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Horizontal Mergers and Exit in Declining Industries*

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Abstract:

Previous work on exit in declining industries has neglected mergers. We examine a simple model that predicts which declining industries experience horizontal mergers. Mergers are more likely if 1) market concentration is high; 2) the inverse demand curve is steep at high levels of output and flat at low levels of output; and 3) the industry declines slowly early on and rapidly later on. The conditions that make mergers privately profitable also tend to make them socially optimal. We test the model using U.S. manufacturing industries that declined during 1975-1995 and find some empirical support.

JEL Codes: L10: Market Structure, Firm Strategy, and Market Performance; **G34:** Mergers and Acquisitions; **L41:** Antitrust Policy, Horizontal Anitcompetitive Practices

Keywords: takeover, restructuring, consolidation, industry dynamics, failing industries

1. Introduction

Interest in declining industries was sparked by Harrigan (1980), who analyzed several declining industries and provided a taxonomy of strategic behavior in such settings. Since Harrigan's study, several game theorists have developed models to analyze exit behavior in declining industries (Ghemawat and Nalebuff, 1985, 1990; Reynolds, 1988; Whinston, 1988; Londregan, 1990; and King, 1998). However, most work to date focuses on a limited range of strategic behavior – firms either reduce capacity incrementally or shut down entirely. The analysis of other possible strategies, such as exit through mergers or acquisitions, has been neglected.[1]

The goal of this paper is to incorporate the possibility of horizontal mergers (mergers between competitors) into a model of exit from a declining industry in order to predict which industries experience mergers. To do this in a simple way, in Section 2 we extend the basic duopoly model of Ghemawat and Nalebuff (1985) to allow for mergers. Though simple, our model provides insight into consolidation and the order of exit. Interestingly, the conditions that make mergers privately profitable also tend to make them socially optimal.

The model generates falsifiable hypotheses about which declining industries experience mergers.[2] Mergers are more likely if 1) market concentration is high; 2) the inverse demand curve is steep at high levels of output and flat at low levels of output; and 3) the industry declines slowly early on and rapidly later on. Result 1 can be tested directly. Results 2 and 3 imply that mergers are more likely when quantity reductions early on in the declining period are associated

[1] One exception is Dutz (1989), who uses a Cournot-style model with linear demand and capacity constraints to analyze how the profitability and welfare implications of horizontal mergers are affected by the level of the intercept of the demand curve pre and post-merger.

[2] Much of the empirical work on declining industries has also neglected mergers (Baden-Fuller, 1989; Lieberman, 1990; Deily, 1991). One exception is Schary (1989), who finds that firm characteristics are insufficient for predicting the form of exit in the cotton textile industry 1924-40. Dutz (1989) also describes case studies of mergers

with larger increases or smaller decreases in price, while quantity reductions later on in the declining period are associated with smaller increases or larger decreases in price. In Section 3 we test these hypotheses using data on four-digit SIC code U.S. manufacturing industries that declined during 1975-1995. The results provide some empirical support for the model.

2. The Model

In this section we develop a simple duopoly model of exit from a declining industry. The model extends the model developed by Ghemawat and Nalebuff (1985) to allow for mergers. There are two firms, *L* and *S*. Firm *L* has capacity K_L and firm *S* has capacity K_S, where $K_L > K_S$. Both firms have the same unit cost of capacity *c*. Production is all or nothing, so each period each firm must produce at capacity or exit the market. Once a firm exits reentry is not possible.[3]

The inverse demand at time *t* depends on the total industry output (which is identical to the industry capacity) and an industrial decline function $g(t)$ that determines how much demand has declined. Assume that $g(0) = 0$ and that $g(t)$ is an increasing function – this implies that when time increases, the inverse demand function decreases. If both firms are in the market

$$P(t) = a - f(K_L + K_S) - g(t), \qquad (1)$$

where $P(t)$ is the price in period *t* and *a* is a constant. If only firm *i* is in the market

$$P(t) = a - f(K_i) - g(t). \qquad (2)$$

Each firm's profit at time *t* is

$$\pi_i(t) = [P(t) - c]K_i. \qquad (3)$$

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in declining industries. In a broader study of corporate restructuring, Mitchell and Mulherin (1996) find that industry sales shocks (positive and negative) are related to merger activity.

[3] The analysis of cyclical industries, where demand is expected to eventually rise again, would be much more complicated because it would be important to allow for new entrants. Gowrisankaran (1999) begins to address these complications by introducing a dynamic equilibrium model with mergers and entry in a stationary setting.

Assume that $a - f(K_L+K_S) = c$. This implies that if both firms are in the market at time 0 then both earn zero profits. Because demand declines from then on, if both firms stay in the market then both earn losses. Therefore one must exit. After one firm exits, the other earns monopoly profits until it, too, exits. Given that $c = a - f(K_L+K_S)$, the monopolist's profit function is

$$\pi_i(t) = [-g(t) - f(K_i) + f(K_L + K_S)]K_i. \quad (4)$$

Expression (4) shows that profits, and therefore behavior, depend on only three things in the model: the firms' capacities, the curvature of the inverse demand function as determined by $f(.)$, and the shape of the decline function.

The monopolist exits when its profit falls to zero. By equation (4) this occurs when

$$g(t) = -f(K_i) + f(K_L + K_S). \quad (5)$$

Inverse equation (5) to obtain

$$t_i = g^{-1}(f(K_L + K_S) - f(K_i)), \quad (6)$$

where t_i is the period when firm i exits. Because $K_L > K_S$ and $g(.)$ is an increasing function, the large firm's exit period is before the small firm's: $t_L < t_S$.

If mergers are not possible, then the model is a special case of the model described by Ghemawat and Nalebuff (1985). Ghemawat and Nalebuff (1985) show that in the unique subgame perfect Nash equilibrium (SPNE) the large firm exits first. The intuition for why this occurs is that when demand declines the small firm can last longer as a monopoly than the large firm. Recognizing this, the large firm does not get involved in a war of attrition it knows it cannot win – it exits immediately.[4]

[4] Of course, if the large firm is large because it is *more efficient* than the small firm, the large firm may be able to outlast the small firm (see Fudenburg and Tirole (1986), for example). Several other authors have also concluded that small firms may have an advantage in declining industries (see Reynolds, 1988; Ghemawat and Nalebuff, 1990; and Londregan, 1990).

Note that Ghemawat and Nalebuff's result does not refer to which firm is more *profitable* as a monopoly – the argument relies only on which firm can last longer. It is possible that cumulative industry profit over the declining period is higher if the small firm exits first. In this case, if mergers are permitted and transactions costs are sufficiently low, the large firm prefers to buy the small firm in period 0 and shut it down. That is, consolidation occurs when the large firm's value as a monopoly is greater than that of the small firm.

The model yields a simple inequality that determines whether mergers occur. To derive this condition, the large and small firms' values as monopolists must be computed. Integrate the profit function (eq. (4)) from period 0 to the firms' exit period t_i:

$$V_i = [-G(t_i) - f(K_i)t_i + f(K_L + K_S)t_i]K_i, \tag{7}$$

where $G(t_i) = \int_0^{t_i} g(t)dt$. For simplicity discounting future payoffs is ignored. The ratio V_L/V_S is

$$\frac{V_L}{V_S} = \frac{[-G(t_L) - f(K_L)t_L + f(K_L + K_S)t_L]K_L}{[-G(t_S) - f(K_S)t_S + f(K_L + K_S)t_S]K_S} \tag{8}$$

$$= \frac{[-G(t_L) + at_L - f(K_L)t_L - at_L + f(K_L + K_S)t_L]K_L}{[-G(t_S) + at_S - f(K_S)t_S - at_S + f(K_L + K_S)t_S]K_S} \tag{9}$$

$$= \frac{[-G(t_L) + t_L(P_L - P)]K_L}{[-G(t_S) + t_S(P_S - P)]K_S}, \tag{10}$$

where $P_L = a - f(K_L)$ ($P(0)$ when L is a monopolist); $P_S = a - f(K_S)$ ($P(0)$ when S is a monopolist); and $P = a - f(K_L+K_S)$ ($P(0)$ when both firms are in the market).

