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A RE-EXAMINATION OF EVENT STUDIES
APPLIED TO CHALLENGED HORIZONTAL MERGERS

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A RE-EXAMINATION OF EVENT STUDIES
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ABSTRACT

A growing body of empirical studies have been interpreted as support for a laissez-faire policy towards mergers. These "event studies" examine the reaction of stock market prices of firms that announce an agreement to merge. The type of reaction reveals whether a merger is motivated by a desire for market power or purely to improve market efficiency.

In this paper, a version of the capital asset pricing model (CAPM) is applied to determine if abnormal returns are earned by rivals of 22 pairs of firms whose attempted horizontal mergers were challenged by the federal antitrust agencies. At most eight, and possibly only five, of the cases were found to be motivated by efficiency in seeking merger, and at most six, and possibly only one, were motivated by market power; the rest were inconclusive.

The event-study technique is highly flawed for the study of business-regulation effects. Numerous unrealistic assumptions, inappropriate data constraints, and questionable interpretations hamper the application of this technique to policy analysis.

Introduction

Since the beginning of the 1980s, empirical studies using stock market data have been used to undermine the basis of traditional horizontal merger policy. Traditional policy holds that when horizontal mergers cause sales concentration to rise beyond some critical level, the tendency of sellers to engage in collusive behavior increases. There is a presumption that some mergers are motivated by a desire to enhance market power. This group of "revisionist" studies tends to support a broad efficiency rationale for horizontal mergers. Two frequently cited "revisionist" studies are by Stillman (1983) and Eckbo (1983). Both studies used the returns to horizontal rivals in challenged mergers as a criterion to determine if these mergers supported the market power hypothesis or if the rival returns supported the efficiency hypothesis. Such studies are often called event studies.

This hypothesis was tested using the Market Model (MM) which analyzes the adjusted stock prices of firms involved in horizontal mergers with their rivals' stock price on certain critical dates (namely, announcement of the merger and announcement of a challenge by antitrust agencies). Under the market power (collusion) hypothesis, the expectation is for abnormal _positive_ returns for rivals on dates of high probability of merger (announcement) but abnormal _negative_ returns on dates of low probability of merger (challenge). Abnormal positive returns for rivals at the merger announcement are expected because if the merger is expected to result in successful collusion the benefits will be gained by rivals inside the collusive scheme as

well as free-rider rivals. Abnormal negative returns at the time a challenge becomes known in the market because the potential gains of the collusive scheme are lost. Abnormal returns are those significantly different from the returns of comparable firms unaffected by the announcement. Stillman and Eckbo found slight positive abnormal returns for rivals on announcement dates but no significant abnormal returns for rivals on the challenge dates of interest. Thus, the market power (collusion) hypothesis was not fully supported, and the authors concluded that the mergers supported the efficiency hypothesis.

One set of criticisms of such studies is methodological. Some researchers doubt the validity of any econometric analyses in the area of horizontal merger policy (Fisher and Lande 1983). Others find fault with the underlying assumptions of the model. The MM assumes no change in systematic risk, assumes only one merger is occurring in the industry, and takes little account of the business cycle as an explanatory factor in merger motivation (Conn 1985).

Stillman and Eckbo are open to additional criticisms, both as to methods and interpretation. The first statistical criticism concerns the sample size of both studies. Stillman's data, based on the mergers challenged within the eight years between 1964 and 1972, may not represent a large enough sample. Eckbo had a larger sample size of mergers but he did not test for significant abnormal returns of the target and bidder firms on the event dates, and thus may have included extraneous mergers in his sample.

A second criticism involves rival selection. Stillman used the internal "fact memoranda" of the antitrust agencies (obtained by the Freedom of Information Act), which identified rivals the enforcement agencies felt would be affected. Eckbo used the Standard Industrial Classification (SIC) codes to identify rivals. The SIC code method may bias the study because these rivals may become candidates for "defensive" mergers themselves. If the rival has the potential to be a target or bidder in a merger, the reaction to the enforcement action may not be entirely due to the market power or efficiency hypothesis for horizontal rival reaction.

A third criticism involves the length of the event period. By using the one-day residual, the abnormal return on the event day, Stillman assumes that all relevant information regarding the merger is available to the capital market in a very short time. Eckbo uses the cumulative average abnormal return (CAR) technique which allows a longer period to be examined. However, this technique assumes that the probability of the merger is equal over the entire "window" period (the days surrounding the merger which is used to obtain the residuals for the determination of abnormal returns).

The final criticism involves evaluating all rivals as equals. Economic theory suggests different effects of horizontal merger for rivals of different size. Merger rivals may also be stratified on the basis of the percentage of the firm's output in the affected industry. For example, if the portfolio of rivals contain a large conglomerate which obtains only a small

portion of its business from the merger-affected industry, the effects may be different than for a firm whose entire output is in the merger-affected industry.

There are also criticisms pertaining to the authors' interpretations. The logic in using evidence from challenged mergers to pronounce antitrust policy inefficient is suspect. Challenged mergers are inherently "borderline cases". What has been neglected in the analysis is the effectiveness of deterrence in preventing anti-competitive mergers. Obviously anti-competitive mergers are often not attempted because the transaction costs for firms are too high when a merger will not withstand the scrutiny of the antitrust enforcement agencies is abandoned (Werden and Williams 1986). The mergers in the Stillman and Eckbo studies all occurred prior to the implementation of the 1982/1984 Department of Justice Merger Guidelines. It is questionable whether the results can have implications for present policy.

Both studies refute the market power hypothesis for the basis of horizontal merger and do not reject the efficiency hypothesis. However, that does not mean that the efficiency hypothesis should be accepted. The authors do not give adequate reasons for accepting the efficiency hypothesis and did not distinguish between economies of scale and other rationales (Halpern 1983).

Objective

The overall objective of this study is to examine the empirical validity of event studies that have sought to explain the market impacts of horizontal merger enforcement at the federal level.

This study will examine the sensitivity of the results of such studies to time period, number of rival firms selected for analysis, statistical technique and the assumption that rival firms can be treated homogeneously. Horizontal merger data will be examined up to the middle of 1980s, so as to enlarge the sample and provide further insight. The technique of rival selection will be in concordance with that of Stillman, i.e., rivals are identified by antitrust enforcement agencies, where available. The supplement rivals identified by FOIA requests, industry analysts, members of academia, government agency analysts and the merging firms were contacted to target the horizontal merger rivals. For the sake of comparison, both the statistical techniques of the one-day residual and the Cumulative Abnormal Return (CAR) will be employed. Horizontal rivals will be stratified by percent shipments in the relevant SIC code to determine if the effects of horizontal merger enforcement differ in this respect.

Oligopoly Theory

The Structure-Conduct-Performance (S-C-P) Paradigm posits that market structure influences firm conduct and hence firm performance. Part of the controversy surrounding horizontal

merger policy may be traced to criticisms of the theoretical underpinning of the S-C-P paradigm.

The historical starting point in formal oligopoly theory is August Cournot. In his theory, established firms assume the output of their major rivals is fixed and set prices in their share of the market as monopolists. This theory concludes that a market composed of a small number of non-colluding oligopolists will have a higher equilibrium price than when a larger number of firms exist.

More recent theories include the dominant firm model and various collusive pricing models. The dominant firm model predicts price setting by the large firm(s) and price-taking followership by the small competitive fringe firms. In the event of a merger involving the acquisition of a fringe firm by the dominant firm by the demand for dominant firm's product becomes less elastic in the short run. This less elastic demand allows for a decreased profit-maximizing output, and thus fringe firms can "free-ride" on higher industry prices (Stigler 1965). Chamberlin's "small-numbers" oligopoly pricing model views the market as being characterized by "mutual interdependence". Assuming entry is blocked, when the number of rivals is small, the firms may recognize that a change in their price or output causes price or quantity changes by their rivals, and, hence, their own profits. Instead of acting independently (as in pure competition) the firms find it best to plan their actions based upon the anticipated responses of rivals, i.e., strategic behavior. One strategy that produces rents for all firms is tacit or

explicit collusion -- a cartel. Further, the effectiveness of this cartel increases as the number of firms decrease because there is an increased probability of detecting cheaters (Stigler 1964).

