Predicting Mergers and Acquisitions in the Food Industry

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ABSTRACT

Two logit models are estimated to explain merger and acquisition (M&A) activities in US food manufacturing using firm level data for public firms: a “target model” predicting the likelihood of a firm being targeted for M&A and a “takeover model” predicting the likelihood of a targeted firm being taken over. Target model results suggest the importance of firm liquidity, debt/leverage, profitability, growth in sales, stock earnings capacity, percentage of common stocks traded in the stock market, and market-to-book ratio. Activity or turnover ratio, firm size, and price–earnings ratio were not statistically significant. Takeover model results suggest the importance of degree of officer control, attitude surrounding the transaction, number of prior bids, existence of litigation during negotiations, and involvement of the bidder and/or target in other takeovers during negotiations. With predictive accuracy of 74.5 and 62.9%, respectively, these models suggest the systematic nature of M&A activities. © 1999 John Wiley & Sons, Inc.

1. INTRODUCTION

Between 1985 and 1995, merger, acquisition, and leveraged buyout (M&A) activity in the food industry was relatively high, compared with similar activity in other industries.¹ As shown in Table 1, in terms of the total value of M&A transactions, the food industry was included among the top 10 most active industries for 10 of the 11 years during the 1985 to 1995 period. It was also included in the top four for six out of the 11 years. As of 1995, two of the largest five transactions in M&A history had been of food firms (see Table 1). A number of large food M&A deals are currently pending.

¹In this paper, we use M&A to refer to mergers, acquisitions, and leveraged buyouts. A bidder is a firm that offers to buy another firm. If the bid is accepted and the merger is completed, the bidding firm becomes the acquiring firm. A target firm is a firm that is under purchase consideration. Once bought, it becomes the taken over or acquired firm.
declarations of the Travellers Group/Citibank and the Monsanto/American Home Products mergers in 1998, the leveraged buyout of RJR Nabisco Inc. by Kohlberg Kravis Roberts & Co. was the largest ever reorganization in US M&A history. The size of the Monsanto deal is expected to exceed $35 billion. According to the Securities Data Corporation (SDC), the total value of all M&As in the food industry alone during the 1985 to 1995 period exceeded $211 billion. While food companies represented only 4% of all publicly held companies in 1988, they accounted for over 18% of leveraged buyouts (Farooq, 1997).

The wave of M&A activities has significantly impacted on the size, structure and performance of the food industry. The industry has become more concentrated in recent years. For example, Farooq (1997) reports that the four-firm concentration ratio of food processing firms in general increased during the 1980–1988 period. Likewise, Nayda, Ellinger, and Padberg (1993) showed that between 1982 and 1987, the ratio increased from 41 to 64% for firms processing steers and heifers, from 44 to 66% for the sheep and lamb processing industry, and from 59 to 82% for the boxed beef industry. A growing number of mergers now involve foreign firms, with notable examples including the recent M&A activities involving A&P and Kings Supermarkets by European supermarket chains and the acquisition

### TABLE 1. Ranking of Value and Number of M&A Deals for the Food and Tobacco Industry (1985–1995) and the Five Largest Transactions in M&A History

<table>
<thead>
<tr>
<th>Year</th>
<th>Value of Deals</th>
<th>Rank (Value)</th>
<th>No. of Deals</th>
<th>Rank (Deals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>14.6</td>
<td>2</td>
<td>93</td>
<td>N/A&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>1986</td>
<td>15.3</td>
<td>3</td>
<td>129</td>
<td>N/A</td>
</tr>
<tr>
<td>1987</td>
<td>4.7</td>
<td>N/I&lt;sup&gt;b&lt;/sup&gt;</td>
<td>106</td>
<td>N/A</td>
</tr>
<tr>
<td>1988</td>
<td>23.0</td>
<td>2</td>
<td>136</td>
<td>10</td>
</tr>
<tr>
<td>1989</td>
<td>40.3</td>
<td>1</td>
<td>125</td>
<td>10</td>
</tr>
<tr>
<td>1990</td>
<td>9.1</td>
<td>6</td>
<td>94</td>
<td>N/A</td>
</tr>
<tr>
<td>1991</td>
<td>2.9</td>
<td>9</td>
<td>60</td>
<td>N/A</td>
</tr>
<tr>
<td>1992</td>
<td>6.4</td>
<td>4</td>
<td>117</td>
<td>8</td>
</tr>
<tr>
<td>1993</td>
<td>8.7</td>
<td>4</td>
<td>114</td>
<td>9</td>
</tr>
<tr>
<td>1994</td>
<td>7.8</td>
<td>8</td>
<td>103</td>
<td>N/A</td>
</tr>
<tr>
<td>1995</td>
<td>18.3</td>
<td>5</td>
<td>138</td>
<td>N/A</td>
</tr>
</tbody>
</table>

The Five Largest Transactions in M&A History (As of 1995)<sup>d</sup>

<table>
<thead>
<tr>
<th>Year</th>
<th>Acquirer</th>
<th>Target</th>
<th>Industry</th>
<th>Value ($Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>Kolhberg Kravis Roberts &amp; Co.</td>
<td>RJR Nabisco Inc.</td>
<td>Conglomerate&lt;sup&gt;e&lt;/sup&gt;</td>
<td>24.56</td>
</tr>
<tr>
<td>1989</td>
<td>Beecham Group PLC-UK</td>
<td>SmithKline Beckman Corp.</td>
<td>Drug, Medical Supplies and Equipment</td>
<td>16.10</td>
</tr>
<tr>
<td>1984</td>
<td>Chevron Corp.</td>
<td>Gulf Corp.</td>
<td>Oil and Gas</td>
<td>13.2</td>
</tr>
<tr>
<td>1988</td>
<td>Philip Morris Companies, Inc.</td>
<td>Kraft Inc.</td>
<td>Food Processing</td>
<td>13.1</td>
</tr>
</tbody>
</table>

<sup>b</sup>N/I means Food Industry was not included in top ten.
<sup>c</sup>N/A means ranking for Food Industry was not available.
<sup>d</sup>Source: *1996 Mergerstat Review.*
<sup>e</sup>Mergerstat Review classified this merger as conglomerate; however, it is widely considered to be a merger in the food and tobacco industry.
of the Pillsbury Company by Grand Metropolitan PLC of the United Kingdom. M&A activities continue relentless and will help shape, in major ways, the direction and long-term performance of the US food industry.

M&A continues to be a popular means for firms to grow in the US food industry. Trends show that food firms are taken over by other food firms seeking to strengthen themselves in certain production or marketing areas, nonfood firms looking to enter the food industry, and foreign firms eager to grab a piece of the pie of the largest food market in the world. If indeed M&A activities are predictable, information obtained from predictive models could be useful to policy makers, academics, and most importantly, investment bankers, lawyers, and accountants involved in the M&A process in better predicting the outcomes of food-related M&A deals. For example, policy makers, who are concerned about the degree of competition, industry concentration ratios, and prices paid by consumers, can pro-actively develop policies and strategies while academics can better understand M&A activity and provide independent advice to the private and public sectors. Corporate leadership in vulnerable companies who prefer to remain independent and desire protection from becoming targets can use this information in developing strategies that may alter their financial characteristics and hence forestall acquisition. If targeted, they may use the information to prevent actual takeover. Investment bankers and lenders will particularly find predictive models useful in identifying vulnerable firms and developing loan and other financial strategies to support their clients. Furthermore, there is potential for individual investors to profit from knowing in advance which firms are likely to be taken over.