The large firm buys the small firm if $V_L/V_S > 1$. This condition holds if

$$\frac{K_L}{K_S} > \frac{-G(t_S) + t_S(P_S - P)}{-G(t_L) + t_L(P_L - P)}. \tag{11}$$

Inequality (11) determines whether consolidation occurs. Partial derivatives show that mergers are more likely when K_L, $P_L - P$, $G(t_S)$, and t_L are high and K_S, $P_S - P$, $G(t_L)$, and t_S are low. In the following paragraphs we describe restrictions on the capacities, $f(.)$, and $g(.)$ that make these conditions hold. Our goal is to formulate testable hypotheses about conditions that lead to mergers in declining industries.

First, inequality (11) is more likely to hold when K_L is high and K_S is low. This suggests a testable hypothesis:

Result 1: Mergers are more likely in declining industries that are more concentrated.

We test this hypothesis below. The theoretical literature on horizontal mergers supports the claim that concentration makes mergers more profitable, and therefore more likely (Salant, Switzer, and Reynolds, 1983; Deneckere and Davidson, 1985; and Perry and Porter, 1985). Our model shows that this claim applies to declining industries as well. Barriers to entry and expansion are also important – empirical work on collusion shows that large market shares of the colluding group combined with barriers to entry and expansion make central coordination more likely to occur (Filson et al. 2001). Here we have assumed that since the industry is declining there is no entry or expansion.

The second condition is that inequality (11) is more likely to hold when $P_L - P$ is high and $P_S - P$ is low. This condition matters because the monopolist gets the markup $P_i - P - g(t)$ throughout the declining period. The condition suggests the following result:

Result 2: Mergers are more likely in industries in which the inverse demand curve is steep at high levels of output and relatively flat at low levels of output (the $f(.)$ function is convex).

To see why Result 2 holds, note that if the inverse demand curve is steep at high levels of output then $P_L - P$ will be high. Further, if the inverse demand curve is relatively flat at low levels of output then $P_S - P$ will be low. Consider an extreme example where the inverse demand curve has a kink at (K_L, P_L), as shown in Figure 1. Figure 1 shows how, for a given value of $P_L - P$, the degree to which the inverse demand curve flattens out at low levels of output affects $P_S - P$.

The third condition is that inequality (11) is more likely to hold when $G(t_S)$ and t_L are high and $G(t_L)$ and t_S are low. This suggests that the pattern of decline is important:

Result 3: Mergers are more likely in markets that experience a low rate of decline early on and a high rate of decline later on.

To see why Result 3 holds, consider an extreme case where $g(t) = 0$ for $t < t^*$, $g(t^* + 1) = a - f(K_L)$ and $g(t^* + 2) = a - f(K_S)$. The market does not decline until time t^*, and then it declines rapidly. Early on in the declining period, no decline occurs, so if firm L is a monopolist it gets the benefit of a high P_L for several periods. Further, $t_L = t^* + 1$ and $t_S = t^* + 2$, so firm S gets only one extra period as a monopolist. If P_S is very close to P_L then the two firms' markups are essentially the same, so if firm L is sufficiently larger than firm S then it must be the more profitable monopolist – firm S's only advantage is that it lasts an extra period, but firm L's advantage is that each period it produces much more output.

This is an extreme example, but real-world decline patterns could come close to it. Empirical studies of technology substitution, such as Norton and Bass (1987, 1992), suggest that the pattern of decline in declining industries is similar to the pattern of growth in new industries: both can be described using S-shaped diffusion curves. The rate of decline is initially low, then it accelerates, and then it diminishes once decline is substantially complete. If the initial period with a low rate of decline is long and the period of acceleration is short then a pattern like that described above would occur (see Figure 2).

Results 2 and 3 cannot be tested separately because it is not possible to distinguish the effects of output changes that cause movements along the inverse demand curve from the effects of decline that cause the curve to shift. However, taken together, the two results yield a testable hypothesis about when mergers are likely to occur: if the inverse demand curve is steep at high levels of output *and* the rate of decline is low initially, then we should observe a steep relationship between price and output early on in the declining period because the inverse demand curve is relatively stable. If the inverse demand curve is flat at low levels of output and the rate of decline is rapid later on in the declining period, then we should observe either a flat relationship between price and output or a positive relationship (price and output may decline together). Therefore, we should observe the following pattern when comparing industries: industries in which mergers occur should have a more negative or less positive relationship between price and output early on in the declining period and a less negative or more positive relationship later on in the declining period. We test this hypothesis below.

Social Welfare

In this subsection we show that the conditions that make mergers likely also tend to make them socially optimal. To see this, compare social welfare when L is a monopolist to when S is a

monopolist. Social welfare in period *t* when *L* is a monopolist is the area under the inverse demand curve above *c*,

$$[a - g(t) - c]K_L - F(K_L), \tag{12}$$

where $F(K_L) = \int_0^{K_L} f(z)dz$. To obtain social welfare over the entire declining period when *L* is a monopolist, integrate expression (12) from 0 to t_L:

$$\begin{aligned} W_L &= [(a-c)t_L - G(t_L)]K_L - F(K_L)t_L \qquad (13)\\ &= [f(K_L + K_S)t_L - G(t_L)]K_L - F(K_L)t_L \\ &= V_L + f(K_L)t_L K_L - F(K_L)t_L. \end{aligned}$$

W_S is defined similarly – simply replace K_L and t_L with K_S and t_S. Given expression (13), if $V_L > V_S$, then a sufficient condition for $W_L > W_S$ is

$$[f(K_L)K_L - F(K_L)]t_L > [f(K_S)K_S - F(K_S)]t_S. \tag{14}$$

Figure 3 shows that $f(K_L)K_L - F(K_L) > f(K_S)K_S - F(K_S)$. The gap between the two expressions is shaded in Figure 3. Clearly the gap is increasing in the concavity of the inverse demand curve as determined by *f*(.). Therefore, a concave inverse demand curve (a convex *f*(.)) makes it more likely that a merger is socially optimal. As noted in Result 2, this is also one of the conditions that makes a merger privately profitable. The only way expression (14) may not hold is that t_S may be much larger than t_L, but as noted in the discussion of Result 3 this makes it less likely that a merger is privately profitable. Therefore, the conditions that make mergers privately profitable also tend to make them socially optimal.

Oligopoly

In this subsection we provide a brief analysis of mergers in the case of three firms to show that the model continues to yield the testable hypotheses described above. Assume that

regulators do not permit a merger unless industry profit is zero and one firm is about to exit. This is a reasonable rule because if industry profit is positive then social welfare is increasing in total industry capacity so mergers that involve capacity reductions would not be permitted. On the other hand, if industry profit is zero then it may be desirable to allow a merger in order to rationalize capacity reduction.

Given the assumption that mergers can occur only when industry profit is zero, if there are positive transactions costs of merging then only the largest firm in the market can find it optimal to purchase another firm. A smaller firm will not incur the expense to purchase the largest firm and shut it down because if no merger occurs the largest firm will exit on its own, and the smaller firm will not purchase and shut down a firm other than the largest because it is better off with the larger reduction in industry capacity that occurs when the largest firm exits (because the industry price rises more).

