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**TOBIN'S Q AND THE ANTI-COMPETITIVE EFFECTS OF LARGE
MERGERS**

City University of New York

PH.D. 1982

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TOBIN'S Q AND THE ANTI-COMPETITIVE EFFECTS OF LARGE MERGERS

by

ESMERALDA O. LYN

A dissertation submitted to the Graduate
Faculty in Business in partial fulfillment
of the requirements for the degree of
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of New York.

1982

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1982

This manuscript has been read and accepted for the Graduate Faculty in Business in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

TOBIN'S Q AND THE ANTI-COMPETITIVE EFFECTS OF LARGE MERGERS

by

Esmeralda O. Lyn

Adviser: Professor Stavros Thomadakis

The direct competitors of target firms are expected to earn abnormal profits when a merger increases the degree of collusion within the industry and thus enables the colluding firms to restrict output and increase prices (collusion hypothesis). They are expected to experience abnormal losses when a merger takes place to realize efficiency gains which may result in higher industry output and lower prices (efficiency hypothesis). These competing hypotheses are tested by using Tobin's Q, which is the ratio of the market value of the firm's securities to the replacement cost of its assets. The modern theory of asset valuation and capital markets states that replacement cost should equal the capitalized competitive rents on employed capital. Thus, the difference between market value and replacement cost reflects the abnormal components of profits.

This thesis also proposed that abnormal performance for the direct competitors need not imply collusion. It may simply imply the presence of exit barriers in the industry and how a merger becomes a means of exit of resources which reduces excess capacity in the industry (exit of resources hypothesis). Exit barriers may arise due to the significant losses that may be incurred if a firm has to liquidate specialized and durable factors of production which, in profitable times, may have served as entry barriers in the industry.

Another hypothesis examined is that mergers are more likely to occur in industries where there are deficient returns due to exit barriers. This follows because of two reasons: first, it is easier to preserve collusive agreements when profits are deficient and consequently there is no threat of entry; second, improved technologies and economies are most needed in these industries. This thesis also makes a distinction between merger types. It is expected that different merger types will have different market effects depending on the merger motives and industry characteristics at the time of the merger. The methodology used by previous researchers, whereby the abnormal returns of a portfolio of common stocks of firms affected by the merger are examined, cannot distinguish between the case of exit barriers before (or after) the merger and entry barriers after (or before) the merger. The distinction can be made by using Tobin's Q because market values which exceed replacement costs indicate barriers to entry of additional resources into the industry, and market values that fall short of replacement costs indicate restrictions on exit of resources out of the industry.

This thesis finds overwhelming support for the hypothesis that mergers are more likely to occur in industries where there are exit barriers. Evidence is also found that mergers typically occur to realize efficiency gains and thus are not expected to enable the direct competitors to overcome exit barriers and earn more normal returns. There is also strong evidence that product extension conglomerate mergers have the greatest negative impact on the direct competitors. Thus, the overall conclusion is that the efficiency hypothesis explains the motivation behind mergers in general and product extension conglomerate mergers in particular.

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1. INTRODUCTION

The view regarding mergers is shifting from one which is in favor of vigorously enforcing the government's anti-merger policies, to another which is in favor of a free market for corporate control. In light of this shifting view regarding the core anti-merger doctrines, it is of great importance to address the fundamental issue of whether anti-merger regulation controls monopoly power and promote competition or deters some otherwise efficient mergers from occurring.

Some of the more recent merger studies have attempted to address this issue by testing whether the Section 7 complaints by the Justice Department (JD) or Federal Trade Commission (FTC) reversed the well-documented abnormal economic rents earned by the stockholders of the target firms.^{1,2} The rationale given for this methodology is that failure to reverse these abnormal rents implies that these rents most likely reflect discounted future cost-savings made possible by technological information revealed by the news of the efficient mergers. No evidence has been found that the antitrust complaints caused a significant reduction in the abnormal rents earned by the stockholders of the target firms.

1. The review of the literature is done in Chapter 2.

2. Section 7 of the Clayton Act prohibits any corporate mergers whose effects may be to substantially lessen competition or create monopoly power.

The failure of the JD or FTC complaints to reverse the target firms' abnormal gains does not prove, as some studies have suggested, that the source of the abnormal gains is increased efficiency. The permanent revaluation of the target firms' common stock may also have stemmed from information that these firms can increase their profitability by engaging in anti-competitive activities.

It is the objective of this thesis to identify the sources of abnormal gains for large corporate mergers by examining the impact of different types of mergers on the target firms' direct competitors (henceforth called TDC).¹ TDCs are expected to benefit when a merger increases the degree of collusion within the industry and thus enables the colluding firms to increase prices (monopolistic hypothesis). They are expected to suffer when a merger takes place to lower production costs of the merging firms, which may result in higher total industry output and lower prices (efficiency hypothesis).

The first systematic large sample test on the impact of a merger transaction on the TDCs and the subsequent JD or FTC complaints against the merger was conducted by Eckbo (1981). He found that a portfolio of common stocks of the TDCs in horizontal mergers exhibited abnormal performance around the first announcement of the merger proposal and that this was not reversed after a Section 7 complaint announcement. Eckbo argued that this phenomenon supports the efficiency hypothesis because it serves as evidence that the TDCs'

1. Large mergers are defined by the FTC as those mergers where the book value of the target's assets is at least \$10 million.

resources are more valuable than previously perceived.

To better distinguish between the competing hypotheses, this thesis takes Eckbo's study a step further by offering an alternative theory about the determination of abnormal rents and the characteristics of the merging firms' industries, and providing a test for this theory. One of the hypotheses this thesis examines is that abnormal performance for TDCs need not imply collusion. Abnormal performance may imply the presence of entry or exit barriers in the industry and how mergers enable TDCs to elevate or overcome these barriers. These barriers may arise due to the time needed to secure specialized and durable resources (entry barriers) or to the significant losses that will be incurred if the firm has to liquidate these resources (exit barriers).

Another hypothesis is that mergers are more likely to occur in industries where there are deficient returns attributable to exit barriers. This follows because of two reasons. First, it is easier to preserve collusive agreements when profits are deficient and consequently there is no threat of entry. Second, improved technologies and economies are most needed in these industries. This thesis also makes a distinction among merger types. It is expected that the different merger types will have different market effects depending on the industry characteristics and merger motives.

The methodology used by Eckbo (1981) and other researchers, whereby the abnormal returns of a portfolio of common stocks of firms affected by the merger are examined, cannot distinguish between the

case of exit barriers before (or after) the merger and entry barriers after (or before) the merger. It is important to make this distinction because public policy toward mergers should depend on whether entry or exit barriers are present. This thesis can make the distinction by using Tobin's Q, which is the ratio of the market value of the firm's securities to the replacement cost of its assets, to determine the existence of entry or exit barriers before and after the merger.

Tobin's Q was originally developed to study aggregate investment behavior. More recent studies by Thomadakis (1977), Lindenberg and Ross (1981), and Lustgarten and Thomadakis (1982) have used Q to identify sources of rents. The principle underlying Q derives from the modern theory of asset valuation and capital markets. It is argued that replacement cost of assets should equal the capitalized competitive rents on employed capital. The difference between the market value of the firm's securities and replacement cost will reflect the monopoly components of future profits. Thus, values which exceed replacement cost indicate barriers to entry of additional resources into the industry, and values that fall short of replacement cost indicate restrictions on exit of resources out of the industry.

The market reaction during the period surrounding the first announcement of the merger proposal is also measured using the methodology of Eckbo's (1981) study to check the consistency of his results with the starting and ending conditions in the industries where the mergers are occurring.

The empirical results, based on a sample of 68 mergers which occurred during the period 1975-1979, are generally consistent with the efficiency hypothesis. The results also show that mergers are more likely to occur in industries with exit barriers and that the product extension conglomerate merger has the greatest absolute impact on the TDCs.

The remainder of the thesis is developed as follows: Chapter 2 critically surveys the relevant merger literature. Chapter 3 develops the theoretical basis for using Tobin's Q in the study of mergers. Chapter 4 presents the merger hypotheses to be tested and their implications on Q. Chapters 5 and 6 describe the data, test designs, and the procedures for estimating Q. Chapter 7 reports the empirical results and interpretations thereof, and Chapter 8 gives the concluding remarks.

2. REVIEW OF THE LITERATURE

A stockholder wealth-maximizing company pursues its fundamental objective by purchasing income-producing assets. These assets may take the form of new capital investments (internal expansion) or another company's existing physical plants (external expansion). Thus, the company is continually faced with the alternative of external rather than internal growth. The relative desirability of the two strategies depends on their respective potential returns. The source of the potential returns for corporate growth through mergers and the scope of antitrust enforcement policies have become the subjects of numerous studies in the literature of finance and economics.

2.1 The Issues

A merger is a transaction whereby two companies agree to combine under the procedures established by the state of incorporation of each of the participating firms. The acquired company goes out of existence leaving its assets and liabilities to the acquiring company.¹

A merger can take the following forms: horizontal, which combines units engaged in the same stage of production, producing similar products, and sharing the same geographic markets; vertical,

1. A merger has to be distinguished from a consolidation, whereby 2 or more companies combine, and thereafter, an entirely new company is formed. However, the terms merger and consolidation tend to be used interchangeably in the merger literature.

which integrates successive stages of production, either backward to the supplier of raw materials or forward to the customers of the products; mixed conglomerate, which involves the acquisition of a firm in the same stage of production for the purpose of extending the markets for existing product lines (market-extension conglomerate), or developing a broader line of similar products (product extension conglomerate); and pure conglomerate, which involves the acquisition of a firm that bears little or no relation to the lines of business of the acquiring firm.

All types of mergers belong to a single choice set and therefore the general motivational framework required to account for them are necessarily the same. The differing viewpoints regarding the nature of merger motives and the corresponding antitrust policies can be divided into two categories: monopolistic versus efficiency.

Under the monopolistic framework, mergers are believed to be motivated by increased monopoly power resulting from the elimination or lessening of actual or potential competition. In a horizontal merger, there is a direct and immediate foreclosure of competition which may result in a greater ability to collude or take a dominant position regarding price-output decisions. By means of integration backward or forward, a firm possessing significant market power at one level in a production or distribution chain can extend its power to other distributive stages. Furthermore, in a vertical merger, exclusion of potential competitors may be achieved by raising the required capital outlay needed to compete with an integrated firm. In a

conglomerate merger, whether mixed or pure, the large acquiring firm is believed to deter new entry by its mere presence and ability to outcompete smaller firms. Conglomerate mergers are also thought to create new market power by increasing the probability of reciprocal dealings, predatory pricing, or other anti-competitive activities.¹

The proponents of the monopolistic view argue for a vigorously enforced anti-merger policy against large business combinations that may result in the lessening of competition or creation of monopoly power. Advocates of this position believe that successful antitrust challenges against mergers will dislodge the monopolistic concentration of corporate wealth.

Under the efficiency framework, mergers are believed to be motivated by production cost savings resulting from the efficient combinations of complementary resources, technologies, and managerial skills. When two companies combine, real economies may be achieved in the sales, marketing, advertising and promotion of similar and complementary products.

A financial rationale for non-synergistic mergers has also been offered. Lewellen (1971) advanced the concept of "co-insurance" effect which states that when two firms with less than perfectly correlated earnings stream combine, the risk of default of the merged

1. See Steiner (1975) for a comprehensive discussion of merger motives and anti-competitive behavior.

firms is reduced and their debt capacity increased. Higgins and Schall (1975) added that capital cost savings may be achieved if the merged firms increase their leverage to take advantage of the tax deductibility of interest expense.

The proponents of the efficiency view argue that mergers reflect the competitive process by which the assets of less efficiently managed companies are transferred to companies which can manage the resources more efficiently. Therefore, efforts to limit merger activity may result in misallocation of resources and deter the useful function of mergers in promoting a competitive market for corporate control.

2.2 The Evidence

For a firm characterized by an objective of stockholder wealth maximization, a test of the merger's success is the merger's effect on stock prices. In an efficient capital market, stock prices should provide accurate signals for resource allocation: that is, security prices at any time should reflect all available information. Thus, at the time of the merger, the stock prices of the constituent firms should reflect all economic gains from the acquisition.¹

Most merger studies in recent years have looked at pre-merger and post-merger stock price performance to measure the market reaction

1. See Fama (1970) for a general review of the theory and empirical work on capital market efficiency.

to the merger. Haugen and Udell (1972) found that the internal rate of return of securities received by the target's stockholders for various intervals before and after the merger outperformed similar investments. Halpern (1973), Bradley (1979), and Jarrell and Bradley (1980) found that stockholders of target firms earned abnormal capital gains before the merger.¹ Bradley (1979) also showed that there was a permanent revaluation in the target's stock price following an unsuccessful acquisition attempt.

Other studies have presumed the validity of the Capital Asset Pricing Model (CAPM) in generating equilibrium expected returns on common stocks.² The time series of residuals from variants of the CAPM market models were used to estimate any abnormal performance to individual securities in the period surrounding the merger or any legal developments in anti-merger proceedings.

Mandelker (1974) was one of the pioneers in utilizing residual analysis to estimate abnormal return performance at the time of the merger. Using the one-factor CAPM model as the return generating process and monthly stock price data of the merger's constituent firms, he found that target firms earned abnormal returns of approximately 13%, and bidder firms earned normal returns of approximately 1% in

1. Halpern (1973) did not distinguish between target and bidder.

2. See Black, Jensen and Scholes (1972) and Fama and Macbeth (1973) for empirical work on CAPM.

the last 7 months before the effective date of the merger. It was also found that prior to the 7-month period, the residuals for target firms were mostly negative, and for bidder firms, mostly positive. No post-merger adjustments were observed in the stock prices of the merged firms, which is consistent with capital market efficiency.

Using Mandelker's (1974) methodology, Ellert (1976) examined the pattern of stockholder returns of companies indicted under the anti-merger laws. He found that indicted bidders earned abnormal returns of about 23% over the last 8 years preceding the antitrust complaints. Only 2% of these returns was reversed on the announcement that an anti-merger case is being filed by the JD or FTC. The target firms, on the other hand, had a long history of negative abnormal returns with dramatic gains of about 15% experienced in the 8 months leading to the merger.