For the food industry, a number of studies have examined the motives for mergers and the nature of merger transactions. Goldberg (1983) identified the following as motivating factors: size, growth, economies of scale, profitability, return on shares, profit variability, market share, market power, synergy, reduction in capacity, acquisition of specific products, strengthening management, power and prestige considerations for management, increased utilization of resources, spreading business risk (diversification), tax loopholes considerations, limiting competition (achieving monopoly profits), increasing business in new territories, achievement of specific resources (e.g., patents or factors of production), and broadening the customer base. He argued that while buying equity is often a cheaper and faster means of entering markets, it requires unique managerial skills (integration and change orientation) rather than the entrepreneurial skills that are needed to launch new ventures. Declerck (1992) argued that managerial and operational synergy motives dominated many takeovers in the 1980s and that financial motives appeared to be the cause of highly leveraged and overpaid transactions.

For the food industry, studies have also examined the effects of mergers on firm performance and profitability. A review of literature by Farooq (1997) indicated that mergers benefited the acquiring firms and that mergers outside of the acquiring company’s area of ex-

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2 Three forms of legal procedures are often used in takeovers: merger or consolidation, acquisition of stock, and acquisition of assets. A merger refers to a combination of two or more firms in which the bidding firm offers to absorb the assets and liabilities of the target firm. The bidding firm usually retains its name while the target firm usually ceases to exist after a formal merger. A consolidation is the same as merger, except that both bidding and target firms combine to create a new entity. With the acquisition of stock, the bidding firm simply offers to purchase the target firm’s voting stock. The purchase may take the form of a cash payout, offer of shares in stock of the bidding firm, a combination of both, or offers of other securities. While this acquisition technique often proves to be challenging if a significant body of minority shareholders in the target firm refuse to sell their shares, many acquisitions by stock end up in a formal merger. The acquisition of assets involves the bidding firm simply offering to buy all or most of the assets of the target firm. The target firm, however, does not necessarily cease to exist.
pertise (conglomerate mergers) and those within the industry (horizontal or vertical) increased accounting profits. On the other hand, Arnould (1969) suggests that conglomerate mergers do not affect the profitability of US food processing firms.

Studies have also examined the effects of mergers on stockholder wealth in the food industry. The finding that mergers benefited the acquiring firm’s shareholders is consistent with Declerck’s (1992) finding that shareholders of target firms in highly concentrated food industries earned an average of 7 and 9% above normal returns and a 15% premium on market price due to the efficiency gains and/or market power benefits earned by such firms. Ding and Caswell (1993) found that related diversification is positively related to stock market evaluation of firm performance while unrelated diversification does not impact on firm performance.3

Some food industry studies have also examined the effects of mergers on industry employment, the economy and society in general. According to Farooq (1997), most managers that have been exposed to mergers viewed M&As negatively: as unhealthy to the economy, detrimental to the food industry, creating significant unemployment, and benefiting only a select group. Notable exceptions are deals involving management buyouts.4 Marion and Kim (1991) showed that mergers and acquisitions played a major role in increasing the concentration in six selected food industries, accounting for two-thirds of the increase in four-firm concentration between 1977 and 1988.

An important area that is wide open in the literature is the predictability of M&A activities in the food industry. Numerous studies in the general M&A literature identified the financial characteristics of firms subject to M&As (e.g., Dietrich & Sorensen 1984; Simkowitz & Monroe, 1971; Stevens, 1973). Some of these even developed predictive models and concluded that it is possible to predict M&As given the historical (3 to 5 year) financial profile of firms that is publicly available.5 Despite the food industry’s importance, none of these studies has been in the food area. Yet, the economic, social and consumer implications of M&A activities are perhaps greater in the food industry than elsewhere.

The general objective of this study is to explore the predictability of M&A activities in the US food manufacturing industry. Specific objectives are to identify firm characteristics that determine their likelihood of being targeted for a merger or acquisition and to identify factors that determine the likelihood of a targeted firm actually being merged or acquired. In contrast to previous studies, which attempted to distinguish the financial characteristics

3There are generally three types of mergers. A horizontal merger occurs when firms within the same industry that compete in the same product markets combine (e.g., acquisition of one supermarket chain by another). A vertical merger occurs when firms within the same industry combine but are involved in production of products or services that are different yet related (e.g., acquisition of a retail outlet by a food manufacturer). A conglomerate takeover occurs when two completely unrelated firms combine (e.g., takeover of a construction company by a food manufacturer).

4A going-private transaction occurs when all the stock of a public firm is bought by a group of private investors. The shares of the public firm are de-listed from the stock exchanges. Usually, the incumbent management of a firm combines with outside private investors in such transactions. Leveraged buyouts (LBOs) and Management buyouts (MBOs) are terms related with going-private transactions. A LBO occurs when a large percentage of the money used to buy all the stock of the public corporation is financed through borrowed money. The term MBO is used in such transactions where the existing management of the public firm that is going private is heavily involved.

5Evidence from a number of stock market studies, however, suggests that the market receives most of the signals about a possible takeover around a very short period prior to the actual announcement for a target (see Dodd and Ruback; 1977; Asquith 1983). Jensen and Ruback (1983) argue that “it is difficult, if not impossible, for the market to predict future targets.”
of firms merged, acquired, or leveraged from a control group of firms that were not reorganized through any of these methods, this study conceptualizes that there exist two primary stages of the M&A process (the targeting stage and the actual takeover of a target). Therefore, empirical models are developed to explore the effects of hypothesized determinants of the likelihood of being targeted and being actually merged, acquired, or leveraged. The two-stage approach approximates the merger process.

The study is also unique in some ways: it focuses on a single industry, the food manufacturing industry, as opposed to the cross-industry analysis performed in prior predictive M&A studies and it econometrically estimates the effects of nonfinancial characteristics that influence the outcome of a takeover bid. Not much attention has been paid to the nonfinancial characteristics of M&A transactions in prior research involving econometric modeling.

The plan for the rest of this article is as follows. In section two, the conceptual framework section, factors hypothesized to affect the probability of a food manufacturing firm being targeted and the probability that a targeted firm will actually be taken over are identified based on existing literature on M&A activities. In section three, the empirical framework section, empirical logit models to predict the potential of a firm being targeted and the potential that the targeted firm will actually be taken over are presented. Section four presents the data sources and the sample selection procedure. Section five presents the empirical results, while section six presents the summary and conclusions.

2. CONCEPTUAL FRAMEWORK: PREDICTING M&A BEHAVIOR

As stated above, no predictive models exist of M&A activities in the food industry. However, studies conducted on other industries and on M&A in general offer useful insights into causal factors. Some of these studies developed hypotheses based on one or more of the merger motives available in the literature by evaluating performance measures or determining financial characteristics of the firms (see Chambers, 1965; Palepu 1986; Stevens, 1973; Taussig & Hayes, 1968). Others utilized the “event studies” approach, which involves the pre- or post-merger study of the effects of changing news and events on stock price behavior (e.g., Affleck-Graves, Flach, & Jacobson, 1988; Asquith, 1983; Dodd, 1980; Jensen & Ruback 1983, Langetieg 1978; Mandelker 1974). These studies serve as the basis for the identification of determinants of M&A activities. The literature suggests a diversity of theories and hypothesis about M&A and suggests a lack of consensus on the theories of M&A activity. Therefore this study, by necessity, is empirical in nature.

In conceptualizing the predictive models of M&A activities, the practitioner’s approach is taken. It suggests that there are three steps to takeovers: identification of a number of potential targets based on strategic criteria of the acquirer’s acquisition strategy, detailed financial analysis on the set of potential targets to arrive at a final target, and due diligence on the final target which eventually leads to final negotiations to acquire the target. This study suggests that takeover activity occurs in two distinct stages, each of which is independent, and that it should be modeled as such. That is, the first two steps are collapsed into Stage 1, the stage where financial considerations are used in deciding who to finally target. The third step is therefore considered Stage 2, the stage where the nonfinancial characteristics become important. This classification scheme makes sense considering that publicly available data on firms do not allow researchers to make a distinction between steps one and two. The empirical analysis that follows assumes a two-stage process.
2.1. Firm Targeting Behavior

The first objective of this study is to identify the determinants of firm targeting behavior. Past studies hypothesized the relationships between firm characteristics and the likelihood of being targeted or taken over. Based on these, the following hypotheses about firm targeting behavior are identified: liquidity, leverage, activity, profitability, size, growth, dividend policy, stock market characteristics and company equity to asset value ratio (Tobin’s $q$ hypothesis). These hypotheses are based on the works of Taussig and Hayes (1968), Simkowitz and Monroe (1971), Belkaoui (1978), Stevens (1973), Rege (1983), Steiner (1975), Wansley and Lane (1983), Harris, Steward, Guilky, and Carleton (1982), Hasbrouck (1983), Dietrich and Sorensen (1984), and Torabzadeh (1984), among others.