Given that only the largest firm can be an acquirer, we analyze conditions under which the largest of three firms finds it optimal to purchase and shut down one of the smaller firms. Index the firms by 1, 2, and 3, where 1 is the largest and 3 is the smallest. Assume that at time 0 industry profits are zero if all three firms are in the market. The formal analysis is quite tedious because a variety of cases must be considered. At time 0, firm 1 may exit, buy firm 2, or buy firm 3. In order to value each one of these options, future choices must be considered. For example, if firm 1 exits, does firm 2 buy firm 3 at some point in the future? If firm 1 buys firm 2, does firm 1 buy firm 3 later on? For brevity, we present a formal analysis of the simplest case in the appendix, and here we restrict ourselves to providing intuition. In the appendix we assume that firm 1 prefers exiting to buying firm 3. This implies that firm 1 compares exiting to buying firm 2. Further, we assume that no future mergers occur.

The intuitive explanation for why Results 1-3 continue to hold in the oligopoly case is as follows. If firm 1 buys one of the smaller firms and shuts it down then a smaller reduction in industry capacity occurs than would be the case if firm 1 exited. The relative profitability of each option (exit, buy firm 2, buy firm 3) depends on how much price rises in each case. For example, if the inverse demand curve is steep when output is greater than $K_1 + K_3$ and relatively flat when output is below $K_1 + K_3$ then, as in the duopoly case, the markup is similar whether firm 1 or 2 is shut down. Further, as in the duopoly case, if demand declines slowly early on then firm 1 benefits from a high markup for several periods, and the larger firm 1's capacity, the more units of output the high markup is spread over. If demand declines rapidly around the time that firm 1 must exit then the exit periods of all of the firms are similar – the small firms do not benefit much from having a longer life. Thus, in the oligopoly case the three results obtained in the duopoly case continue to hold: mergers are more likely if firm 1 is large, the inverse demand curve is concave, and demand declines slowly early on and rapidly later on.

3. Empirical Analysis

Most of the empirical literature on declining industries uses a case study approach (pioneered by Harrigan, 1980, and employed by Ghemawat and Nalebuff, 1990, among others; Lieberman, 1990, is a notable exception). In contrast, we provide large sample results to test our model. There are advantages and disadvantages to our approach. An advantage is that we can be confident that our results are not specific to a few isolated cases. A disadvantage is that our data is not sufficiently detailed to examine many of the issues case studies address, such as the precise order of plant shutdowns. Given this, our empirical analysis focuses on the model's testable implications for mergers and not on the order of exit.

Data

The data includes all of the four-digit SIC (Standard Industrial Classification) manufacturing industries in the United States that declined during the period 1975-1995. The four-digit SIC code industries are used because of the availability of data on concentration ratios, price, quantity, and mergers. Price and output measures are from the NBER Manufacturing Productivity Database (Bartelsman and Gray, 1996). Industry output was calculated by dividing the value of shipments in each industry by its price index. After computing output, the price indexes were deflated using the CPI to remove economy-wide inflation, and the deflated prices were used to compute the statistics reported below. The market concentration ratios are from the Census of Manufactures. Merger data is from the Lexis-Nexis database, which allows searches for mergers and acquisitions by SIC code.

From the 459 U.S. manufacturing industries in the NBER database, 104 declining industries were selected using the following criteria: an industry is defined as *declining* when the industry output begins declining in the 1975-85 period, declines over at least a five-year period, and then stays below its level at the first period of decline until at least 1995. These criteria are designed to exclude industries that decline due to cyclical fluctuations.

The declining industries are classified into two groups. There are 47 industries in the "no-merger group," in which no horizontal mergers or acquisitions occur. There are 57 industries in the "merger group," in which horizontal mergers occur. Because the theoretical model does not distinguish between mergers and acquisitions we do not distinguish between the two here. Firms in the no-merger group may be involved in vertical mergers (mergers with buyers or suppliers) or other types of mergers. We count only mergers between competitors that have significant operations in the U.S., and we include cases where a firm acquires a major division from a competitor. Thus, a merger need not involve the exit of a firm, although in most cases it does.

Before proceeding to the hypothesis tests we present summary statistics. Tables 1a and 1b summarize the declining periods and the rates of decline in the no-merger group and the merger group, respectively. For example, SIC code 2067, Chewing Gum, declined from 1979-1991, and output fell 18.7% during this period. By 1995 output had increased somewhat; output fell 6.1% from 1979-1995. The averages show that the average length of the declining period is higher in the merger group and the average rate of decline is lower in the merger group, but the differences are small and statistically insignificant.

Tables 2a and 2b list the number of firms in 1977 and 1992. The Census of Manufactures provides firm numbers every five years, and some SIC codes change over time (see fn. 5 below). The numbers in Tables 2a and 2b provide a rough measure of firm numbers before and after decline and the net exit rate. Net exit occurs in most industries, but in some cases net entry occurs. This suggests that future models might explore the implications of allowing entry to occur during the declining period, although as we noted above in fn. 3, this would complicate the analysis considerably. The results in the tables show that, on average, industries with mergers have more firms and less exit. Although the differences in the averages are large they are statistically insignificant because there is a high amount of variation in firm numbers and exit rates within each group.

Hypothesis Tests

The first hypothesis states that mergers are more likely to occur in markets that are more concentrated at the beginning of the declining period. Table 3a and 3b reports the share of the value of shipments of the four largest, eight largest, twenty largest, and fifty largest firms in 1977 (CR4, CR8, CR20, and CR50).[5] The results show that, on average, there is not much difference

[5] Concentration ratios and firm numbers are available from the Census of Manufactures every five years. In a few cases (SIC 2111, 2823, and 3263), some of the concentration ratios were withheld to protect firms' private

between the two groups. The industries in the merger group are more concentrated using the CR4 measure but less concentrated using the other measures, and the differences are very small and statistically insignificant. This appears to provide little support for the hypothesis.

However, one fact has not been considered: antitrust officials are less likely to allow large firms in more concentrated industries to merge. Taking this as given, if firms in more concentrated industries are neither more nor less likely to attempt mergers then what we should expect to see in Tables 3a and 3b is that average concentration is much higher in the no-merger group. Attempts would be equally likely regardless of concentration but firms in more concentrated industries would be blocked more often. The fact that we do not observe this pattern in Tables 3a and 3b suggests that firms in more concentrated industries are more likely to attempt mergers, and this supports our hypothesis.

The second hypothesis states that mergers are more likely to occur in industries where the relationship between price and quantity is more negative or less positive early on in the declining period and less negative or more positive later on. To test this hypothesis we look for evidence of a structural break in the price-output relationship during the declining period. We divide the declining period in each industry into two equal parts and investigate the price-output relationship in each part.

First, we look for evidence that prices rise more or fall less in the early part of the declining period in industries where mergers occur. Tables 4a and 4b show that, on average, prices fall less early on in the merger group than in the no-merger group. Further, prices fall at a

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information. In these cases we computed the minimum possible concentration ratio given the number of firms. In some other cases (SIC 2325, 2656, 2999, 3339, 3362, 3494, 3536, 3553, 3556, 3594, 3613, 3641, 3671, 3965) the composition of the SIC code had changed since 1977, and in those cases we computed firm numbers and concentration ratios using weighted averages of the old SIC codes. The weights are from the NBER web site in the materials provided by Bartelsman and Gray (1996).

higher rate later on in the merger group than in the no-merger group. These results support the hypothesis.

To proceed further, we regress the natural log of price on the natural log of output in each industry in each part of the declining period. Using logs removes the impact of units of measurement on the results. The OLS equation is

$$lp_t = \alpha_0 + \beta_0 lq_t + \varepsilon_t ,$$

where lp_t is the log of the price series, lq_t is the log of the output series, α_0 and β_0 are coefficients, and ε_t is the error term.

The model predicts that changes in the steepness of the price-output curve over the declining period affect the likelihood of mergers. In industries where mergers occur, β_0 should be lower early on in the declining period and higher later in the declining period, where "lower" and "higher" are determined relative to the industries where mergers do not occur.

