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Mergers have over the course of the last century transformed the corporate landscape. A look at the 100 largest corporations in the United States reveals a mere handful for which mergers did not figure substantially in their growth at one time or another. Exxon and United States Steel were born in the great merger wave of the turn of the century, General Motors in the wave of the twenties, ITT, Textron and Occidental Petroleum are products of recent merger history. The process of transformation through merger continues unabated through today.

Despite the venerability of this process and its profound influence, surprisingly little direct empirical evidence exists about the effects of mergers on the internal economic efficiency of the merging firms or on market power. Much of the evidence we do have is of the effects of mergers on profitability, but profits might rise following a merger either because of an increase in market power or an improvement in efficiency. Moreover, mergers often result in reevaluations of asset values and profit figures, making before and after comparisons difficult. Partly for this reason, most recent empirical investigations of the effects of mergers have examined their impact on the returns on common shares, which in turn are dominated by stock price movements. But these studies suffer form the same ambiguity as the profit rate evidence, in that one cannot know whether a stock price change at the time of a merger reflects an anticipated change in efficiency or market power. With respect to acquired firms, where most of the increases in stock prices occur, there is the added ambiguity introduced by the necessity of paying a premium for the shares of the acquired firm for there to be any acquisition at all.

Even if one could infer unambiguously from an increase in profits or stock prices following a merger that, say, internal efficiency had improved, it is difficult to infer

from the existing literature what the effects of mergers have been, since no consensus exists over whether mergers have on average resulted in increased profits and asset values.[1] A new look at the effects of mergers, employing a new methodology seems in order.

This paper presents such a new approach. It examines the effects of mergers on market shares. The following section analyses the relationship between changes in internal efficiency or market power and market shares. Section II describes the data and empirical tests. The results follow in Section III and conclusions in the final section.

I. The Effects of Changes in Efficiency and Market Power on Market Shares.

A. Conglomerate Mergers

The number of hypotheses about the causes and effects of conglomerate mergers has grown so much over the years that even a mere listing of all candidates would take inordinate space.[2] Considerable time can be saved by grouping existing theories into those implying changes in internal efficiency and those implying changes in markte power. We shall assume that any improvement in efficiency eventually translates into lower costs of production. We shall depict changes in market power as changes in the degree of cooperation or collusion among the firms in an industry. Although changes in the degree of cooperation seem more likely to follow horizontal mergers, John Scott (1982) has recently presented evidence suggesting that conglomerate mergers can lead to enhanced collusion, when the acquiring company and several of the incumbent companies have contact with one another in several industries. Moreover, claims that a given conglomerate acquisition would have a "chilling" effect or an exhilerating effect on the degree of cooperation in an industry have often appeared in the case literature. Thus, allowing for possible anticompetitive

effects from conglomerate as well as horizontal mergers seems warranted.

Given that we seek to examine the long run effects of mergers, a third, possible consequence must be considered. Its acquisition may change the actual or perceived characteristics of a firm's products. One of the leading hypotheses concerning conglomerate mergers sees them as improving the flow of capital by giving acquired firms access to more efficient internal capital markets (Weston, 1970; Williamson, 1970). The "deep pocket" doctrine, first put foreward in Proctor and Gamble's acquisition of Clorox, also envisages greater expenditures, in this case for advertising, as a result of the acquired firm's having access to the greater resources of its acquirer. Should greater R and D or advertising follow a merger, changes in actual or perceived product characteristics are likely.

We thus need a model of the effects of mergers that allows for (1) changes in costs, (2) changes in product characteristics, and (3) changes in the degree of cooperation in the industry, and which is sufficiently tractable to relate changes in each parameter to market shares. With these goals in mind, we assume that the acquired firm operates in a monopolistically competitive industry in which each firm $\underline{i}$ faces a linear demand schedule of the following form

$$p_i = a_i - bx_i - sb \sum_{j \neq i}^{n} x_j$$

where p_i and x_i are price and quantity, respectively. All demand schedules have the same slope but can differ in their intercepts. These parameters, a_i, capture the perceived quality characteristics of the products. A higher a_i implies a greater willingness by each consumer to pay for each unit of the product. The parameter $\underline{s}$ measures the degree of substitutability among the products in the industry, $0 \leq s \leq 1$. If $s = 1$, the products are perfect substitutes, an increase in any firm's output has the same impact on i's price. If $s = 0$, each firm is effectively a monopolist. Marginal costs are allowed to

differ across firms, and again for analytic convenience we assume a linear total cost function, $TC_i = c_i x_i$.

The degree of cooperation or collusion in an industry can be modeled in several different ways[3]. We account for it by assuming that each firm $\underline{i}$ maximizes an objective function that includes its profits and a weighted sum of the profits of all other firms in the industry.

$$O_i = \Pi_i + \Theta \sum_{j \neq i}^{n} \Pi_j = x_i(a_i - bx_i - sb \sum_{j \neq i} x_j) - c_i x_i$$

$$+ \Theta \sum_{j \neq i} \left[x_j(a_j - bx_j - sb \sum_{k \neq j} x_k) - c_j x_j \right] \qquad (2)$$

A cooperative equilibrium in the industry is defined as a (tacit) agreement among all firms on the magnitude of Θ, i.e. on the weight to be placed on the profits of other firms. We shall assume such an equilibrium exists. Each firm $\underline{i}$ thus chooses an x_i to maximize (2), and the simultaneous solution to these $\underline{n}$ equations is the equilibrium outcome. A value of $\Theta = 1$, corresponds to perfect collusion. Each firm chooses an output so as to maximize the joint profits of the industry. When $\Theta = 0$, each firm selects its output ignoring the impact of its choice on the profits of the other firms, and an equilibrium results analogous to the Cournot outcome. Θs < 0 imply rivalrous competitive behavior as each firm is willing to trade off own profits to reduce the profits of the other firms in the industry. The most plausible values of Θ probably lie in the $(-1, 1)$ range.

Maximizing (2) with respect to x_i we obtain

$$x_i = \frac{a_i - c_i}{2b} - \frac{s(1+\Theta)}{2} \sum_{j \neq i}^{n} x_j \qquad (3)$$

The first term in (3) plays an important role in the analysis and we shall define it as q_i, the quality-efficiency index for firm $\underline{i}$. Increases in q_i imply either improvements in product quality or reductions in costs. If we call

$s(1+\Theta)/2$, r, and substitute into (3) along with each x_j, we get

$$x_i = q_i - r\left[\sum_{j\neq i} q_j - r(n-1)x_i - r(n-2)\sum_{j\neq i} x_j\right] \qquad (4)$$

Adding and substracting rq_i and $r(n-2)x_i$ and rearranging we obtain

$$x_i = (1+r)q_i - rQ + r^2(n-2)X \qquad (5)$$

where $Q = \sum_i^n q_i$, $X = \sum_i^n x_i$

Summing (5) over all n firms in the industry and solving for industry output we obtain

$$X = \frac{Q}{nr-r+1} \qquad (6)$$

which upon substitution into (5) gives

$$x_i = \frac{q_i}{1-r} - \frac{r\,Q}{(1-r)(nr-r+1)} = \frac{qi}{1-r} - \frac{rX}{1-r} \qquad (7)$$