The **Liquidity Hypothesis** suggests a positive relationship between a firm’s liquidity (as measured by liquidity ratios) and its likelihood of being targeted. Liquidity ratios reflect the short-term solvency of a firm. High liquidity is desirable to a creditor, since it reflects ability to pay. However, it is also desirable to a bidder because it implies that the management of the target firm is not maximizing shareholder’s wealth or utilizing the firm’s cash and other short-term assets efficiently. A bidding firm may be able to utilize the excess cash more efficiently. Liquidity can be measured as the current ratio (CR), the acid test or quick ratio (QR), and the working capital (WCAP) to total assets (AT) ratio (i.e., $WCTA = WCAP/AT$).

The **Leverage Hypothesis** suggests an inverse relationship between a firm’s leverage ratios and its likelihood of being targeted. These ratios reflect a firm’s capitalization structure. Firms use a combination of equity capital and debt to run their operations. A highly leveraged firm has a high percentage of debt compared to equity and assets. Since debt is often cheaper than equity, many firms prefer to borrow as opposed to raising more equity to fund projects. A bidding firm looking to borrow more money to expand its operations is likely to avoid a highly leveraged firm (Lintner, 1971). Leverage can be measured via the debt to equity ratio (DTEQ), the long-term debt ratio (LTDR) and the pre-tax interest coverage ratio (PIC).

The **Activity or Turnover Hypothesis** suggests that there is a relationship between activity ratios and the likelihood of a firm being targeted. Activity ratios indicate the efficiency with which a firm utilizes its assets to generate sales. High activity ratios indicate efficient asset utilization or increased cash flows. A bidding firm may be interested in taking over a firm with high activity ratios to improve its post-acquisition efficiency. However, it may also be interested in firms with low activity ratios because it could benefit from utilizing the assets more efficiently. Consequently, no a priori assumptions are made about the relationship between activity ratios and the likelihood of being targeted. Activity turnover can be measured via the inventory turnover (INVX), the receivables turnover (RECX), the working capital turnover (WCAPTO), and the total asset turnover (ATT).

The **Profitability Hypothesis** suggests that because profitability is the bottom line for shareholders, it determines the probability of a firm being targeted (Buckley, 1972; Goldberg 1983). Highly profitable firms may be desirable to bidding firms because of high cash flows. On the other hand, less profitable firms may be attractive due to the potential for improved profits through better management. In fact, Arnould (1969) found no relationship between the degree of diversification and profitability. Hence, no a priori assumptions are made about the relationship between profitability and the likelihood of a firm being targeted. Profitability can be measured via the pre-tax profit margin (PPM), rate of return on assets (ROA), and rate of return on equity (ROE). It is important to note that the relationship
between total asset turnover (sales/asset), return on assets (profit/assets) and return on sales (profit/sales) increases the possibility of multicollinearity.

The Size Hypothesis predicts an inverse relationship between firm size and the likelihood of being targeted based on the notion that takeover-related transaction costs increase with the size of the targeted firm (Goldberg, 1983). Such costs may include the costs of absorbing the target and costs incurred in fighting the resistance from the target firm’s shareholders and/or management. Common indicators of company size include the log of total assets (LNAT = ln [AT]) and the natural log of firms’ net sales (LNSALE = ln [Sales (Net)], where AT is total assets).

The Growth Hypothesis suggests the importance of growth in determining the probability of being targeted (Chen, 1984; Goldberg, 1983; Lewellyn, 1971). Firms experiencing low growth but rich in resources may be attractive targets. However, firms experiencing high growth but poor resources can be of interest to potential acquirers. Therefore, no a priori assumptions are made about the relationship between firm growth and the likelihood of a firm being targeted. Firm growth can be proxied by the growth of the firm’s net assets (GAT), and the growth of the firm’s net sales (GSALE).

The Dividend Policy Hypothesis suggests an inverse relationship between dividend payout and the likelihood of being targeted. Proponents argue that a bidding firm is more interested in a firm with low dividend payouts because high dividend payouts indicate lack of investment opportunities which in turn implies lower future cash flows (Dietrich & Sorensen, 1984). Dividend policy can be proxied by the dividends (DV) to cash-flow ratio (DVCFLR).

The Price-Earnings (P/E) Hypothesis suggests an inverse relationship between the P/E ratio of a firm and the likelihood of being targeted. Bidding firms with high P/E ratios seek targets with low P/E ratios because there is an immediate increase in the price of the acquiring company’s shares (Bierman & Hass 1970; Simkowitz & Monroe, 1971; Sudarsanam, 1995; Taussig & Hayes, 1968).

The Stock Market Hypothesis suggests that firms whose shares are heavily traded on the stock market (e.g., high trading activity of common shares) are more likely candidates for takeover. Heavy trading may imply that the transaction costs of acquiring the firm may be lower due to marketability. However, heavy stock trading can also be the result of M&A activity. A commonly used indicator of trading activity is the ratio (or percentage) of common shares traded in the stock market (CSTR).

Finally, Tobin’s q Hypothesis is based on the relationship between a firm’s assets and its market value. Tobin’s q is the ratio of a firm’s market value to its asset replacement costs (Sudarsanam, 1995; Tobin, 1969). A ratio of less than unity will be attractive to some acquirers because it indicates management inefficiency. That is, the likelihood of a firm being targeted increases when \( q < 1 \) and approaches zero. Industrial organization economists, however, argue that a ratio of greater than unity may indicate monopoly rents resulting from a firm’s access to highly specialized nonreproducible resources in a particular industry. The only feasible way for a bidding firm to enter such an industry is through a takeover. This argument implies that the likelihood of being targeted rises with values of \( q \) when \( q > 1 \). Given the above, no a priori assumptions are made regarding the relationship between a firm’s \( q \) ratio and its likelihood of being targeted. Following Sudarsanam (1995), Tobin’s \( q \) can be proxied by the market-to-book ratio (MKBK).

Table 2 lists the variables hypothesized to affect the likelihood of being targeted (Objective 1) and the abbreviated variable names and expected signs. Data sources are discussed below.
2.2. Firm Takeover Behavior

The second objective of this study is to identify factors that determine whether or not a targeted firm will be taken over. No empirical research exists in the literature. However, Pickering (1983) sheds some light on the causes of abandoned mergers based on the experience of firms in the United Kingdom. His study was qualitative. In this study, an attempt is made to test some of his findings quantitatively.

Pickering (1983) provided four broad reasons for the abandonment of proposed mergers: change of mind, lack of market support for the bid, operation of competition policy, and other acquisitions. For each, he gave specific reasons that are presented below.

With respect to abandonment arising from a **change of mind**, Pickering (1983) provided five reasons: a target may not be as attractive as it first appeared; the bidders’ own financial position may deteriorate; general economic conditions may reduce the attractiveness of a target; the bidder may not be able to face the resistance put up by the target; and the target may not be able to meet the terms of the proposal because of unexpected difficulties over financial terms, personality clashes, problems in employing some individuals after a takeover, and incompatibilities in management styles.