Tables 4a and 4b report the β_0 coefficients from OLS regressions when the declining period in each industry is divided in two. The results support the hypothesis of the model. The average β_0 over the first half of the declining period of the merger group (0.10) is lower than the coefficient of the no merger group (0.11), and the average β_0 over the second half of the declining period of the merger group (0.18) is higher than the coefficient of the no merger group (0.078). The difference between the early coefficients is statistically insignificant, but the difference between the late coefficients is significant at the 5% level.

Thus, the results suggest that the main effect driving mergers is that in the industries in which mergers occur, demand declines rapidly late in the declining period. In this case, small firms cannot survive much longer than large firms, so the large firms' advantage from having higher profits in the short term makes the large firm more valuable.

4. Conclusion

This paper presents a theoretical model and an empirical analysis to investigate horizontal mergers in declining industries. Ghemawat and Nalebuff (1985) show that when production is all-or-nothing large firms exit before small firms in declining industries. Our simple extension of their model shows that large firms may be more valuable than small firms, and this implies that when mergers are allowed the large firms may buy the small ones and shut them down. The large and small firms' values are determined by three factors: the firms' capacities, the shape of the inverse demand function, and the rate of decline in demand (and how this rate changes over time). Mergers are more likely in industries where the pre-merger market is concentrated and where small capacity reductions early on in the declining period lead to larger increases in price. The empirical results conform to the model's predictions.

Note that the model presented here is very simple, and it cannot explain all of the possible reasons for merging in a declining industry. One notable absence is that we have not considered efficiency advantages, which cannot be measured with our data but are probably important (see Dutz, 1989). Introducing efficiency advantages could affect many of our results. For example, in our model the acquiring firm is always larger than the acquired firm, but this need not be the case if efficiency differences exist. A small efficient firm may choose to buy a large inefficient firm's capacity in order to use the capacity more effectively.

Future work on mergers in evolving industries could make several contributions. In addition to considering efficiency differences, the assumption of all-or-nothing production could be relaxed (as in Ghemawat and Nalebuff, 1990), and firms could be allowed to buy each other's plants. Second, the analysis could consider entry and allow for the fact that while many industries decline, few disappear completely. Allowing for entry and incomplete decline would

allow the analysis to move beyond declining industries to consider industries at various stages in development. Recent work suggests that exploring how integration varies at different stages in an industry's evolution would be useful: Franco and Filson (2001) show that horizontal mergers were an important form of exit in the disk drive industry during the 1980s and 1990s, and Filson (2001) shows that vertical integration occurred early in the personal computer industry's life cycle and just prior to its shakeout in the early 1990s.

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Appendix: Formal Analysis of the Three-Firm Oligopoly

Whether firm 1 prefers to exit at time 0 or buy firm 2 and shut it down depends on which firm is more valuable as a duopolist competing with firm 3. If firm 1 exits at time 0 then firms 2 and 3 coexist until demand declines to the point where firm 2 must exit - denote this period by t_2. If firm 1 buys firm 2 and shuts it down at time 0 then firms 1 and 3 coexist until demand declines to the point where firm 1 must exit – denote this period by t_1. Using similar steps to those in the duopoly case the two firms' values can be computed as follows:

$$V_i = [-G(t_i) - f(K_i + K_3)t_i + f(K_1 + K_2 + K_3)t_i]K_i, \qquad (15)$$

where $i = 1,2$. Again, following steps similar to those in the duopoly case, $V_1 > V_2$ if

$$\frac{K_1}{K_2} > \frac{-G(t_2) + t_2(P_2 - P_0)}{-G(t_1) + t_1(P_1 - P_0)}, \qquad (16)$$

where $P_1 = a - f(K_1 + K_3)$ ($P(0)$ when 1 and 3 are duopolists); $P_2 = a - f(K_1 + K_2)$ ($P(0)$ when 2 and 3 are duopolists); and $P_0 = a - f(K_1 + K_2 + K_3)$ ($P(0)$ when all three firms are in the market).

Clearly, expression (16) is directly comparable to expression (11) obtained in the duopoly case, so the results obtained for the duopoly case apply to this case. For the sake of brevity we have not presented a variety of other cases with different future paths (for example, instead of exiting at t_1 firm 1 might prefer to buy firm 3 and shut it down), but note that even in the other cases the V_i terms in expression (15) are part of each firm's value, if not the entire value. Therefore, any factors that make expression (16) more likely to hold contribute towards making mergers more profitable.