In addition to collusion, another form of oligopoly conduct is predation. The threat of predatory conduct by established firms post-entry is a barrier to entry. Predatory behavior is characterized by the oligopolistic firm overproducing output or over-purchasing inputs. The intent of this behavior is to disadvantage rival firms by reducing market price or imposing unsustainable higher costs. Predation is not an outcome that is discussed at great length in the event-study literature. This lack of attention may stem from the inconclusive effects on rivals. If it is accepted that price-wars or cost-escalations are not a necessary condition for predation, then there is no observable phenomenon for event studies to measure. Also, there is a body of theoretical opinion that predatory pricing is innately irrational (Scherer and Ross 1990).

Legally, market power is defined as the ability of a firm(s) to raise prices above the competitive level without suffering below-normal profits or the ability to raise barriers to entry. Economically, market power is defined as the ability to set price above marginal cost or the ability to follow strategies that reduce the profitability of entry by at least some would-be entrants. Market power is important because legislation pro-hibits mergers which "may substantially lessen competition", the

legal terminology for a small chance of a significant increase in market power.

The evolution of U.S. case law revealed violations of Section 7 of the Clayton Act, until the early 1980s, by the following structural conditions:

1. the merger would result in a "large" combined market share of the newly merged company;

2. the merger would lead to a substantial increase in industry concentration (Allen (1981) found the CR4[1] must exceed 40% of the relevant market);

3. the merger must be indicative of a "massive trend" towards fewer independent firms in the relevant market, i.e., incipiency.

The prohibition of horizontal mergers stems from potential welfare losses generated by the market power of anticompetitive mergers. Welfare losses may stem from the production of the wrong set of goods and services, an inadequacy in output, or from technical inefficiencies. The annual dollar value of losses related to horizontal mergers the U.S. economy have estimates as low as 0.01% of GNP and as high as 0.06% of GNP (Pautler 1983).

In horizontal merger policy, the question is whether or not the merger may yield market power. The methods used by anti-trust agencies have changed over time and are now at their most

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[1] CR^4 is the concentration ratio, or the combined market share, for the four largest firms in the industry.

"sophisticated and quantitative" with the implementation of the Department of Justice 1984 Merger Guidelines. Looser industry concentration standards for challenging mergers implied by the guidelines, and a tendency to broader product and geographic market boundaries resulted in far fewer challenged mergers in the 1980s. The antitrust agencies also permitted merging firms to drop one or a few product lines as a prior condition of merger. This "fix-it-first" policy also reduced merger challenges.

Motivation for Merger

The underlying assumptions of the workings of mergers are hotly debated. Some of the theories for merger are: market power, corporate control, and financial "value maximization" (a version of the efficiency school of mergers). As noted above, Stillman and Eckbo number among the proponents of the efficiency hypothesis. Mergers are viewed as an efficient alternative to bankruptcy, a protective device for small shareholders, and as a means of greater management efficiency and thus better allocation of resources (Manne 1965). One justification proposed for the efficiency hypothesis is due Schumpeter. In this view, monopoly power and its attendant profits are a necessary condition for technical advances, while perfectly competitive markets hinder these advances. If progress is defined as innovation, there is no consensus in the current literature verifying this view. The empirical relationships between firm size,

concentration and technological innovation are in dispute (Williamson 1968, Brozen 1982, Kamien and Schwartz 1982).

The financial-value-maximization school argues that high stock prices for some firms are the result of good management decisions, luck, reputation, innovativeness, and the like. Other efficiency-type rationales for merger are seen in the financial realm and are termed "value maximization motivation". One such theory is the financial motivation of merger as a tool for the "redeployment of excess cash" held by the target or bidder firm. This "synergy" argument for mergers rests on the expectation that cash flows will be greater than that of the two original firms. These greater cash flows may be predicted on expected economies of scale or excess capacity in the factors of production. Examples of these factors are managerial and financial control.

A final financial goal of merger is an attempt to capture the benefits from asymmetric information in the market. This asymmetry may be a disparity in the market value of a target firm or information held by the bidder, which if deployed by the target would increase the market price of the targets' stock. Examples of this type of information include technological or other operating strategies.

Therefore, high profits do not result so much from "artificial scarcity" or collusion but as from "superior entrepreneurship". A provocative and often quoted line of reasoning suggests that it is "natural frictions and ignorance that characterize any real economy", not barriers to entry,

which yields market power (Demsetz 1973). It follows from this argument that antitrust enforcement policy that penalizes large efficient firms may lead to problems by decreasing innovative success and result in welfare losses to society. This view has been instrumental in attempts to relax antitrust policy towards horizontal mergers.

An alternative theory argues that mergers occur out of a desire by managers for corporate control. This desire for corporate control is seen as conceptually distinct from economies of scale, innovativeness, market power, or other profit-driven motives. Managerial utility related to sheer company size is the driving force, irrespective of its impact on stockholder wealth.

A related managerial motivation for an acquisition may be the defensive strategy of avoiding a takeover or what Greer has called "buying so as not to be bought" (Greer 1986). The reasons underlying this defensive strategy may be to accumulate an unpalatable debt or become sufficiently large to deter a merger-hungry acquiring firm. The act of acquisition may thwart the takeover attempt when the bidder has already obtained a portion of stock and an acquisition on the part of the target "dilutes" the stock. The other reasons for defensive acquisitions are strategic position, regulated buys and reciprocal reaction. If an industry is experiencing extensive merger activity, a firm may deem aggressive acquisition necessary to cover its flanks. The regulated buy is a special case in which the acquisition of a particular company by the target would

deter the bidder because of regulatory entanglements. Reciprocal reaction is the "Pac-Man" defense in which the hunter becomes the hunted.

The Empirical Model

Economic theory posits that if a merger is efficient, it will generate an increase in societal welfare and represent a Pareto-efficient change (Stillman 1980). By contrast, if a merger reduces competition, the allocation of resources will be less than optimal. Stillman defines an inefficient merger as one in which the sum of consumer and producer surplus is less than that surplus if the merger had not occurred.

This suggested welfare measurement is not feasible because it is difficult to determine when to begin measuring the price effects; there is also the problem of anticompetitive effects occurring outside the realm of price parameters. Empirical studies using stock return data and the event-study methodology have become more numerous due to wider access to computerized stock data tapes, dissatisfaction with the use of accounting data, the acceptance of the efficiency of capital markets, and the acceptance of the cumulative abnormal return (CAR) as a normative index. The CAR can be interpreted as an indicator of short-term changes in market-adjusted stock prices and an *ex ante* valuation for the long-run effects of the merger.

Assumptions of the Market Model

The event-study methodology employs several assumptions:

1. the capital market is efficient,

2. the capital market reacts to all new information,

3. stock returns have multivariate normal distribution,

4. risk is stationary, and

5. no other mergers are occurring that involve the firm or industry of interest at the same time.

These assumptions are open to a number of criticisms, especially when using daily stock price data in an econometric analysis. Daily data have been found to exhibit leptokurtic distributions when compared to monthly normal distributions. These "fat-tailed" distributions have a greater number of observations in the tails and thinner peaks. This effect is mitigated when the abnormal returns are averaged cross-sectionally but the firm-specific abnormal return may exhibit cross-sectional dependence. For a more thorough examination of these issues, see Brown and Warner (1985). A second problem, that of non-synchronous trading, occurs when the firm's stock and the market portfolio or market index are measured over different trading intervals. Non-synchronous trading can cause the abnormal returns to display serial dependence.

The assumption of stationarity of risk, or beta stationarity has come under review in recent analyses of event studies (Conn 1985, Halpern 1983). Economists at the FTC, using data from Stillman (1983), found that the systematic risk for rivals decreases after events which increase the probability of merger.