The common interpretation given to the results of the above studies is that the abnormal gains experienced by the target's stockholders reflect the greater value of the assets under more efficient management. Ellert (1976) suggested that the superior performance of the bidder firms may represent the proven capacity for operational efficiency and any JD or FTC challenge could not dislodge the gains. However, the hypothesis that the bidder's superior performance may also reflect monopolistic accumulation of wealth cannot be rejected. The above studies still leave the issue of monopolistic versus efficiency hypothesis unresolved.

The study of Mandelker (1974), Ellert (1976) and Langetieg (1978)

(M/E/L) suffers a serious limitation in using the effective date of the merger to examine the market reaction to the merger. Usually, public announcement of negotiations and proposed terms of the merger is made well before the date of the final approval. The earlier date is of critical importance because information regarding the merger starts to leak at this time and most information would have been released by the time of the merger completion. M/E/L confound their results by not being able to discriminate between gains due to the market reaction to the announcement of the merger proposal and gains due to the prior good performance of the constituent firms.

Dodd (1980) replicated the M/E/L studies using daily stock data to utilize prior information concerning the specific day of the month the event occurs. He looked at the pre-merger performance of the targets' stocks for the period of 250 days prior to the merger event (-250, 0). If the event used was the effective date of the merger, the targets' stockholders earned approximately 30% during the 250-day period, of which 23% was earned from day -250 to -50. If the event used was the first announcement of the merger proposal, the abnormal returns for the entire 250 days were 24% of which 21% was earned during the last 50 days leading to the merger. The latter abnormal return can be clearly seen as direct results of the merger proposal and do not reflect any pre-merger good performance by the firm.

Dodd and Ruback (1977) attempted to discriminate between the monopolistic and efficiency hypotheses by examining market reaction to unsuccessful tender offers. Using monthly stock data, they found

that market reaction is concentrated on the month of the offer. Average residuals for unsuccessful targets during the event month was 19%. For unsuccessful bidders, the average residuals fluctuated randomly around zero. The positive residuals for the targets did not fall back to pre-offer level, whereas for the bidders, the returns turned negative. Dodd and Ruback concluded that the above results served as evidence for the efficiency hypothesis. They argued that the positive abnormal returns experienced by unsuccessful targets were not reversed because the information of future potential gains from the elimination of the source of inefficiency was revealed by the tender offer.¹ The negative returns for bidders reflect the cost incurred from unsuccessful takeovers.

The overwhelming evidence from the above studies indicates that stockholders of target firms earned abnormal positive returns and stockholders of bidder firms earned at the most only normal rates of return at the time of the merger. The unresolved issue is whether increased market values for the merging firms' common stocks reflect the capitalization of higher profits from increased efficiency or from monopoly power. The failure of the JD and FTC complaints or of the unsuccessful takeovers to reverse the target firms' abnormal returns does not prove, as some of the above studies have suggested, that the source of the targets' abnormal gains is increased efficiency.

Eckbo (1981) addressed this unresolved issue by testing the

1. Jarrell and Bradley (1980) suggested that the extensive disclosure required by the Williams Act of 1968 for tender offers may be the likely source of this information.

hypothesis that horizontal mergers generate positive abnormal returns because they increase the probability of successful collusion among direct competitors. The rationale behind the hypothesis is that the TDCs are expected to benefit when a merger increases the degree of collusion within the industry and thus enables the colluding firms to reduce output and increase prices (monopolistic hypothesis). They are expected to suffer when a merger takes place to lower production costs of the merging firms which may result in higher industry output and lower prices (efficiency hypothesis).

Eckbo (1981) used residual analysis to examine the abnormal stock price performance of the target's direct competitors. Three variants of the CAPM were used: the mean-adjusted returns, one-factor, and two-factor models. Eckbo found that the TDCs earned positive and statistically significant returns over the intervals (-20, 10) relative to the merger proposal. Under the one-factor model, the TDCs earned 2.45%. Under the mean-adjusted returns model, the return was slightly higher. Under the two-factor model, the positive returns were insignificantly different from zero. The first two results seem to offer evidence for the monopolistic behavior.

If the TDCs capitalized monopoly rents around the announcement of the merger proposal, then the same firms should show negative abnormal performance in response to any anti-merger proceedings that will prevent the completion of the merger. Eckbo (1981) found statistically insignificant abnormal performance by the TDCs over the (-20, 10) interval relative to the announcement of the antitrust complaints. He concluded that since the positive abnormal performance was not reversed by the JD and FTC challenges,

the rents earned by the TDCs before the merger proposal announcement were not discounted monopoly rents. Rather, the TDCs gain because the merger proposal leaks technological information which indicates that the resources of the TDCs are more valuable than previously estimated. Thus, Eckbo offered the results as evidence consistent with the efficiency argument for mergers.

Eckbo argued that the failure of the data to confirm the monopolistic hypothesis implies that antitrust challenges distort the efficient allocation of corporate resources by making efficient mergers unprofitable or by preventing their occurrence altogether. Using this argument in support of the efficiency hypothesis is simply not convincing.

This thesis sets out to demonstrate that the TDCs' abnormal performance at the time of the merger need not imply collusion, as Eckbo and earlier investigators have stressed.¹ Abnormal performance may imply the presence of entry or exit barriers in the industry and the ability of the firms to heighten or overcome them through the mergers. This proposition is examined by determining the following: (1) what type of barriers is present in the industry where the merger is occurring, (2) whether these barriers are a motivating factor in the merger, and (3) whether, as a result of the merger, entry or exit barriers are exacerbated.

Residual analysis does not provide an adequate test for the above three-pronged proposition. Abnormal performance is measured in

1. Stigler (1965) and Demsetz (1973) have examined the relative performance of groups of fringe firms within the industry to diagnose market power.

the residual method by estimating the cumulative average residuals (CAR) for the common stocks of the merging firms and the TDCs; however, this method cannot determine the starting and ending conditions in the industry where the merger is occurring. Market reaction, as captured by CAR, during a short period surrounding the merger announcement has to be interpreted in conjunction with the existing market structure and profitability in the industry. Failure to do so may lead to inaccurate conclusions regarding industry effects of mergers and the corresponding antitrust policies.

This thesis offers an alternative test of the market effect of mergers. Tobin's Q, which is the ratio of the market values of the firm's securities to the replacement cost of its assets, is utilized to measure the existence of entry or exit barriers before and after the merger. Subsequent chapters discuss more fully the theory of Q and the rationale for using it in merger studies; however, from its definition alone, one can see that it offers a more comprehensive measure of industry profitability than CAR. Tobin's Q looks not only at market values of securities but also their relation to the replacement cost of the underlying assets of those securities.

Residual analysis, which measures only one component of Q, is used as an additional tool to measure market reaction at the first announcement of the merger proposal. Tobin's Q and CAR, used in conjunction with each other, are hoped to give results that may lead to the right conclusions regarding mergers.

2.3 Some Institutional Considerations

Unlike most merger studies which either did not make a distinction among the different types of mergers in their sample or focused only on one type of merger, this thesis makes the distinction. Although all types of mergers are within the reach of Section 7 of the Clayton Act, and all must be tested by the same statutory standards, a merger is given a label to emphasize the factors most important in measuring the probability that it will have the proscribed anti-competitive effects. Therefore, the speed and the magnitude of the market reaction to the merger may depend on the type of the merger it is perceived to be and on the probability that it will be challenged.

Testing the effects of a merger under Section 7 requires a definition of the relevant market of the constituent firms both as to product lines and geographic area. Market definition is of great significance because it affects the characterization of the merger as mixed conglomerate rather than horizontal. Since the antitrust enforcement agencies have more frequently challenged horizontal mergers and rarely lost a Section 7 case in the Supreme Court, the probability of a challenge and its possible outcome may in fact be controlled by the market definition.¹

1. See Duggan (1981) for a discussion of the U.S. Supreme Court judgements on antitrust cases.

Until the early 70's, there was an almost mechanistic approach in enforcing anti-merger laws against horizontal and vertical mergers. A horizontal merger in an industry marked by a significant trend toward concentration was conclusively presumed illegal. For a vertical acquisition, the size of the market foreclosed was a critical factor to determine its illegality. For conglomerate mergers, great emphasis was given by the antitrust enforcement agencies to the absolute size and strength of the acquiring firm in relation to other firms in the industry. High barriers to entry in the target's industry were also a decisive factor in determining Section 7 illegality, although ease of entry or absence of entry barriers was given little weight by the courts or by FTC.¹

In the 80's, because of the growing conservative mood in the country, the antitrust policies has come under sharp attack. There is evidence that the JD and FTC are reducing their antitrust activity. The new merger guidelines recently announced are left ambiguous as to what mergers are more likely to be challenged.² Until recently therefore, it was not a very difficult task to ascertain whether a merger would be challenged or not.

1. See Kalinowski (1981) for a discussion of antitrust enforcement.

2. The merger guidelines recently announced by the JD under the Reagan Administration uses the Herfindahl index, which is the sum of the squared market share of the firms in the industry, as the main tool in measuring the anticompetitive effects of mergers.

In 1976, an amendment to the Clayton Act, called Section 7A, imposes notification and a 30-day waiting period requirement (15 days for cash tender offers) on large firms contemplating mergers.¹ Furthermore, the merger must be consummated within one year after the expiration of the waiting period.

Section 7A was intended to strengthen the enforcement of Section 7 by giving the FTC and JD notice of large mergers and a reasonable opportunity to investigate them before they are consummated. Although the amendment does not affect legality of the merger, nor does compliance preclude later challenges, the expiration of the waiting period without a threat of a challenge may be interpreted as a reasonable indication that the merger will be completed. Therefore, market reaction toward large mergers may be spread over a longer period of time as investors reassess the probability that the merger will be successful as more information enter the public domain.

1. The notification requirement applies to mergers where the target firm has assets or sales of \$10 million or more and the bidder, \$100 million or more. The waiting period can be terminated or extended for a very limited time by the antitrust enforcement agencies.

3. THE APPLICATION OF THE THEORY OF TOBIN'S Q TO MERGERS

3.1 The Theory of Q

The asset valuation principles, as embodied in the Capital Asset Pricing Model (CAPM), were developed by Sharpe (1964), Lintner (1965), and Mossin (1968). These principles have been utilized almost exclusively for the structuring of optimal portfolios for individual and institutional investors rather than the structuring of producers' capital demand.

Investment theory has been enriched by Modigliani and Miller (1958, 1961, 1966) when they presented and elegantly justified the proposition that real and financing decisions are independent from each other. Stiglitz (1974) and Scott (1976), among others, found that the Modigliani and Miller proposition applies only under restrictive assumptions, such as the perfect substitutability of personal and corporate leverage, the uniformity of lending and borrowing rates, and the insignificant magnitude of bankruptcy costs. A nexus between real and financing decisions has been captured by another strand of investment theory that starts with the premise that a firm will be induced to invest if the market values the firm greater than the replacement cost of its assets. The relation between the market value of the firm's securities to the replacement cost of the firm's assets is summarized in their ratio, known as Tobin's Q.¹

1. See Tobin (1969, 1978), and Tobin and Brainard (1963, 1968, 1977).

The valuation assigned by the market to the firm represents the competitive returns the firm earns from its employed capital and any abnormal returns it earns from specialized factors of production or from the exercise of monopoly power. The total market value, MV_t , of the firm at time t is given by:

$$MV_t = RC_t + M_t \quad (3.1)$$

where RC_t is the replacement cost at time t of the firm's capital stock, such as plant, equipment, and inventory, and is equivalent to the capitalized rents on this capital stock, and M_t is the capitalized monopoly rents. Scaling equation (3.1) by RC_t , we have

$$Q_t = \frac{MV_t}{RC_t} = 1 + \frac{M_t}{RC_t} \quad (3.2)$$

If a firm is in a competitive industry where all profitable investment opportunities are rapidly exploited, then

$$Q_t = 1$$

However, if barriers to entry can be put into effect, the difference between Q and unity, as shown more rigorously by Lindenberg and Ross (1981), becomes the upper bound of monopoly rents, that is

$$M_t = [0, Q_t - 1] \quad (3.3)$$

If a firm is engaged in positive investments to replace its existing capital stock, the market value of the firm cannot fall below its replacement cost since

$$M_t \geq 0$$

However, if the firm is growing so rapidly that the factor markets cannot meet its capital goods demands, we can have the situation where

$$Q_t > 1$$

even if $M_t = 0$,

The deviation of Q from unity can also occur from the other direction. It is possible that a firm is no longer replenishing its existing capital, and therefore

$$Q_t < 1$$

even if $M_t > 0$.¹

Entry and Exit Barriers. Thomadakis and Lustgarten (1982) offered another explanation for the divergence of Q from its long-run equilibrium value. They argued that adjustments in real investments may be sluggish compared to the rapid adjustments in the market value

1. The firm is referred to as belonging to a "dying" industry, an example of which is the steel industry.

of the firm's securities to any emergence of relevant information and opportunities because of the existence of entry and exit barriers.

Entry barriers arise in an industry because of advantages existing firms may have over potential entrants. Assuming no government supported entry barriers, there are three possible sources of these advantages.¹ First, absolute cost advantages may accrue to existing firms because they possess superior production techniques or because they pay lower prices for productive factors such as labor, material, plant, or capital. Second, buyers may have a preference for established products as compared to those introduced by new entrants. Therefore, the existence of product differentiation raises the selling costs that have to be incurred by new entrants to gain market share for their products. Third, the presence of economies of large scale in an industry may raise the absolute capital requirement for new entrants to build plants large enough to reach the lowest attainable unit production costs enjoyed by existing firms.

Caves and Porter (1976) explained that the factors that impede entry are also likely to impede exit from an industry in so far as these factors involve assets which are durable and specific to a particular business or productive activity, to the company employing them, to the physical location, or to any combination of these. Assets must be specific to the industry, at least temporarily, so that the cost for new entrants to acquire the assets will be higher than the

1. See Bain (1956).

opportunity costs for existing firms. Product differentiation barriers stem from the firm-specific goodwill assets created by large advertising and promotional outlays. Thus, the large expenditure on goodwill, which may not have value for another company, results in a high risk of loss for the firms if it must exit. Scale economies may not have a direct connection to exit barriers unless the firm's productive assets are durable and specific. The liquidation of such assets may result in significant losses for the firm.