On the **lack of market support for the bid**, Pickering (1983) suggested that the price that the bidder offers may not gain market support for two reasons: bidding problems or effective defense. Examples of bidding problems include problems in arriving at a realistic valuation of the target; difficulty in revising the offer if the initial offer was resisted; the real-
ization that errors were made in the bidding strategy (e.g., timing of bid, level of the initial offer could be too low, buying stock of target while the bid is in progress, etc.); problems in the manner in which the target’s board, senior management and employees were approached; and lack of conviction for the logic of the merger and benefits to the target’s shareholders. In explaining effective defense, Pickering suggests that a bid may be opposed by the targeted firm for numerous reasons, including personality clashes, hostility in the bidder’s approach to the target, doubts about the logic of the proposed merger, concerns among the board members about their own futures, a preference for remaining independent, a feeling that the value offered is too low, and a belief that company would do better on its own.

With respect to the operation of competition policy, Pickering (1983) suggests that legal issues may arise which may result in a merger abandonment. With respect to other acquisitions, Pickering suggests that a number of factors may come to play, including a takeover of the bidder itself by another company not interested in a merger. Another possibility is that the target may takeover other firm(s), thereby making it more difficult and costly for the bidder. Pickering also raises the possibility of other companies bidding for the same target. On the basis of the above, the following hypotheses are advanced about the probability of actual takeover.

The Ownership Hypothesis suggests that the nature of firm ownership affects the probability of actual takeover. Fama and Jensen (1983) argue that because proposed mergers may be perceived by managers and directors, who are not owners of the firm, as a direct threat to their careers, they may offer some resistance. On the other hand, if ownership is concentrated in the hands of directors and managers, then resistance is less likely if the takeover offer is attractive (would be more likely if the offer is not attractive). Ownership can be measured as OWNER (percentage of ownership by directors and management). No a priori assumptions are made about the effect of OWNER.

The Control Hypothesis suggests that there is a relationship between the degree of control officers have over the board and the probability of actual takeover occurring. For example, if management does not possess a significant amount of firm ownership, its objectives can be in conflict with the interest of shareholders and a takeover/merger attempt may be rejected despite its attractiveness. Management control can be measured as the percentage of seats occupied by officers (management) of the company on the board of directors (CONTROL). No a priori assumptions are made about the relationship between control and the probability of takeover.

The Attitude Hypothesis suggests a positive relationship between a friendly takeover attempt and the likelihood of a firm being merged or acquired. A friendly attitude implies the agreement of both management and board of the target firm with the takeover. Hence, rather than resist, they actually cooperate and facilitate the transaction. Lack of cooperation may cause a bidder to withdraw an offer. The attitude surrounding a deal (ATTITUDE) can be measured as a dummy variable which takes on the value of 1 if friendly and 0 otherwise.

The Relatedness Hypothesis suggests that the strategy behind and nature of a merger can affect the probability of success. That is, whether a merger is horizontal, vertical (related), or conglomerate will influence the probability of actual takeover. Evidence from the literature suggests that takeover activity in the 1980s and 1990s was primarily motivated by strategic factors (see Ding & Caswell, 1993; Ding, Caswell, & Rogers; 1993, Yu, 1993 for insights on the relatedness of food manufacturing firms). Typically, when the primary or secondary activity of both the targeted and bidding firms are in the same four-digit SIC categories, the deal is considered horizontal; when the primary or secondary SIC codes for
both the targeted and bidding firms are in the same two-digit SIC code (i.e., SIC 20), the
firms are considered related;\(^6\) and when the two-digit primary or secondary SIC codes of
the bidding and target firms differed, the deal was considered a conglomerate deal. Dumu-
ny variables can be used to capture relatedness. For example, HORIZ = 1 if the bidder’s
and target’s four-digit SIC codes matched, 0 otherwise; and RELATE = 1 if the bidder’s
and target’s two-digit SIC code (20) matched, 0 otherwise. Therefore, a deal is considered
a conglomerate deal (CONGL = 1) if HORIZ = RELATE = 0. If the strategic relatedness
hypothesis is true, then both HORIZ and RELATE can be expected to have a positive rela-
tionship with the likelihood of a targeted firm being taken over.

The authors acknowledge the limitation with this measure of relatedness. Many food
firms are in a number of SIC codes and this could miss some important relatedness, espe-
ially in cases where a larger firm purchases a smaller more firm in its secondary product
market. Also, there may be synergies in distribution and other operational areas that would
be missed using the SIC criteria. Unfortunately, data on such relationships are not always
publicly available.

The Investor Group Takeover Hypothesis suggests an inverse relationship between the
bidder being an investor group and the likelihood of a firm being taken over. The rationale
is that targeted firms are more likely to resist a takeover attempt by an investor group
because they see the bidders’ motive as being primarily financial. Another argument is
that the management of a target firm may be reluctant to facilitate the sale of the firm
to an investor due to psychological factors (e.g., they may feel that they have built a pro-
ductive firm which may be ruined because of the lack of experience of the investor group).
A dummy variable (INVGRP) can be used to capture the investor group effect. If the
bidding firm was an investor group, then INVGRP is equal to 1. Otherwise, INVGRP is
equal to 0.

The Previous Bids Hypothesis suggests that the number of previous bids is positively re-
lated to the likelihood of being taken over. The rationale is that when the same firm is tar-
geted again by another firm following a past unsuccessful takeover, the new bidding firm
works based on the knowledge of why earlier bid(s) failed and would probably have a stra-
egy to overcome the problem with the previous bid(s). This argument is especially true for
publicly traded firms since information becomes public about the deal. The number of pri-
or takeover attempts (NPBIDS) can be constructed as a variable.

The Litigation Hypothesis brings in the dimension of legal issues arising in a takeover.
It is hypothesized that an inverse relationship exists between the presence of litigation and
the likelihood of a targeted firm being taken over. A takeover attempt is more likely to fail
if negotiations result in litigation. A variable LITIG can be defined to capture the effect of
litigation on the likelihood of a merger or acquisition. That is, LITIG is equal to 1 if there
was litigation, and 0 otherwise.

The Consideration Hypothesis suggests that the type of consideration offered by the bid-
der may affect the target shareholder’s decision to be merged or acquired. A cash offer to
buy shares may give shareholders more incentive to sell their shares as opposed to an offer
of stocks or a combination of cash and stock or other forms of consideration. Consideration
can be measured as the CONSID variable. CONSID is equal to 1 if the terms of the deal in-
cluded cash only, 0 otherwise. Therefore, a positive relationship is expected between CON-
SID and the likelihood of a firm being taken over.

\(^6\)Note that firms with the same 4-digit SIC codes and hence the same 2-digit SIC code that were included in
the horizontal category were not included again in the related category.
The Other Acquisitions Hypothesis suggests an inverse relationship between the existence of other ongoing acquisition plans by the target or bidder (OTHER) and the likelihood of a targeted firm being taken over. A takeover attempt might be withdrawn if either the target or bidder was engaged in another takeover. The variable can be defined as follows: OTHER is equal to 0 if the bidder or target was not involved in other takeovers announcement(s) during the present announcement, and 1 otherwise. Whether or not a firm was targeted (the dependent variable for the target model) was not included as an explanatory variable in the takeover model because virtually all firms that are taken over are targeted first. That variable will likely have so much explanatory power and dwarf the other effects.

Table 3 lists the variables hypothesized to affect the likelihood that a targeted firm will be taken over and the abbreviated variable names and expected signs. Data sources are discussed below.