This may reflect a less risky market environment for rivals. It was also found that systematic risk increases after events which decrease the probability of merger (Kupiec and Mathios 1986). This change in risk may be associated with the tendency for mergers to occur in periods of economic expansion when stock prices are likely to rise and interest rates to fall. In this case the beta or systematic risk parameter may change.

Aside from the controversy about the assumptions of the Market Models, it is readily accepted that stock price movements provide a means of analysis of merger effects. If an event has implications for the value of a stock it ought to be reflected in the stock's price as soon as it is anticipated by one or more market participants. The Market Model is a specific model of equilibrium expected returns, a "valid benchmark", which may be used to measure abnormal changes associated with regulatory changes.[2] Fama, et al. are credited with devising the "event time analysis" of abnormal performance. Abnormal performance is the deviation from the realized return of the firm and the expected risk-adjusted return. The Market Model implies that with efficient capital markets, the stock returns to firms that are rivals of the merging firms will be linearly related to overall market returns. Thus the relationship between rival

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[2] The major difference between the CAPM and the Market Model is that the intercept term in the CAPM is the risk-free rate of return minimum variance zero-beta portfolio which may change over time while the MM intercept term is constant over time.

returns and overall market returns can be estimated via an Ordinary Least Squares (OLS) regressor.

The concept of event-time involves analyzing all firms in a particular sample that have been affected by a regulatory announcement or other piece of information likely to affect future profits. As part of this concept, analysis is inde-pendent of calendar time, depending only on the event, regard-less of when the event occurred. The abnormal returns of these firms should not be correlated and the variance of the average abnormal returns should be proportional to the sum of the indi-vidual abnormal returns (Schwert 1981). This absence of corre-lation is useful when combining firms from unrelated mergers into a large single portfolio.

Specific Procedures

In order to examine mergers likely to have affected rivals, a filter would be performed which required either the bidder or the target firm to exhibit a statistically significant abnormal return on both event dates.

The steps involved in implementing the Market Model are as follows:

1. The first step is to estimate the stock's characteristic line (i.e., the linear relationship between the returns of merger participants and overall market stock returns) with Ordinary Least Squares to obtain the intercept (α) and slope (β) coefficients for a period up to, but not including, the event window. The event window is a period of days surrounding the merger event date which

is judged to capture the effects of the event on the price of the stock. The characteristic line is

(1) $E(r_j | r_m) = \hat{\alpha}_j + \hat{\beta}_j r_{mt}$,

where:

r_j = the stock market return for the merger participant,

r_{mt} = the market factor, an equally weighted portfolio of firms, which captures the affect of market-wide shocks, and

E = the expectations operator.

Equation (1) estimates the conditional expected value of the merger participants stock return.

2. Calculate the difference, or residual, between the expected return based on the conditional response, as in (1), and the actual return of the stock during a ten-day window period surrounding the event

(2) $e_{jt+10} = r_{jt} - E(r_j | r_{mt})$,

where:

ϵ_{jt} = the residual.

3. Sum the residuals to obtain the cumulative abnormal return (CAR) for the ten-day window period:

(3) $e_{j+10} = \sum_{t=n}^{m} e_{jt}$,

where:

n = the first day in the window, and

m = the last day in the window.

4. To counteract the problem of response to other informa-
   tion and insure that the abnormal returns are due to
   merger events, the sample of N stocks which have a
   merger announcement and challenge are examined and the
   accumulated response relative to day 0, the event day,
   is computed as an average of the residuals:

   $$(4) \quad \overline{E}_t = \frac{1}{N} \sum_{j=1}^{N} e_{jt} \cdot$$

5. The final step is to compare actual stock returns on the
   event date to the average computed in (4). If there is
   a statistically significant difference between these
   values, it can be concluded that abnormal returns
   occurred. The presence of abnormal returns for merging
   firms provides the basis for analyzing rival returns.
   This analysis follows Stillman who relegates the
   industry-shock term to the disturbance term.

6. In the initial assessment of the bidder and target firms
   returns to determine further investigation, steps (1)
   through (3) were completed. A t-test is then calculated
   to test the null hypothesis, that is the residual is
   zero ($H: \epsilon_{jt}=0$). The null hypothesis may be interpreted
   that the merger had no significant impact on the returns
   to the bidder or target firms.

7. After determination of which mergers were significant
   by the above analysis, the returns to rival firms were
   analyzed to test for indications of anticompetitive
   effects of the mergers. The equations used to analyze

the response of horizontal rivals of challenged mergers were provided by Brown and Warner (1985).[3] A procedure similar to the above is performed to analyze rival returns at the merger announcement and challenge. The residuals calculated in this step are used to test for anticompetitive and efficiency effects of horizontal mergers.

In calculating the test statistic, a series of windows of fixed sizes are shifted during the observation period. In this study the length of the observation period is allowed to vary with the size of the window.[4] For each day in the observation period an average and a variance of the cumulated errors (residuals) for all rivals in the portfolio is calculated and the overall results are combined to yield the t-statistic.

8. In this analysis, two sets of regressions are obtained for the challenge date. The first set of OLS regressions re-estimated. The second set of OLS regression deletes the observations falling within the announcement window in the estimation period establishing normal

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[3] Please note the differences in equations are corrections of typographical errors in the original article. The goal of these equations is the same as the previous equations in this chapter but are calculated differently.

[4] For example, the 31 day window has an estimation period of 75 days; when the window size is decreased to 21 days the estimation period increased to a length of 85 days.

expected returns for the challenge date. The equations are or the residuals were obtained as

(5) $\quad A_{jt} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$,

where:

R_{it} = the daily return of the rival's stock,

R_{mt} = the equally-weighted market portfolio,

A_{it} = the residual or difference between the expected and actual return, and $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the OLS market model parameters for each firm.

Equation (5) corresponds to equations (1) and (2). It gives a residual for each day in the estimation period, to be used in computing the variance, and a residual or abnormal return for each day in the window period. For example, the 31-day window has an estimation period of 75 days; when the window size is decreased to 21 days the estimation period increased to a length of 85 days.

9. Then, the average deviation $(\overline{A})$ across the firms for each day (t), is computed as

(6) $\quad \overline{A} = \dfrac{1}{N} \displaystyle\sum_{i=1}^{N_t} A_{it}$,

with corresponding variance,

(7) $\quad \hat{S}^2(\overline{A}_t) = \dfrac{1}{W_k + 95 - 1} \displaystyle\sum_{\tau=t-95}^{t-w_k} (\overline{A}_\tau - \overline{\overline{A}}_t)^2$,

where

(8) $\quad \overline{\overline{A}}_t = \dfrac{1}{W_k + 95} \displaystyle\sum_{\tau=t-95}^{t-w_k} \overline{A}_\tau$

for each window of length w_k days. The window lengths used in the examination of rival portfolios were 31, 21, 11, 3, and 1. These window lengths were used in Eckbo-Weir (1985). The use of windows of varying length stem from the uncertainty about the time the information presented by the event is imputed in the market. If a window is too short, there is the risk of losing information about the effects of the announcement. Conversely, if the window is too long, there is the possibility that the information on the effect of the event will be diluted by looking at superfluous data.

10. The final step is to compute the overall t-statistic, T, according to the following expression

$$(9) \quad T \doteq \frac{\displaystyle\sum_{\tau = \frac{1}{2} - \frac{1}{2}w_k}^{\frac{1}{2}w_k - \frac{1}{2}} \overline{A}_\tau}{\left[\displaystyle\sum_{\tau = \frac{1}{2} - \frac{1}{2}w_k}^{\frac{1}{2}w_k - \frac{1}{2}} \hat{S}^2(\overline{A}_\tau) \right]^{\frac{1}{2}}},$$

Testing for the Market Power Hypothesis

This hypothesis posits that a merger may signal the increased probability of an effective collusive scheme with both the merged firm and its horizontal rivals obtaining monopoly (monopsony) rents. The horizontal rivals will obtain these rents whether they are participants in the collusive scheme or free-rider beneficiaries. The stream of future rents is capitalized into the firm's stock value. Thus, assuming that an effective collusive scheme did not exist among these firms prior to the merger, at the time the merger becomes known in the

capital market, the rivals should exhibit positive abnormal returns. Assuming there is some chance it will be blocked, they will experience negative abnormal returns at the time a challenge by the antitrust enforcement agency becomes known.