Caves and Porter (1976) also found a strong association between exit barriers and managerial factors, even if management skills are non-specific. The reason given for this phenomenon is that poor performance of a firm may reduce managers' mobility by acting as a signal of their competence to potential employers. Thus, there may not be perfect symmetry between entry and exit barriers because entry barriers may be more binding than exit barriers for some firms, and vice-versa.

Entry barriers prevent or delay an upward adjustment in real investments and give existing firms opportunities to raise prices above a competitive level without attracting new firms to enter the industry. Therefore, in the presence of entry barriers we have the case where

$$Q_t > 1$$

Exit barriers, on the other hand, prevent or delay a downward adjustment in real investments and inflict sub-competitive profits to existing firms. Therefore, in the presence of exit barriers, we have the case

where

$$Q_t < 1$$

From the exposition above, Tobin's Q provides not only a measure of the firm's potential returns if the firm engages in new investments but also as a determinant of the existence of entry and exit barriers that may give rise to abnormal or deficient profits.

Mergers as a Form of Investment. A firm increases its productive capacity, expands its markets or product lines, or enter an entirely new business activity either by making capital investments on new plants, equipment, and machinery, or by merging or acquiring the physical assets of another firm. However, a merger does not add to aggregate capital investments as capital spending on new plant and equipment does, but it serves as a form of external growth on the firm level. Therefore, a merger, like a purchase of an income-producing asset, is a capital budgeting decision.

In a merger, the increment to the value of the acquiring firm is the net present value (NPV) of the merger.¹ The NPV of this form of investment can be gleaned from Q which, in effect, represents the relationship between the cost of the merger to the firm and the capitalized rents on the capital stock being acquired. Since a merger is a form of external expansion, Q and changes in Q can be used to

1. This is true only if there is no interaction between purchased assets and existing assets.

measure its benefits for all firms affected by the merger. Furthermore, Q can be utilized to determine whether a merger is more likely to occur in an industry where there are entry barriers or where there are exit barriers.

3.2 Problems of Application

Marginal Q as opposed to average Q is unobservable. When a firm undertakes a new investment project which causes Q to rise or fall, this change in Q may be due to the changed prospects of the entire business as reassessed by financial investors and not to the new investment per se.

To overcome these difficulties, Tobin and Brainard (1977) and Von Furstenberg, et al (1980) used average Q to explain investment behavior in the expectation that there is a very high, if not perfect, correlation between average and marginal Q , that is, the rankings of firms by average Q correspond very closely with the rankings that would prevail if the true Q was known.

Another problem in the application of Q is how to isolate the movements in the true underlying Q from the intertemporal changes in average Q which reflect fluctuations in economy-wide factors, such as increased aggregate demand or rapid rise in interest rates. It is possible for a firm to have a consistently low Q , not because of its investment behavior, but because of the pessimistic outlook of financial investors regarding the economy's overall prospects which results in

depressed securities markets. Thus, changes in Q over time may convey little new information regarding the firm's future prospects. Changes in the relative standing of the firm vis-a-vis other firms may perhaps be more important in signalling shifts in the distribution of investments between firms or industries. Such changes are indicated by variations in Q divided by the coincident value of the economy-wide Q .

Previous work by Von Furstenberg, et al (1980) on industry Q -ratios has found that an increase in Q is less favourable to investment in the industry if there are parallel increases in other industries. In other words, only when relative Q rises would a firm's or industry's relative as well as absolute position have improved. Therefore, the impact of an investment decision should be measured not only by changes in absolute Q but also by relative Q . The relative Q becomes the main tool for testing the various merger hypotheses.

4. THE MERGER HYPOTHESES

In a competitive industry, each firm holds a minute proportion of industry supply and is a "price-taker". A competitive firm extends his output until marginal cost is equal to price, as long as price is equal to or greater than its average cost. The long-run industry price will be determined jointly by the output adjustments of an initial number of firms in the industry and by the entry and exit of firms in response to excess profits and losses. Entry and exit of firms will cease only when total output is such that price equals minimum average costs, which all firms have attained.

The proposition that all firms in a competitive industry have the same minimum average cost at any given industry output assumes that all firms use the most efficient technique of production. However, it is possible that some firms are more efficient than others, and therefore could lower their average cost without changing marginal cost. In this case, the more efficient firms increase their profitability and still remain "price-takers".

The competitive environment of an industry may be disturbed in a number of different ways, for example: firms may combine within the industry toward the point of monopoly or oligopoly; collective market conduct regarding price-output decisions may be instituted by a group of firms; a large firm may enter the industry via the merger route and introduce advantages through massive advertising outlays to

differentiate product; or technology may be introduced that will make optimal scale larger. In all these cases, there is a firm or a group of firms which can affect the level of industry output and consequently the price. In an industry characterized by "price-searchers", output is set so that the marginal cost of the industry is less than the price, and thus, excess profits can be made. It appears then that in some sense the monopolized industry tends to produce a smaller output than in a competitive industry.¹ This is the premise of many antitrust laws governing business activity.

To the extent that a merger leads to a shift in equilibrium price and industry output, it may result in a redistribution of wealth among the merging firms, their direct competitors, their suppliers and customers. The effect of the merger in this redistribution will evidently be contingent on the extent to which advantages such as monopoly power or efficiencies are achieved through a merger. It is in this context that the different hypotheses regarding the effects of mergers on the TDCs are discussed in the following sections.

4.1 Barriers Hypotheses

This class of hypotheses states that a merger results in gains for firms in the industry where the merger is occurring. Previous studies, such as Eckbo's (1981), have emphasized that the gains derive

1. Bain (1952) stated that this is true only if the following are given: the industry demand curve, the factor prices entering into costs, techniques of production and efficiency in the scale of the firm.

from the possibility of collective market conduct when the merger is consummated (collusion hypothesis). This thesis offers another source of merger gains: the possibility of removal or reduction of excess capacity in the industry (exit of resources hypothesis).

Collusion Hypothesis. This hypothesis assumes that mergers occur for the purpose of increasing market power by reducing output and raising product prices in the target firm's industry, while having no effects on production costs.

A merger which leads to the elimination of a competitor is believed to be a vehicle for firms in the industry to increase their ability to collude regarding output-price decisions by increasing the industry's concentration.¹ According to the free-rider proposition in Stigler (1974), a cartel agreement will be possible only in the presence of coercion or appropriable inducements, such as increased profits. If the cartel is successful in restricting output and raising prices, the merged firms and their direct competitors will share in the resulting gains.

Complete cartelization of the industry is not necessary for the collusion hypothesis to be valid. It is possible for a dominant firm, or a small group of colluding firms to restrict output to a new profit-maximizing level. In this case, the direct competitors

1. See Peltzman (1977) and Lustgarten (1978) for a discussion on the gains and losses from industrial concentration.

benefit in the resulting price increases without incurring any cartel-related costs.¹

The precise character of the results of collective market conduct with respect to price and output will obviously depend upon the conditions of entry in the industry. If the industry can effectively erect entry barriers, the established firms can maximize industry profits without attracting entry. However, as long as there is threat of entry, collusive agreements that are successful in raising profits above normal may attract entry. The new entry will add capacity to the industry, thus raising output, lowering prices, and eliminating excess profits.

An alternative theory is offered by this thesis. It is that mergers which are able to produce successful collective action can occur in industries where there are barriers to exit. The rationale for this is that there is no threat of new entry in an industry beset by exit barriers. Caves and Porter (1976) also suggested that exit barriers raise the demand for collusive agreements because of the desire of existing firms to mitigate their downside risk and pursue more certain profits. Thus, the probability of successfully increasing profits through collusive agreements may be greater where there are exit barriers.

Exit of Resources Hypothesis. This hypothesis assumes that mergers may occur to transfer resources out of an industry. A merger

1. This assumes that the fringe firms could not engage in independent pricing because of possible retaliation, absolute disadvantage in costs, or lack of funds to serve a larger market.

can serve as a means of exit for a firm if it can be acquired by another who has the ability to convert durable and specific assets to other uses. This conversion can be achieved through transformation, such as retooling or remodelling machinery and equipment, or retraining manpower.

The reasoning above becomes clearer if one considers that exit barriers may result not only because of the durability and specificity of assets, but also because these assets may be indivisible or "lumpy". A firm may not be able to reduce capacity in response to decreased demand because it cannot break-up and sell a fraction of its "lumpy" assets. However, it may be able to sell the firm as a going concern to another who has the ability to transform some or all the acquired resources for other uses.

To the extent that a merger removes the excess resources from the industry, the remaining firms will benefit from the merger. As partial or complete exit of firms takes place, the industry output declines, price rises, and profits increase for the remaining firms.

Empirical Implications. Since we cannot know whether the gains the TDCs experience after the merger derive from collusive activity or from the elimination of excess resources in the industry, the implications of both collusion and exit of resources hypotheses are necessarily the same. Thus, the change in Q and RQ are expected to be:

$$\begin{aligned} DQ &> 0 \\ DRQ &> 0 \end{aligned}$$

where the direction of the changes in Q and RQ should be the same, but the magnitude may differ.

4.2 Efficiency Hypothesis

This hypothesis assumes that firms merge to increase efficiency of operations. A merger is labelled allocational when less efficient management transfers resources into new management hands that will use or serve them more successfully.¹

Cost savings are achieved by an efficient merger through the more economical use of existing technology, or through the discovery and utilization of new technology. Lower capital costs may also be achieved in non-synergistic mergers as a result of "co-insurance effect", which lowers the risk of default of the merging firms. Economies of scale may also result from a merger of two firms within the industry or from the entry of a large acquiring firm with superior resources.

The TDCs in the industry will be affected by an efficient merger depending on whether or not the decrease in average production cost for the merging firms bring about a shift in marginal cost. If it does not, then the merging firms will be able to increase profit without affecting industry output and price. In this case, the TDCs

1. Grossman and Hart (1981) contrast allocational takeovers with acquisitional takeovers which occur not because improvements will be introduced to the target's operations but because the bidder believes that the target is undervalued at its current price.

will not be affected by the presence of a more efficient firm in the industry. If it does, such that only the merging firms enjoy minimum average costs, then the TDCs will suffer because of the ability of the merging firms to increase output and lower prices. This case necessarily assumes that the newly acquired efficiencies of the merged firms cannot be imitated by the other firms in the industry.

Empirical Implications. If the efficiency hypothesis is valid, the effect of an efficient merger on the Q and RQ of the TDCs will depend on whether or not the introduced efficiencies increase the ability of the merged firms to affect industry output and price. Therefore, the simultaneous change in Q and RQ are expected to be:

$$\begin{aligned} DQ &\leq 0 \\ DRQ &\leq 0 \end{aligned}$$

where the equality holds if the more efficient merged firms increase profits without affecting industry output and price.

4.3 Exit Barriers as a Motivating Factor for a Merger

Entry and exit barriers are forms of market structure that influence market conduct and performance. Entry barriers result in excess profits for firms while exit barriers inflict subnormal profits. A potential entrant into an industry with entry barriers may overcome such barriers by buying into the industry through a merger. However, the capital requirement for buying a successful firm may be enormous and thus deter such activity from occurring. Exit barriers, on the other hand, make liquidation of an unsuccessful firm a last resort,

and thereby may tend to lower the average price at which a new entrant can buy into the industry. The perceived "bargains" may attract merger activity in the industry.

As discussed under the collusion hypothesis, firms in an industry with exit barriers may have a higher propensity to collude to maintain prices when "disaster" threatens. This increased ability to raise mean expected profits through collusive agreements without attracting new entry may serve as a motivating factor for two firms within the industry to merge, or for a firm to buy into the industry.

Efficient mergers are also more likely to occur in industries where there are deficient returns. Such deficient returns reflect poor management of resources or obsolescence of technologies used. It is in these industries wherein efficiencies and new or improved technologies are most needed, and introducing these improvements may serve the bidder firm well in the form of increased profits.

Empirical Implications. If mergers are more likely to occur in industries where there are exit barriers, then the Q and RQ of TDCs before the merger are expected to be:

$$Q < 1$$

$$RQ < 1$$

Table 4.1 and 4.2 summarize the predictions of the barriers and efficiency hypotheses under entry and exit barriers as starting conditions.

Table 4.1

Values of Q and Relative Q and Changes in Q and Relative Q
for TDC Firms as Predicted by the Barriers Hypotheses
under Entry/Exit Barriers

Barriers Hypotheses under:	Before the Merger	Effect of the Merger	After the Merger
Entry Barriers	$Q > 1$ $RQ > 1$	$DQ > 0$ $DRQ > 0$	$Q > 1$ $Q > 1$
Exit Barriers	$Q < 1$ $RQ < 1$	$DQ > 0$ $DRQ > 0$	$Q \approx 1$ $RQ \approx 1$

Table 4.2

Values of Q and Relative Q and Changes in Q and Relative to
for TDC Firms as Predicted by the Efficiency Hypothesis
under Entry/Exit Barriers

Efficiency Hypothesis under:	Before the Merger	Effect of the Merger	After the Merger
Entry Barriers	$Q > 1$ $RQ > 1$	$DQ \leq 0$ $DRQ \leq 0$	$Q \geq 1$ $RQ \geq 1$
Exit Barriers	$Q < 1$ $RQ < 1$	$DQ \leq 0$ $DRQ \leq 0$	$Q < 1$ $RQ < 1$

4.4 Differences in Industry Effects between Merger Types

In some cases, the absolute magnitude of the industry effect of a merger may depend on the merger type. If the market perceives that the merger is for the purpose of gaining market power through collective market conduct, then a horizontal merger may have a greater market impact than other types of mergers. The reason for this is that a horizontal merger directly eliminates an existing competitor. The reduced number of firms in the industry make collusive agreements or price leadership easier to carry out than in other types of mergers. Therefore, the probability of realizing market power gains through collective market conduct may be greater for horizontal mergers.

If the market perceives that the merger is occurring as a means of exit of resources, then a mixed conglomerate merger may have a greater probability of achieving this objective than other types of mergers. The acquiring firm in a mixed conglomerate merger uses similar or complementary resources as the target firm. Therefore, it may be more successful in transforming some or all of the target's specialized resources to its own use than the acquiring firms in other types of mergers.