From (6) and (7) it is easy to show that an increase in the quality-efficiency index for any firm i results in an increase in both its output and the industry's output, holding the degree of cooperation Θ, and the q_j for all other firms fixed, i.e.

$$\frac{\partial X}{\partial q_i} > 0 \ , \ \frac{\partial x_i}{\partial q_1} > 0 \qquad (8)$$

Over a long period of time, the sales of all firms in an industry expand. To allow for this growth we shall look for the effects of a merger by examining firm market shares. Our assumption is that in the absence of mergers all firms in the industry would have grown at the same rate. Changes in market shares reflect changes in the relative quality-efficiency characteristics of the individual firms. From (6) and (7) we obtain for the ith firm's market share

$$m_i = x_i/X = \frac{q_i(nr-r+1)}{(1-r)Q} - \frac{r}{(1-r)} \qquad (9)$$

$$\frac{\partial m_i}{\partial q_i} = \frac{nr-r+1}{(1-r)Q} - \frac{(nr-r+1)q_i}{(1-r)Q^2} = \frac{(Q-q_i)(nr-r+1)}{(1-r)Q^2} > 0 \qquad (10)$$

An increase in the ith firm's quality efficiency index following a merger increases its market share.

Equation (9) defines the ith firm's market share in quantity units. Our market share data are for revenues, however. It would be nice if we could derive the analogous condition to (10) for market shares measured in revenues, but we cannot. Obviously if price rises because quality has improved ($\Delta a_i > 0$), market share in revenue units rises also. Furthermore, if q_i increases because costs fall, but quality remains unchanged ($\Delta a_i = 0$, $\Delta c_i < 0$), revenue increases as the marginal revenue of the firm is positive for all relevant points along its demand schedule, if $c_i > 0$. But it is possible to construct cases in which both the demand schedule and the cost functions shift so that output expands but revenue falls ($\Delta(q_i - c_i) > 0$, $\Delta q_i < 0$, $\Delta c_i < 0$). That is, if the merger results in both a deterioration in product quality and a reduction in unit costs, the output of the firm may expand even though revenues fall. Despite this possibility we shall employ as our criterion for deducing an improvement in the quality-efficiency index of an acquired firm, an increase in its market share. Mergers resulting in a significant worsening of quality characteristics, and more than offsetting cost and price reductions so that market share in physical units expands while market share in revenues decline, seem likely to be rare. But the possibility remains a caveat to our analysis.

Up until now, we have assumed that the only effect of a merger is on the quality-efficiency index of the acquired firm. Two additional possibilities need to be explored. The first is that a change in q_i may affect some of the other q_j. It is unlikely that a conglomerate merger affects the costs of the other firms in an industry. But, a change in q_i can come about due to a perceived change in the quality of i relative to j resulting in a simultaneous reduction in the q_j for some other firms. From (10) it is obvious that such an effect reinforces the positive effect of an increase in the acquired firm's quality-efficiency index on its market share.

Consider next a change in the degree of cooperation. Recalling that $r = s(1+\Theta)/2$, and taking the partial derivate of (9) with respect to r, we have

$$\frac{\partial m_i}{\partial r} = \frac{q_i(n-1)-Q}{(1-r)Q} + \frac{q_i(nr-r+1)-r}{(1-r)^2Q} = \frac{q_i n - Q}{(1-r)^2 Q} \qquad (11)$$

Thus,

$$\left(\frac{\partial m_i}{\partial r} \gtrless 0\right) \leftrightarrow \left(q_i \gtrless \frac{Q}{n}\right) \qquad (12)$$

A merger that increases the degree of cooperation in an industry increases the market shares of those companies having higher than average quality-efficiency indexes, and reduces the market shares of those with below average q_i. Since m_i and q_i are themselves positively related, an increase in collusive activity should increase the market shares of the bigger firms and reduce those of the smaller companies. This result becomes intuitive when one recalls that Θ is the weight placed on the other firms' profits in the industry. An increase in Θ is an increase in the weight placed on the most profitable firms, i.e. those with above average quality-efficiency indexes.

Table 1 presents the four possible outcomes depending on the effect of the merger on Θ, and the relationship between q_i and Q/n. Intuitively the cases in quadrants 1 and 4 seem the most likely, i.e. an acquisition of a relatively large firm increases the degree of cooperation, the acquisition of a small company reduces cooperation. Both cases impy an increase in the acquired firm's market share. Thus, when we observe market share increases following a merger, the possibility exists that we are observing changes in the degree of cooperation in the industry rather than improvements in quality or efficiency. Nevertheless, particularly for conglomerate mergers, changes in efficiency or quality seem so likely to outweigh changes in the degree of cooperation that we shall maintain our quality-efficiency-market share criterion. This possible source of bias must be kept in mind, however.

Table 1 : Possible Effects of Changes in the Degree of Cooperation on Market Shares

	$\Delta \Theta > 0$	$\Delta \Theta < 0$
$q_i > \frac{Q}{n}$	$\Delta m_i > 0$	$\Delta m_i < 0$
$q_i < \frac{Q}{n}$	$\Delta m_i < 0$	$\Delta m_i > 0$

B. Conglomerate Acquisitions: The Price-Taker Case

Although most firms face downward sloping demand schedules, even when they sell products which are physically indistinguishable from those of their competitors, because of location differences, delivery speed differences and the like, we analyse here briefly the case of a small, price-taking firm for completeness.

A price-taker sets price equal to marginal cost. If the merger does not affect its status as a price-taker, its only impact can be on costs. A merger that lowered marginal costs would expand a firm's sales and market share, and vice versa. Our market share-welfare criterion covers the price-taker case without modification.

C. Horizontal Mergers

In a horizontal merger mutual interdependence in the industry must increase at least in so far as the outputs of the two merging firms are coordinated as in perfect collusion following the merger. If $\underline{j}$ and $\underline{k}$ merged, we can write the objective function of the merged company as

$$O_m = \Pi_j + \Pi_k + \Theta \sum_{i \neq j,k}^{n} \Pi_i \qquad (13)$$

If (13) is maximized with respect to x_j and x_k, and all other firms maximize their objective functions as before, industry output following the merger is

$$X = \frac{Q}{nr-r+1} - \frac{\frac{s}{2}(1-\Theta)}{nr-r+1} (x_j + x_k) \qquad (14)$$

The first term to the right of the equal sign is the output of the industry in the absence of the merger. If the products in the industry are partial substitutes ($s > 0$), and collusion is not perfect ($\Theta < 1$), industry output falls following a merger by a fraction of the merging companies' combined outputs.

The burden of reducing industry output falls entirely on the merged company. A glance at (7) reveals that the other firms in the industry expand output slightly in response to the reduction by the merged company. Since the merging companies' output declines as all other firms expand, its market share falls relative to the sum of the premerger market shares of the merging companies. Thus, when the only effect of a horizontal merger is to bring about perfect collusion between the two merging companies, the merger reduces the market share of the merging companies.

As with conglomerate mergers, increases in the quality-efficiency index of either participant in a horizontal merger tend to expand the market share of the merged company ceteris paribus. For the reasons just given the ceteris paribus assumption definitely does not hold in a horizontal merger. Thus, the market share reducing effects of the increased cooperation between the merging firms and the market share increasing effects of an increase in q_j or q_k would tend to offset one another. Thus, for horizontal mergers, modest improvements in the quality-efficiency index of the merging firms may go undetected due to the reduction in output perfect collusion between the merging firms brings about.