Figure 1

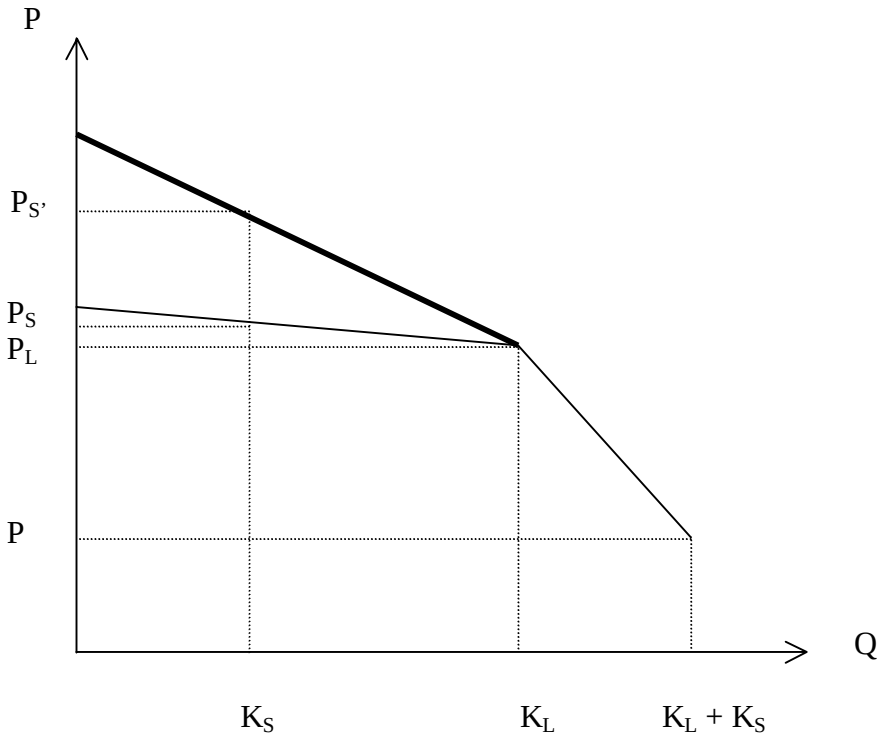

Figure 2

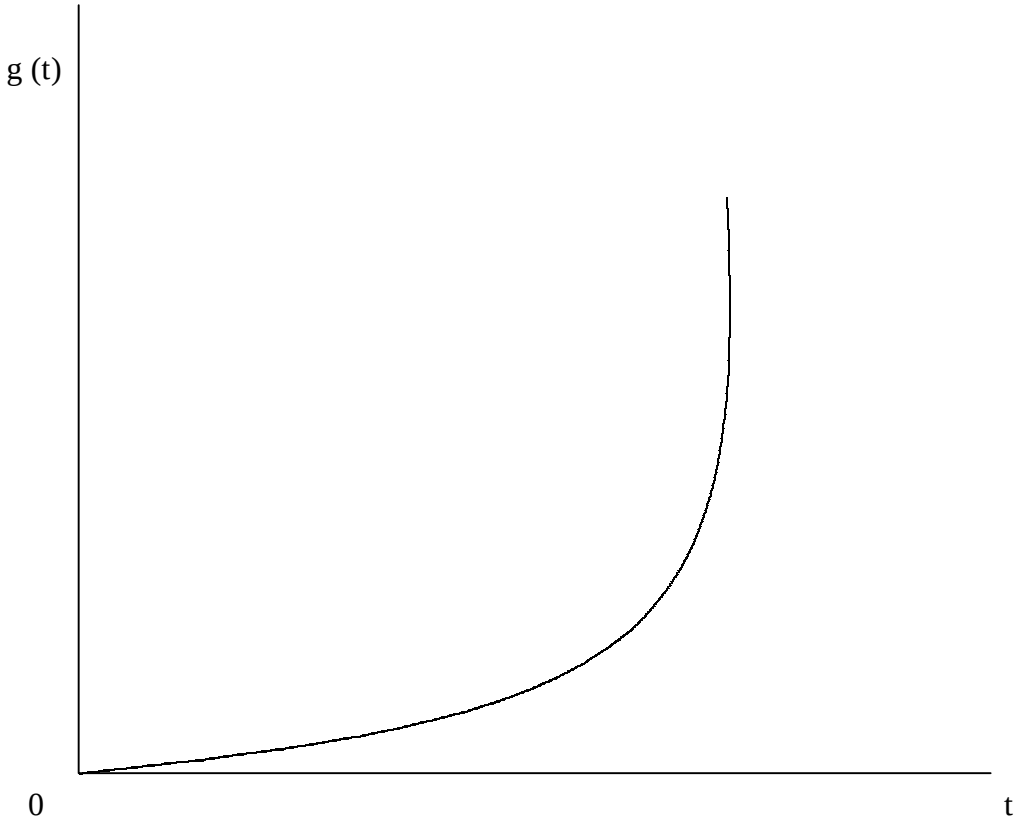

Figure 3

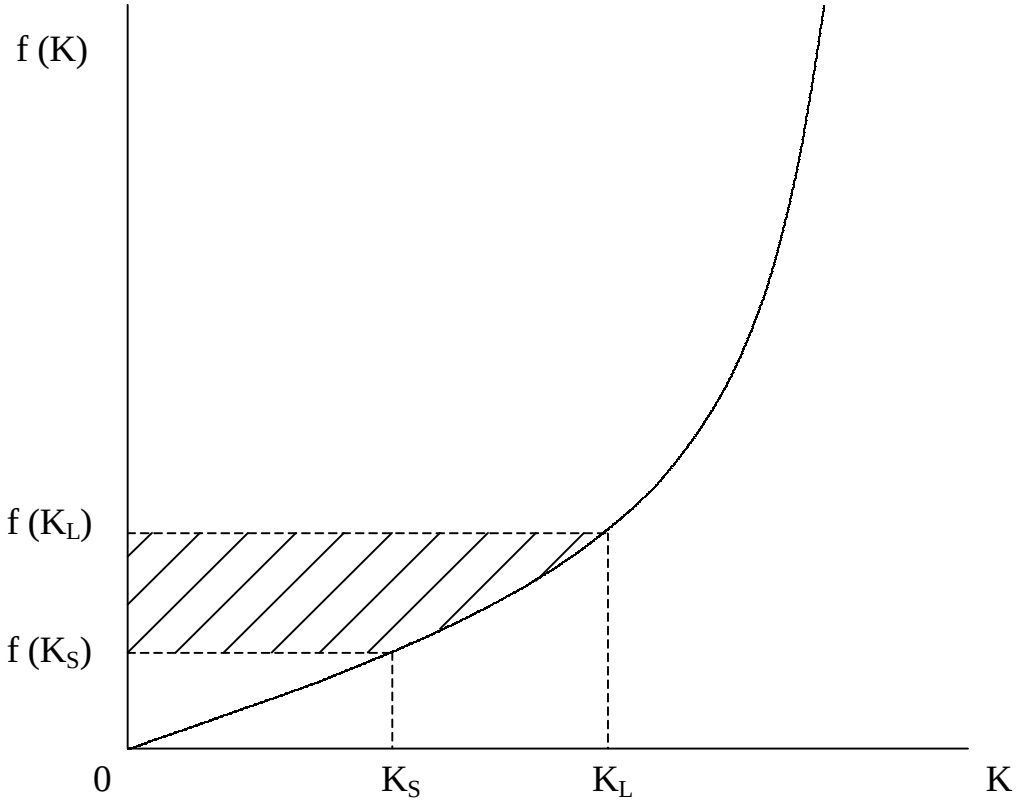

Table 1a: Decline in Output in the No-Merger Group

SIC Code	Description	Period of Decline	Total Rate of Decline	Total Rate of Decline as of 1995
2067	Chewing gum	1979-91	-18.7	-6.1
2111	Cigarettes	1981-93	-35.4	-11.7
2141	Tobacco stemming and redrying	1976-86	-41.4	-27.9
2296	Tire cord and fabrics	1978-93	-49.4	-38.9
2337	Women's, misses', and juniors' suits and coats	1982-95	-32.9	-32.9
2371	Fur goods	1979-95	-89.3	-89.3
2381	Fabrics dress and work gloves	1978-88	-66.3	-37.5
2385	Waterproof outerwear	1976-95	-69.8	-69.8
2386	Leather and sheep-lined clothing	1975-91	-62.2	-47.8
2397	Schiffli machine embroideries	1982-95	-34.4	-34.4
2429	Special products sawmills, nec	1976-92	-82.0	-81.3
2449	Wood containers, nec	1975-86	-54.4	-49.2
2517	Wood television and radio cabinets	1978-91	-59.0	-23.3
2519	Household furniture, nec	1981-91	-29.1	-26.2
2655	Fiber cans, drums, and similar products	1979-95	-25.6	-25.6
2675	Die-cut paper and board	1983-92	-19.9	-9.3
2873	Nitrogenous fertilizers	1980-86	-29.7	-6.1
2999	Petroleum and coal products, nec	1981-90	-25.9	-19.4
3021	Rubber and plastics footwear	1975-87	-35.0	-7.1
3111	Leather tanning and finishing	1977-86	-43.6	-25.4
3131	Footwear cut stock	1981-95	-61.9	-61.9
3142	House slippers	1980-95	-74.3	-74.3
3143	Men's footwear, except athletic	1976-91	-42.1	-38.2
3151	Leather gloves and mittens	1976-95	-71.6	-71.6
3161	Luggage	1980-86	-46.6	-37.9
3172	Personal leather goods, nec	1978-95	-58.9	-58.9
3199	Leather goods, nec	1976-95	-46.3	-46.3
3259	Structural clay products, nec	1978-93	-70.0	-62.3
3262	Vitreous china table and kitchenware	1980-88	-41.3	-21.4
3263	Semivitreous table and kitchenware	1975-86	-88.3	-83.4
3291	Abrasive products	1984-92	-21.7	-13.7
3292	Asbestos products	1975-95	-100.0	-100.0
3331	Primary copper	1978-86	-54.7	-6.7
3355	Aluminum rolling and drawing, nec	1980-89	-80.8	-60.2
3366	Copper foundries	1981-91	-31.2	-29.2
3411	Metal cans	1977-86	-15.2	-8.3
3412	Metal barrels, drums, and pails	1979-86	-45.8	-40.3
3433	Heating equipment, except electric	1980-91	-32.6	-20.9
3498	Fabricated pipe and fittings	1979-87	-49.1	-7.6
3534	Elevators and moving stairways	1985-92	-27.1	-17.2
3536	Hoists, cranes, and monorails	1981-87	-54.9	-34.7
3553	Woodworking machinery	1975-91	-50.6	-18.5
3634	Electric housewares and fans	1980-92	-32.1	-22.1
3676	Electronic resistors	1984-94	-44.9	-39.6
3873	Watches, clocks, watchcases, and parts	1978-95	-73.7	-73.7
3951	Pens and mechanical pencils	1981-86	-32.3	-21.7
3965	Fasteners, buttons, needles, and pins	1977-89	-41.7	-34.8
Avg.		(length) 11.9	-48.8	-37.8
S.D.		4.0	20.7	25.0