However, consider the possibility of predatory behavior. The post merger firm might be expected to become a more effective predator because of increased size and diversification. As mentioned above, this scenario is not seriously considered by the revisionists. They reason that if the predator is willing to take the short-run losses incurred when driving out rivals, the assets will go to other firms entering the market (Scherer 1990). The differences turn on entry conditions. Predation may be entirely possible if high sunk costs in either plants or brand names make new entry into the market less rewarding. If predation is feasible, then abnormal positive returns will go to the merged firm, while negative returns to rivals at announcement.

Testing for the Efficiency Hypothesis

The efficiency hypothesis rests on the assumption of a competitively structured industry in which the merger takes place. Those adhering to the efficiency hypothesis argue that there are two types of efficient mergers. The productively efficient merger puts downward pressure on product prices and upward pressure on factor prices. As a result, horizontal rivals are expected to obtain negative abnormal returns at the time of the merger announcement and positive abnormal returns at the time of the challenge -- the same result as for predation.

The other efficiency hypothesis is information efficiency. There are two possible scenarios. First, if the efficiency information the merger reveals is in an area of technological advance that cannot exclude the rivals, and the technological advances are not dependent on an act of merger for the rival firms to take advantage of this information, then the pattern of rival returns and positive at the time of the announcement and zero at the time of the challenge. This pattern of signs is the same as the scenario of the merger occurring because resources held by the target (and rivals) are under-valued and the merger signals this information to the market. Second, if the efficient information involves an area of technological advance that necessitates the completion of a merger by rival firms, then the pattern of rival returns are non-negative at the time of the announcement and non-positive at the time of the challenge.

Combined Effects

Eckbo (1983) suggests that the collusion and efficiency hypotheses are not mutually exclusive. The changes in the rival's returns can represent the sum of the simultaneous effects of efficiency and collusion. He adds, "In principle, efficiency gains can outweigh collusive gains", so that positive abnormal returns at the time of announcement and negative abnormal returns at challenge is a necessary but not sufficient condition for accepting the collusion hypothesis.

Summary of Effects

The competing hypotheses concerning the effects of challenged horizontal mergers are briefly summarized in Table 1.

Table 1. Expected Signs of Returns for Rival Firms
as a Result of Horizontal Merger, Three
Economic Hypotheses

Hypothesis	Event	
	Announcement	Challenge
1. Market Power:		
a. Collusion	+	−
b. Predation	−	+
2. Economic Efficiency:		
a. Productivity	−	+
b. Information	+/0	0
3. Combined Effects		
Collusion/Efficiency	+/−	−/+

The goal of this research is to re-examine whether previous empirical findings on horizontal mergers challenged under Section 7 of the Clayton Act are valid by examining the sensitivity of results to changes in sampling or testing procedures. Stillman (1983) found that upon examining the one-day residuals of 18 merger events involving 11 challenged horizontal mergers, only 2 of these events exhibit abnormal returns consistent with market power hypothesis (1.a. in Table 1). Eckbo (1983) found that rival portfolios on announcement had an average of +2.45% abnormal return, which was three standard deviations from zero. Rival portfolios earned on challenge +1.78% above normal returns, which was only one

standard deviation from zero. Both of these returns relied upon a 31-day window. Thus, this study found that, on average, economic efficiency due to information (2.b.) was the rule.

Eckbo-Wier's (1985) subsequent article found similar results. Rivals earned significant positive returns on announcement and positive but less significant returns on challenge. This result was consistent for periods before and after the passage of the Hart-Scott-Rodino Act and for both SIC and agency-based rival portfolios.)

Sample of Horizontal Mergers

The challenged mergers and rivals for the Stillman study were provided by his unpublished dissertation. Eckbo's dissertation provided challenged mergers to 1978. A lengthier list of challenged horizontal mergers through 1980 was developed for Eckbo and Wier (1985).[5] The sample of challenged horizontal mergers was extended from 1980 to 1985 by the first author.

The mergers in this study came from the Trade Regulation Reporter (Department of Justice cases) and the Federal Trade Commission's FTC Decisions. Because the Center for Research in Security Prices (CRSP) daily stock returns data begin on July 2, 1962, only mergers announced after this date are under consideration. The first task in the data selection process was to

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[5] The rivals in the Eckbo-Wier study were obtained from Michael Williams, a Department of Justice staff economist. The DOJ had replicated the Eckbo-Wier study published in 1985, and had obtained the rivals from Eckbo.

select challenged Section 7 horizontal mergers in cases where the complaint stemmed from damage to actual competition, not potential competition nor incipiency. However, according to the Werden-Williams study, some of the challenged mergers in the Eckbo-Wier study did not conform to this criterion. The Stillman study excluded the horizontal mergers of industries which were "heavily regulated", such as banking or airlines.

The challenge date was provided by the same publication which listed the merger. All the authors stated that they used the Wall Street Journal to find the announcement date. If that method was unavailable for the additional 1980-1985 observations we developed, we used the date of the completion of the acquisition.

For this study, a stringent filter was employed in order to ensure that the events in each merger were truly significant. The merger was dropped from the sample if both the bidder and the target were not listed on the CRSP tape. Regressions were performed on the firms using a 31-day and a 3-day window surrounding the merger announcement and challenge. The merger remained in the sample if there was a statistically significant abnormal return at a 90% confidence level for either firm in the window surrounding both event dates.[6]

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[6] Stillman used a similar filter without requiring both firms to be on the tape by demonstrating investors' reaction to the merger events for one of the merging firms and used the collusion hypothesis to test whether the firm's abnormal return was consistent with the hypothesis on that event date.

Following this method a final sample of 22 mergers remain (see Appendix table). Of the 22 mergers, 16 mergers had significant abnormal returns for either or both firms on the announcement and challenge dates using a 3- and 31-day window. The remaining five firms had significant abnormal returns for both event dates for the target firm while the bidder firm did not have abnormal returns.

Selection of Horizontal Merger Rivals

A rival portfolio was obtained for all the mergers with at least one significant t-statistic for both event dates. The rivals for the mergers in the Stillman study were published in both the 1983 article and his dissertation. The Stillman rivals were all firms which were specified in agency publications or documents obtained via the Freedom of Information Act (FOIA). The rivals in the larger Eckbo-Wier (1985) sample were kindly provided by researchers at the U.S. Department of Justice. The rivals for the Eckbo-Wier study consisted of both SIC code rivals and agency rivals. For the portion of later mergers (1980-1985) in the study, the sample of rivals was obtained by examining court dockets and through FOIA requests from the antitrust agencies. When possible, for each merger, researchers, industry experts, government analysts, and the merged firms themselves were contacted and aided in the identification of rival firms. This resulted in a small yet accurate rival portfolio, possibly more accurate than previous studies. In some cases the affected rival firms were not included in the rival portfolio because these firms were not listed on either

the New York or American Stock Exchanges. As an example, Dr. Jim MacDonald of the Economic Research Service of U.S. Department of Agriculture was contacted regarding rivals on the ConAgra and Peavey merger. The major rivals of interest in the flour milling industry were Cargill, Bunge, and Hubbard Milling. All are privately and hence unavailable for examination. Some additional mergers which a major relevant rivals that were privately owned or foreign owned were Great Lakes Chemical and Northwest Industries for which the rival was Dead Sea Chemical, an Israeli firm.