A traditional concern with horizontal mergers is that the reduction in the number of sellers enhances the degree of cooperation among the remaining firms, i.e. Θ increases. Returning to Table 1, we see that an increase in Θ increases the market share of a firm with above average q_i, reduces it for a firm with below average q_i. When relatively large firms are involved in horizontal mergers, the two collusion-effects tend to be offsetting. A rise in Θ increases a large firm's market share, but the perfect collusion brought about between the two merging firms reduces their combined market share. When small firms join in a horizontal merger their combined market share should definitely fall.

D. Vertical Acquisitions

In a vertical acquisition both firms are in different industries and the effects of the merger on the acquired company can be studied as with a conglomerate merger. A complication arises in measuring the change in a firm's market share, however, in that our estimates of market share are based on sales to other firms. If the acquired company were to shift some of its sales to its purchaser, and these are now treated as internal transfers, we would underestimate the acquired firm's share of the market where the market is defined to include the purchases of its parent firm. We shall, therefore, make special allowance for this possible bias in our empirical work.

E. Summary

When the only effect of a merger is to improve the efficiency or quality of the acquired firm's product(s), its market share increases. Changes in the degree of cooperation could increase or decrease a firm's market share. With respect to horizontal mergers, a reduction in market share is caused by the restriction in output the perfect collusion among the merging firms induces. This reduction would be offset to some extent if the quality-efficiency index of the firms improved, or the degree of cooperation increased and they were of large size. While the possibility of mixed cases raises some ambiguities in interpreting the effects of mergers by examining market shares, the nature of the results are such as to allow us to draw rather clear, and surprising, conclusions. Thus, we move on now to the empirical work, and return to the various possible outcomes in the concluding section.

II. Data and Methodology

Our sample is drawn from Federal Trade Commission surveys for 1950 and 1972 of sales at the 5-digit level for the 1,000 largest companies in each year[4]. The sample of acquired firms consists of all companies that were (1) among the 1,000 largest of 1950, and (2) were acquired by a firm among the 1,000 largest in both 1950 and 1972. Any company meeting this criterion that was spun off or sold prior to 1973 was omitted from the sample. If a company A was acquired by B which in turn was acquired by C, and A and C met the criterion, A was included in the sample. When only a division of a firm was acquired, then this division was treated as the acquired firm. Using these criteria a sample of 209 acquired and 123 acquiring companies was constructed[5].

Whenever the 5-digit product definition seemed too disaggregate we aggregated upward until a more meaningful economic definition of the market was obtained, placing particular weight on substitution in production in defining the market[6]. Between 1950 and 1972 there were numerous changes in SIC product definitions. These changes required further combining and rearranging of product lines to match 1950 and 1972 markets. Fortunately, most industries that could not be compared had small 1950 sales, so that the percentage of 1950 sales that could not be matched to 1972 markets was only 5.8 percent, although in some cases the "match" was admittedly somewhat loose.

To test for the efficiency effects from conglomerate mergers, a weighted average market share was constructed for each acquired firm over all markets j in which it had 1950 sales, and its acquirer did not. If M_{ij50} is firm i's share of market j in 1950; and S_{ij50} is its sales in j in 1950, then its average market share M_{i50} is defined by

$$M_{i50} \equiv \sum_j S_{ij50} \cdot M_{ij50} / \sum_j S_{ij50} \qquad (15)$$

Two weighted market shares were constructed for acquired firm i's acquiring company, I, using I's sales and market shares

in the J industries in 1972 that match the j industries in 1950 in which i had sales. The first weights the 1972 market share of I by the 1950 sales of i in each market, the second uses the 1972 sales of the acquiring firm, I, as weights, i.e.

$$M^{50}_{I72} = \sum_j S_{ij50} \cdot M_{IJ72} / \sum_j S_{ij50} \qquad (16)$$

$$M^{72}_{I72} \equiv \sum_J S_{IJ72} \cdot M_{IJ72} / \sum_J S_{IJ72} \qquad (17)$$

By comparing the two M_{I72} with M_{i50} to determine the effects of the merger, we make the strong assumption that all sales the acquiring firm makes in 1972 is markets in which it did not sell in 1950, but in which the acquired firm did sell, are attributable to this acquisition. Alternatively, the firm might have entered these markets by internal expansion, or it may have made additional acquisitions of firms not among the 1,000 largest of 1950, which had sales in these industries. The sales of any firm acquired between 1950 and 1972 that was not in the 1950 - 1,000 largest list are not accounted for in this study. We return to this possible bias below.

One expects and observes the M_{I72} using 1972 sales as weights to exceed, usually but not always, the M^{50}_{I72}. One strategy for improving the efficiency of acquired companies often mentioned is a redeployment of its assets[7]. Acquiring firms may abandon unprofitable lines of business and reallocate capital to more profitable lines more rapidly than incumbent managers. Evidence of this strategy would be a markedly better performance for mergers based on M^{72}_{I72} comparisons with M_{i50}, than when M^{50}_{I72} and M_{i50} are compared.

We define as horizontal those portions of a merger in which both the acquiring and acquired companies had 1950 sales in the same market. For horizontal mergers the combined sales of the two companies in 1950 in the j markets in which they both operated are compared with the acquiring firms' sales in the comparable markets in 1972. Let g be the acquiring firm, d the acquired firm, and

i the combined company. Then

$$S_{ij50} \equiv S_{gj50} + S_{dj50}, \qquad M_{ij50} \equiv M_{gj50} + M_{dj50},$$

and M_{ij50}, M^{50}_{I72} and M^{72}_{I72} can be constructed using (15), (16) and (17) for horizontal mergers.

If market shares were compared immediately before and after a merger, one might legitimately attribute any change in market share observed entirely to the merger. Over time, however, entry and exit occur and the average market share of a surviving member of the 1,000 largest firms of 1950 might drift up or down. To allow for such drift, and to allow for downward bias in 1972 market shares introduced by the lack of a perfect match between markets in the two time periods, the effects of mergers on acquired firm market shares are judged against a control group that (1) did not acquire a member of the 1,000 largest of 1950 between 1950 and 1972, and (2) were themselves in the 1,000 largest samples in 1950 and 1972. Although the control group did not acquire members of the 1950 - 1,000 largest list, they did make acquisitions over this 23 year period of firms not on this list, as did the acquiring companies in the sample. Thus, we are not comparing a sample of merging firms with a sample of nonmerging firms. We return to this point and possible biases in choice of control group below.

The FTC divided the 1950—1,000 largest into the 200 largest, 201-500 largest, and 501-1000 largest. In forming the control group, one firm was selected from each of the 3 size categories for every 3 acquired firms in the merger sample. After rounding up this gave a control group of 78 firms. Since the sales of acquired companies are divided between markets in which the acquiring firm did not sell (the conglomerate portion) and markets in which it did (the horizontal portion), the total sales of the control group firms actually amount to 88 percent of the total sales of the conglomerate portions of all acquisitions, and 180 percent of the sales in the horizontal portions [8].