Table 1b. Decline in Output in the Merger Group

SIC Code	Description	Period of Decline	Total Rate of Decline	Total Rate of Decline as of 1995
2051	Bread, cake, and related products	1976-93	-18.6	-18.1
2062	Cane sugar refining	1976-95	-49.8	-49.8
2079	Edible fats and oils, nec	1979-95	-40.7	-40.7
2085	Distilled and blended liquors	1980-92	-37.4	-36.2
2091	Canned and cured fish and seafoods	1981-86	-77.8	-75.3
2095	Roasted coffee	1985-95	-29.2	-29.2
2121	Cigars	1975-89	-62.5	-49.7
2221	Broadwoven fabrics mills, manmade fiber, silk	1983-91	-21.9	-7.1
2311	Men's and boys' suits and coats	1977-95	-61.8	-61.8
2325	Men's and boys' trousers and slacks	1983-90	-18.1	-0.4
2331	Women's, misses', and juniors' blouses and shirts	1982-89	-32.4	-32.3
2341	Women's and children's underwear	1980-93	-37.4	-28.8
2652	Setup paperboard boxes	1976-93	-53.2	-40.3
2656	Sanitary food containers	1976-95	-34.6	-34.6
2823	Cellulosic manmade fibers	1979-94	-49.2	-48.9
2892	Explosives	1975-95	-49.4	-49.4
3052	Rubber and plastics hose and belting	1979-91	-38.0	-19.5
3144	Women's footwear, except athletic	1976-95	-72.4	-72.4
3149	Footwear, except rubber, nec	1980-91	-76.9	-68.5
3171	Women's handbags and purses	1978-95	-73.2	-73.2
3221	Glass containers	1977-95	-44.3	-44.3
3241	Cement, hydraulic	1978-91	-27.1	-14.1
3255	Clay refractories	1978-93	-50.9	-38.7
3312	Blast furnaces and steel mills	1979-86	-49.5	-33.3
3321	Gray and ductile iron foundries	1978-91	-47.3	-31.5
3322	Malleable iron foundries	1976-92	-78.4	-75.0
3325	Steel foundries, nec	1979-86	-67.7	-51.5
3334	Primary aluminum	1979-86	-41.4	-33.2
3339	Primary nonferrous metals, nec	1980-92	-46.5	-41.7
3356	Nonferrous rolling and drawing, nec	1977-92	-44.8	-34.1
3441	Fabricated structural metal	1980-92	-21.7	-10.5
3443	Fabricated plate work (boiler shops)	1979-86	-48.2	-27.9
3463	Nonferrous forgings	1980-91	-44.4	-17.0
3484	Small arms	1976-91	-47.5	-41.4
3489	Ordnance and accessories, nec	1984-94	-50.6	-41.7
3493	Steel springs, except wire	1978-86	-41.1	-25.7
3494	Valves and pipe fittings, nec	1981-92	-43.8	-37.9
3511	Turbines and turbine generator sets	1976-86	-38.3	-17.8
3523	Farm machinery and equipment	1979-87	-64.0	-42.9
3532	Mining machinery	1975-92	-63.1	-51.6
3533	Oil and gas field machinery	1981-87	-77.9	-74.4
3541	Machine tools, metal cutting types	1981-91	-59.9	-55.7
3542	Machine tools, metal forming types	1975-92	-51.5	-37.1
3556	Food products machinery	1978-86	-36.8	-21.4
3579	Office machines, nec	1985-91	-46.5	-32.8
3592	Carburetors, pistons, rings, and valves	1984-91	-45.4	-22.9
3594	Fluid power pumps and motors	1981-93	-31.7	-22.5
3613	Switchgear and switchboard apparatus	1979-91	-27.5	-13.9
3641	Electric lamp bulbs and tubes	1979-95	-21.7	-21.7
3644	Noncurrent-carrying wiring devices	1979-91	-27.6	-10.2
3645	Residentail lighting fixtures	1978-91	-34.9	-18.8
3671	Electron tubes	1980-91	-34.1	-10.2
3731	Ship building and repairing	1981-95	-43.1	-43.1
3795	Tanks and tank components	1985-95	-69.9	-69.9
3931	Musical instruments	1976-89	-52.4	-47.0
3942	Dolls and stuffed toys	1984-95	-67.4	-67.4
3944	Games, toys, and children's vehicles	1981-90	-37.1	-19.2
Avg.		(length) 12.2	-46.7	-37.5
S.D.		4.00	16.0	19.4

Table 2a: Firm Numbers in the No-Merger Group

SIC Code	Description	Number in 1977	Number in 1992	Rate of change
2067	Chewing gum	14	Not available	
2111	Cigarettes	8	8	0.0
2141	Tobacco stemming and redrying	38	32	-15.8
2296	Tire cord and fabrics	8	12	50.0
2337	Women's, misses', and juniors' suits and coats	1558	1009	-35.2
2371	Fur goods	620	211	-66.0
2381	Fabrics dress and work gloves	100	59	-41.0
2385	Waterproof outerwear	157	61	-61.1
2386	Leather and sheep-lined clothing	236	115	-51.3
2397	Schiffli machine embroideries	357	220	-38.4
2429	Special products sawmills, nec	522	181	-65.3
2449	Wood containers, nec	238	217	-8.8
2517	Wood television and radio cabinets	91	104	14.3
2519	Household furniture, nec	198	197	-0.5
2655	Fiber cans, drums, and similar products	166	153	-7.8
2675	Die-cut paper and board	316	356	12.7
2873	Nitrogenous fertilizers	110	103	-6.4
2999	Petroleum and coal products, nec	60	70	16.7
3021	Rubber and plastics footwear	67	53	-20.9
3111	Leather tanning and finishing	428	297	-30.6
3131	Footwear cut stock	174	94	-46.0
3142	House slippers	65	28	-56.9
3143	Men's footwear, except athletic	115	108	-6.1
3151	Leather gloves and mittens	84	55	-34.5
3161	Luggage	286	285	-0.3
3172	Personal leather goods, nec	253	190	-24.9
3199	Leather goods, nec	512	428	-16.4
3259	Structural clay products, nec	94	60	-36.2
3262	Vitreous china table and kitchenware	26	35	34.6
3263	Semivitreous table and kitchenware	22	28	27.3
3291	Abrasive products	353	367	4.0
3292	Asbestos products	86	12	-86.0
3331	Primary copper	8	11	37.5
3355	Aluminum rolling and drawing, nec	18	27	50.0
3366	Copper foundries	476	324	-31.9
3411	Metal cans	153	132	-13.7
3412	Metal barrels, drums, and pails	120	116	-3.3
3433	Heating equipment, except electric	678	406	-40.1
3498	Fabricated pipe and fittings	513	815	58.9
3534	Elevators and moving stairways	134	162	20.9
3536	Hoists, cranes, and monorails	231	171	-26.0
3553	Woodworking machinery	291	278	-4.5
3634	Electric housewares and fans	239	189	-20.9
3676	Electronic resistors	77	87	13.0
3873	Watches, clocks, watchcases, and parts	283	179	-36.7
3951	Pens and mechanical pencils	133	104	-21.8
3965	Fasteners, buttons, needles, and pins	249	221	-11.2
Avg.		235.1	182.0	-14.0
S.D.		262.2	194.1	32.8