Every effort was made to assure a relevant rival portfolio. Geographic boundaries of the relevant market were taken into consideration. Eckbo's rivals were pared down when necessary in order to conform to this criterion. For example, the Atlantic Richfield/Sinclair merger had a geographic market boundary for branded gasoline in the "Northeast, Rocky Mountain, Southeast and Central State markets". Eckbo-Wier found 31 rivals, consisting of 5 agency and 25 SIC rivals. After checking to make sure the rivals were in the relevant geographic and product market there remained 16 rivals in the branded gasoline market in these regions.[7]

Traditionally, horizontal merger rivals are obtained by one of two methods. Stillman used the agency rival method in which Freedom of Information Act requests are made to the agency which

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[7] Two of the rivals, Union Oil of California, now Unocal, and Tetra Tech could not be extracted form the CRSP tape leaving 14 rivals in the portfolio.

challenged the merger. The alternate method uses the Standard Industrial Classification (SIC) code for a company's principle business, which is available on the CRSP tape. The inherent difficulty in the second method involves the general nature of the four-digit level SIC code available on the CRSP tape and the specific and narrow nature of the merger-affected market.

As an example of this difficulty, consider the Allied-Signal Companies merger. The affected market for this merger was air turbine starters used for large commercial aircraft, which is a small part of the ignition/starter systems market. Not all firms that make aircraft starter systems make air turbines. Another SIC code problem is illustrated by the White Consolidated-White Motor merger. Eckbo used the SIC code of the target firm as the relevant market. White Motor's SIC code is 3711 yet the relevant market was SIC 3523, which is heavy farm equipment. As a result the entire rival portfolio was incorrect.

So in summary, there can be several problems in using the SIC code method in selecting rival firms. The relevant market can be quite narrow so that the SIC code on the tape does not assure that every firm targeted actually produces in that narrow market. This is often the case when conglomerate or very diversified firms are in the portfolio. Another problem occurs when an improper convention is used to obtain the SIC code for the merger. Therefore, in this analysis, rivals were obtained from a variety of sources with the expectation of an accurate

portfolio which would reveal anticompetitive or efficiency effects of merger (see Hopkins (1987:Table 4.1)).

Stratification of Rival Portfolios

All previous authors treated merger rivals homogeneously. Some economists would argue that the effects of a collusive or efficient merger on rivals, is asymmetric depending on the size or status of the rival firm in the market. A firm that is one of the dominant core may be affected differently by a collusive merger than would a competitive fringe firm. A smaller fringe firm may accrue greater benefits from a collusive scheme than a dominant core firm. Also a highly diversified, conglomerate firm may be affected differently than a firm producing a single product line in the merger-affected market. One obvious stratifier would be market share. Other classification schemes included diversification strategy (i.e., Rumelt 1978) and firm size.

One classification strategy was made available through information on the percentages of the rival firm's shipments in the relevant market. This is not market share data and thus does not reflect firm size. It reflects the degree of specialization of the rival firm in the relevant market. This information was provided by the DOJ with the rivals of the Eckbo-Wier study. The DOJ believed this information came from the Department of the Census in the form of a tape which had the top 20 firms and their shipment data within a four-digit SIC code. Because this information was not available for all firms, it was decided that the wealth gain for each firm would be

calculated for the 31-day window surrounding each event and a contingency table would be generated utilizing percent shipments for these firms. The wealth gain for a firm is the abnormal return, or residual, multiplied by the price and the number of outstanding shares. This daily wealth gain is then cumulated over the 31-day window.

A contingency table depicts the measure of association between two variables or to what extent the level of wealth gain occurs with the level of percent shipments in the relevant market. The $\chi2$ test of statistical significance is an appropriate measure. The firms were divided into three roughly equal-sized categories based on shipments in the relevant market: 8-20%, 21-50%, and 50-100%. The following table, Table 2, contains the names of rivals in the strata.

<div align="center">Empirical Results</div>

Results of Rival Portfolios of Challenged Horizontal Mergers

Of the 44 events involving 22 challenged horizontal mergers, 22 events exhibited significant abnormal returns in at least one of the five windows surrounding the event date at the 95% level of statistical significance. The pattern of returns for each hypothesis and the mergers conforming to the patterns are listed in Table 3.

Put another way, looking at each event separately, there is a preponderance (50%) of insignificant (from zero) results. Of the 22 announcement events, 10 were insignificant, 7 were

Table 2. Rival Firms Stratified by Percent Shipments in the Relevant Industry

Strata[1]	Rivals	
8-20%	Panasote, Inc. Reynolds Metals, Inc. General Electric Company Allis Chalmers Chevron Corporation United States Tobacco Company	Kaiser Aluminum and Chemical Corporation Ingersoll Rand Company Studebaker Worthington, Inc. Westinghouse Electric Corporation Mobil Oil Square D Technology
21-50%	Reichhold Chemicals Joy Manufacturing Amoco Corporation Gulf Corporation Emerson Electric Company Shell Oil Company American Brands, Inc.	Chicago Pneumatic Tool General Electric Company Exxon Corporation Phillips Petroleum Company Ashland Oil Company Amoco
51-100%	Baker International Corporation Sunbeam Corporation Hughes Tool Company Gearhart Industries, Inc. Sun, Inc. Electronics Corporation Amer.	Marathon Oil Company Rohm & Haas Company Sohio Smith International, Inc. Universal Cigar Corporation

[1] Percent of company total sales in the four-digit SIC industry in which the horizontal merger occurred.

Source: Author 1986 (Department of Justice).

positive and 5 were negative. Of the 22 merger challenges, 12 were insignificant, 7 were positive and 3 were negative. It is important to note that the results for the one day window, which was used by Stillman, was significant for only two of his 44 merger events.[8]

Analysis Utilizing Received Hypotheses

Examining the sign of the abnormal returns the mergers were categorized by economic hypotheses. Of the 16 mergers which had at least one significant event, 11 did not fit any of the hypotheses posited by the efficient markets position. Of these eleven, four had no abnormal returns, either at the announcement or challenge date. This can be seen as fitting the information efficiency hypothesis or being inconclusive.

The United Technologies and Babcock & Wilcox merger fit the collusion hypothesis of positive abnormal returns at the time of the announcement and negative abnormal returns at the time of the challenge. This is also consistent with the hypothesis that there are combined effects of collusion/efficiency. The American Maize and Bayuk Cigar merger fit the productive efficiency hypothesis of negative abnormal returns at announcement and positive abnormal returns at challenge, but this pattern is consistent with a predatory scenario.

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[8] These two events were the announcement and challenge dates for the Alcan Aluminum and Revere Copper and Brass. The announcement exhibited positive significance over all 5 windows. The challenge exhibited positive significance over 3 windows.

Table 3. Mergers Grouped by Patterns of Signs on Returns to Rivals Mergers.

Mergers	Rival Return		Hypothesis Supported
	Announcement	Challenge	
United Technologies/ Babcock & Wilcox	+	−	Market Power (Collusion)
American Maize/Bayuk Cigars	−	+	Productive Efficiency
DuPont/Conoco	+	0	Information Efficiency/ Market Power[1]
LTV/Republic Steel*			
Texaco/Getty*			
Wheelabrator-Frye/Pullman			
Allied Chemical/General Foam	0	0	Information Efficiency/ Inconclusive
ConAgra/Peavey*			
Eversharp/Schick			
Exxon/Reliance Electric			
Cooper/Westinghouse*			
Atlantic Richfield/Sinclair	−	0	None/ Efficiency
Allied/King Radio*			
Warner Lambert/Parke-Davis			

Mergers	Rival Return		Hypothesis Supported
	Announcement	Challenge	
Chemetron/Harnischfeger	0	+	None/ Efficiency
Cooper/Gardner-Denver			
Allied/Signal*			
White Consolidated/White Motor			
Great Lakes Chemical/ Northwest Industries	0	-	None/ Market Power
Alcan Aluminum/ Revere Copper & Brass	+	+	None
Tenneco/Monroe Auto Equipment			
Gifford-Hill/Interpace*	-	-	None

[1] Upper hypothesis suggested by Eckbo and lower hypothesis the author's interpretation of theory. See Table 1 above.

* Post-1981 merger.