If the market perceives that the merger is for the purpose of introducing efficiencies in the form of new or improved technologies, or economies in the form of larger optimal scale, then mixed conglomerate and horizontal mergers may have a greater market impact than any other type. If barriers to exit are to some degree industry-specific, new or improved technologies are more likely to be introduced by a firm

outside the industry which may be using similar or complementary resources such as production techniques or distributional network. Therefore, the probability of realizing efficiency gains through improved or new technologies may be greater for mixed conglomerate mergers. In a horizontal merger the larger size of the combined firms make the probability of achieving economies of scale greater.

Empirical implications. If the collusion hypothesis is valid, then the absolute changes in Q and RQ of the TDCs are expected to be greater for horizontal mergers than for other types of mergers.

$$|DQ_h| > |DQ_v| , |DQ_{mc}| , |DQ_{pc}|$$

$$|DRQ_h| > |DRQ_v| , |DRQ_{mc}| , |DRQ_{pc}|$$

where h stands for horizontal, v for vertical, mc for mixed conglomerate, and pc for pure conglomerate.

If the exit of resources hypothesis is valid then the absolute changes in Q and RQ are expected to be greater for mixed conglomerate merger.

$$|DQ_{mc}| > |DQ_h| , |DQ_v| , |DQ_{pc}|$$

$$|DRQ_{mc}| > |DRQ_h| , |DRQ_v| , |DRQ_{pc}|$$

If the efficiency hypothesis is valid, then the absolute

changes in Q and RQ are expected to be greater for horizontal and mixed conglomerate mergers.

$$|DQ_h| \quad , \quad |DQ_{mc}| > |DQ_v| \quad , \quad |DQ_{pc}|$$

$$|DRQ_h| \quad , \quad |DRQ_{mc}| > |DRQ_v| \quad , \quad |DRQ_{pc}|$$

5. ESTIMATION OF TOBIN'S Q

The estimation of Q requires separate calculations for the market value of the firm's securities and the replacement cost of its assets, whose components are:

<u>Replacement Cost</u>	<u>Market Value</u>
Inventory	Total Debt
Net Plant	Common Equity
Other Assets	Preferred Stock

5.1 Replacement Cost

Replacement cost is defined as the lowest dollar outlay needed to purchase a new asset with equivalent productive capability as the current one and with the most advanced technology available. It is difficult to estimate replacement cost because of the lack of active secondary markets for used capital goods. Previous estimates based on the book value of assets no longer serve as a close proxy for replacement cost because of high inflation rates and rapid technological advances. However, since 1976, the Securities and Exchange Commission started requiring large companies to disclose in their annual 10-K reports the replacement cost data for plant and equipment, inventories, depreciation expense, and cost of goods sold.¹ These replacement cost

1. The reported replacement cost data do not necessarily correspond to the definition of replacement cost given above because the SEC disclosure guidelines leave a good deal of discretion to each company.

data are also in machine readable form for the period 1976-78 as provided by S & P Investment Services, Inc. in its Compustat Replacement Cost File.

To compute replacement cost for 1974-75 and 1979, the technique used by Lindenberg and Ross (1981) is utilized. Adjustment factors for net plant and inventory are estimated. The following notation is used to explain the adjustment process for each firm i and year t :

RC_{it}	=	replacement cost of total assets
HNP_{it}	=	net plant and equipment at historical cost
RNP_{it}	=	net plant at replacement cost
$HINV_{it}$	=	inventory at historical cost
$RINV_{it}$	=	inventory at replacement cost
I_{it}	=	capital expenditure
D_{it}	=	current depreciation expense at historical cost
d_{it}	=	$D_{it}/HNP_{i,t-1}$, the book fraction of net assets depreciated annually which is assumed to be equal to the real fraction
P_t	=	capital goods price index (GNP deflator for non-residential fixed investment)
b_i	=	constant rate of technical progress

Adjustment for Net Plant. The replacement cost of net plant is affected by (1) the rate of inflation, P_t , (2) cost-reducing technical progress, b_i , (3) real economic depreciation, d_{it} , and (4) investment, I_{it} , in new plant and equipment. At any year t , the estimated replacement cost of net plant is given by

$$\text{RNP}_{it} = \text{RNP}_{i,t-1} \left[\frac{1 + P_t}{(1+d_{it})(1+b_i)} \right] + I_t \quad (5.1)$$

The rate of technical progress, b_i , is computed endogenously by using equation (5.1) for the years 1976-78 for which replacement cost data are available. The two relevant formulae are the following:

$$\text{RNP}_{78} = \text{RNP}_{77} \left[\frac{1 + P_{78}}{(1+d_{78})(1+b_{78})} \right] + I_{78} \quad (5.2a)$$

$$\text{RNP}_{77} = \text{RNP}_{76} \left[\frac{1 + P_{77}}{(1+d_{77})(1+b_{77})} \right] + I_{77} \quad (5.2b)$$

Equations (5.2a) and (5.2b) are solved for b_{77} and b_{78} and the average is computed to obtain b_i which is applied as the constant rate of technical progress for years 1974-75 and 1979. A backward recursion is performed for years 1974-75 starting with the solution for RNP_{i75} as follows:

$$\text{RNP}_{i76} = \text{RNP}_{i75} \left[\frac{1 + P_{76}}{(1+d_{i76})(1+b_i)} \right] + I_{i76}$$

$$\text{RNP}_{i75} = \text{RNP}_{i74} \left[\frac{1 + P_{75}}{(1+d_{i75})(1+b_i)} \right] + I_{i75}$$

For 1979, replacement cost is computed starting with the disclosed RNP_{178} , as follows:

$$RNP_{179} = RNP_{178} \left[\frac{1 + P_{79}}{(1+d_{i79})(1+b_i)} \right] + I_{179}$$

Although the estimation of Q is sensitive to alternative treatments of d_i and b_i , it is believed that no serious smoothing is done in the above procedure because only two years backward and one year forward are involved.

Adjustment for Inventory. For years 1974-75 and 1979, adjustment to the book value of inventories depends on the inventory valuation method a firm uses. There are four major methods of inventory valuation: first-in first out (FIFO), last-in first-out (LIFO), average costing, and retail cost method. FIFO records the value of the firm's remaining inventories at the most recent prices, LIFO at the earliest prices, average costing at the average of $t-1$ and t prices, and retail costing at the expected retail price. Only FIFO approximates the replacement cost of inventory, therefore

$$RINV_{it} = HINV_{it} \quad (5.3)$$

If the firm uses any other method of inventory valuation, this study assumes that the firm reports inventory at the average of prices at $t-1$ and t ; therefore, the adjustment is that of Lindenberg and Ross (1981)

which is given by

$$RINV_{it} = HINV_{it} + \frac{2P_t}{(P_t + P_{t-1})} \quad (5.4)$$

where P_t is the price index appropriate to inventories. Since no price index for inventory is available, the GNP deflator for non-residential fixed investment is used.

To summarize the procedure described above, the total replacement cost of the firm's assets is given by the following:

$$RC_{it} = HTA_{it} + (RNP_{it} - HNP_{it}) + (RINV_{it} - HINV_{it}) \quad (5.5)$$

5.2 Market Value

The S & P Compustat Annual Industrial Tape provides market values only for common equity, which is the number of shares outstanding times price per share. The tape contains book values for debt and preferred stock which are poor proxies for market values during times of rapidly rising or declining interest rates. The problem is to convert these book values to market values.

Debt has two components - the marketable and non-marketable components. The non-marketable component consists of notes, capitalized lease obligations and other long-term obligations. Generally, no price quotations are available for non-marketable debt. The marketable portion

of debt consists of convertibles, subordinated debt, and debentures, for which monthly price quotations are reported by S & P Bond Guide and Moody's Bond Record, but only for issues listed in the New York or American Bond Exchange. Ideally, quoted prices should be used to estimate market values but price quotations, if at all available, are not complete, thus leading inevitably to some form of approximation. Most studies on Q used either the book value of debt as a proxy for market value, or adjusted book value utilizing aggregate bond indices as adjustment factor. This study uses an approach utilized by Pogue (1978) which is midway between these two approaches.

A bond risk rating is prepared for each sample firm for the years ending 1974 through 1979. The bond risk ratings are obtained from the S & P Bond Guides and range from AAA (highest quality) to B (lowest quality) for the bonds of the sample firms. If no bond rating is available, the firm's debts are assigned the average rating of firms in the TDC portfolio.

Once a bond risk rating is obtained for each sample firm, a yield to maturity is assigned to the debt, which is the corresponding yield on the S & P Bond Index for the same risk rating. The market value of debt corresponding to the book value is estimated using the relationship between embedded financing cost and the current cost. A factor is computed for the firm's debt issues which converts the book value to estimated market value. The factor, F_i , for firm i is defined as

$$F_i = \sum_{i=1}^T \frac{c_i}{(1+r_i)^t} + \frac{1.0}{(1+r_i)^T} \quad (5.6)$$

where c_i is the embedded debt cost per dollar of book debt, computed by dividing interest expense on long-term debt by the book long-term debt, and r_i is the current cost of capital equivalent to the assigned yield of the debt. T is the average maturity of the long-term debt, assumed to be equal to the average maturity of all outstanding corporate bonds (about 11 years), as used in Pogue (1978). The estimated market value of long-term debt is then added to the current obligations of the firm to obtain the market value of total debt.

For preferred stocks, a similar process is applied. Equation (4.6) collapses to

$$F_i = \frac{c_i}{r_i} \quad (5.7)$$

since T is typically infinite for preferred stock issues.

Summarizing the procedure described above, the total market value of firm i at time t is given by

$$MV_{it} = MVD_{it} + MVC_{it} + MVP_{it} \quad (5.8)$$

where MVD is the market value of debt, MVC is the market value of common equity, and MVP is the market value of preferred stock.

5.3 Relative Q-Ratio

The relative measure, RQ is estimated for each direct competitor i in the merger sample. For firm i at time t , we have

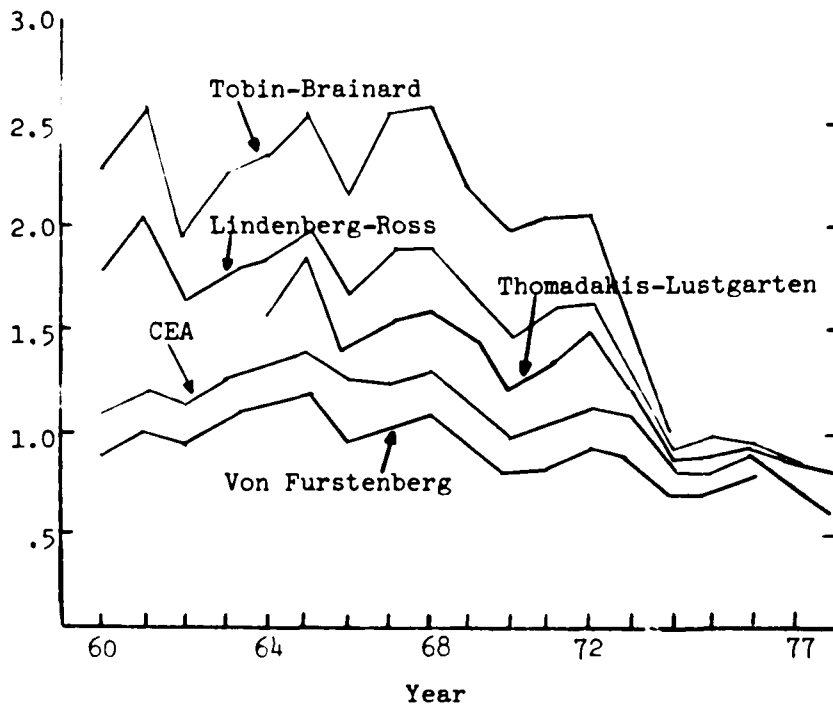
$$RQ_{it} = \frac{Q_{it}}{Q_{mt}} \quad (5.9)$$

where Q_{mt} is the economy-wide Q at time t . The Lustgarten and Thomadakis (1982) values for Q_{mt} are being used because their method of estimating Q is the closest to this researcher's method.¹ Figure 5.1 shows estimates of economy-wide Q -values from different studies.

1. The Q -values for 1974 through 1979 are .836, .830, .942, .892, .863, and .806 respectively.

Figure 5.1

ECONOMY-WIDE Q IN 1960-78



6. THE DATA AND TEST DESIGNS

6.1 Merger Sample

The data used are a subsample of all large corporate mergers during the period 1975-1979. Only the mergers meeting the following criteria were included. First, the merger was horizontal, vertical, product extension conglomerate, or pure conglomerate. Market extension conglomerates were not included because there were very few mergers of that type during the sample period. Second, the target's major product line was in a mining or manufacturing industry with assets of at least \$10 million. The FTC's Statistical Report on Mergers and Acquisition was utilized in gathering the merger sample data. Third, there existed one or more firms listed on the New York or American Stock Exchange during the merger event whose major line of business was the same as the target's. A line of business is defined to be major if it comprises at least 30% of the firm's entire business. Furthermore, these firms did not engage in any merger activity during the year of the merger. Fourth, the first announcement of the merger proposal was mentioned in the Wall Street Journal.

6.2 Selection of Direct Competitors

Since in a typical merger the acquiring firm is relatively large and diversified, while the target firm is relatively small and specialized, it is less costly to classify the major lines of business of the target firm, and thus to identify its direct competitors.

Furthermore, the antitrust authorities are more concerned with the anti-competitive effects of the merger on the industry of the smaller firm, which is typically the target. Therefore, the focus of the empirical analysis is the target firm's industry.

This thesis used the selection procedure of Eckbo (1981). Using information from the Standard and Poor's (S & P) Registry of Corporation and the Moody's Industrial Manual, a 4-digit SIC code was assigned to each target firm and to all firms in the S & P Compustat Replacement Cost File.¹ Whenever a particular 4-digit SIC code contained a broad range of commodities, a number system identifying single products was used. Any firm having the same 4-digit SIC code and product number as the target's was labelled a TDC. To ensure that the target was not an insignificant firm in the industry, its total assets must be at least 10% of the assets of any of its TDCs. This screen was needed to avoid including insignificant mergers in the sample which may bias any industry effect toward zero.