### 2.3. Methodological Issues

In developing predictive models of M&A activity, it is important to consider the methodological flaws inherent in prior predictive studies which make them susceptible to biased estimates. First, many past studies were performed on firms across a number of industries.7 The impact of industry variations on accounting earnings and security returns have been well documented by King (1966), Brown and Ball (1967), Magee (1974), and Livingston (1977). Because factors that may affect one industry may not affect another, many of these studies tried to control for industry variations. Other studies suggested that further research be conducted within industry environments. Second, in estimating predictive models, several studies used samples containing an equal number of taken over and non-taken over firms. Such evenly balanced samples are not representative of the actual ratio of taken over

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7Only a few studies have focused on identifying financial characteristics and constructing probability models of M&As for a particular industry. For example, Angrisani (1994) distinguished the characteristics of merged from non-merged hospitals and developed an acquisition model for the hospital industry. Ngassam (1989) did the same for the banking industry. The literature review revealed no such studies on the food industry.
to non-taken over firms in the underlying population, and results derived are likely to be bi-
ased. Both Harris et al (1982) and Palepu (1986) pointed out this problem with earlier stud-
ies. In this paper, we randomly draw samples of targeted/un-targeted and merged/un-merged
firms.

3. EMPIRICAL FRAMEWORK

Past studies have used various statistical techniques in the development of predictive M&A
models. Examples include analysis of differential means, discriminant analysis, the Lin-
ear Structural Relations (LISREL) programing technique and logit or probit regression tech-
niques. In this study, the logit regression technique is employed because of its consisten-
cy with the actual merger and acquisition decision making process. The ideal situation is to
model the two stages of M&A, target and takeover stages, with a binary choice dependent
variable. The ordinary least squares regression technique is inappropriate for binary choice
models due to the nonnormality of the error term. Limited dependent variable estimation
techniques are more appropriate. Consequently, the logit modeling approach is used in this
study. The models are presented below.

3.1. Logit Model of Firm Targeting Behavior

The first objective of this study can be accomplished by estimating the following model:

$$P_i = \text{Prob (TARGET}_i = 1 | C_{ir}, QR_i, WCTA_i, DTEQ_i, \text{PIC}_i, \text{INVX}_i, \text{RECX}_i, \text{WCAPTO}_i, \text{ATT}_i, \text{PPM}_i, \text{ROA}_i, \text{ROE}_i, \text{LNAT}_i, \text{LNSALE}_i, \text{GAT}_i, \text{GALE}_i, \text{DVCFLR}_i, \text{PE}_i, \text{CSTR}_i, \text{MKBK}_i)$$

where TARGET$_i = 1$ if firm $i$ was targeted and TARGET$_i = 0$ if firm $i$ was not targeted.
The specific logit model for predicting the likelihood of a firm targeted is expressed as
follows:

$$P(\text{TARGT} = \alpha + \beta_1 \text{CR}_i + \beta_2 \text{QR}_i + \beta_3 \text{WCTA}_i + \beta_4 \text{DTEQ}_i + \beta_5 \text{LTDR}_i + \beta_6 \text{PIC}_i + \beta_7 \text{INVX}_i + \beta_8 \text{RECX}_i + \beta_9 \text{WCAPTO}_i + \beta_{10} \text{ATT}_i + \beta_{11} \text{PPM}_i + \beta_{12} \text{ROA}_i + \beta_{13} \text{ROE}_i + \beta_{14} \text{LNAT}_i + \beta_{15} \text{LNSALE}_i + \beta_{16} \text{GAT}_i + \beta_{17} \text{GALE}_i + \beta_{18} \text{DVCFLR}_i + \beta_{19} \text{PE}_i + \beta_{20} \text{CSTR}_i + \beta_{21} \text{MKBK}_i + e_i$$

3.2. Logit Model of Firm Takeover Behavior

The second objective of this study can be accomplished by estimating the following model:

$$P_i = \text{Prob (TAKEOVER}_i = 1 | \text{OWNER}_i, \text{CONTROL}_i, \text{ATTITUDE}_i, \text{HORIZ}_i, \text{RELATE}_i, \text{INVGRP}_i, \text{NPBIDS}_i, \text{LITIG}_i, \text{CONSID}_i, \text{OTHER}_i)$$

8See, for example, Taussig and Hayes (1968), Vance (1969), Buckley (1972), and Mejros (1978).
9See, for example, Simkowitz and Monroe (1971), Stevens (1973), Belkaoui (1978), Rege (1983), Wansley and
Lane (1983), Wansley (1984), and Saridereli (1986).
10See, for example, Harris et al (1982), Hasbrouck (1983), Dietrich and Sorensen (1984) and Palepu (1986).
where \( \text{TAKES\_OVER}_i = 1 \) if firm \( i \) was merged/acquired and \( \text{TAKES\_OVER}_i = 0 \) if the offer to acquire firm \( i \) was withdrawn. The empirical model specified for estimation is as follows:

\[
P(\text{TAKES\_OVER}_i) = \alpha + \beta_1 \text{OWNER}_i + \beta_2 \text{CONTROL}_i + \beta_3 \text{ATTITUDE}_i + \beta_4 \text{HORIZ}_i + \beta_5 \text{RELATE}_i + \beta_6 \text{INVGRP}_i + \beta_7 \text{NPBIDS}_i + \beta_8 \text{LITIG}_i + \beta_9 \text{CONSID}_i + \beta_{10} \text{OTHER}_i + \epsilon_i \quad (4)
\]

4. DATA MANAGEMENT AND SAMPLE SELECTION PROCEDURE

For a sample of food firms within the 4-digit SIC codes in the 2000–2099 range, data were obtained from Standard & Poor’s COMPUSTAT PC PLUS for Windows™ (COMPUSTAT) and the database of M&A transactions maintained by Securities Data Corporation (SDC). Some 170 firms were previously included in the data set, but were subsequently deleted from the COMPUSTAT database during the period January 1985 to December 1994. Of these, 51 firms were deleted because of a merger or acquisition. To allow access to other information not available through COMPUSTAT, the sample of merged firms was further restricted to firms that were listed on either the NYSE (New York Stock Exchange), AMSE (American Stock Exchange), or NASDAQ (National Association of Securities Dealers’ Automatic Quotations), including the NMS (National Market System). This lowered the number of merged or acquired firms to 42. Data on all the variables in equations 1 through 4 were gathered for these 42 firms. Missing data resulted in the dropping of 14 firms. Therefore, there were a total of 28 firms in our sample that were either merged or acquired.

The control group for the target model was constructed as follows. The COMPUSTAT consisted of 189 firms that were not deleted as of the end of December 1994. Of these, 164 were listed on the NYSE, AMSE, or NASDAQ. Of these, 163 existed as of the end of 1994. Data were obtained for all the variables for these 163 firms. Missing data reduced the number of firms to 77.

Since the model involves prediction of targets, it was necessary to determine which of the 77 firms were targeted but not necessarily deleted. COMPUSTAT does not provide such information. Therefore, information on firms that were targeted for a merger or acquisition but were withdrawn from further consideration was obtained from SDC. Names of targeted but withdrawn firms obtained from SDC were matched with the names of firms existing as of the end of 1994 obtained from COMPUSTAT. This process resulted in 3 firms that were targeted but not deleted from the COMPUSTAT database. Therefore, the target prediction model was estimated using data of 105 firms, of which 31 firms were targeted and 74 were not targeted (the control group).