The pattern of abnormal returns which characterize the hypothesis of efficiency/information is positive or zero abnormal returns at the time of announcement and zero returns at the time of the challenge. This is indicative of the merger as a signal of undervalued resources in the target firm which may or may not extend to the merger rivals. Four mergers fell in this category. One of these, the Texaco and Getty merger is a special case because the assumptions of the model require that no other merger is occurring in the industry and in the same year the Chevron and Gulf merger was attempted and challenged.

There were five mergers which had no significant returns or a zero sign at both the announcement and at the challenge. This pattern can be interpreted as an information-efficiency effect or as inconclusive.

Two mergers had abnormal positive returns at both the announcement and the challenge and one merger had negative returns for both events, patterns that fit no hypothesis. Five mergers had no abnormal returns on announcement and significant returns at the time of the challenge. Four of the mergers had positive significant returns at the challenge. Again, no hypothesis is verified in these cases.

By the revisionist framework these returns can seem inconclusive. If the pattern of returns are given new interpretations or the assumption of no collusion is relaxed, it is possible to have alternative hypotheses.

Interpretation of Inconclusive Patterns of Rival Returns

One of the patterns of returns, one of positive returns on announcement and zero returns on the challenge corresponds to the information efficiency hypothesis but could be construed, *ad hoc*, as collusive because there is historical evidence of collusion in these industries or structural conditions would permit it. The DuPont and Conoco merger with its relevant market of acrylic fibers; LTV and Republic Steel merger with the hot and cold rolled, sheet and stainless steel; and Texaco and Getty merger with the relevant market of refined light products and the transport of those products are all in industries with high sunk costs and thus considerable barriers to entry. The Wheelabrator-Frye and Pullman merger's relevant market is electric arc furnaces and tall industrial chimneys. Research revealed that this is a competitive bid industry, in which profits for all firms would tend to increase when the number of bidders is reduced.

However, a number of the mergers remain that do not correspond to any of the accepted theories. Eleven of the mergers in this sample had inconclusive patterns of returns for rivals for the events examined. In an effort to understand these results the following *post hoc* hypotheses are presented. The pattern of negative returns on announcement and zero returns on challenge was exhibited by three mergers -- Atlantic Richfield and Sinclair, Allied and King Radio, and Warner Lambert and Park-Davis. Of these, two of the bidder firms had negative returns on announcement -- Atlantic Richfield and Warner Lambert. This

may be seen as evidence of market inefficiency. The stock prices are adjusting to new information or beliefs about the state of health of the industry. An additional explanation may be that insignificant returns at the time of the announcement may reflect an expectation at that time in the capital markets that the merger will be challenged.

Alternative Hypotheses

If the assumption that the merging firms operate in a competitive industry is dropped, then the market power hypothesis may allow the merged firm to act as a monopolist in the long-run if the industry has a high degree of differentiation. Of the three mergers in the negative/zero pattern, two relate to highly differentiated products. Warner Lambert and Park-Davis deal with over-the-counter and prescription drugs, and Allied and King Radio deal in weather radar for commercial aircraft. The Atlantic Richfield and Sinclair merger was in the branded retail gasoline market, which may be seen as differentiated. This negative/zero pattern could also occur under a productive efficiency hypothesis where the challenge was anticipated. This is believed to be the more likely of the two scenarios.

If the merger is productively efficient but occurs in a collusive environment, then the pattern of abnormal returns could be zero at the time of announcement. Rivals may not perceive the threat of the efficient merger. Then, returns could be positive at the time of the challenge because the danger of the productive efficient merger could be realized by the rivals and is relieved by the challenge. This could also be the

pattern where the window was unable to detect abnormal returns due to advance information leakage. If the merger occurs in a homogeneous product market then there is a possible benefit from the announcement because there is a reduced chance of predatory behavior. The assumption is homogeneous product markets might incur greater losses from predatory behavior because there is little differentiation or product loyalty for these firms. The challenge would not have a perceived effect on the rivals.

An Evaluation of Event Studies

Information Assumption Problems

Some problems are shared by this study and previous studies. One problem involves the validity of the information assumption. The model assumes that the information about the merger and its effects are efficiently and completely distributed to the market. When utilizing event studies to make policy implications about the efficacy of antitrust enforcement, it is important to note that antitrust enforcement agencies may have some information about the competitive and efficiency effects not available to investors in the capital market. This is especially true in the case of the mergers' effects on rivals.

An additional consideration of the information hypothesis is that the information about the merger must be new and unanticipated. Werden and Williams (1986) suggest that merger events are oftentimes anticipated. This is based on their observation that the parties who are interested in the merger spend considerable resources to find out about the course of the investigation.

The fact that much information is anticipated has implications for the preponderance of inconclusive results. The effects on the price of a firms' stock in response to a merger may not reflect the merger's effect on profits. Some of the revenues garnered by collusion are diverted to rent-seeking -- the costs of holding together the collusive scheme. One reply that has been made on the theoretical level is that the effects of the efficient merger may be ambiguous on stock prices because the efficiency may not have an impact on market price since savings in fixed or variable costs may be inframarginal and not be reflected in the stock's price (Werden and Williams 1986). Inconclusive results may occur because the majority of challenged horizontal mergers are not mergers tending toward monopoly, but are mergers which result in "only moderate increases in market concentration" (Werden and Williams 1986). Horizontal merger policy may have a component of self-enforcement because merger attempts are not costless and mergers that are undoubtably anticompetitive are never put forth.

Rival Selection Problems

The problems involved in rival selection have been discussed with respect to the Eckbo-Wier study in Chapter Four. Many of the relevant rivals are too small to be actively traded on either of the exchanges or are privately-owned. Large publicly traded rivals may be highly diversified and the response of the firm's stock may be to an event other than the merger in question. The possibility of other events which occur in the estimation period may also further obscure the firms' reaction

to the merger. An additional problem is the possibility of asymmetric effects on the rivals to the merger events. It is to this end that the stratification of rivals was attempted.

Stratification and Results

The stratification of rival firms is desirable because a merger having a motivation of market power (collusion) may have differential effects on the rivals depending on the firm's size or degree of participation in the market. Therefore, a χ^2 test of statistical significance was performed to measure the observed joint distribution of the cases that would have occurred when no association of the variables occur in the population. The percentage of rival firm shipments in relevant SIC code data was available for 34 of the rival firms in this study. For all rivals, the firm's wealth gain (WG) for the 31-day period surrounding the event date was computed with the following equation:

$$(10) \quad WG = (A_{it})(P_{it})(S_{it}),$$

where:

A_{it} = residual or daily abnormal return,

P_{it} = daily share price for firm i, and

S_{it} = number of outstanding shares for firm i.

The wealth gains for the 31 days surrounding the event were stratified in three roughly equal groups in order to construct a contingency table. The contingency table provided a measure of association between the variables, percent shipments in the

market and the wealth gain around the event, as indicated by a χ^2 distribution.

A further variable was added to determine whether the statistical analysis the merger, based on the returns to the rival portfolio was significant. The hypotheses were put in three broad groups, in order of decreasing evidence of collusion; market power, inconclusive, and efficient.

The goal of the stratification of the merger rivals and the contingency table analysis of the wealth gain surrounding the event and the percent shipments in the relevant market was to determine if there is a connection between the level of partici-pation in the market and the wealth gain for the firm at the time surrounding the event. When the percent shipments in the relevant industry were compared with the wealth gain in the period surrounding the merger announcement, the contingency table had a confidence level of 91.6% based on a χ^2 distribution. There was a tendency for firms with a small commitment to the market to have small wealth gains. Firms with medium-level commitment had a lesser tendency to have smaller wealth gains and a greater tendency to be associated with larger wealth gains. Firms highly specialized had a low tendency to exhibit high wealth gains. Thus seven of the twelve medium percent shipments firms had high wealth gains at announcement while only two of the twelve had low wealth gains, and one of the ten high shipments had high wealth gains. This indicates that there is not a linear relationship between percent shipments in the relevant industry and wealth gain at announcement. Wealth gains

on announcement which is the abnormal return multiplied by the price and number of shares outstanding, tend to be larger for larger firms which may be due to the number of shares outstanding which is greater for larger firms.