An example of the selection procedure would be: A target firm that manufactures audio equipment is classified under industry 3651. This particular industry also includes firms which produce television sets. To account for this, audio equipment is given the product code (1) and television sets, the product code (2). Only firms producing (1)

1. The SEC disclosure requirement regarding replacement cost applies to all companies which have inventories and gross plant, equipment, and property that both (a) aggregate to more than \$100 million and (b) comprise more than 10% of total assets.

in industry 3651 is considered as a TDC. In effect, 5-digit SIC codes were used to identify TDCs.

This careful selection procedure eliminated many firms from the sample but was necessary to exclude irrelevant firms from the portfolio of TDCs. By definition, irrelevant firms will not be affected by the merger, therefore, their inclusion will bias the industry effect toward zero. Table 6.1 lists the number of merging firms and direct competitors in the total data base by year and by merger type. Table 6.2 lists the number of mergers in the total population of large mergers in the mining and manufacturing industries by year and by merger type.

6.3 Test Designs

The barriers and efficiency hypotheses under entry/exit barriers are tested by estimating the absolute and relative Q-ratios of the TDCs before and after the first announcement of the merger proposal. No independent probability statements can be made regarding the market effect of the merger because, by assumption, the direct competitors are affected simultaneously by the merger announcement. Thus, the Q-ratios are pooled together into one equally-weighted portfolio.

Because of the difficulty of estimating the replacement cost of assets (as discussed in Chapter 5), which is the denominator of Q, and because such data are furnished by firms only on an annual basis starting in 1976, the existence of entry or exit barriers in the industry

Table 6.1

The Number of Mergers in the Sample of Large Mergers in the Mining and Manufacturing Industries by Year of Announcement of the Merger Proposal

Year	No. of Mergers*					No. of TDCs*				
	1	2	3	5	All	1	2	3	5	All
1975	-	-	1	1	2	-	-	1	4	5
1976	2	-	3	8	13	4	-	9	27	40
1977	7	2	5	7	21	27	5	13	10	55
1978	2	2	4	9	17	12	5	10	33	60
1979	2	2	6	5	15	4	8	30	15	59
1975-79	13	6	19	30	68	47	18	63	89	217
Mean No. of TDC per Merger	3.6	3.0	3.3	3.0	3.2					

* 1-Horizontal 2-Vertical 3-Product Extension Conglomerate
5-Pure Conglomerate

Table 6.2

The Number of Mergers in the Total Population
of Large Mergers in Mining and Manufacturing Industries
by Year of Completion of the Merger

Year	No. of Mergers*					All
	1	2	3	4	5	
1975	5	2	25	1	26	59
1976	14	4	26	8	29	81
1977	26	4	39	-	31	100
1978	22	13	37	-	39	111
1979	5	5	41	2	44	97
1975-79	72	28	168	11	169	448

* 1-Horizontal 2-Vertical 3-Product Extension Conglomerate
4-Market Extension Conglomerate 5-Pure Conglomerate

is determined by estimating year-end Q and RQ before and after the merger event.

Previous studies, like Dodd and Ruback (1977) and Dodd (1980), found that market reaction is concentrated mostly during the last 50 days leading to the merger. If the merger announcement occurred within 50 days of any year-end, the Q of the preceding year is used as the pre-merger Q, and the Q of the following year as the post-merger Q. For example, if the merger announcement date is on January 14, 1978, the year-end before the merger is December 31, 1976, and the year-end after the merger is December 31, 1978. If it is on December 15, 1978, the year-end before the merger is December 31, 1977, and the year-end after is December 31, 1979. This procedure is essential to avoid double-counting of the impact of the merger proposal during the event period.

The cross-sectional values of absolute and relative Q of a sample of N direct competitors before and after the merger event is defined as

$$Q_t = \frac{1}{N} \sum_{i=1}^N Q_{it} \quad (6.1)$$

$$RQ_t = \frac{1}{N} \sum_{i=1}^N \frac{Q_{it}}{Q_{mt}} \quad (6.2)$$

Let $t = y_-$ for the year-end before the merger and $t = y_+$ for the year-end after the merger, Q_{it} is the Q-ratio of competitor i at

time t , and Q_{mt} is the economy-wide Q at time t . To examine whether entry or exit barriers existed before the merger, a Student t -test is performed to determine whether pre-merger Q and RQ are significantly different from unity.

A more stringent test is also utilized to determine whether pre-merger Q and RQ are signals for the occurrence of the mergers. To accomplish this, the Q -variables of the sample of TDCs is compared to those of a group of firms not designated as TDCs during the time of the merger. The comparison is made by taking the sample of firms in Thomadakis and Lustgarten (1982) and identifying the TDC firms. The remaining firms are designated as non-TDCs. A dummy variable (D) is created to represent the occurrence of the merger, whose value is $[D = 0/\text{if no merger occurs}]$ and $[D = 1/\text{if a merger occurs}]$. The following cross-sectional tests are performed:

$$RQ_{y-} = a_1 + b_1 D + u_1 \quad (6.3a)$$

$$Q_{y-} = a_2 + b_2 D + u_2 \quad (6.3b)$$

If the coefficient b_1 and b_2 are positive, then we can conclude that entry barriers were present at the time of the merger. If the coefficients are negative, then we can conclude that exit barriers were present.

One weakness in the measurement of Q is that replacement cost of certain assets is not included, such as advertising expense and

research and development. To check for this omission, two independent variables are added to the above regressions: advertising divided by sales (ADV) and research and development divided by sales (RD). If the magnitude and sign of the coefficient of D are kept intact, then we can conclude that the pre-merger Q and RQ are indeed a reliable signal for a merger. The additional cross-sectional tests are:

$$RQ_{y-} = c_0 + c_1 ADV + c_2 RD + c_3 D + e_1 \quad (6.4a)$$

$$Q_{y-} = c_4 + c_5 ADV + c_6 RD + c_7 D + e_2 \quad (6.4b)$$

To test whether the merger significantly altered the structure and profitability of the industry where the merger occurs, the changes in Q and RQ are measured and given by

$$DQ = Q_{y+} - Q_{y-} \quad (6.5a)$$

$$DRQ = RQ_{y+} - RQ_{y-} \quad (6.5b)$$

and the Student t-test is employed to determine whether DQ and DRQ are significantly different from zero.

To determine whether DQ and DRQ were a function of the merger activity and the type of merger, an additional test similar to equations (6.3a) and (6.3b) is performed for each type of merger. The cross-sectional regressions utilized are:

$$DRQ = a_3 + b_3 D + u_3 \quad (6.6a)$$

$$DQ = a_4 + b_4 D + u_4 \quad (6.6b)$$

If the coefficients b_3 and b_4 are positive, then we can conclude that the merger heightened entry barriers and increased the ability of firms to earn excess profits. If the coefficients are negative, then we can conclude that the merger exacerbated exit barriers and resulted in even more deficient returns for the TDCs.

6.4 Estimation of Abnormal Performance during the Merger

The abnormal performance of common stocks during a period surrounding the merger represents a change only in one component of Q . If there were no inflation, no technical change, and no investments or disinvestments undertaken, such that $dRC = 0$ then the estimate of this abnormal performance may be a good proxy for a firm's DQ and DRQ during the merger period. However, these assumptions are too strong to make and thus any estimate of the abnormal performance of common stock price should be interpreted in conjunction with year-end Q and RQ before and after the merger.

The model used to estimate abnormal performance at the time of the first announcement of the merger proposal is the simple market model pioneered by Fama, Fisher, Jensen, and Roll (1969), which states that the ex-ante relation between expected return and risk is described by

$$E(\tilde{R}_{it}) = E(\alpha_i) + E(\tilde{R}_{mt})\beta_{im} \quad (6.7)$$

where

$E(\tilde{R}_{it})$ = expected rate of return of security i in time t

$$E(\alpha_i) = E(R_{it}) - \beta_{im} E(\tilde{R}_{mt})$$

$E(\tilde{R}_{mt})$ = expected rate of return of the market portfolio of risky assets M which is a linear combination of all securities.

$$\beta_{im} = \text{cov}(\tilde{R}_{it}, \tilde{R}_{mt}) / \text{var}(\tilde{R}_{mt})$$

The return which will be realized on security i in period t is

$$\tilde{R}_{it} = \alpha_i + \beta_{im} \tilde{R}_{mt} + \tilde{\epsilon}_{it} \quad (6.8)$$

where $\alpha_i + \beta_{im} \tilde{R}_{mt}$ is expected return given by equation (6.7) and $\tilde{\epsilon}_{it}$ is the abnormal or unexpected component.

In an efficient market and assuming that the return-generating process is correctly specified, the expected value of $\tilde{\epsilon}_{it}$ should be equal to zero, that is,

$$E(\tilde{\epsilon}_{it}) = [E(\tilde{\epsilon}_{it}/I=0)] p(I=0) + [E(\tilde{\epsilon}_{it}/I=1)] p(I=1) = 0 \quad (6.9)$$

where I is an integer which is equal to zero when no event takes place, and equal to 1 when a particular event takes place, and p is the probability that I=k, k=1, 0. If the event, in this case the merger announcement, has a significant economic impact for security i then $(\tilde{\epsilon}_{it}/I=1)$ should be significantly different from $(\tilde{\epsilon}_{it}/I=0)$. In other words, the

abnormal returns can be systematically different from zero but should have an expected value of zero.

The model given by equation (6.7) is estimated using OLS and the daily stock returns of a sample of TDCs, as shown in Table 6.3, obtained from the Center for Research and Security Prices (CRSP) for trading days -200 to -51 where day 0 is the event day.¹ The merger-related abnormal performance is estimated by calculating abnormal returns for the period -50 to 50 using coefficients $\bar{\alpha}_i$ and $\bar{\beta}_i$ of the expected return model estimated on the pre-event estimation period. The event period -50 to 50 is used because most merger studies based on CAPM have found that the greatest impact occurred within 50 days of the merger announcement. The 50-day post-merger period is used to determine if any more merger-related information leaks to the market after the event.

The abnormal performance of a sample of N securities over the event period t is given by the cumulative average residuals, CAR, which is computed by

$$CAR_{K,L} = \sum_{t=K}^L AAR_t \quad (6.10)$$

where $K \geq -50$ and $L \leq 50$ and AAR_t is the abnormal return over day t

1. Brown and Warner (1980) showed a significant increase in the power of the test designs for measuring abnormal performance when prior information concerning the specific day of the month the event occurs is accounted for.

TABLE 6.3
Number of Direct Competitors
per Target Firm Used in Estimating CAR*

Merger Type	Number of Mergers	Number of TDCs	Mean No. of TDCs per Target
Horizontal	13	54	4.2
Vertical	6	21	3.5
Product Extension	19	67	3.5
Pure Conglomerate	30	95	3.2
All	68	237	3.5

* Because of the greater availability of data for common stock returns than for replacement costs, the sample for the estimation of CAR is greater than in the estimation of Q. See Table 6.1 for comparison.

and defined as

$$AAR_t = \frac{1}{N} \sum_{i=1}^N AR_{it} \quad (6.11)$$

and AR_{it} is the abnormal return to security i over day t and is defined as

$$AR_{it} = R_{it} - (\bar{\alpha}_i + \beta_i R_{mt}) \quad (6.12)$$

where R_{it} is the realized return to security i over the period t and $\bar{\alpha}_i + \beta_i R_{mt}$ is the predicted return over the same period.

Test of Significance. To test whether the CAR is significantly different from zero over an interval of event-related time, a t-statistics is constructed. Since non-synchronous trading induces first-order serial dependence on the returns of individual securities and portfolios as shown by Scholes and Williams (1977), the abnormal returns from equation (6.11) exhibit first-order autocorrelation. To incorporate the first order-dependence, the technique given by Ruback (1982) is used for the test of significance, wherein the variance of CAR is defined by

$$\text{var} (CAR_{K,L}) = T \cdot \text{var} (AAR_t) + 2 (T-1) \text{cov} (AAR_t, AAR_{t+1}) \quad (6.13)$$

where $T = L-K+1$ and

$$\overline{AAR} = \frac{1}{30} \sum_{t=-50}^{-21} AAR_t \quad (6.14)$$

$$\text{var}(AAR_t) = \frac{1}{30} \sum_{t=-50}^{-21} (AAR_t - \overline{AAR})^2 \quad (6.15)$$

$$\text{cov}(AAR_t, AAR_{t+1}) = \frac{1}{30} \sum_{t=-50}^{-21} (AAR_t - \overline{AAR})(AAR_{t+1} - \overline{AAR}) \quad (6.16)$$

The t-statistics for CAR for the event period starting at day K and ending on day L is

$$t = \frac{CAR_{K,L}}{\sqrt{\text{var}(CAR_{K,L})}} \quad (6.17)$$

which has a Student t-distribution when AAR_t is stationary normal and the variance and first-order autocovariance of AAR_t is constant over time.

7. EMPIRICAL RESULTS

7.1 Pre-merger Q and RQ

Table 7.1 reveals that the 217 direct competitors of the target firms in 68 mergers are generally associated with pre-merger Q and RQ which are less than unity. For every merger type, the hypothesis that mergers are more likely to occur in industries where there are exit barriers is confirmed by the values of Q and RQ, which are significantly less than unity at the 1% level. TDCs in vertical mergers have the most intense exit barriers and TDCs in product extension conglomerate mergers the least intense. The values of RQ convey the information that the TDCs are significantly worse off relative to other firms.

Table 7.2 shows the results of the tests to determine whether there is a difference in the level of pre-merger Q and RQ between merging and non-merging industries. From the Thomadakis and Lustgarten (1982) sample of 477 companies with replacement cost data for 1974-1978, 162 companies were identified as belonging to this thesis' sample of TDCs. The remaining firms were labelled non-TDC. The group of non-TDC firms is not a strict control group because there is no assurance that mergers did not occur in the industries where they belong. However, this limitation is not expected to pose a serious problem.