M_{i50}, M^{50}_{I72}, and M^{72}_{I72} are calculated for each control group firm using (4), (5), and (6) with $\underline{i}$ and $\underline{I}$ now referring to the same company, i.e. M^{50}_{I72} is control group firm I's 1972 market share averaged over only those markets in which it had 1950 sales using these S_{ij50} as weights; M^{72}_{I72} is its market share averaged over these same markets but using its 1972 sales in these markets, S_{IJ72}, as weights.

In the absence of merger a firm's market share in 1972 is assumed to be a monotonic increasing function of its 1950 market share approximated by the second degree polynominial

$$M^{w}_{I72} = \alpha M_{i50} + \beta M^{2}_{i50} + u_i \quad w = 50,72 \tag{18}$$

where $\alpha > o$, $\beta \gtrless o$. To test for the effects of mergers we pool one of the merger samples with the control group sample, and measure separate αs and βs for each subsample using a dummy variable, D=1 if the firm was acquired, and O if it is in the control group, i.e. (19)is estimated

$$M^{w}_{I72} = \alpha M_{i50} + \gamma D.M_{i50} + \beta M^{2}_{i50} + \delta D.M^{2}_{i50} + u_i, \tag{19}$$

$$w = 50,72$$

If γ and δ are of the same sign, or $\delta \simeq o$, then mergers are assumed to increase, leave unchanged, or reduce welfare as $\gamma \gtrless o$. If γ and δ are of opposite sign their magnitudes must be compared before inferences can be drawn. When estimating (19), several alternative weighting schemes are employed, and an alternative definition of D, but these are best described with the results.

III. The Results

A. Conglomerate Mergers

In Table 2 are presented the estimates from several variants on equation (19). The first two equations estimate the basic quadratic relationship over both the control group and merging firm samples omitting those merging firms for which all sales in 1950 were in industries in common with their acquiring firms. The coefficient on M_{50} suggests some erosion in market share over time, the coefficient on M_{50}^2 suggests that this erosion is greater, the greater the 1950 market share of the company.

Equations 3 and 4 include the dummy variable for merger terms. The first coefficient is negative, the second positive. The curves predicting 1972 market share are of opposite concavity and cross at 1950 market shares of .33 and .34 for equations 3 and 4, respectively, i.e. for all companies with $M_{50} < .33$, we predict lower 1972 market shares if they were acquired by another firm than if they were not. For those with $M_{50} > .34$ the reverse prediction is made. The reversal in the concavity of the market share curve is subject to two, alternative economic explanations. The quality-efficiency indexes for firms with relatively large market shares improved following mergers, while those of smaller firms declined. The second, economic explanation is that the degree of cooperation increased following the acquisition of companies of all sizes leading to declines in the market shares of relatively small firms and increases for the biggest firms. My own guess is that the explanation is statistical rather than economic, a combination of outlier bias and collinearity among the four variables. In any event, the number of firms whose market shares increased following mergers is few, the mean 1950 market share for our sample is .067 with a standard deviation of .098, so that the mergers for which an increase in market share is predicted are distributed more than 2 standard deviations above the mean.[9]

In eqs. 1-4 each observation consists of the weighted average market share of an acquired company over just those markets in which the acquiring firm did not also have 1950 sales. One company's market share in a single market in which it has $ 33,000 sales gets equal weight with the weighted average market share of companies with hundreds of millions of dollars of sales. Obviously a 10 percent increase in average market share for one of the latter firms has greater economic significance than a similar increase for the former case. A more defensible weighting of each observation is by the 1950 sales involved in the acquisition. A second advantage of this, and subsequent, choices of weights is that it "spreads the observations around" making the results less susceptible to outlier bias. The unweighted market shares fall mostly in the $0 < .1$ range, and a few observations with very large market shares could bias the results. Weighting by sales mitigates this possible bias. Eqs. 5-8 duplicate 1-4 using S_{i50} as weights (see w column). Two differences are apparent between the two sets of equations; the coefficient on M^2_{50} is positive indicating that erosion of market share declines and reverses as 1950 market share increases, and, second, the $D.M^2_{50}$ term is insignificant (and negative). Thus, when allowance is made for the economic importance of the acquisitions, mergers have a uniform and significant negative effect on market share.

The mergers in the sample took place throughout the period 1950-72[10]. It could be that the relative declines in market shares of the acquired companies implied by the negative coefficients on $D.M_{50}$ took place before they were acquired, and that their post-acquisition performance was no worse or even better than that of the control group firms. This observation would be consistent with the failing firm hypothesis (Dewey, 1961), or with the hypothesis that takeovers occur to replace poor managers (Manne, 1965). To test for this alternative possibility, D was redefined as $D = (73-YR)/23$, where YR is the year of the acquisition, YR = 50, 72. A merger occuring relatively early in the '50-'72 interval receives a heavier weight in the merger vector than a merger occuring late in the

TABLE 2

Conglomerate Mergers

n = 260

Eq	Dependent Variable	M_{50}	$D \cdot M_{50}$	M_{50}^2	$D \cdot M_{50}^2$	W	D	λ[a]	$\bar{R}^2$
1	M_{72}^{50}	.79 12.37		- .33 2.43		1			.501
2	M_{72}^{72}	.90 13.29		- .52 3.63		1			.471
3	M_{72}^{50}	1.11 11.65	- .48 3.91	-1.22 5.96	1.44 5.54	1	1,0		.556
4	M_{72}^{72}	1.23 12.22	- .51 3.87	-1.45 6.66	1.51 5.45	1	1,0		.527
5	M_{72}^{50}	.49 15.63		.62 4.64		S_{50}			.898
6	M_{72}^{72}	.68 17.01		.69 4.03		S_{50}			.906
7	M_{72}^{50}	.59 23.92	- .42 14.00	.37 3.65		S_{50}	1,0		.942
8	M_{72}^{72}	.83 30.25	- .62 18.53	.33 2.86		S_{50}	1,0		.959
9	M_{72}^{50}	1.05 13.69	-1.54 6.38	-1.26 7.54	9.06 9.01	1	$\frac{73-YR}{23}$		.619
10	M_{72}^{72}	1.15 14.01	-1.53 5.88	-1.44 8.03	9.05 8.35	1	$\frac{73-YR}{23}$		.582
11	M_{72}^{50}	.59 24.41	- .69 15.84	.37 3.90		S_{50}	$\frac{73-YR}{23}$		.948
12	M_{72}^{72}	.82 31.44	- .98 19.90	.34 3.14		S_{50}	$\frac{73-YR}{23}$		.963
13	M_{72}^{72}	1.51 8.16	- .42 2.11	-2.04 2.20		$\frac{1}{M_{50}}$	1,0		.022
14	M_{72}^{72}	1.45 8.76	- .59 2.02	-2.24 2.34		$\frac{1}{M_{50}}$	$\frac{73-YR}{23}$		.021
15	M_{72}^{72}	1.02 20.54	- .56 11.03	- .77 2.57		S_{50}/M_{50}	1,0		.837
16	M_{72}^{72}	.85 34.99	- .73 7.23			S_{50}/M_{50}	$\frac{73-YR}{23}$		.799
17	M_{72}^{50}	1.04 14.34	- .14 3.11	- .10 1.06		1	$\frac{73-YR}{23}$	.18	.497
18	M_{72}^{72}	1.15 15.93	- .14 2.93	- .27 2.70		1	$\frac{73-YR}{23}$	.21	.481
19	M_{72}^{50}	1.09 14.44	- .14 3.75	- .09 1.05		S_{50}	$\frac{73-YR}{23}$	.11	.708
20	M_{72}^{72}	1.20 10.07	- .14 3.63	- .23 2.54		S_{50}	$\frac{73-YR}{23}$	.13	.716

Notes: _ values under coefficients

a) λs are from Box-Tidwell transformations of all variables

interval. Control group firms continue to have D = O. If the decline in market shares preceeded the acquisitions, this alternative weighting of observations in the $D.M_{50}$ vector should reverse the sign of, or at least raise the coefficient on, this term.