When the same comparison was made with wealth gains for the firm over the merger challenge period, the χ^2 was in the 97.4% confidence level. The same tendency was found in the analysis of wealth gain at the challenge with the percent shipments as was found in the analysis of wealth gain at announcement. Firms with small percent shipments exhibited a greater propensity to wealth gains. Firms with mid-level percent shipments had less than-expected mid-level wealth gains and more high wealth gains. The firms with high percent shipments had more mid and high level wealth gains.

When comparing the firm's wealth gain at the time of the announcement and the category the merger fell into based on the results of the pattern and sign of rival returns, the χ^2 was found to be significant at a 98.5% confidence level. The firms which fit the collusive hypothesis had a less than expected level of small wealth gains and greater than expected levels of higher wealth gains. The efficiency hypothesis firms had no significant differences in all predicted categories. The inconclusive merger firms had greater small wealth gains and higher levels of mid-level wealth gains. This can be summed up by the finding that the level of wealth gain increases as the evidence of collusion increases. This is true for wealth gain at both event dates.

The comparison of the wealth gain at the time of the challenge and the merger hypothesis had a 0.2% significance level. Firms fitting the collusive hypothesis had no observations in the smallest wealth gain category and a higher than expected level of high wealth gains. There was a greater tendency for the efficiency hypothesis firms to have mid-level and high level of wealth gains. The inconclusive firms had no observations in the high wealth gain group.

Conclusions

On the basis of the 44 merger events (22 mergers) examined in this study, a variety of rival market return patterns emerge. In many challenged horizontal merger cases, the strategy behind the merger is obscure. The reactions of the rival's returns may be in response to many events unrelated to the merger event.

In any case, the event-study methodology is not without flaws. It may be that changes in the systematic risk were significant and uncorrected. These changes may be related to the tendency of mergers to coincide with increases in the indicators of economic expansion and may reflect a financial environment conducive to merger. Moreover, no attempt was made to discern between scale economies and other rationales in the efficiency argument.

Using the received hypotheses, there were trends in the data that suggested market power in only 1 of the 22 mergers in the sample. This was the pattern of positive abnormal returns at the announcement and negative abnormal returns at the challenge.

The efficiency hypothesis appeared to be acceptable in 5 of the 22 mergers, with patterns of returns at announcement and challenge of negative/positive and zero/positive. The remaining 16 mergers had inconclusive patterns of signs using the received hypotheses.

Using our alternative hypotheses, the data suggest market power in six of the 22 mergers in the sample. These mergers had the pattern of signs at the announcement and the challenge of positive/negative, zero/positive and zero/negative. The efficiency hypothesis was evidenced in eight of these mergers with the pattern of signs: negative/positive, negative/zero and zero/positive. The remaining seven mergers had inconclusive patterns of signs of rival returns.

Examining the eight mergers that were challenged after the implementation of the 1982 Merger Guidelines, it was found that two of the eight corresponded to the information efficiency hypothesis posited by Eckbo-Wier (1985), and the market power hypothesis with the market's expectation of the challenge posited by the author. Two mergers had zero, or no abnormal returns for rivals at both events dates. The remaining four mergers had various patterns of rival returns that were inconclusive using the received hypotheses.

The main merger rationales examined in this study are market power and economic efficiency. Other rationales exist that cannot be analyzed with event studies.

The Market Model

The model used in this study was the Market Model, a variant of the Capital Asset Pricing Model both of which employ five major assumptions. The assumption of efficiency in capital markets has been questioned by many authors and some results of this study can support these questions.

The assumption of market reaction to all information has critics inside and outside of event-study methodology. The assumption of the stationarity of systematic-risk or beta stationarity in event-study methodology was examined by Kupiec and Mathios. These authors found, using data from Stillman (1983), that the systematic risk of the rival firms decrease after the events which increase the probability of the merger (announcement) and increase after the events which decrease the probability of merger (challenge). Thus, the stationarity assumption is probably incorrect for merger analysis.

The assumption of no other mergers occurring in the industry is a real problem. One of the mergers in the original sample of this study Texaco and Getty was undertaken at a time when another challenged and highly visible merger between Chevron and Gulf was being played out in board rooms and the media. There were also prior bids for the target, which may affect the returns. This was also true in three cases in the samples of prior researchers. Information leaks about other mergers in the industry, even if "unannounced", seriously hamper event studies.

Sample Selection

Authors of similar event studies differ in the selection of the portfolio of rivals. No standard or even replicable selection criterion has been developed. Thus, the critical decision of the identify of rivals in the market is highly judgmental. Non-listed rivals must be omitted, both domestic and international. All rivals are treated as homogeneous, whereas, in fact, they differ in size and relation to the market.

An analysis of the stratification of the rivals in our sample on the basis of specialization in the market compared with wealth gain for the firm in the 31-day period surrounding the announcement or challenge date, showed that the two variables were not independent. Thus, event analyses of mergers that treat all rivals the same are faulted. Rivals differ by degree of specialization and probably other features as well.

Policy Analysis

When using the received hypotheses to analyze this sample, certain mergers in the sample may be seen as exhibiting evidence of collusion (4.5%), some mergers exhibit evidence of efficiency (22.7%), and the remaining mergers appear inconclusive (72.7%). When using the author's hypotheses, market power may be detected in 27.3% of the mergers, efficiency in 36.4%, and the remaining mergers (36.4%) are inconclusive. These results have implications for policy towards challenged horizontal mergers. Previous researchers have accepted that the market for corporations is inherently efficient, denounced restrictions on mergers as inefficient, and called for changes in merger policy. These

policy suggestions are at best premature. The event-study methodology is fraught with problems. These problems include unrealistically strict assumptions of the model, questionable results of event studies, and rival-portfolio selection difficulties. Major improvements in the event-study method is needed before any changes in merger policy can be contemplated.
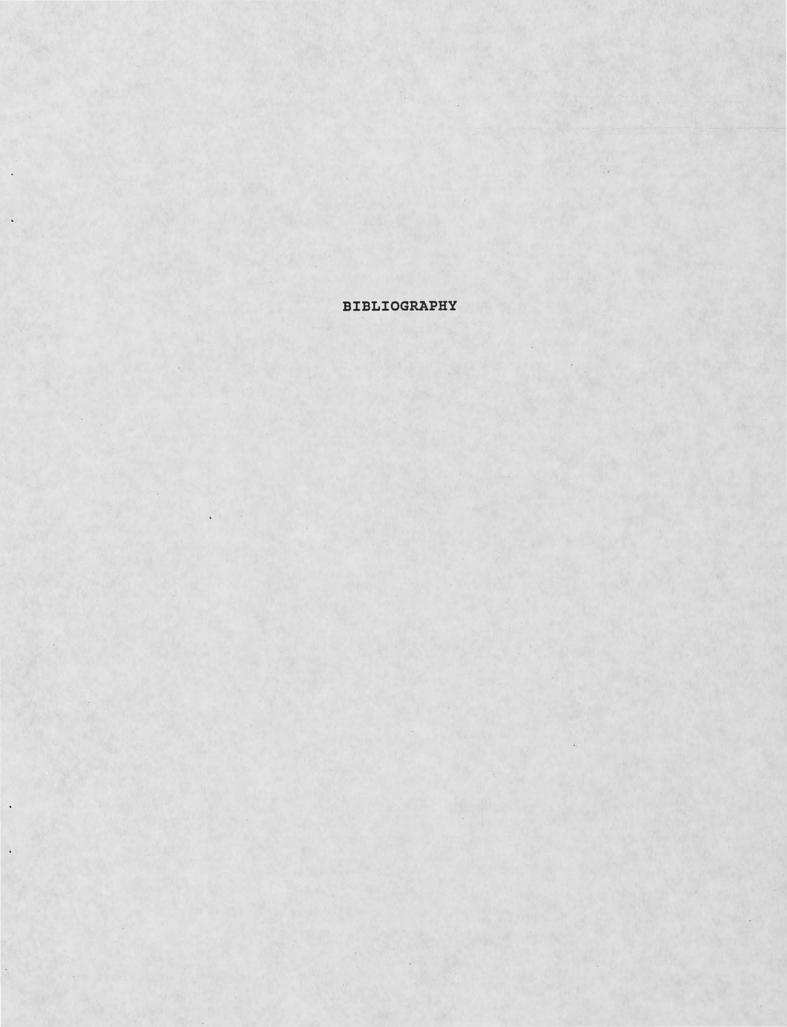
Limitations of the Study

The sample of challenged mergers used in this study consists of legally borderline cases. U.S. managers are well aware of merger law; most would probably not attempt mergers which would be considered grossly anticompetitive. The result is that the mergers challenged since 1960 are not likely to present overwhelming evidence of market power.