Model 1 in Table 7.2 is a cross-sectional regression of pre-merger RQ against a dummy variable, D, which represents the occurrence

Table 7.1

Pre-Merger Q and RQ of TDC Firms
for the Whole Sample and by Merger Type

(t-values in parenthesis)

Type Variable	All	Horizontal	Vertical	Product Extension	Pure Conglomerate
RQ	.7721*** (-7.0830)	.7383*** (-4.4280)	.5921*** (-6.4743)	.8755*** (-1.9703)	.7530*** (-5.7789)
Q	.6858*** (-11.887)	.6699*** (-6.213)	.5374*** (-7.614)	.7799*** (-3.770)	.6577*** (-9.069)

*** indicates that Q and RQ are significantly different from unity at the 1% level.

Table 7.2

Regression Results of Pre-Merger Q and RQ on
Dummy and Missing Variables

Dependent Variable	Coefficient (t-values)		
	D	ADV	RD
(1) RQ	-.0795* (-1.8630)	-	-
(2) RQ	-.0230 (- .6058)	5.0362*** (10.3555)	10.9046*** (16.2493)
(3) Q	-.0561 (-1.4870)	-	-
(4) Q	-.0063 (- .1881)	4.4268*** (10.2828)	9.6500*** (16.2446)

***, * indicate 1% and 10% significance level, respectively.

or non-occurrence of a merger. The coefficient of D is negative and significant at the 10% level. This result indicates that exit barriers are present in the TDC firms' industries before the merger. Model 2 includes the variables for advertising (ADV) and research and development (RD) to take into account possible errors in the measurement of Q. Although the coefficient of D becomes insignificantly different from zero, the negative sign survives the addition of the two independent variables. Models 3 and 4 use Q as the dependent variable and also show negative but statistically insignificant coefficients for D. The uniform negative results for the coefficient of D for every model in Table 7.2 offer some confirmation of the hypothesis that mergers are more likely to occur in industries where there are exit barriers.

7.2 The Behavior of Q and RQ in Response to the Merger

The results in Table 7.3 indicate that there is a statistically significant negative change in the Q and RQ for the whole sample of TDCs. The negative DQ and DRQ are found in all merger types except for the positive but insignificant DRQ of TDCs in vertical mergers. However, only the TDCs in product extension conglomerate mergers have statistically significant negative values for both DQ and DRQ which indicate that only this merger type is able to change the position of the industry in relation to other industries.

Table 7.3 reveals that, for horizontal, vertical, and pure conglomerate mergers, the efficiencies introduced by the acquiring firms affect only insignificantly the profitability of the TDCs. This

suggests that the merging firms are able to reduce their average production costs but not to the extent of affecting industry output and price. Product extension conglomerate mergers, on the other hand, serve as a vehicle for acquiring firms to increase their market share by introducing efficiencies that increase industry output and lower prices. Thus, the significant negative DQ and DRQ for TDCs in product extension conglomerate mergers offer evidence that the emergence of a more efficient firm in the industry resulted in the TDCs earning even more deficient returns. The overall results of Table 7.3 are generally consistent with the efficiency hypothesis.

The results of the tests to show whether there is a statistically significant difference in the magnitude of DQ and DRQ between merging and non-merging industries are presented in Table 7.4. The procedure used in Table 7.2 to create the groups of TDC firms and non-TDC firms was again utilized. Models 1 and 2, which regress DRQ and DQ respectively against the dummy variable D show negative coefficients, which are significant at the 1% level, for the whole sample of TDCs. However, only in product extension conglomerate mergers are the DQ and DRQ both significantly less than zero. These results indicate that only in product extension conglomerate does the industry change its position relative to other industries as a result of the merger. Table 7.4 offers further confirmation of the conclusions derived from the results of Table 7.3.¹

1. The counterparts of Models 2 and 4 in Table 7.2 were deemed not to be applicable to DQ and DRQ. The errors in the measurement of Q are expected to be washed out in computing the difference between pre-merger and post-merger values.

Table 7.3

Change in Q and RQ of TDC Firms as a Result of the Merger for the Whole Sample and by Merger Type

(t-values in parenthesis)

Type Variable	All	Horizontal	Vertical	Product Extension	Pure Conglomerate
DRQ	-.0492*** (-3.17)	-.0208 (.57)	.0018 (.03)	-.1105*** (3.93)	-.0311 (-1.42)
DQ	-.0560*** (-3.78)	-.0412 (-1.21)	-.0384 (-.69)	-.1205*** (-4.45)	-.0217 (-1.02)

*** indicates that DRQ and DQ are significantly different from zero at the 1% level

Table 7.4

Regression Results of DQ and DRQ on
Dummy Variable by Type of Merger

Dependent Variable	Coefficient of Dummy Variable (t-values)				
	All	Horizontal	Vertical	Product Extension	Pure Conglomerate
(1) DRQ	-.0428*** (2.5731)	-.0144 (-. 4753)	.0081 (.0471)	-.1041*** (-3.9522)	-.0247 (-1.0988)
(2) DQ	-.0863*** (5.5035)	.0716*** (2.5195)	-.0687 (-1.5640)	-.1509*** (6.0946)	-.0520*** (-2.4543)

*** indicates 1% significance level

Tables 7.3 and 7.4 also offer support for the hypothesis that the magnitude of DQ and DRQ depend on the merger type. The results indicate that product extension conglomerate mergers induce the most negative DQ and DRQ and thus have the greatest impact on the TDCs. This is consistent with the hypothesis that acquiring firms in product extension conglomerate mergers are most likely to be successful in introducing new or improved technologies to the target firms to the extent that they are able to increase industry output and lower prices. The hypothesis that the horizontal mergers achieve economies of scale to the extent that they disturb industry equilibrium conditions to the detriment of their competitors is not upheld by the data. Table 7.5 combines the results of Tables 7.1 and 7.3 and presents the ending conditions in the industry after the merger, which are lower levels of Q and RQ for all merger types.

7.3 Abnormal Returns to TDCs as Measured by CAR

The results of the residual analysis are interpreted in conjunction with the pre-merger and post-merger RQ of the TDCs. DRQ covers a period of at least one year while CAR covers a shorter period of 101 days and measures the change in only one component of Q. As Eckbo (1981) has suggested, an examination of various characteristics of the merging firms' industries, of which Q is one, is desirable in order to provide a check of the consistency of his results of positive CARs for TDCs.

Figure 7.1 and Table 7.6 show that the portfolio of common

Table 7.5

Post-Merger Q and RQ of TDC Firms
for the Whole Sample and by Merger Type

(t-values in parenthesis)

Type Variable	All	Horizontal	Vertical	Product Extension	Pure Conglomerate
RQ	.7229*** (-10.948)	.7175*** (-6.1955)	.5939*** (-6.6848)	.7650*** (-4.0237)	.7220*** (-7.5303)
Q	.6298*** (-16.376)	.6287*** (-9.155)	.4991*** (-9.174)	.6593*** (-6.434)	.6360*** (-11.275)

*** indicates that Q and RQ are significantly different from unity
at the 1% level.

Figure 7.1
Cumulative Average Residuals for the
Target Firms' Direct Competitors in All Mergers

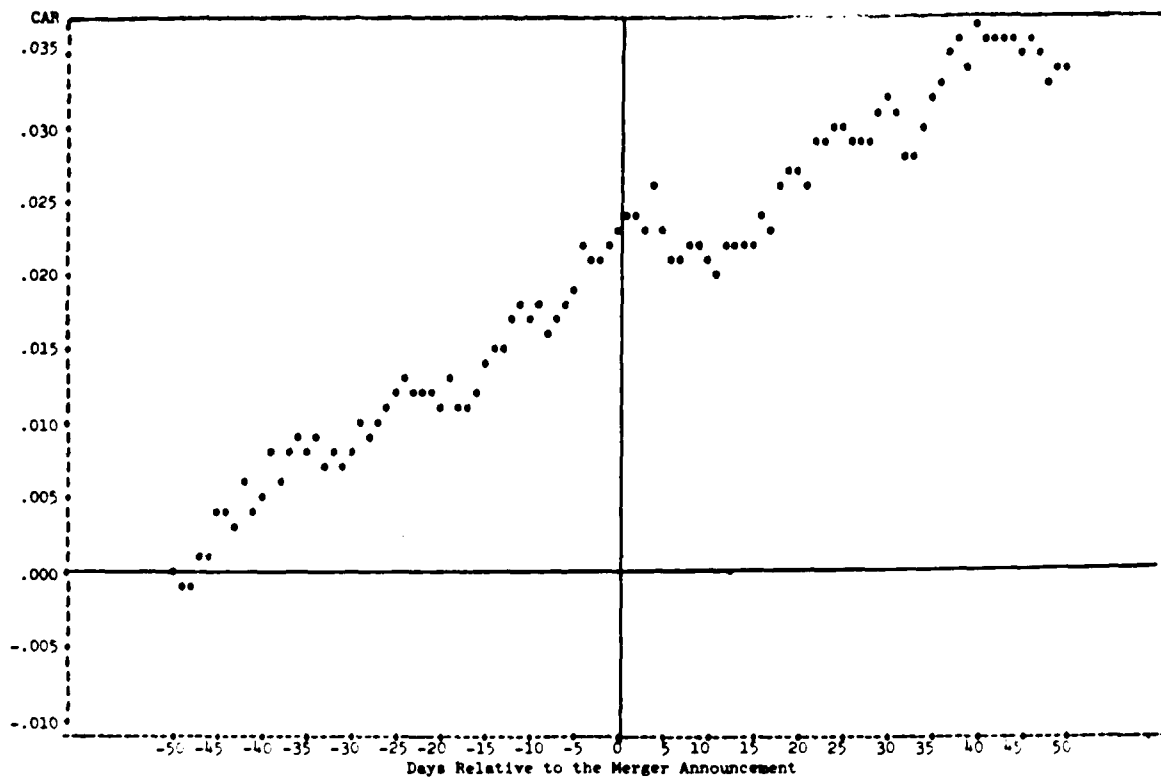


Table 7.6

Cumulative Average Residuals and T-Values
to the Target Firms' Direct Competitors Relative to
the Merger Proposal Announcement

Days Relative to Merger Proposal Announcement	CAR	t-values
(-50, 50)	.0338***	4.6546
(-20, 20)	.0151	3.2099
(-10, 10)	.0035	1.0119
(-3, 3)	.0009	.4213
(-1, 1)	.0028*	1.7255
(-50,-20)	.0111***	2.7006
(-20,-10)	.0057**	2.1856
(-10, -3)	.0032	1.4124
(-3, 0)	.0009	.4773
0	.0002	.1100
(0, 3)	.0002	.1229
(3, 10)	-.0030	-1.3276
(10, 20)	.0049*	1.8954
(20, 50)	.0071*	1.7227

***, **, * indicate 1%, 5%, and 10% significance level, respectively.

stocks of 237 TDCs in 68 mergers is generally associated with positive abnormal returns over the interval -50 to 50 surrounding the first announcement of the merger proposal. Fourteen event-related intervals are presented in Table 7.6. The total CAR of .0338 for the entire 101 days has an autocovariance-adjusted t-value of 4.6546, which is significant at the 1% level. CAR of .0111 is earned by the TDCs over days -50 to -20 and .0057 over days -20 to -10, which are significantly different from zero at the 1% and 5% levels, respectively. The remaining portion of the CAR is earned from day 10 to 50 after event day. The results of Table 7.6 and the picture shown in Figure 7.1 clearly demonstrate that all information relevant to the merger have not been fully leaked to the market by event day. The positive CAR after the event day may indicate that there is a learning process regarding the probability that the merger will be consummated.

Other merger studies, whose sample periods have generally not gone beyond 1977, may not have fully captured the empirical phenomenon described above because its cause may be the recent developments in the government's merger guidelines. The market may no longer be certain whether a particular merger will be challenged or not. Since the mechanistic approach in enforcing anti-merger laws was abandoned in the early 70's, the market may be waiting for signals that may resolve the uncertainty regarding a possible merger challenge.

Figures 7.2a and 7.3a-b show that the learning process occurs for horizontal, product extension, and pure conglomerate mergers, with the TDCs in horizontal mergers earning the greatest portion of

their CARs during the post-event period. The explanation for the results on horizontal mergers is that the probability of challenge is greatest for horizontal mergers and thus the market waits for more information regarding possible JD or FTC action.

Figure 7.2b shows that the CAR of the 21 TDCs in vertical mergers is earned during the pre-event period and reversed during the post-event period. The positive CAR during the pre-event period may have been caused by takeover speculations regarding the remaining firms in the industry. The abnormal performance of the TDCs' common stocks may simply be a "bubble" during the event period.

Tables 7.7 through 7.10, which present 14 different event-related intervals, show that all merger types have positive CARs for the portfolio of TDCs for the entire event period of 101 days, but statistically significant only for product extension conglomerate mergers. Table 7.7 shows that the TDCs in horizontal mergers earn significant positive CAR of .0374 during days -20 to 20, of which .0249 is earned from days 10 to 20. Table 7.8 reveals that the TDCs in vertical mergers earn significant positive CAR of .0799 from days -50 to -20 which is subsequently reversed after event day. Table 7.9 shows that the TDCs in product extension conglomerate mergers earn significant positive CAR of .0418 during the entire event period, of which .0255 is earned on days -50 to -20. The CAR of the TDCs in pure conglomerate mergers, as shown in Table 7.10, is not significant in any of the event-related intervals. These results support the hypothesis that there is a difference in the magnitude of the market impact among merger types,