Table 2b. Firm Numbers in the Merger Group

SIC Code	Description	Number in 1977	Number in 1992	Rate of change
2051	Bread, cake, and related products	2549	2180	-14.5
2062	Cane sugar refining	27	12	-55.6
2079	Edible fats and oils, nec	66	72	9.1
2085	Distilled and blended liquors	64	43	-32.8
2091	Canned and cured fish and seafoods	215	144	-33.0
2095	Roasted coffee	133	134	0.8
2121	Cigars	94	25	-73.4
2221	Broadwoven fabrics mills, manmade fiber and silk	267	321	20.2
2311	Men's and boys' suits and coats	619	249	-59.8
2325	Men's and boys' trousers and slacks	347	278	-19.9
2331	Women's, misses', and juniors' blouses and shirts	1292	1411	9.2
2341	Women's and children's underwear	548	264	-51.8
2652	Setup paperboard boxes	280	146	-47.9
2656	Sanitary food containers	122	46	-62.3
2823	Cellulosic manmade fibers	5	5	0.0
2892	Explosives	63	65	3.2
3052	Rubber and plastics hose and belting	101	146	44.6
3144	Women's footwear, except athletic	243	99	-59.3
3149	Footwear, except rubber, nec	159	84	-47.2
3171	Women's handbags and purses	404	205	-49.3
3221	Glass containers	31	16	-48.4
3241	Cement, hydraulic	87	122	40.2
3255	Clay refractories	98	95	-3.1
3312	Blast furnaces and steel mills	395	135	-65.8
3321	Gray and ductile iron foundries	865	641	-25.9
3322	Malleable iron foundries	58	24	-58.6
3325	Steel foundries, nec	287	271	-5.6
3334	Primary aluminum	12	30	150.0
3339	Primary nonferrous metals, nec	81	102	25.9
3356	Nonferrous rolling and drawing, nec	153	161	5.2
3441	Fabricated structural metal	2319	2438	5.1
3443	Fabricated plate work (boiler shops)	1683	1801	7.0
3463	Nonferrous forgings	43	72	67.4
3484	Small arms	105	177	68.6
3489	Ordnance and accessories, nec	89	71	-20.2
3493	Steel springs, except wire	116	107	-7.8
3494	Valves and pipe fittings, nec	741	226	-69.5
3511	Turbines and turbine generator sets	68	64	-5.9
3523	Farm machinery and equipment	1868	1578	-15.5
3532	Mining machinery	293	268	-8.5
3533	Oil and gas field machinery	386	474	22.8
3541	Machine tools, metal cutting types	874	394	-54.9
3542	Machine tools, metal forming types	411	212	-48.4
3556	Food products machinery	685	498	-27.3
3579	Office machines, nec	191	143	-25.1
3592	Carburetors, pistons, rings, and valves	131	116	-11.5
3594	Fluid power pumps and motors	515	158	-69.3
3613	Switchgear and switchboard apparatus	542	439	-19.0
3641	Electric lamp bulbs and tubes	128	76	-40.6
3644	Noncurrent-carrying wiring devices	174	177	1.7
3645	Residentail lighting fixtures	675	511	-24.3
3671	Electron tubes	125	174	39.2
3731	Ship building and repairing	542	562	3.7
3795	Tanks and tank components	20	37	85.0
3931	Musical instruments	400	437	9.3
3942	Dolls and stuffed toys	223	204	-8.5
3944	Games, toys, and children's vehicles	754	894	18.6
Avg.		402.6	348.0	-8.7
S.D.		545.6	523.2	41.5

Table 3a: Concentration in 1977 in the No-Merger Group

SIC Code	Description	CR4	CR8	CR20	CR50
2067	Chewing gum	93	99	100	100
2111	Cigarettes	50	100	100	100
2141	Tobacco stemming and redrying	67	85	98	100
2296	Tire cord and fabrics	80	100	100	100
2337	Women's, misses', and juniors' suits and coats	15	20	31	45
2371	Fur goods	11	19	31	51
2381	Fabrics dress and work gloves	44	63	82	96
2385	Waterproof outerwear	41	52	70	90
2386	Leather and sheep-lined clothing	16	28	50	78
2397	Schiffli machine embroideries	26	36	50	67
2429	Special products sawmills, nec	11	19	36	57
2449	Wood containers, nec	25	38	64	87
2517	Wood television and radio cabinets	45	75	88	98
2519	Household furniture, nec	39	51	73	90
2655	Fiber cans, drums, and similar products	54	73	85	94
2675	Die-cut paper and board	43	55	71	85
2873	Nitrogenous fertilizers	34	54	82	99
2999	Petroleum and coal products, nec	67	84	94	99
3021	Rubber and plastics footwear	58	73	95	99
3111	Leather tanning and finishing	17	28	51	76
3131	Footwear cut stock	21	32	55	83
3142	House slippers	44	64	87	99
3143	Men's footwear, except athletic	31	46	73	95
3151	Leather gloves and mittens	38	54	79	97
3161	Luggage	40	50	66	85
3172	Personal leather goods, nec	38	49	67	86
3199	Leather goods, nec	13	24	44	65
3259	Structural clay products, nec	40	60	85	97
3262	Vitreous china table and kitchenware	71	94	99	100
3263	Semivitreous table and kitchenware	68	75	96	100
3291	Abrasive products	58	65	77	87
3292	Asbestos products	42	64	90	98
3331	Primary copper	87	100	100	100
3355	Aluminum rolling and drawing, nec	81	95	100	100
3366	Copper foundries	16	23	37	57
3411	Metal cans	59	74	90	98
3412	Metal barrels, drums, and pails	34	47	71	94
3433	Heating equipment, except electric	14	26	44	69
3498	Fabricated pipe and fittings	18	29	49	70
3534	Elevators and moving stairways	52	68	82	94
3536	Hoists, cranes, and monorails	16	30	57	80
3553	Woodworking machinery	35	46	62	80
3634	Electric housewares and fans	46	59	78	94
3676	Electronic resistors	38	63	86	98
3873	Watches, clocks, watchcases, and parts	58	66	82	94
3951	Pens and mechanical pencils	50	64	80	94
3965	Fasteners, buttons, needles, and pins	50	61	73	87
Avg.		42.2	56.9	73.6	87.5
S.D.		21.1	23.8	20.4	14.5

Table 3b. Concentration in 1977 in the Merger Group

SIC Code	Description	CR4	CR8	CR20	CR50
2051	Bread, cake, and related products	33	40	54	68
2062	Cane sugar refining	63	90	99	100
2079	Edible fats and oils, nec	43	63	90	99
2085	Distilled and blended liquors	52	71	91	99
2091	Canned and cured fish and seafoods	52	65	79	91
2095	Roasted coffee	61	73	89	97
2121	Cigars	56	79	95	99
2221	Broadwoven fabrics mills, manmade fiber and silk	42	58	76	90
2311	Men's and boys' suits and coats	21	32	48	67
2325	Men's and boys' trousers and slacks	49	60	73	86
2331	Women's, misses', and juniors' blouses and shirts	12	18	30	47
2341	Women's and children's underwear	22	29	43	64
2652	Setup paperboard boxes	12	21	37	58
2656	Sanitary food containers	48	68	87	96
2823	Cellulosic manmade fibers	80	100	100	100
2892	Explosives	64	79	96	99
3052	Rubber and plastics hose and belting	55	71	87	97
3144	Women's footwear, except athletic	29	39	56	79
3149	Footwear, except rubber, nec	24	41	68	91
3171	Women's handbags and purses	21	31	48	70
3221	Glass containers	54	75	98	100
3241	Cement, hydraulic	24	41	74	99
3255	Clay refractories	47	67	86	98
3312	Blast furnaces and steel mills	45	65	84	95
3321	Gray and ductile iron foundries	34	44	60	73
3322	Malleable iron foundries	54	72	88	99
3325	Steel foundries, nec	26	38	56	77
3334	Primary aluminum	76	93	100	100
3339	Primary nonferrous metals, nec	56	76	96	99
3356	Nonferrous rolling and drawing, nec	42	56	79	95
3441	Fabricated structural metal	10	15	23	35
3443	Fabricated plate work (boiler shops)	26	32	43	57
3463	Nonferrous forgings	77	85	97	100
3484	Small arms	58	78	95	99
3489	Ordnance and accessories, nec	48	72	91	99
3493	Steel springs, except wire	44	59	84	97
3494	Valves and pipe fittings, nec	13	21	37	59
3511	Turbines and turbine generator sets	86	97	99	100
3523	Farm machinery and equipment	46	61	70	78
3532	Mining machinery	37	50	70	88
3533	Oil and gas field machinery	30	45	66	87
3541	Machine tools, metal cutting types	22	35	56	77
3542	Machine tools, metal forming types	18	32	55	77
3556	Food products machinery	14	24	40	60
3579	Office machines, nec	60	76	88	98
3592	Carburetors, pistons, rings, and valves	52	71	92	98
3594	Fluid power pumps and motors	17	29	52	78
3613	Switchgear and switchboard apparatus	51	65	78	88
3641	Electric lamp bulbs and tubes	90	95	98	99
3644	Noncurrent-carrying wiring devices	25	39	65	89
3645	Residentail lighting fixtures	25	33	45	61
3671	Electron tubes	58	78	95	99
3731	Ship building and repairing	43	58	76	88
3795	Tanks and tank components	87	97	100	100
3931	Musical instruments	31	53	78	91
3942	Dolls and stuffed toys	37	46	66	87
3944	Games, toys, and children's vehicles	34	47	66	82
Avg.		42.6	56.8	73.4	85.9
S.D.		20.3	22.6	21.0	15.9