By limiting the rival portfolio to CRSP tape firms on the American or New York Stock Exchanges, the results of event studies are automatically biased toward large firms. It would be better to look at the stock price effects on the smaller firms in the over-the-counter market because the collusion and efficiency hypotheses should have clearer effects on smaller firms. A further problem exists with regard to stratifying the rival firms. Market share data would be optimal yet it is difficult to obtain. A second option would be to categorize firms by size. Using employment data for firms on a sector or plant basis is a future stratification scheme when the data base with that information is made available.

The announcement date used for the merger may not be the best period to examine abnormal returns. It is thought that

perhaps the firm's strategic choice to merge may have greater impact on the market than the choice of a particular target firm. Another consideration is the common practice of the anti-trust enforcement agency issuing a consent decree at the same time as the challenge. This practice limits the applicability of event studies because it converts an event to a non-event.

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Appendix Table.Mergers, Relevant Markets, and Rival Portfolios.

Merged Firms (market)	Rival Firms		
	Name	Principal SIC	Sources[1]
Allied Chemical General Foam (urethane foam)	Panasote, Inc. Reichhold Chemicals, Inc. Rohm & Haas	2821 2821 2821	E1 E1 E1
Alcan Aluminum Revere Copper (aluminum)	Aluminum Co. America Kaiser Aluminum Reynolds Aluminum	3353 3334 3353	E1, E2 E1, E2 E1, E2
Cooper Gardner-Denver (gas compressors, air tools)	Baker International Binks Mfg. Chicago Pneumatic Tool Copeland Corporation Gearhart Hughes Tool Ingersoll Rand Joy Mfg. McDermott Milton Roy Smith International Studebaker Worthington	3533 3561 3563 3563 3533 3533 3563 3532 3533 3561 3533 3563	E1 E1 E2 E2 E1 E1 E1, E2 E1, E2 E1 E1 E1 E2
United Technologies Babcock & Wilcox (utility power equipment)	Allis Chalmers Combustion Engineering Cooper Industries Foster Wheeler General Electric Riley Company Westinghouse	3511 3511 3511 3511 3511 3511 3511	E1 E1 E1 E1 E1 E1 E1
Gifford-Hill Interpace (large diameter pressure pipe)	Ameron Jim Walter	3272 2661	H13 H13
Atlantic Richfield Sinclair (branded retail gasoline)	Amoco Ashland Oil Chevron Conoco Exxon Gulf Husky Marathon Mobil Phillips Shell Oil Sohio Sun	2911 2911 2911 2911 2911 2911 2911 2911 2911 2911 2911 2911 2911	E2 E1 E1 E2 E2 E1 E1 E1 E1 E1 E2 E1 E1
Chemetron Harnischfeger (welding apparatus)	Airco Hobart Newcor, Inc. Union Carbide	2813 3551 3623 2819	H7 H7 E1 H7
Eversharp Schick (shaving equipment)	General Electric Gillette Sunbeam Corporation	3634 3421 3634	E1 H2 E1

Merged Firms (market)	Rival Firms		
	Name	Principal SIC	Sources[1]
Exxon Reliance Electric (motor speed regulators)	Electronics America Emerson Electric Square D Company Vishay Intertech	3622 3621 3622 3622	E1 E1 E1 E1
Tenneco Monroe Auto Equipment (replacement shocks)	Arvin Maremont Questor	3714 3714 3714	E2 E2 E2
DuPont Conoco (acrylic fibers)	Akzona Allied Corporation American Cyanamid Imperial Chemical Sohio	2823 2812 2833 2824 2911	H2 H2 H2 E1 H2
Warner-Lambert Parke-Davis (ethical drugs)	Abbott Labs American Cyanamid American Home Products Baxter Travenol Carter Wallace Chesebrough Ponds Cutter Labs Dart Industries Forrest Labs ICN Pharmaceuticals Inolex Marion Labs Miles Labs Morton Shoe Companies Pfizer Richardson Merrill Robins A H Inc. Rorer Group Schering Plough Searle Smith Kline Beckman Squibb Sterling Drug Syntex Upjohn	2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834 2834	E1 E2 E2 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E1 E2
Wheelabrator-Frye Pullman (tall chimneys, arc furnaces)	Heinicke Inst. Raymond International, Inc.	3811 1629	H15 E1
White Consolidated White Motor (farm machinery)	Allis Chalmers Deere & Co. International Harvester Massey Ferguson	3511 3523 3523 3523	H5 H5 H5 H5
American Maize Bayuk Cigars (cigars)	Culbro American Brands Loews U.S. Tobacco Universal Cigar	2121 2111 2111 2121 2121	E1, E2 E2 H2 E2 E1, E2

Merged Firms (market)	Rival Firms		
	Name	Principal SIC	Sources[1]
LTV Republic Steel (rolled, sheet, stainless steel)	Bethlehem Steel Inland Steel Interlake, Inc. U.S. Steel Wheeling Pittsburgh	3312 3312 3312 3312 3312	H2 H2 H2 H2 H2
Allied King Radio (weather radio for aircraft)	Rockwell Sperry	3714 3574	H8 H8
Allied Signal Companies (air turbine starters)	Plessy Plc S L Industries Smith International Sundstand Corporation Talley Industries Transtechnology United Technologies	3662 3579 3533 3541 3873 3483 3724	H9, H11 H9, H11 H9, H11 H2 H9, H11 H9, H11 H2
Texaco Getty (refined light petroleum products & transport)	Amoco Chevron Exxon Gulf Oil Mobil Oil Phillips Sohio	2911 2911 2911 2911 2911 2911 2911	H2 H10 H10 H10 H2 H2 H2
ConAgra Peavey (hard wheat & bakery flour milling)	Carnation Company General Mills, Inc. International Multifoods Nabisco Brands Pillsbury	2031 2043 2052 2052 2045	H3 H3 H3 H3 H3
Great Lakes Chemicals Northwest Industries (bromine, Br-flame retardants)	Dow Chemical Ethyl Corporation	2812 2899	H12 H12
Cooper Westinghouse (aviation lighting equipment)	E G & G General Electric Harvey Hubbell TRW, Inc.	8911 3634 3643 3714	H6 H6 H6 H6

[1] Key for sources:

E =   Eckbo (1983).
H =   Hopkins (1987).
  1 = SIC rival
  2 = Agency rival (FTC or DOJ)
  5 = Mr. W. Van Beek, Department of Agricultural Economics, Purdue University
  6 = FAA publication
  7 = M. Bruce, NDR Oxygen, Lafayette, IN
  8 = Dr. Irwin Treager, Department of Aviation Technology, Purdue University
  9 = Dr. Jack Marchand, Department of Aviation Technology, Purdue University
 10 = Oil & Gas Journal Data Book, 1985
 11 = Aviation Week and Space Technology, 1986 International Directory, 123(26)
 12 = Mr. Don Bouchard, Great Lakes Chemical, company representative
 13 = Gifford-Hill, company representative
 14 = Dr. Jim MacDonald, USDA-ERS
 15 = Thomas' Register

PRIVATE STRATEGIES, PUBLIC POLICIES & FOOD SYSTEM PERFORMANCE

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