Eqs. 9-12 replicate 3, 4, 7 and 8 substituting the alternative definition for D. The same nonlinearity appears in the unweighted equations, with the coefficients on the two D-terms both becoming dramatically larger in absolute values. Indeed, they are implausibly large and predict negative M_{72} for acquired firms with $M_{50} \leq .065$, i.e. all acquired firms with 1950 market shares just below the mean. The intercorrelations between the 4 variables in these two equations appear to exaggerate the coefficients.

The coefficients on $D.M_{50}$ in the sales weighted equations (11, 12) are negative and larger in absolute value than when D is a O, 1 dummy. The relative deterioration in market shares for acquired companies is more severe, the earlier they occur[11].

Much of the obviously severe intercorrelation among the independent variables in eqs. 9 and 10, and perhaps 3 and 4 can be broken by deflating the entire equation by M_{50}. The dependent variable then becomes M^{w}_{72}/M_{50}, the M_{50} coefficient becomes the intercept, etc. Results are presented for M^{72}_{72}/M_{50} as dependent variable in eqs. 13 and 14. The key "explanatory variable" is now the intercept, so that the $\bar{R}^2$ drops dramatically. Nevertheless, both $D.M_{50}$ and M^2_{50} have significant coefficients. $D.M^2_{50}$ is (negative) and insignificant when deflated by M_{50}. The coefficient on $D.M_{50}$ when D is defined continuously is lower than when D = 1, O, again suggesting that it is the mergers that cause the deterioration in market share, not the reverse. In eqs. 15 and 16 each observation is weighted by S_{50}/M_{50}. These results can be compared with eqs. 8 and 12. The D-variables are again negative and highly significant, the continuous D term has the lower coefficient. Quite analogous results to those in eqs. 13-16 emerged with M^{50}_{72} as dependent variable.

As one might expect, the undeflated equations 1-12 exhibited heteroscedastic residuals[12]. An additional reason for deflating by M_{50} is to remove this heteroscedasticity. Only for eq. 16 was this objective fully achieved, however. Further experimentation with weights, e.g. $1/\sqrt{M_{50}}$, $\sqrt{S_{50}}$, etc. failed to produce a set of weights that consistently eliminated heteroscedasticity. The pattern of results observed in eqs. 11-16 continued to appear regardless of the choice of weights. The conclusion that mergers lower market shares is robust to a wide set of alternative, plausible choices of weights.

Although the presence of heteroscedasticity is troublesome, the coefficients remain unbiased estimates of the true coefficients. That the estimates are inefficient, also does not seem particularly serious, given that we have 260 observations. Where heteroscedasticity is most severe, in eqs. 7, 8, 11 and 12, the standard errors of the $D.M_{50}$ terms range from 1/14 to 1/20th of their coefficients. Thus, a several fold expansion of the standard errors is possible to allow for the downward bias in standard error estimate, without overturning the conclusion that mergers have resulted in a relative deterioration in the acquired firms' market shares.

Market shares are bounded by zero and one and positively skewed within this range. Market shares appear on both sides of the equation, and their presence brings about non-normally distributed error distributions. A standard procedure for correcting this problem is to transform the variables as proposed by Box and Cox, $y = (y^{\lambda} - 1)/\lambda$ (see, Judge, et. al., 1980, pp. 308-11). This transformation tends to produce error distributions that are both normal and homoscedastic, and is thus another attack on heteroscedasticity. Since both the dependent and independent variables are not normally distributed, the transformation was applied to all variables. Efforts to allow each variable to have its own λ did not achieve convergence. All variables are transformed by the same λ, therefore.

Eqs. 17-20 report Box-Cox (or more accurately, Box-Tidwell) results when D=(73-YR)/23. The likelihood ratios (not reported) imply strong overall fit for the equations. The λ estimates are fairly close to zero, particularly for the sales weighted equations. A $\lambda = 0$ is equivalent to taking logs of each variable, $\lambda = 1$ implies a linear specification. With $\lambda \approx .1$, the Box-Tidwell transformations undo some of the effect of weighting by S_{50}, explaining why M_{50}^2 now has a negative coefficient in all equations. Of most interest, however, is the $D.M_{50}$ variable. Its coefficient is negative and significant throughout, and, interestingly enough, identical to the second decimal place in all equations. That these coefficients are smaller in absolute value than in the equations in which the variables are untransformed is less important than that they are negative. In Box-Cox regressions the estimated coefficients do not equal the partial derivatives of the dependent variable to the respective right-handside variable, but are only proportional to this effect (see, Poirier and Melino, 1978). Box-Tidwell estimates with D=1,0 produced coefficients on $D \cdot M_{50}$ that were negative, significant[13] and smaller in absolute value than those in eqs. 17-20.

The consistently lower estimated coefficients on the $D \cdot M_{50}$ terms when D is defined so as to put more weight on more recent mergers imply that it is the mergers that are causing the deterioration in market shares, and not the reverse. To determine the quantitative importance of the loss in market share following mergers, we have reestimated eqs. 11 and 12 replacing D by T, defined as the number of years after a firm's acquisition; i.e. T=0 for control group firms, T=1 if the firm was acquired in 1972, 23 if it was acquired in 1950, etc. The results were as follows (t values are below coefficients):

$$M_{72}^{50} = \underset{25.41}{.59M_{50}} - \underset{15.84}{.030T \cdot M_{50}} + \underset{3.90}{.38M_{50}^2} \qquad \bar{R}^2 = .948$$

$$M_{72}^{72} = \underset{31.44}{.82M_{50}} - \underset{19.90}{.043T \cdot M_{50}} + \underset{3.14}{.34M_{50}^2} \qquad \bar{R}^2 = .963$$

The results indicate, depending on choice of dependent variable, a 3 or 4 percent loss in market share per year following a merger. After 20 years the predicted market share of an acquired firm is zero[14)].

Industry effects were tested for by constructing a vector for each company of the percentage of its 1950 sales in each 2-digit industry. These results did not suggest important differences across industries except that acquisitions of firms in the petroleum and printing industries appeared to be relatively more successful. Tests for firm-effects for the 44 companies making more than one acquisition did not indicate significant firm effects either. Neither set of results is reported here.

If we set aside the possibility that conglomerate mergers have had a significant impact on the degree of cooperation, the results in this subsection reject the hypothesis that mergers improve the operating efficiency of the aquired company, or the quality of its products as might be expected from an improvement in managerial talent. The most meaningful results weight each observation by its economic importance, measured by the sales involved. These results imply unequivocally that acquired firms achieve substantially lower market shares than nonacquired firms, and that the deterioration in their market shares is greater the earlier the merger occurs.