Figure 7.2 Cumulative Average Residuals for TDCs

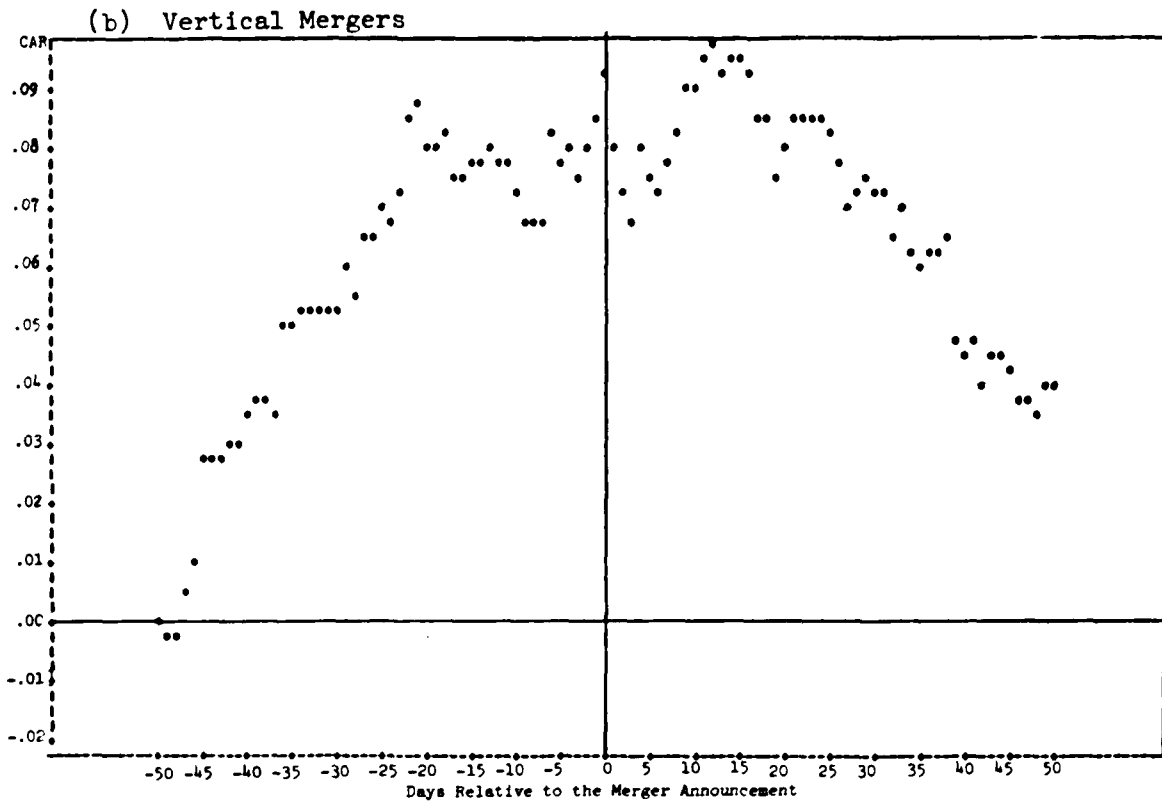
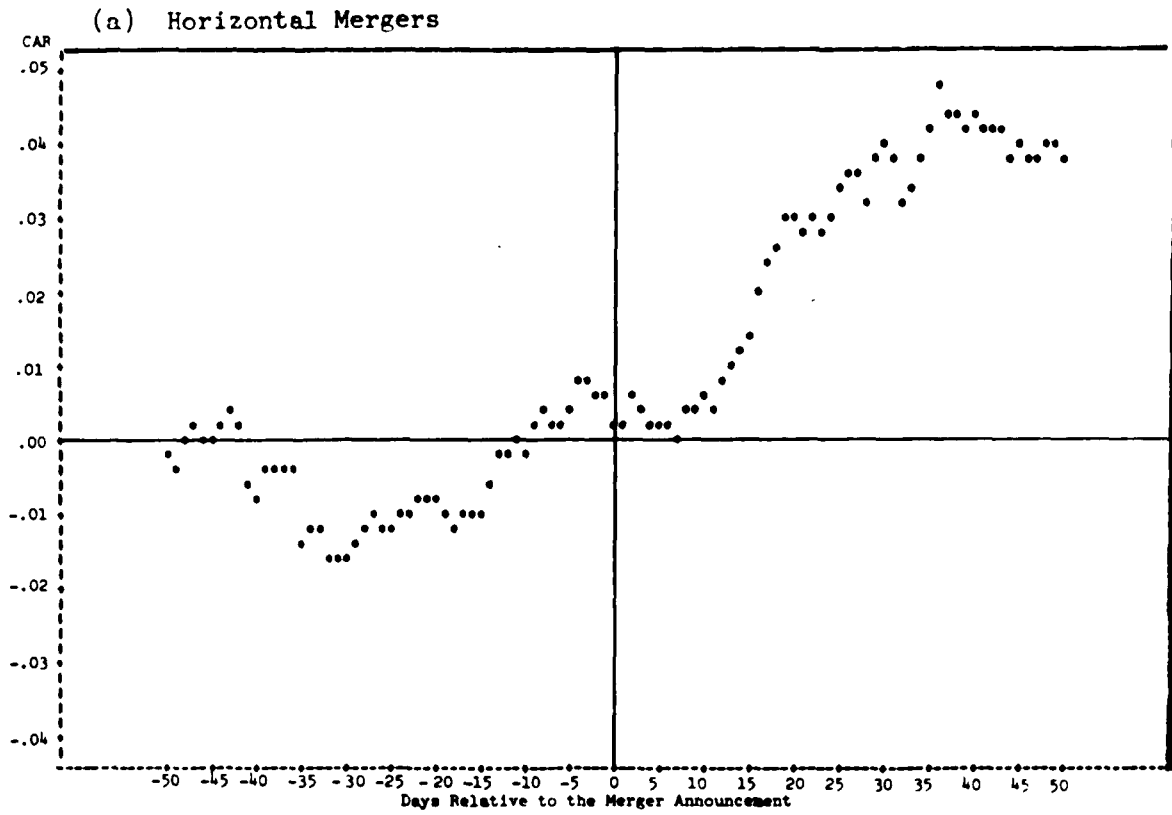


Figure 7.3 Cumulative Average Residuals for TDCs

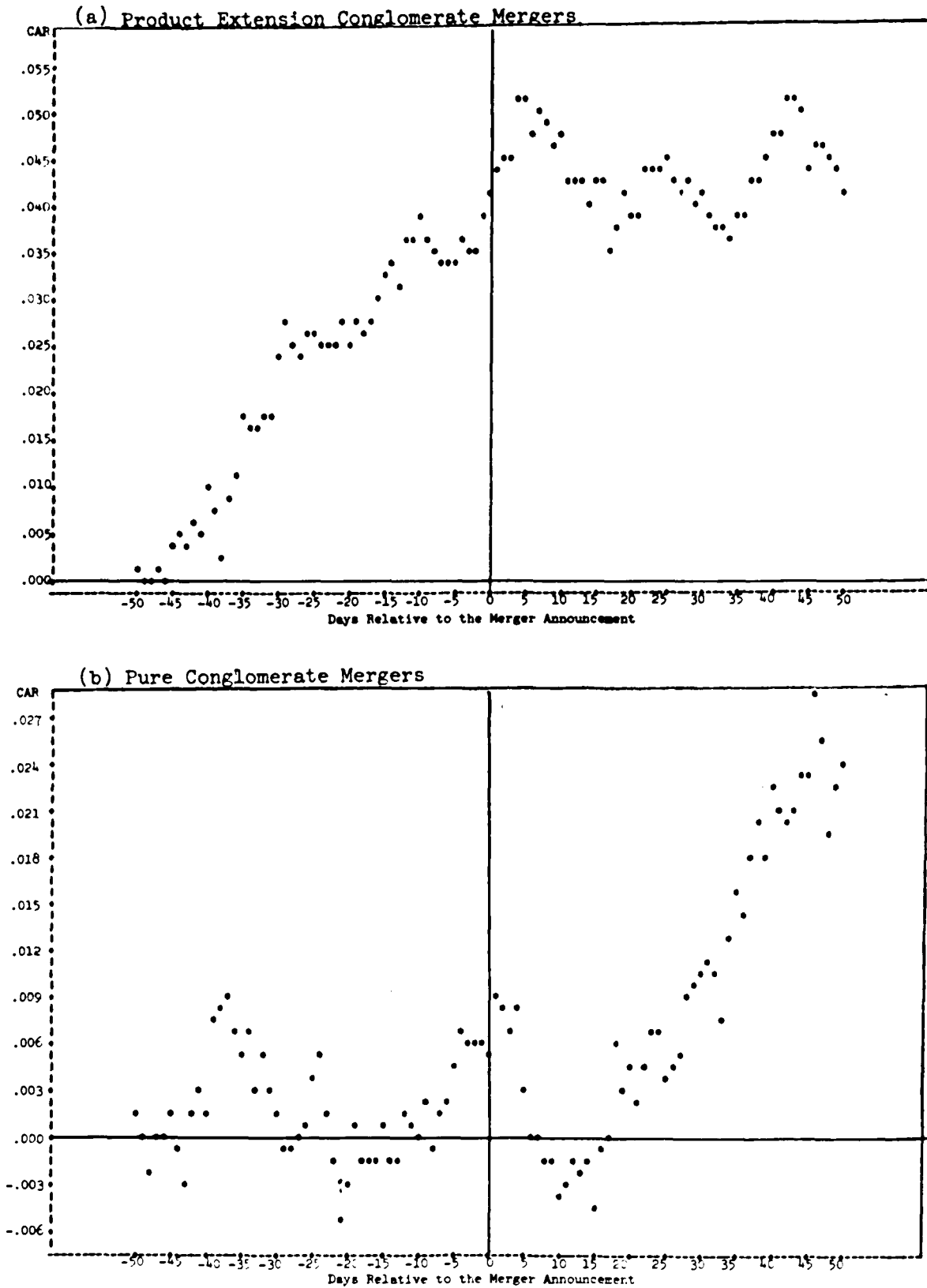


Table 7.7

Cumulative Average Residuals and T-Values
to the Target Firms' Direct Competitors in Horizontal Mergers
Relative to the Merger Proposal Announcement

Days Relative to Merger Proposal Announcement	CAR	t-values
(-50, 50)	.0380	1.1259
(-20, 20)	.0374*	1.7427
(-10, 10)	.0050	.3272
(-3, 3)	-.0033	- .3796
(-1, 1)	-.0028	- .4949
(-50,-20)	-.0086	- .4604
(-20,-10)	.0067	.6028
(-10, -3)	.0071	.7602
(-3, 0)	-.0047	- .7127
0	-.0030	-1.2600
(0, 3)	-.0017	- .2535
(3, 10)	-.0008	- .0867
(10, 20)	.0249**	2.2556
(20, 50)	.0082	.4406

** , * indicate 5% and 10% significance level, respectively.

Table 7.8

Cumulative Average Residuals and T-Values
to the Target Firms' Direct Competitors in Vertical Mergers
Relative to the Merger Proposal Announcement

Days Relative to Merger Proposal Announcement	CAR	t-values
(-50, 50)	.0407	.6762
(-20, 20)	-.0059	- .1543
(-10, 10)	.0113	.4144
(-3, 3)	-.0116	- .7412
(-1, 1)	.0004	.0377
(-50,-20)	.0799**	2.4022
(-20,-10)	-.0130	- .6560
(-10, -3)	-.0037	- .2214
(-3, 0)	.0115	.9765
0	.0056	1.0300
(0, 3)	-.0175	-1.4911
(3, 10)	.0157	.9336
(10, 20)	-.0086	- .4345
(20, 50)	-.0355	-1.0680

** indicates 5% significance level.

Table 7.9

Cumulative Average Residuals and T-Values
to the Target Firms' Direct Competitors in Product Extension
Conglomerate Mergers Relative to the Merger Proposal Announcement

Days Relative to Merger Proposal Announcement	CAR	t-values
(-50, 50)	.0418*	1.6860
(-20, 20)	.0013	.7116
(-10, 10)	.0111	.9775
(-3, 3)	.0095	1.4383
(-1, 1)	.0080*	1.8080
(-50,-20)	.0255*	1.8541
(-20,-10)	.0106	1.2873
(-10, -3)	-.0012	- .1685
(-3, 0)	.0050	.9784
0	.0023	.7100
(0, 3)	.0069	1.3529
(3, 10)	.0024	.3370
(10, 20)	-.0079	- .9562
(20, 50)	.0001	.0064

* indicates 10% significance level.

Table 7.10

Cumulative Average Residuals and T-Values to the
Target Firms' Direct Competitors in Pure Conglomerate Mergers
Relative to the Merger Proposal Announcement

Days Relative to Merger Proposal Announcement	CAR	t-values
(-50, 50)	.0014	.6804
(-20, 20)	.0097	.4320
(-10, 10)	-.0046	- .2892
(-3, 3)	-.0001	- .0082
(-1, 1)	.0029	.4948
(-50,-20)	-.0033	- .1689
(-20,-10)	.0057	.4948
(-10, -3)	.0057	.5859
(-3, 0)	-.0013	- .1935
0	-.0008	- .3600
(0, 3)	.0005	.0692
(3, 10)	-.0124	-1.2686
(10, 20)	.0057	.4966
(20, 50)	.0211	1.0754

with product extension conglomerates having the greatest impact.

The absence of significant CARs for the TDCs in pure conglomerate mergers in any of the event-related intervals is consistent with the insignificant DRQ found in Table 7.3. The positive CAR for the TDCs in vertical mergers during the pre-event period is assumed to be a speculative "bubble" because it is reversed immediately after event day and its value becomes insignificantly different from zero over the entire event period. These results show that both CAR and DRQ of TDCs in vertical and pure conglomerate mergers offer consistent evidence that the efficiency hypothesis is valid for these merger types. Vertical and pure conglomerate mergers introduce efficiencies but are not expected to affect the amount of rents earned by the TDCs.

The statistically significant positive CARs for the TDCs in horizontal and product extension conglomerate mergers in two event-related intervals indicate that the market expects these mergers to increase the amount of rents earned by the TDCs through collective market conduct or exit of resources. These results are consistent with the barriers hypotheses. However, these results contradict the findings on DRQ that the TDCs of product extension conglomerate mergers experience a significant decline in their RQ while the TDCs in horizontal mergers experience a statistically insignificant decline in their RQ. The contradiction implies that the positive market reaction to the first announcement of the merger proposal did not bear out over the longer period of time covered by DRQ. In other words, the expectation of the market that the TDCs will benefit from the horizontal and product

extension conglomerate mergers did not prove right as more information regarding these mergers are received by the market.

7.4 Summary of Results

The main results of the empirical analysis, based on the values of the different Q-variables and CAR, are summarized in the following conclusions:

(1) There is evidence from the pre-merger Q and RQ that mergers are more likely to occur in industries where exit barriers exist and returns are deficient.

(2) There is evidence from DRQ and partially from CAR that mergers typically occur to realize efficiency gains and thus are not expected to enable TDCs to overcome exit barriers and earn more normal returns. This result is inconsistent with the collusion and exit of resources hypotheses.

(3) Both CAR and DRQ offer evidence that the market effect of mergers on TDCs differ depending on the merger type, with the product extension conglomerate mergers having the greatest absolute impact.

(4) There is evidence from DRQ that product extension conglomerate mergers introduce efficiencies that produce an increase in total industry output thus cutting into the TDCs' profitability.

(5) There is evidence that the positive market reaction, as measured by CAR, toward the effects of product extension conglomerate mergers on the TDCs is not sustained over the long-run, as shown by DRQ.

