutoff calculation using Maximisation of Returns Method (Powell, 2001)

Decile	# firms	# targets	# non-targets	C-ratio	Cutoff	Targets	Non-targets	Type I error	Type II error	% total correct	% targets in portfolio
Model 2											
1	24	8	16	0.33	0.00	122	2	0	120	50.82%	50.41%
2	25	9	16	0.36	0.38	114	16	8	106	53.28%	51.82%
3	24	10	14	0.42	0.40	105	32	17	90	56.15%	53.85%
4	25	10	15	0.40	0.42	95	46	27	76	57.79%	55.56%
5	24	9	15	0.38	0.44	85	61	37	61	59.84%	58.22%
6	25	14	11	0.56	0.45	76	76	46	46	62.30%	62.30%
7	24	13	11	0.54	0.47	62	87	60	35	61.07%	63.92%
8	25	15	10	0.60	0.50	49	98	73	24	60.25%	67.12%
<b>9</b>	<b>24</b>	<b>17</b>	<b>7</b>	<b>0.71</b>	<b>0.56</b>	<b>34</b>	<b>108</b>	<b>88</b>	<b>14</b>	<b>58.20%</b>	<b>70.83%</b>
10	24	17	7	0.71	0.64	17	115	105	7	54.10%	70.83%
Total	244	122	122								

Model 4											
1	24	10	14	0.42	0.00	122	1	0	121	50.41%	50.21%
2	25	12	13	0.48	0.30	112	14	10	108	51.64%	50.91%
3	24	10	14	0.42	0.66	100	27	22	95	52.05%	51.28%
4	25	7	18	0.28	0.77	90	41	32	81	53.69%	52.63%
5	24	7	17	0.29	0.48	83	59	39	63	58.20%	56.85%
6	25	12	13	0.48	0.44	76	76	46	46	62.30%	62.30%
7	24	16	8	0.67	0.66	64	89	58	33	62.70%	65.98%
8	25	12	13	0.48	0.37	48	97	74	25	59.43%	65.75%
9	24	17	7	0.71	0.36	36	110	86	12	59.84%	75.00%
<b>10</b>	<b>24</b>	<b>19</b>	<b>5</b>	<b>0.79</b>	<b>0.75</b>	<b>19</b>	<b>117</b>	<b>103</b>	<b>5</b>	<b>55.74%</b>	<b>79.17%</b>

Table A2: Significant variables and other info by various researchers

Paper	Method	Selection of non-target	Significant variables	Cutoff Method	Predictive Accuracy	Abnormal returns
Stevens (1973)	MDA, after factor analysis to remove multicollinearity and overlapping	Matched by Size of assets	EBIT/Sales, NWC/TA, Sales/TA, LT L/Assets	NA	70.00%	Not tested
Belkaoui (1978)	Dichotomous classification test, MDA	Industry match, Assets<25%	NI/NW, CF/NW, WC/TA	NA	NA	Not tested
Wansley et al (1983)	MDA	Random	PER, Debt, Sales, MTB	Top 25 firms	69.20%	Possible; and positive
Palepu (1986)	Logit	Random	Avg Excess Return, Growth-Resource Dummy, BV(assets)	Minimisation of Errors	45.66%	Not possible
Bartley & Boardman (1990)	MDA	Random	NA	Lachenbruch U method	82.50%	Not tested
Barnes (1990)	MDA, after factor analysis	Matched as per industry and Market Cap	NA	NA	74.30%	Not tested
Ambrose & Megginson (1992)	Univariate comparison, Logit Model	Random; temporal Matching	FA/TA, Change in shareholding, Voting Rights, Blank Cheque Preferred Stock	Not tested	Not tested	Not tested
Walter (1994)	Binomial Logit	All nontargets with data in 1985	MTB	Minimisation of Errors	66%-72%	Possible; and positive
Chen & Su (1997)	Binomial Logit	Matched by Size of assets or sales	R&D Exp/Sales, QA/CL	NA	Not tested	Not tested

Powell(1997)	Logit (Binomial & Multinomial)	Random	<i>All takeovers</i> : Raw vars: Liq, Size, FCF; IW vars: Liq, Size <i>Hostile takeovers</i> : Raw vars: Liq, Size, MTB, ROCE; IW vars: Liq, Size, MTB <i>Friendly takeovers</i> : Raw vars: Lev, Size; IW vars: Lev, Size	Not tested	Not tested	Not tested
Barnes (1998)	Logit and LDA, after removing multicollinearity (removed vars with correl >0.65)	Matched as per industry and Mkt Cap	Profitability, sales growth & Shareholders' Equity	Weighted; Errors Minn; Returns Maxn	98.57%; 97.64%; 98.5%	Not possible
Barnes (2000)	Logit and LDA, after removing multicollinearity (removed vars with correl >0.65)	Matched as per industry and Mkt Cap	Profitability, sales growth & Shareholders' Equity as per Logit; Dividend growth, sales growth & leverage as per LDA	Weighted; Returns Maxn	98.49%	Not possible
Sorensen (2000)	Univariate ANOVA, Multivariate Factor Analysis, Logit	Matched by size and industry	None ! Liquidity (Weakly significant)	NA	~60%	Not tested
Cudd & Duggal (2000)	Logit	Random	Size, ROE, growth – resource mismatch, growth, leverage, liquidity, industry disturbance	Error Minn	76.10%	Not tested
Powell (2001)	Binomial Logit	Random	NA	Return Maxn	77%(Raw) 88%(Wtd)	Not possible
Powell (2004)	Multinomial logit	Random	Hostile target: Lower Liquidity; Friendly target: Smaller size, growth resource imbalance, industry characteristics	Return Maxn	>90%	Not possible
Ooghe, Langhe, Camerlynck (2006)	Comparison	Not selected	Multiple target: higher sales generating ability, lower asset growth;	Not tested	Not tested	Not tested