Also rejected is the hypothesis that mergers improve efficiency by consolidating the sales of the acquired companies on their most efficient production lines. Coefficients on $D.M_{50}$ with M_{72}^{72} as dependent variable are in all cases less than or equal to the coefficients on $D.M_{50}$ with M_{72}^{50} as dependent variable, ceteris paribus. Acquired firms experience at least as great if not greater market share declines when 1972 sales weights are used to calculate market shares, as when 1950 sales are used, i.e. acquired firms perform no better if not worse

than nonacquired firms in those markets in which each chooses to concentrate its sales over time. The full implications of these results along with the possibility that mergers have changed the degree of cooperation are taken up in the final section.

B. Horizontal mergers

Table 3 presents the results for those mergers having horizontal aspects pooled once again with the control group companies. The format of the Table resembles Table 2 and the results are not discussed in detail. A few general observations are required, however.

The same nonlinearities appear when the individual observations on firms are entered unweighted. The coefficients do not behave as irratically as in Table 2, however, particularly when D is defined continuously. The market share curve for the acquired firms lies beneath that of the nonacquired firms up to a M_{50} of between .40 and .42 for all 4 equations, so that even these equations predict relatively lower market shares for acquired companies for all but a handful of acquisitions with very large 1950 market shares.

In all of the weighted equations the $D.M^2$ term is insignificant. The $D.M_{50}$ term is negative and significant in all equations in which S_{50} is used as a weight. Thus, when weighted by a merger's economic importance, the results for horizontal mergers also imply a deterioration in the market shares of acquired companies. In every case, the coefficient on D, defined continuously, is less than the coefficient on D defined as 1, 0 for the corresponding equations implying that the observed deterioration in market shares for the merging companies occurs after the mergers.

TABLE 3

Horizontal Mergers

n = 176

Eq	Dependent Variable	M_{50}	$D \cdot M_{50}$	M_{50}^2	$D \cdot M_{50}^2$	W	D	λ a)	$\bar{R}^2$
1	M_{72}^{50}	1.11 12.08	- .49 3.79	- 1.22 6.18	1.22 4.91	1	1,0		.539
2	M_{72}^{72}	1.23 12.69	- .60 4.41	- 1.45 6.92	1.44 5.44	1	1,0		.512
3	M_{72}^{50}	.59 25.25	- .20 3.11	.35 3.53		S_{50}	1,0		.964
4	M_{72}^{72}	.83 32.21	- .42 5.94	.32 2.97		S_{50}	1,0		.976
5	M_{72}^{50}	1.08 12.27	- .63 3.50	-1.17 6.08	1.55 4.72	1	$\frac{73-YR}{23}$		.536
6	M_{72}^{72}	1.19 12.82	- .77 4.08	-1.39 6.78	1.83 5.23	1	$\frac{73-YR}{23}$		.508
7	M_{72}^{50}	.60 25.46	- .29 3.48	.35 3.54		S_{50}	$\frac{73-YR}{23}$		.965
8	M_{72}^{72}	.83 32.58	- .58 6.30	.32 3.01		S_{50}	$\frac{73-YR}{23}$		.977
9	M_{72}^{50}	1.19 4.12	.17 .49	-2.23 1.43		$\frac{1}{M_{50}}$	1,0		.003
10	M_{72}^{72}	1.64 4.72	- .07 .18	-3.39 1.81		$\frac{1}{M_{50}}$	1,0		.007
11	M_{72}^{50}	.80 18.26	- .20 3.26	- .78 2.89		S_{50}/M_{50}	1,0		.866
12	M_{72}^{72}	.99 20.35	- .36 5.27	- .59 1.83		S_{50}/M_{50}	1,0		.902
13	M_{72}^{50}	1.23 4.61	.16 .34	-2.28 1.47		$\frac{1}{M_{50}}$	$\frac{73-YR}{23}$		.002
14	M_{72}^{72}	1.64 5.11	- .13 .22	-3.38 1.81		$\frac{1}{M_{50}}$	$\frac{73-YR}{23}$		.007
15	M_{72}^{50}	.82 19.24	- .34 4.24	- .84 3.21		S_{50}/M_{50}	$\frac{73-YR}{23}$		.872
16	M_{72}^{72}	1.00 21.67	- .56 6.46	- .60 2.13		S_{50}/M_{50}	$\frac{73-YR}{23}$		.909
17	M_{72}^{50}	1.12 15.66	- .06 1.29	- .31 2.91		1	$\frac{73-YR}{23}$	.22	.424
18	M_{72}^{72}	1.23 16.92	- .10 2.30	- .44 3.97		1	$\frac{73-YR}{23}$	.23	.389
19	M_{72}^{50}	1.11 16.65	- .08 2.18	- .24 2.58		S_{50}	$\frac{73-YR}{23}$	.19	.788
20	M_{72}^{72}	1.23 18.17	- .12 3.41	- .36 3.75		S_{50}	$\frac{73-YR}{23}$	.19	.790

Notes: t values under coefficients

a) λs are from Box-Tidwell transformations of all variables

The coefficients on $D.M_{50}$ are higher in Table 3 than in Table 2, and when only $1/M_{50}$ is used as a weight, all four coefficients are insignificantly different from zero, two being positive. The unweighted Box-Tidwell regression explaining M_{72}^{50} (# 17) also has an insignificant, but negative coefficient on $D.M_{50}$. Thus, the results for horizontal mergers suggest a considerably reduced, but nevertheless generally negative impact of these mergers on market share.

C. Results After Removing "Vertical" Acquisitions

The FTC classified as vertical all mergers in which "the two companies involved had a potential buyer-seller relationship prior to the merger" (1980, p. 108). A "vertical" merger might also have substantial horizontal or conglomerate aspects, and could be entirely nonvertical, if the potential that led to the vertical classification were never realized. For example, Ford's acquisition of Philco, a large manufacturer of radios, television sets, and electric appliances was categorized as vertical, presumably because Philco made car radios. But car radios were a small fraction of Philco's sales prior to the merger, and any bias introduced by ignoring this vertical aspect must be trivial.

In most cases, as in the Ford-Philco merger, the fraction of the acquired firm's sales that was potentially vertically related to its merger partner could not be determined. I thus decided to exclude all mergers with a vertical potential and reestimate the equations. The product lines of each pair of companies in a potentially vertical acquisition were compared to determine whether the merger was potentially a backward or a foreward vertical integration[15]. The results for conglomerate mergers can be biased only if there is backward vertical integration, so that only these mergers were dropped

from the conglomerate sample. Table 4 presents results for 10 of the 20 equations from Table 2 after removing the 7 observations with backward integration potential. These results are almost identical to those in Table 2 for the comparable equations.

In a horizontal merger the sum of the market shares of the merging companies is compared with the combined firm's market share in 1972. A bias would be introduced if either the acquiring firm became a supplier of the acquired company, or vice versa. All mergers with potential vertical linkages were removed from the horizontal merger sample and the equations reestimated. Table 5 presents 4 examples of these results. A comparison with Table 3 again reveals but modest differences.

The vertical aspects of the mergers in our sample appear too small to bias the results[16].

D. Biases and Caveats

Before drawing conclusions, the other possible biases in the results must be reviewed.