To obtain a sample of firms for the takeover prediction model, data were also obtained from the SDC database. For the January 1, 1985 to December 31, 1994 period, the database consisted of a total of 1,602 deals in which the targeted firm was in SIC 2000–2099. The following information and criteria were used to obtain a sample for analysis: (a) there were 454 deals in which the target had public ownership, (b) for 89 of these deals, the bidder sought 100% ownership of target, (c) for 83 of these deals, the bidder would have had to acquire at least 51% ownership to own 100% of the target, (d) for 36 of these, the deal was completed and 100% ownership resulted. The deals were withdrawn in 19 cases, while the rest of the deals were pending. Data requirements reduced the final number of firms used in the analysis for objective 2 to 35. Of these 35 firms, 30 firms were merged or acquired while five were withdrawn from takeover consideration.
As discussed above, the variables hypothesized to affect the probabilities of being targeted and of being actually taken over are presented in Tables 2 and 3. For a number of variables, annual data were gathered for 3 fiscal years prior to the observation year, the ratios were computed for each year and their average was used in model estimation. These include variables depicting the liquidity dimension (CR, acid test or QR, and WCTA = WCAP/AT), leverage (DTEQ, LTDR = DLTT/[DLTT + SEQ], and PIC = EBIT/XINT), activity/turbulence (INVX, receivables turnover [RECX], WCAPTO, ATT), profitability (PPM, ROA, and ROE), and dividend policy (DVCFLR = DV/[IB + DP]). For variables depicting the size dimension (LNA T = ln AT and the LNSALE = ln [Sales (Net)]) and dividend policy (DVCFLR = DV/[IB + DP]), data were collected for 1 fiscal year prior to the observation year and transformed by the natural logarithm before inclusion in the model as a proxy.

For variables depicting the growth dimension (GAT and GSALE), annual data were obtained for 4 fiscal years prior to the observation year. The growth rate was computed for each of the three years prior to observation and their average was included in the model. For the P/E ratio (PE = PRCCF/EPSPX), the current year’s annual data were used in modeling. For the stock market hypothesis (Ratio of CSTR = CSHTR/CSHO), the data were computed for the calendar year prior to the observation and included in the model. To test Tobin’s q hypothesis, the current year’s Market-to-Book ratio (MKBK = PRCCF/BKVLPS) was obtained from COMPUSTAT PC PLUS and used directly in the model.

With respect to the variables in the second model, data on OWNER were obtained from Compact Disclosure. Data on CONTROL were obtained from Moody’s Industrial and O.T.C. Manuals and Compact Disclosure. Data on ATTITUDE, HORIZ, RELATE, CONGL, NPBIDS, INVRGRT, LITIG, CONSID and OTHER were obtained from the SDC.

Since many variables were derived from two or more other variables, the possibility of collinearity among the explanatory variables was high. As will be seen below, diagnostic tests were used to detect collinearity among variables and appropriate corrective measures were undertaken.

5. EMPIRICAL RESULTS

5.1. Estimates of the Logit Target Prediction Model

Three different specifications of the target model were estimated. The results are provided in Table 4. Specification 1 involved all 21 explanatory variables for the 150 firms in the sample. Collinearity diagnostics by Belsley, Kuh, and Welsch (1980) performed suggested that the variables CR, ATT, ROA, LNA T, and GAT should be dropped (see details in Farooq, 1997). These variables were dropped and Specification 2 was estimated. Influence diagnostics tests were run on Specification 2 to determine the presence of extreme or influential observations. This procedure resulted in dropping seven firms. All seven firms dropped were targeted firms. Therefore, one could be relatively assured that the method used in identifying influential and extreme values was appropriate. These seven firms were dropped from the analysis and Specification 3 was re-estimated with 98 firms in the sample.

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11 It should be noted that dropping the five variables did not involve dropping any of the hypotheses to be tested.

12 The rationale is as follows. The targeted firms are events that have occurred while the non-targeted firms are essentially used as a control group. It would not make sense to label firms in a control group as extreme or influential.
The results in Table 4 show that Specification 3 fit well. The $-2 \log L$ statistic was significant at the 0.001 level and the Score statistic was statistically significant at the 0.01 significance level. McFadden’s $R^2$ is an impressive 66.29%. This value is relatively high for the type of data used in this analysis. Of the sixteen variables in the model, nine were statistically significant at the 10% level. Five of these were statistically significant at the 5% level. The analysis of the empirical results that follow is based on the results obtained for Model 3.

Consider first the variables depicting liquidity. The variable QR was significant at the 0.05 level. However, it had a negative sign instead of the expected positive sign. Since QR is a measure of short-term liquidity, it appears that firms with higher short-term liquidity were less likely to be targeted. Prior studies have observed that excess short-term liquidity for a firm is indicative of inefficient asset allocation and/or debt capacity and that such firms are likely candidates for takeover. The variable WCTA, however, took a positive sign as

### Table 4. Parameter Estimates of the Target Prediction Models

<table>
<thead>
<tr>
<th>Variable</th>
<th>Expected Sign</th>
<th>Specification 1 Estimates (Includes all variables)</th>
<th>Specification 2 Estimates (Collinear variables removed)</th>
<th>Specification 3 Estimates (Collinear variables removed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Estimate</td>
<td>Pr &gt; $\chi^2$</td>
<td>Estimate</td>
</tr>
<tr>
<td>INTERCEPT</td>
<td>-</td>
<td>-0.855 (0.692)</td>
<td>-1.200 (0.495)</td>
<td>4.926 (0.213)</td>
</tr>
<tr>
<td>CR</td>
<td>+</td>
<td>-1.368 (0.163)</td>
<td>-0.499 (0.248)</td>
<td>-4.152 (0.039)</td>
</tr>
<tr>
<td>QR</td>
<td>+</td>
<td>1.751 (0.148)</td>
<td>0.001 (0.651)</td>
<td>-0.242 (0.234)</td>
</tr>
<tr>
<td>WCTA</td>
<td>+</td>
<td>4.389 (0.312)</td>
<td>6.984 (0.012)</td>
<td>35.304 (0.014)</td>
</tr>
<tr>
<td>DTEQ</td>
<td>-</td>
<td>0.002 (0.663)</td>
<td>-5.000 (0.040)</td>
<td>-37.701 (0.016)</td>
</tr>
<tr>
<td>LTDR</td>
<td>-</td>
<td>-2.659 (0.388)</td>
<td>-0.048 (0.030)</td>
<td>-1.432 (0.004)</td>
</tr>
<tr>
<td>PIC</td>
<td>-</td>
<td>-0.055 (0.044)</td>
<td>-0.009 (0.797)</td>
<td>-0.059 (0.301)</td>
</tr>
<tr>
<td>INVX</td>
<td>?</td>
<td>-0.256 (0.057)</td>
<td>0.091 (0.089)</td>
<td>0.141 (0.143)</td>
</tr>
<tr>
<td>RECX</td>
<td>?</td>
<td>0.063 (0.330)</td>
<td>0.002 (0.764)</td>
<td>0.020 (0.360)</td>
</tr>
<tr>
<td>WCAPTO</td>
<td>?</td>
<td>0.001 (0.749)</td>
<td>-0.009 (0.797)</td>
<td>-0.059 (0.301)</td>
</tr>
<tr>
<td>ATT</td>
<td>?</td>
<td>0.940 (0.265)</td>
<td>0.032 (0.439)</td>
<td>-0.052 (0.564)</td>
</tr>
<tr>
<td>PPM</td>
<td>?</td>
<td>0.067 (0.548)</td>
<td>0.032 (0.439)</td>
<td>-0.052 (0.564)</td>
</tr>
<tr>
<td>ROA</td>
<td>?</td>
<td>0.081 (0.689)</td>
<td>0.032 (0.439)</td>
<td>-0.052 (0.564)</td>
</tr>
<tr>
<td>ROE</td>
<td>?</td>
<td>-0.021 (0.745)</td>
<td>0.025 (0.591)</td>
<td>0.754 (0.008)</td>
</tr>
<tr>
<td>LNAT</td>
<td>-</td>
<td>-1.170 (0.501)</td>
<td>0.025 (0.591)</td>
<td>0.754 (0.008)</td>
</tr>
<tr>
<td>LNSALE</td>
<td>-</td>
<td>1.061 (0.536)</td>
<td>0.117 (0.525)</td>
<td>0.059 (0.898)</td>
</tr>
<tr>
<td>GAT</td>
<td>?</td>
<td>0.035 (0.163)</td>
<td>0.032 (0.439)</td>
<td>-0.052 (0.564)</td>
</tr>
<tr>
<td>GSALE</td>
<td>?</td>
<td>-0.051 (0.135)</td>
<td>-0.016 (0.267)</td>
<td>-0.187 (0.011)</td>
</tr>
<tr>
<td>DVCFLR</td>
<td>-</td>
<td>1.491 (0.133)</td>
<td>1.863 (0.036)</td>
<td>13.515 (0.006)</td>
</tr>
<tr>
<td>PE</td>
<td>-</td>
<td>-0.019 (0.243)</td>
<td>-0.014 (0.215)</td>
<td>-0.015 (0.658)</td>
</tr>
<tr>
<td>CSTR</td>
<td>+</td>
<td>0.542 (0.184)</td>
<td>0.735 (0.052)</td>
<td>6.314 (0.005)</td>
</tr>
<tr>
<td>MKBK</td>
<td>?</td>
<td>-0.098 (0.695)</td>
<td>-0.031 (0.748)</td>
<td>-1.908 (0.038)</td>
</tr>
</tbody>
</table>