(6) The reversal of the statistically significant positive CAR of TDCs in vertical mergers immediately following event day is evidence that there may be a takeover speculation for the remaining firms in the industry during the event period.

8. CONCLUDING REMARKS

The overall conclusion that can be made from the evidence gathered in this thesis is that the efficiency hypothesis explains the motivation behind mergers in general, and product extension conglomerate mergers in particular. Examination of the structural and profitability characteristics of the industries where the mergers occur reveals that such industries are already experiencing deficient returns and exit barriers. The efficiencies introduced by horizontal, vertical, and pure conglomerate mergers do not affect the TDCs' profitability.

An important policy implication of the evidence found in this thesis is that efforts by the regulatory bodies to limit mergers may result in the misallocation of resources and may prevent an efficient merger from taking place. If mergers contribute desirable consequences to the economy in the form of greater efficiencies, then the JD and FTC challenges of corporate mergers suspected of violating Section 7 of the Clayton Act will produce more inefficiencies in the economy than they eliminate.

The theory and results of this thesis also reveals the importance of using Tobin's Q in the study of mergers. Q serves not only as a profitability variable but also as a structural variable that may be used to examine characteristics of the merging firms and their industries. The thesis has also shown the importance of

examining industry characteristics to check the consistency of the results based on the cumulative average residuals of common stocks around the announcement of the merger proposal.

A more precise measurement of replacement cost and market value of debt is desirable to add greater reliability to any empirical tests employing Q. If this can be accomplished through greater data availability and the inclusion of possible missing variables, then Q and changes in Q can be measured for targets, bidders, and for a larger number of TDCs to reinforce the conclusions of this thesis. Furthermore, a study on the degree of industry-specificity of entry and exit barriers can be examined to determine its relevance to the industry effects of mergers. These are left for future research.

APPENDIX: DATA DESCRIPTIONS

SAMPLE OF HORIZONTAL MERGERS

(Format: bidder name - target name; year of merger announcement - year of merger completion; assigned SIC codes (product numbers to target, ...))

1. South Royalty - Aztec Oil and Gas; 76-76; 1311
2. Marathon Oil Co. - Pan Ocean Oil Corp.; 76-76; 1311
3. Superior Oil and Gas - Australia Oil; 77-78; 1381, 1382
4. National Distillery and Chemicals - Emery Industries; 77-78; 2821 (1, 2), 2869 (1-5)
5. Clark C and J Ltd. - Hanover Shoe, Inc.; 7--78; 3141
6. Portland Zement - Lehigh Portland Cement; 77-77; 3241
7. LTV Corp. - Lykes Corp.; 77-78; 3312 (1-4)
8. General Signal - Sola Basics; 77-77; 3567, 3621
9. Dana Corp. - Weatherhead Corp.; 77-77; 3494
10. Eaton Corp. - Cutler Hammer; 78-78; 3622, 3662 (1, 2) 3822, 3823
11. General Signal - Leeds and Northrup; 78-78; 3622, 3822
12. Halle and Stiglitz - Irvin Industries; 79-79; 3714 (7, 8)
13. AMPCO Pittsburg - Pittsburg Forging; 79-79. 3743 (1)

SAMPLE OF VERTICAL MERGERS

1. Kennecott Copper - Carborundum; 77-77; 3291
2. Kaneb Services - Diamond M. Co.; 77-78; 1381, 1382
3. Lone Star Industries - Maule Industries; 77-78; 3271, 3273
4. Thyssen A.G. - Budd Co.; 78-78; 3714 (2, 4)
5. Standard Oil of Indiana - Cyprus Mines; 79-79; 1021, 1031, 1044
6. Blount Inc. - Washington Steel; 79-79; 3312 (2, 3)

SAMPLE OF PRODUCT EXTENSION CONGLOMERATE MERGERS

1. Gould Inc. - I.T.E. Imperial; 75-75; 3613 (1-3)
2. Louisiana Land Expl. - Copper Range; 76-77; 1021
3. Champion International - Hoerner Waldorf; 76-77; 2631 (1-3)
4. N.L. Industries - Rucker Co.; 76-77; 3533
5. Dominican Bridge - Amtel Co.; 77-78; 3559 (1)
6. Pacific Industries - International Mining Corp.; 77-77; 1041, 1061
7. Gulf Oil Corp. - Kewanee Industries; 77-77; 2899 (1, 2)
8. Bayer A. G. - Miles Lab. Inc.; 77-77; 2899 (1, 2)
9. Union Oil Co. of Calif. - Molycorp Inc.; 77-77; 1061
10. Reynolds R.J. - Del Monte Corp.; 78-79; 2033 (1-3)

11. Louisiana Pacific - Fibreboard; 78-78; 2421 (1, 2) 2611, 2631 (1-3)
12. Pillsbury Co. - Green Giant; 78-79; 2033 (3)
13. Philip Morris - Seven-Up; 78-78; 2086
14. Gifford Hill and Co. - Amcord Inc.; 79-79; 3241
15. Cooper Inds. - Gardner Denver ; 79-79; 3531 (1-4), 3533, 3561, 3563
16. Levi Strauss - Koracorp Inds.; 79-79; 2311 (1, 2), 2327, 2328, 2329
17. U.S. Filter - Riley Co.; 79-79; 3622
18. NVF Company - UV Industries; 79-79; 3613 (2, 3), 1021
19. Mattel, Inc. - Western Publishing; 79-79; 2751, 2752

SAMPLE OF PURE CONGLOMERATE MERGERS

1. Porter H.K. - Missouri Portland; 75-76; 3241
2. Atlantic Richfield - Anaconda; 76-77; 1021
3. ITT - Carbon Inds. Inc.; 76-77; 1211
4. Penn Central Co. - Edgington Oil Co.; 76-76; 2911
5. Hanson Trust - Hygrade Food Products; 76-76; 2011
6. Northwest Inds. - Microdot; 76-76; 3452, 3321 (3)
7. Colgate Palmolive - Riviana Foods; 76-76; 2044, 2011, 2046
8. Lear Siegler - Royal Inds.; 76-76; 3714
9. General Electric - Utah International; 76-76; 1211
10. Nestlé S. A. - Alcon Lab; 77-78; 2834
11. Allegheny Ludlum - Chemetron Corp.; 77-77; 2813
12. Beatrice Foods - Harman International; 77-77; 3651 (1), 3679 (1, 2)
13. Wallace Murray - Hydrometals; 77-77; 3432
14. Carrier Corp. - Inmont Corp.; 77-77; 2893
15. Tenneco Inc. - Monroe Auto Equipment; 77-77; 3714 (1, 3)
16. Unilever Ltd. - National Starch and Chem.; 77-78; 2046
17. General Cable - Automation Inds.; 78-78; 3079 (1-3)
18. United Technologies - Carrier Corp.; 78-79; 3585
19. Johnson Controls - Globe Union; 3679 (1, 2), 3675
20. Time Inc. - Inland Containers; 78-78; 2653
21. Wheelabrator Frye - Neptune International; 78-79; 3824 (1), 3558
22. Ziff Corp. - Rust Craft Greeting; 78-79; 2771
23. Gulf and Western - Simmons Co.; 78-78; 2512, 2514, 2515
24. Esmark - STP Corp.; 78-78; 2899 (1)
25. Crane Co. - Medusa Corp.; 78-79; 3241
26. Allied Chemical - Eltra Corp.; 79-79; 3694 (1, 2)
27. Schlumberger - Fairchild Camera and Instr.; 79-79; 3674
28. Penn Central Corp. - Marathon Mfg.; 79-79; 3531 (1-4)
29. Swiss Aluminum - Maremont Co.; 79-79; 3714 (1, 3, 6)
30. Exxon - Reliance Electric; 79-79; 3612, 3613 (1-3), 3621 (1), 3622

DEFINITION OF THE MAJOR INDUSTRIES AND PRODUCTS

ASSIGNED TO TARGET FIRMS

- 10 METAL MINING
- 1021 Copper Ores
 - 1031 Lead and Zinc Ores
 - 1041 Gold Ores
 - 1044 Silver Ores
 - 1061 Ferroalloy Ores
- 12 Coal
- 1211 Bituminous Coal and Lignite
 - 1. coal
 - 2. lignite
- 13 OIL AND GAS EXTRACTION
- 1311 Crude Petroleum and Natural Gas
 - 1381 Drilling Oil and Gas Wells
 - 1382 Oil and Gas Field Exploration
- 20 FOOD AND KINDRED PRODUCTS
- 2011 Meat Packing Plants
 - 2033 Canned Fruits, Vegetables, Preserves, Jams and Jellies
 - 1. juices
 - 2. tomato products
 - 3. canned fruits and vegetables
 - 2044 Rice Milling
 - 2046 Wet Corn Milling
 - 2086 Bottled and Canned Soft-drinks and Carbonated Water
- 23 APPAREL AND OTHER FINISHED PRODUCTS MADE FROM FABRICS AND SIMILAR MATERIALS
- 2311 Men's, Youth's and Boy's Shirts and Nightwear (except Work Shirts)
 - 1. men's clothing
 - 2. youth's and boy's
 - 2327 Men's, Youth's and Boy's Separate Trousers
 - 2328 Men's, Youth's and Boy's Work Clothing
 - 2329 Men's, Youth's and Boy's Clothing, n.e.c.

- 24 LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE
 - 2421 Sawmills and Planing Mills, General
 - 1. lumber
 - 2. sawmills
- 25 FURNITURE AND FIXTURES
 - 2512 Wood Household Furniture, upholstered
 - 2514 Metal Household Furniture
 - 2515 Mattresses and Bedsprings
- 26 PAPER AND ALLIED PRODUCTS
 - 2611 Pulp Mills
 - 2631 Paperboard Mills
 - 1. paperboard
 - 2. folding cartons
 - 3. boxboard
 - 2653 Corrugated and Solid Fibre Boxes
- 27 PRINTING, PUBLISHING, AND ALLIED INDUSTRIES
 - 2751 Commercial Printing, Letterpress and Screen
 - 2752 Commercial Printing, Lithograph
 - 2771 Greeting Card Publishing
- 28 CHEMICALS AND ALLIED PRODUCTS
 - 2813 Industrial Gases
 - 2821 Plastic Materials, Synthetic Resins and Non-vulcanizable Elastomers
 - 1. polythelene
 - 2. acrylic
 - 2831 Biological Products
 - 2834 Pharmaceutical Preparations
 - 2869 Industrial Organic Chemicals
 - 1. organic acids
 - 2. methyl
 - 3. plasticizers
 - 2893 Printing Ink
 - 2899 Chemicals and Chemical Preparations, n.e.c.
 - 1. for oil and gas products
 - 2. coating chemicals
- 29 PETROLEUM REFINING AND RELATED INDUSTRIES
 - 2911 Petroleum Refining
- 30 RUBBER AND MISCELLANEOUS PLASTIC PRODUCTS
 - 3079 Miscellaneous Plastic Products
 - 1. plastic raw materials
 - 2. resins
 - 3. vulcanized fiber
- 31 LEATHER AND LEATHER PRODUCTS
 - 3141 Footwear, except House Slippers and Rubber Footwear

- 32 STONE, CLAY, GLASS AND CONCRETE PRODUCTS
 - 3241 Cement, Hydraulic
 - 3271 Concrete Block and Brick
 - 3273 Ready-mixed Concrete
 - 3291 Abrasive Products

- 33 PRIMARY METALS INDUSTRIES
 - 3312 Blast Furnaces, Steel Works, and Rolling Mills
 - 1. cold rolled steel 2. galvanized sheet steel
 - 3. strips and plate steel 4. hot rolled steel
 - 3321 Gray Iron Foundries
 - 1. castings

- 34 FABRICATED METAL PRODUCTS, EXCEPT MACHINERY AND TRANSPORTATION EQUIPMENT
 - 3432 Plumbing Fixtures, Fittings and Trims (Brass)
 - 3452 Bolts, Nuts, Screws, Rivets and Washers
 - 3494 Valves and Pipe Fittings, except Plumbers' Brass Goods

- 35 MACHINERY, EXCEPT ELECTRICAL
 - 3531 Construction Machinery and Equipment
 - 1. tractors 2. harvesting machines
 - 3. garden tractors and equipment 4. conveyors
 - 3533 Oil Field Machinery and Equipment
 - 3558 Pollution Control Devices
 - 3559 Special Industry Machinery, n.e.c.
 - 1. petroleum refining equipment
 - 3561 Pumps and Pumping Equipment
 - 3563 Air and Gas Compressors
 - 3567 Industrial Process Furnaces and Ovens
 - 3585 Air Conditioning, Warm Air Heating Equipment and Commercial, Industrial Refrigeration Equipment

- 36 ELECTRICAL AND ELECTRONIC MACHINERY, EQUIPMENT AND SUPPLIES
 - 3612 Power, Distributor and Specialty Transformers
 - 3613 Switchgear and Switchboard Apparatus
 - 1. switchboards 2. circuit breakers
 - 3. switchgears
 - 3621 Motors and Generators
 - 1. electric motors
 - 3622 Industrial Controls
 - 3651 Radio and Television Receiving Sets, except Communication Types
 - 1. audio equipment
 - 3662 Radio and Television Transmitting, Signalling and Detection Equipment and Apparatus
 - 1. missile systems 2. aircraft control systems

- 3674 Semiconductors and Related Devices
- 3675 Electronic Capacitors
- 3679 Electronic Components, n.e.c.
 - 1. circuits
 - 2. switches
- 3694 Electrical Equipment for Internal Combustion Engines
 - 1. generators
 - 2. ignition system

37 TRANSPORTATION EQUIPMENT

- 3714 Motor Vehicle Parts and Accessories
 - 1. mufflers and exhaust system
 - 2. brake materials/parts
 - 3. shock absorbers
 - 4. wheels and rims
 - 5. windshields
 - 6. axles and suspension system
 - 7. engine parts
 - 8. transmissions and parts
- 3743 Railroad Equipment
 - 1. cars and car equipment

38 MEASURING, ANALYSING AND CONTROLLING INSTRUMENTS

- 3822 Automatic Temperature Controls
- 3823 Automatic Controls for Regulating Residential/
Commercial Environment
- 3824 Totalizing Fluid Meters and Counting Devices
 - 1. fluid meters

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