The most important of these is that we have data on only those acquired companies that were in the top 1000 of 1950. If a company acquired two firms with sales in the same market, one in the 1950—1000 largest, the other not, the 1972 market share reflects the contribution of both acquired firms, while we attribute all of the sales to the one acquired firm in our sample. The estimate of the merger's impact on the acquired firm's market share is biased upward, and this bias could be considerable. For example, St. Regis Paper acquired 3 firms from the 1950—1000 largest list between 1950 and 1972, each is an observation in the sample. But, the 1973 Moody's Industrial Manual lists some 53 companies as having been acquired by St. Regis between 1953 and 1972 alone, and the

TABLE 4

Conglomerate Mergers - Vertical Mergers Removed

n = 253

Eq	Dependent Variable	M_{50}	$D \cdot M_{50}$	M_{50}^2	$D \cdot M_{50}^2$	W	D	λ a)	$\bar{R}^2$
1	M_{72}^{50}	1.11 11.50	- .48 3.81	-1.22 5.88	1.44 5.43	1	1,0		.554
2	M_{72}^{72}	1.23 12.06	- .50 3.79	-1.45 6.58	1.50 5.36	1	1,0		.526
3	M_{72}^{50}	.59 23.51	- .43 13.65	.38 3.65		S_{50}	1,0		.942
4	M_{72}^{72}	.83 29.78	- .62 18.01	.33 2.88		S_{50}	1,0		.960
5	M_{72}^{50}	1.05 13.54	-1.55 6.27	-1.26 7.46	9.10 8.88	1	$\frac{73-YR}{23}$		.618
6	M_{72}^{72}	1.16 13.89	-1.55 5.83	-1.45 7.99	9.12 8.29	1	$\frac{73-YR}{23}$		.582
7	M_{72}^{50}	.59 24.96	- .70 15.45	.38 3.85		S_{50}	$\frac{73-YR}{23}$		.948
8	M_{72}^{72}	.82 30.97	- .98 19.36	.34 3.08		S_{50}	$\frac{73-YR}{23}$		.963
9	M_{72}^{72}	1.15 15.79	- .14 2.87	- .28 2.73		1	$\frac{73-YR}{23}$	.22	.480
10	M_{72}^{72}	1.20 15.86	- .14 3.60	- .22 2.48		S_{50}	$\frac{73-YR}{23}$	.13	.712

Notes: t values under coefficients

a) λs are from Box-Tidwell transformations of all variables

TABLE 5

Horizontal Mergers - Vertical Mergers Removed

n = 160

Eq	Dependent Variable	M_{50}	$D \cdot M_{50}$	M_{50}^2	$D \cdot M_{50}^2$	W	D	λ a)	$\bar{R}^2$
1	M_{72}^{72}	1.23 12.19	- .62 4.28	-1.45 6.65	1.46 5.27	1	1,0		.506
2	M_{72}^{72}	1.19 12.26	- .80 3.90	-1.38 6.48	1.85 5.02	1	$\frac{73-YR}{23}$		.500
3	M_{72}^{72}	.83 30.70	- .42 5.83	.32 2.84		S_{50}	1,0		.976
4	M_{72}^{72}	.83 31.07	- .58 5.83	.32 2.87		S_{50}	$\frac{73-YR}{23}$		.977

Notes: t values under coefficient

a) λs are from Box-Tidwell transformations of all variables

bulk of these appear to be in the lumber and paper industries. Our comparison of 1950 and 1972 market shares ignoring these 50+ additional mergers must certainly overestimate any increase or underestimate any decline in St.Regis' market shares that occurred.

The most important biases are for firms like St. Regis that made numerous acquisitions in the same industries. Numerous mergers in the same industry are more likely for horizontal mergers.Thus, the estimates for horizontal acquisitions are more likely to be biased in favor of finding a positive effect of mergers on market share than are the conglomerate mergers' estimates. It should be recalled, however, that we define as conglomerate any acquisition, or part thereof, where the two firms did not sell in the same market in 1950. Often the acquiring firm had sales in a market neighboring the acquired company's markets, and made several acquisitions in these besides the one in our sample. In these market-extension conglomerate mergers, a considerable upward bias in our estimates of the beneficial effects of mergers on market shares is also possible. Nevertheless, the greater upward bias is probably in the horizontal merger results.

This bias in estimating the impact of mergers is offset to the extent control group firms also made acquisitions during the period in the industries in which they were selling in 1950. While they did, a comparison of the merger histories of the acquiring and control group companies reveals the former to be far more active in the market for corporate control. This finding is not surprising. Any company that was among the 1000 largest in 1950, and made many acquisitions over the next 22 years is likely to have acquired at least one other company in the 1950 top 1000, and thus appear in the merger sample. Whatever bias exists from not having data on premerger market shares of acquired firms not in the 1950—1000 largest group leads toward an overestimate of the positive effects of mergers on market share.

An opposite bias could be introduced by our neglect of spinoffs. Although all acquisitions in which the acquiring firm sold before 1973 the previously acquired company were excluded from the sample, information allowing an adjustment for partial acquisitions was lacking. While the control group firms also undertook unrecorded spinoffs, it is reasonable to assume that spinoffs of assets acquired through merger are more common than internally generated assets. If a bias from ignoring unreported spinoffs were significant, one would expect acquired firms to perform much better when their market shares are measured using 1972 sales as weights than when 1950 sales are used, since the 1972 sales weights allow for the spinoffs. As noted above, the deterioration in market shares for acquired firms is,if anything, greater when one uses 1972 sales as weights so that whatever bias exists is more than offset by other factors.

A bias in favor of a positive effect of mergers on market shares is introduced by omitting entirely all acquisitions in which full spinoffs subsequently occurred. Few firms buy a company,improve its performance, and then sell it. A spinoff of an acquired firm is, or at least was in the '50s and '60s, an admission of failure. A hint of the validity of this conjecture is apparent in the few instances in which data on both purchase and sales prices of acquired and later spunoff companies are available (see Table 6). Taking into account inflation and the normal growth in asset values that occurred in the years between purchase and sale it is hard to believe the operating efficiency of these companies improved following their acquisition. We expect the same is true of the 9 other spinoffs for which no sales price is reported. Were it possible to calculate market shares for these companies in 1972 and include them in the sample we expect they would reinforce the negative findings regarding the effects of mergers.

The matching of 1950 and 1972 markets is of varying degrees of accuracy. To the extent these markets are not fully comparable, errors in observation are introduced in the market share data and regression coefficients are biased toward zero. The same market definitions have been used for the merging firms and the control group companies, so that this bias should be removed or reduced for the variables measuring the impact of the mergers, the D variables.

Table 6

Purchase and Sales Prices of Spinoffs of 1000 Largest Acquisitions

Acquiring Firm	Acquired Firm	Year Acquired	Year Sold	Purchase Price $ '000	Sales Price $ '000
Murray (Walace-Murray)	Easy Washer	1955,57	1963	9,400	770
National Sugar	Godchaux Sugar	1956	1961	14,000	9,600
Kennecott Copper	Okonite	1957	1966	31,300	31,700
Heublin	Theo Hamm	1965	1973	62,006	6,000

Source: Moody's Industrial Manual, 1973

As in all merger studies, conclusions are contingent on the presumed counterfactual. We have chosen a size matched, but otherwise random control group of companies that were also among the 1000 largest of 1950, but neither acquired another member of this group or were themselves acquired. The presumption is that those companies that were acquired would have had similar market share histories to these control group firms. The relative performance of the continuous- and discontinuous - D variables indicates that the relative deterioration in acquired firm market shares followed rather than preceded their acquisition. But we can never know what in fact would have happened had they not been acquired.