No. of targets | 31 | 31 | 24 |
No. of Non-targets | 74 | 74 | 74 |
$-2 \log L$ | 39.238c | 27.606b | 72.328c |
Score | 29.684a | 20.921 | 32.178c |

a Significance at the 0.1 significance level.
b Significance at the 0.05 significance level.
c Significance at the 0.01 significance level.

McFadden $R^2 = 66.29%$. 
expected and was significant at the 0.05 level. Thus, firms with higher working capital to asset ratios are more likely to be targeted.

While both QR and WCTA are measures of short-term liquidity, it appears that when considering food firms as takeover targets, bidding firms look for firms with low QR ratios and high WCTA ratios. Upon closer examination of the definitions of the ratios, one observes that a higher QR implies that a firm has relatively higher cash or cash equivalents when compared to its current liabilities. A higher QR therefore implies inefficient use of cash. A higher WCTA ratio implies inefficient allocation of current assets. Therefore, it appears that bidding firms were relatively more interested in food firms with inefficient asset allocation as opposed to food firms that had excess cash.

All three measures of leverage were in Specification 3 and all had the expected negative signs. However, only two variables were significant, namely LTDR and PIC. These results are consistent with a prior expectations.

The INVX had a negative sign, while the RECX and the WCAPTO had positive signs. However, none of these were statistically significant. Thus, the turnover hypothesis that bidding firms are interested in target firms with high turnover ratios is not confirmed.

The coefficient of the PPM had a negative sign, but was not statistically significant. However, the ROE coefficient had a positive sign and was significant at the 0.01 level. This implies that food firms with higher return on equity were more likely to be targeted. The results, therefore, are consistent with a priori expectations that firms with high levels of profitability are more likely to be targeted.

The coefficient of the LNSALE, a proxy for size, is not statistically significant. This suggests that company size is not a determinant of the probability of being targeted. This contradicts the findings of prior studies that smaller firms are more likely to be taken over than larger firms. An analysis of the descriptive statistics showed that while the mean of targeted firms was smaller than the mean of nontargeted firms, the minimum value for targeted firms was higher than the minimum value for nontargeted firms. In other words, targeted firms were not the smallest firms. Note that the data chosen for analysis in this study come from a period in which the food industry experienced record setting transactions in takeover activity.

The coefficient of the growth of the targeted firm’s GSALE took a negative sign and was significant at the 0.05 level. This implies that target firms that were experiencing lower growth in sales were more likely targets and ideal candidates for takeovers. This finding is consistent with prior hypotheses which argue that bidding firms may be interested in firms that are either experiencing low growth but are rich in resources, or firms that are experiencing high growth but have poor resources.

The DVCFLR took a positive sign and was significant at the 0.01 level. The positive sign implies that food firms that had high dividend payouts were more likely to be targeted. Researchers, however, have argued that high dividend payouts indicate a lack of investment opportunities, which implies lower future cash flows. Note, however, that dividend policies vary across industries. Many investors invest in stocks of food firms with the intention of earning relatively higher dividend income as opposed to substantial appreciation in the value of the stocks.

Consistent with a priori expectations, the coefficient of the PE was negative, but not significant. The coefficient of the CSTR took a positive sign and was significant at the 0.01 level. This finding is consistent with a priori expectations that firms whose shares are heavily traded on the stock market are potential candidates for takeover. Heavy trading may imply that the transaction costs of acquiring the firm may be lower due to marketability.

The descriptive statistics are not shown in this paper; however, they are available by request from the authors.
The coefficient of the MKBK variable was used as an approximation for Tobin’s $q$. The variable took a negative sign and was significant at the 0.05 level. This result implies that food firms with lower market-to-book ratios have a higher likelihood of being targeted than food firms with higher ratios. In other words, food firms with relatively lower management efficiency were likely candidates of takeovers. This result is consistent with Tobin’s $q$ hypothesis.

To determine the classification accuracy of Specification 3, classification information is presented in Table 5. This table is essentially a frequency table of observed and predicted targets and nontargets. In the case of this study, an “Event” refers to a targeted firm and a “Non-Event” refers to a nontargeted firm. The table presents statistics on how many observed targets were predicted as targets, how many observed nontargets were predicted as nontargets, how many observed nontargets were incorrectly predicted as targets, and how many observed targets were incorrectly predicted as nontargets. The table also lists the percentage of overall correct predictions of observed targets and nontargets (Correct), percentage of correct predictions of observed targets as targets (Sensitivity) percentage of correct predictions of observed nontargets as targets (Specificity), percentage of incorrect predictions of observed nontargets as targets (False Positive), and percentage of incorrect predictions of observed targets as nontargets (False Negative).

If the predictive ability of Specification 3 was evaluated at the Prob Level of 0.500 then the model would predict 58.3% of observed targets as targets; 87.8% of the observed nontargeted firms as nontargets. At this level, of all the firms which were predicted as targets, 39.1% were incorrectly predicted and of all the firms that were predicted as nontargets, 13.3% were incorrectly predicted. The overall correct predictions for both targets and nontargets was 80.6%.

14This is the level that most of the previous studies have used to evaluate the predictive ability of their models.