IV. Conclusions

The results reported in this paper indicate that companies acquired between 1950 and 1972 achieved smaller market shares than they would have had they performed as the size-matched control group firms did. Moreover, the earlier they were acquired the greater the loss in market share. The deterioration in performance is more pronounced for conglomerate acquisitions than for horizontal, but the results for horizontal mergers are more likely to be biased in favor of finding a positive effect of mergers on market share. The estimates of the magnitude of market share loss vary over a considerable range. The economically most meaningful and statistically reliable of these are for the various sales weighted equations. These imply cumulative losses in market share from time of acquisition up through 1972 of an average 42 percent of original market share or more for conglomerate mergers, and at least a 20 percent loss for horizontal mergers.

The theoretical discussion of Section I suggests two explanations for this loss in market share: changes in the degree of cooperation, and declines in efficiency or the quality of a firm's products. The results for unweighted market shares indicate declines in market share for all but the firms with the largest market shares. Reference to Table 1 indicates that this result is consistent with mergers having <u>increased</u> the degree of cooperation. The sales weighted results imply market share declines for firms with small and large initial market shares. This latter result is possible only if the acquisition of relatively small firms increased the degree of cooperation, while the acquisition of relatively large firms decreased the degree of cooperation - an implausible combination. With respect to horizontal mergers, the perfect coordination of output decisions of the two merging firms following the merger implies unambiguously a decline in their market shares. Thus, if the empirical results are to be rationalized on the basis of changes in the degree of cooper-

ation, it would appear that mergers tend to increase the degree of cooperation.

But, in my mind, a more plausible explanation for the reductions in market shares observed, particularly for the conglomerate mergers, is that the acquired firms experienced a loss in efficiency and/or product quality following the mergers. If this interpretation is valid, the results reported here directly contradict two of the leading hypotheses concerning conglomerate mergers: the hypothesis that they improve the quality of management, and the hypothesis that they improve the allocation of capital. The results reported here indicate declines in market share, and by implication efficiency, follow the acquisitions, and are as great if not greater when measured over those products on which the new management chooses to concentrate its selling efforts. It is hard to deduce from these improvements in managerial talent or the deployment of capital.

It is, of course, possible that the market share declines we observe would have occurred in the absence of the mergers. Smiley (1976) and Mandelker (1974) found that acquired firms had below average stock market performance prior to their acquisition. These below average stock market returns may signal the declines in market shares we record following a company's acquisition. Donald Dewey (1961) has expressed the view that mergers take place to rescue "falling firms" from bankruptcy. Assuming this interpretation is correct, our results suggest that mergers at best cushion a company's fall, they do not alter its trajectory. Moreover, the possible validity of the falling-firm hypothesis does not alter our rejection of the corporate control and internal capital market theses. If bad management or the lack of access to internal capital markets leads to a firm's fall and subsequent acquisition, then the new management and new source of capital does not appear to reverse the company's performance.

The results presented here strongly imply that mergers do not improve operating efficiency or product quality, and may even worsen them. While the literature abounds in hypotheses about how mergers improve efficiency, few theories exist about how they may reduce it. Our results suggest that work developing this alternative set of theories should begin. Perhaps, the best place to start is simply to reverse the arguments put forward claiming that mergers increase efficiency and product quality. Acquiring firm managers may be less competent at managing the assets of the companies they acquire, than the previous management. Rather than supplying additional capital to the newly acquired units to improve their efficiency and product quality, perhaps a management lacking either knowledge or commitment to a product line foreign to the parent firm's main lines allows them to "whither on the vine", an allegation often seen in the business press and in case studies of merger failure.

Present merger policy allows any merger that does not threaten a substantial lessening of competition to take place, on the apparent presumption that these mergers increase efficiency. The results of this paper call this presumption into question. Acquired companies were judged to be significantly worse than otherwise similar nonacquired companies by the most fundamental of all economic performance measures, their ability to attract customers in the market. This finding suggests that the 1000 or more mergers per year that have occurred over the last 30 years may have actually reduced the internal operating efficiency of the firms involved, worsened the relative attractiveness of their products. Should these findings withstand further empirical scrutiny, a fundamental rethinking of public policy toward mergers would be in order.

Footnotes

* Preliminary work on this paper was done while I was a consultant to the FTC. My thanks go to Carl Schwinn for his programs aggregating the CPR data into our economic markets, and to Paul Bagnoli, John Hamilton and Talat Mahmood for additional computer assistance. The views expressed in this paper are my own, and should not be assumed to be shared by the above mentioned gentlemen, any of the FTC staff, or its commissioners.

1. For surveys of this literature see, Hogarty (1970), Steiner (1975), Mueller (1977, 1981), Scherer (1980, pp. 138-41), and Halpern (1982).

2. See, Steiner (1975) and Mueller (1980, ch. 2).

3. The most frequent approach used today is to define it as the change in all other sellers' outputs in response to a given firm's change in output (see, e.g. Cowling and Waterson, 1976; Dansby and Willig, 1979). The first time I recall seeing the degree of cooperation analysed as in this paper was in unpublished working papers by William F. Long in the early seventies.

4. The 1950 survey has been published (FTC, 1972), the 1972 survey has not been released.

5. The list of merging and control group companies is available from the author.

6. The market definitions used are given in Appendix A-2 of (Mueller, 1983).

7. See, Williamson (1970) and Weston (1970).

8. Note that an acquired company having some sales in markets in which the acquiring had sales, and some in markets where it did not, appeared in both the conglomerate and horizontal merger samples. Its market share in each was calculated by aggregating over the j appropriate to each definition.

9. The distribution of market shares is obviously not normal. The econometric difficulties this causes are taken up below.

10. Because our reference point in selecting a sample is firms in existence and relatively large in 1950, a far smaller percentage of our mergers took place in the late '60s than is true for the population of all firms in existence at each point in time. The (unweighted) mean year for a merger in the sample is 1961, virtually in the middle of the time period.

11. Equations 1-12 were also estimated with intercept terms with analogous results.

12. The procedure proposed by Gleijser (1969) was employed to test for the presence of heteroscedasticity, with M_{50}^{α} and S_{50}^{α} as likely scale variables, α = .5, 1, 2.

13. The t-statistics are conditional on the λ estimates, and exceed the unconditional t-statistics, however.

14. Obviously a straight line estimate of market share loss cannot be projected indefinitely, since market share cannot fall below zero. The reported results are offered simply to indicate orders of magnitude. Multiplying T by M^2 actually gave a slightly superior statistical fit for both dependent variables indicating proportionately greater market share losses following mergers for those acquired firms having larger initial market shares.

15. These classifications are included in the separate appendix listing the sample companies.

16. This conclusion should not be construed to mean that there were no important vertical acquisitions by the 1,000 largest companies. Many important vertical acquisitions by these firms were out of manufacturing, i.e. either backward into raw materials or forward into wholesaling, retailing or transportation. Our sample includes vertical acquisitions only within manufacturing.

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