<table>
<thead>
<tr>
<th>Prob Level</th>
<th>Correct Event</th>
<th>Correct Non-Event</th>
<th>Incorrect Event</th>
<th>Incorrect Non-Event</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>24</td>
<td>74</td>
<td>0</td>
<td>0</td>
<td>24.5%</td>
</tr>
<tr>
<td>0.020</td>
<td>23</td>
<td>47</td>
<td>27</td>
<td>1</td>
<td>71.4%</td>
</tr>
<tr>
<td>0.040</td>
<td>22</td>
<td>50</td>
<td>24</td>
<td>2</td>
<td>73.5%</td>
</tr>
<tr>
<td>0.060</td>
<td>22</td>
<td>52</td>
<td>22</td>
<td>2</td>
<td>75.5%</td>
</tr>
<tr>
<td>0.080</td>
<td>20</td>
<td>53</td>
<td>21</td>
<td>4</td>
<td>74.5%</td>
</tr>
<tr>
<td>0.100</td>
<td>19</td>
<td>53</td>
<td>21</td>
<td>5</td>
<td>73.5%</td>
</tr>
<tr>
<td>0.120</td>
<td>19</td>
<td>54</td>
<td>20</td>
<td>5</td>
<td>74.5%</td>
</tr>
<tr>
<td>0.140</td>
<td>18</td>
<td>54</td>
<td>20</td>
<td>6</td>
<td>73.5%</td>
</tr>
<tr>
<td>0.160</td>
<td>18</td>
<td>54</td>
<td>20</td>
<td>6</td>
<td>73.5%</td>
</tr>
<tr>
<td>0.180</td>
<td>18</td>
<td>55</td>
<td>19</td>
<td>6</td>
<td>74.5%</td>
</tr>
<tr>
<td>0.200</td>
<td>18</td>
<td>57</td>
<td>17</td>
<td>6</td>
<td>76.5%</td>
</tr>
<tr>
<td>0.300</td>
<td>15</td>
<td>62</td>
<td>12</td>
<td>9</td>
<td>79.6%</td>
</tr>
<tr>
<td>0.400</td>
<td>15</td>
<td>63</td>
<td>11</td>
<td>9</td>
<td>81.6%</td>
</tr>
<tr>
<td>0.500</td>
<td>14</td>
<td>65</td>
<td>9</td>
<td>10</td>
<td>86.2%</td>
</tr>
<tr>
<td>0.600</td>
<td>14</td>
<td>64</td>
<td>8</td>
<td>10</td>
<td>81.6%</td>
</tr>
<tr>
<td>0.700</td>
<td>13</td>
<td>68</td>
<td>6</td>
<td>11</td>
<td>82.7%</td>
</tr>
<tr>
<td>0.800</td>
<td>12</td>
<td>70</td>
<td>4</td>
<td>12</td>
<td>83.7%</td>
</tr>
<tr>
<td>0.900</td>
<td>12</td>
<td>71</td>
<td>3</td>
<td>12</td>
<td>84.7%</td>
</tr>
<tr>
<td>1.000</td>
<td>0</td>
<td>74</td>
<td>0</td>
<td>24</td>
<td>75.5%</td>
</tr>
</tbody>
</table>
The rates of Sensitivity and Specificity are roughly equal at a Probability Level of 0.180. At this level, the rate of predictions of observed targets as targets and observed nontargets as nontargets are approximately equal (70%). This is the level that Palepu (1986) refers to as the “optimal cutoff acquisition probability.” In the case of this study, each firm is predicted to be a target if the predictive probability is equal to or more than 0.180. Firms with a predictive probability of less than 0.180 are predicted as nontargets. At this level, 18 observed targets are correctly predicted as targets (75% accuracy). Of the 74 observed nontargets, 55 are predicted as nontargets (74.3%). The overall accuracy of the model is 74.5%. These results are impressive. However, it should be noted that the model predicted 19 observed nontargets as targets (the False Positive rate is 51.4%). The False negative rate is a low 9.8%.

5.2. Estimates of the Logit Takeover Prediction Model

The actual takeover model specified in equation (4) was estimated for the second objective of this study. However, due to data limitations, complete data were not available for the OWNER variable and it was dropped from the model. The revised model estimated is as follows.

$$P(\text{TAKOVER}_i) = \alpha + \beta_1 \text{CONTROL}_i + \beta_2 \text{ATTITUDE}_i + \beta_3 \text{HORIZ}_i + \beta_4 \text{RELATE}_i + \beta_5 \text{INVGRP}_i + \beta_6 \text{NPBIDS}_i + \beta_7 \text{LITIG}_i + \beta_8 \text{CONSID}_i + \beta_9 \text{OTHER}_i + \epsilon_i$$

(5)

Due to the small sample size, equation (5) could not be estimated in SAS due to non-convergence. To solve the problem, the software LogXact-Turbo was used in the hope of solving the problem of small sample size and the discrete nature of much of the data in the model.\textsuperscript{15} However, this attempt also failed.

As an alternative, equation (5) was re-estimated in SAS using fewer variables. By trial and error, it was determined that models could be estimated with five variables. Therefore, different combinations of the nine variables were tried to obtain logit regression estimates. The objective was to obtain the best-fitted specification. The criterion used for retaining a model specification was if the model had $-2 \log L$ statistic significant at the 0.1 level. This approach resulted in nine specifications. From these nine, the logit regression estimates of the best-fitted specification are presented in Table 6.

The results in Table 6 show that the both $-2 \log L$ and the Scores statistics were significant at the 0.05 level. McFadden’s $R^2$ is 47.03. The variable ATTITUDE was significant at the 0.1 level and had the correct hypothesized positive sign (i.e. a friendly attitude in a transaction increases the likelihood of a takeover). If the level of significance is reduced to 0.2, then all five variables become significant. The variable CONTROL has a positive sign (implying that a greater number of seats by officers on the board of directors increases the likelihood of a target being taken over). The variable NPBIDS took the hypothesized positive sign, implying that prior bids for a transaction increases the likelihood of a takeover. The variable LITIG took a positive sign, which implies that litigation in a transaction increases the likelihood of a takeover. This finding is inconsistent with a priori expectations. Finally, the variable OTHER took the hypothesized negative sign, implying that the likelihood of a takeover transaction will decrease if either the target or the bidding firm is involved in another takeover transaction.

\textsuperscript{15}Available from Cytel Software Corporation in Cambridge, MA.
It must be mentioned that the ATTITUDE variable entered each of the other eight models for which logit regression estimates were obtained. In each of these, ATTITUDE had a positive sign and was significant at the 0.1 level. Thus, the significance of attitude in a transaction cannot be denied.

Table 7 presents the classification accuracy of the estimated model at the Probability Level 0.500. The predictive ability of the model is impressive. Twenty-eight of the 30 observed taken over firms were correctly predicted as taken over. The overall correct predictions were 85.7%. Note, however, that only two of the five withdrawn transactions were correctly predicted as withdrawn (i.e., the rate of specificity is relatively low). The model is strong in that the rate of false takeover predictions is lower (9.7%) than the rate of false withdrawal predictions (50%).

The sensitivity and Specificity of the takeover predictive model, however, are approximately equal (60–63%) at the Probability Level of 0.960. At this level, the overall classi-
fication accuracy is 62.9%. False Positive rate (Type I error) is only 9.5%. The False Negative rate (Type II error) is 78.5%. The model therefore incorrectly predicts a large number of observed taken over targets as nontargets.

6. SUMMARY AND CONCLUSIONS

This study develops predictive models of M&A activity using data on large public firms that were subject to M&A activity during the 1985–1994 period. With a predictive accuracy of 74.5%, the analysis suggests that the likelihood of a firm being targeted for M&A is affected by its QR, WCTA, LTDR, PIC, ROE, GSALE, DVCFLR, CSTR, and MKBK. Furthermore, with a predictive accuracy of 62.9%, the analysis suggests that the CONTROL, ATTITUDE, NPBIDS, LITIG, and OTHER are the variables that affect the likelihood of a targeted firm being taken over. Study results show promise in terms of the predictability of M&A activities in the food industry.

A number of suggestions for future research are salient. A reduction in the study period will minimize the noise created by exogenous factors. Alternatively, external factors such as economic growth and interest rates might be included in regressions based on time series data. The use of hazard rate models is also suggested for future research. Incorporating group effects to capture the effects of strategic merger motivations should also improve predictive accuracy. An attempt to incorporate nonfinancial characteristics in the takeover decision was made in this study. Future studies might consider a larger sample size in order to test the effects of nonfinancial characteristics. Attention should also be paid to the interaction effects of nonfinancial characteristics.

A major limitation of this and other similar studies is the limited availability and high cost of data required for in-depth analysis. The authors of this article had to purchase huge data at exorbitant costs. This limitation is due to the fact that most M&A data are proprietary and publicly available data sources are usually incomplete and expensive. Future researchers might attempt to access private data from commercial institutions heavily involved in M&A consulting. Furthermore, a significant number of M&A transactions involve private firms and small public firms. Unfortunately, such transactions have not gained the attention of researchers due to lack of data. Future researchers might explore data sources for private transactions as well as transactions for small public firms.

7. ACKNOWLEDGMENTS

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REFERENCES


16 In this study, most of the variables were averages of observations up to 3 years prior to the firm being targeted. Further thought should be given to extend the time period and to incorporate time series data instead of averages.

17 For more information on hazard rate models, see Teachman and Hayward (1993). Bandopadhaya (1992) used hazard rate model to examine the probability of a firm’s exit.


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