Table 4a: Price Changes and P-Q Curve Results for the No-Merger Group

SIC Code	Description	Early avg. rate of price change	Late avg. rate of price change	Early slope	Late Slope
2067	Chewing gum	-.8	0.6	-.39**	.13
2111	Cigarettes	7.8	5.6	-2.22***	-.64**
2141	Tobacco stemming and redrying	-1.3	-2.2	.25*	.42
2296	Tire cord and fabrics	-2.7	-2.2	.34***	.46
2337	Women's, misses', and juniors' suits and coats	-2.4	-2.8	.26	.70
2371	Fur goods	4.7	-5.1	-.26***	.16***
2381	Fabrics dress and work gloves	-2.1	-0.6	.12***	.096
2385	Waterproof outerwear	-2.6	-1.5	.59*	.13
2386	Leather and sheep-lined clothing	1.4	-5.5	-.14	.018
2397	Schiffli machine embroideries	.3	-2.1	.008	.31
2429	Special products sawmills, nec	-3.6	7.3	.39***	-.39**
2449	Wood containers, nec	-1.5	-1.6	-.015	.14
2517	Wood television and radio cabinets	-0.8	-2.6	.092**	.28***
2519	Household furniture, nec	-0.7	-2.9	.095	-.038
2655	Fiber cans, drums, and similar products	-0.2	0.9	.024	-.67**
2675	Die-cut paper and board	-0.2	-1.3	.17	-.10
2873	Nitrogenous fertilizers	-4.1	-7.9	.71*	.71
2999	Petroleum and coal products, nec	-6.6	6.1	.80	-1.10*
3021	Rubber and plastics footwear	-3.2	-2.1	.056	.17
3111	Leather tanning and finishing	1.8	2.0	-.98***	-.19**
3131	Footwear cut stock	0.3	-1.7	-.018	.19***
3142	House slippers	-1.2	-2.8	.26*	.098
3143	Men's footwear, except athletic	-0.9	0.0	-.012	-.045
3151	Leather gloves and mittens	0.7	-0.4	-.037	.067
3161	Luggage	1.1	-1.8	-.058	.17
3172	Personal leather goods, nec	-0.8	-1.3	.080	.24*
3199	Leather goods, nec	0.2	-0.6	-.085	.059
3259	Structural clay products, nec	-1.2	-2.4	.15***	.34***
3262	Vitreous china table and kitchenware	0.3	0.9	.016	-.055
3263	Semivitreous table and kitchenware	-0.8	-0.1	.046	-.004
3291	Abrasive products	-1.5	-0.2	.074	.17
3292	Asbestos products	-0.3	-3.2	.12*	.071
3331	Primary copper	-4.7	-4.3	.69	.45
3355	Aluminum rolling and drawing, nec	-4.3	2.6	.16*	-.13**
3366	Copper foundries	-3.2	0.7	.50	-.23
3411	Metal cans	-1.3	-1.4	.46*	.55
3412	Metal barrels, drums, and pails	-2.2	-1.4	.12**	.14
3433	Heating equipment, except electric	-0.8	-1.2	.18**	.31
3498	Fabricated pipe and fittings	-0.8	-1.7	.29***	.081**
3534	Elevators and moving stairways	-1.6	-3.4	.30	.31
3536	Hoists, cranes, and monorails	-1.5	-1.3	.050	.10
3553	Woodworking machinery	-0.2	-1.8	.004	-.034
3634	Electric housewares and fans	-2.0	-2.5	.52**	.36
3676	Electronic resistors	-0.5	1.4	.11	-.30**
3873	Watches, clocks, watchcases, and parts	-2.2	-1.8	.20***	.14
3951	Pens and mechanical pencils	-6.1	1.6	.42	-.096
3965	Fasteners, buttons, needles, and pins	-2.7	-1.8	.60***	.15***
Avg.		-1.2	-1.0	0.11***	0.078
S.D.		2.4	2.7		
V(Avg.)				0.0010	0.0010

*, **, ***: Sig. at the 10%, 5%, and 1% levels. The null hypothesis in the "early slope" column is that the coefficient is equal to zero. The null hypothesis in the "late slope" column is that the coefficient is equal to the coefficient in the early slope column.

Table 4b. Price Changes and P-Q Curve Results for the Merger Group

SIC Code	Description	Early avg. rate of price change	Late avg. rate of price change	Early slope	Late Slope
2051	Bread, cake, and related products	-1.0	0.5	.73***	-.29***
2062	Cane sugar refining	0.6	-1.5	-.068	.65
2079	Edible fats and oils, nec	-4.1	0.5	.71**	-.041*
2085	Distilled and blended liquors	-1.2	0.2	.25*	-.21**
2091	Canned and cured fish and seafoods	-7.3	-1.0	.30	.022
2095	Roasted coffee	-1.6	2.6	-.30	-1.23
2121	Cigars	-3.0	0.0	.47***	-.04***
2221	Broadwoven fabrics mills, manmade fiber and silk	-2.0	-2.3	.40*	1.04
2311	Men's and boys' suits and coats	-1.7	-.9	.64***	.14***
2325	Men's and boys' trousers and slacks	-1.2	-1.8	.24	.34
2331	Women's, misses', and juniors' blouses and shirts	1.5	-1.8	-.18*	.24**
2341	Women's and children's underwear	-1.2	-2.1	.39**	.41
2652	Setup paperboard boxes	-0.1	-1.1	-.024	.15*
2656	Sanitary food containers	-0.1	.8	.034	-.024
2823	Cellulosic manmade fibers	.4	-1.7	-.14	.17
2892	Explosives	0.0	2.6	-.14	-.35
3052	Rubber and plastics hose and belting	-.4	-1.0	-.050	-.012
3144	Women's footwear, except athletic	-1.3	-1.3	.38***	.13*
3149	Footwear, except rubber, nec	-2.9	-.6	.24***	.034**
3171	Women's handbags and purses	-.6	-2.1	.055	.24***
3221	Glass containers	.4	-2.0	.047	.59***
3241	Cement, hydraulic	-2.1	-3.7	.39*	.57
3255	Clay refractories	.8	-1.6	-.19***	.30***
3312	Blast furnaces and steel mills	-2.2	-3.4	.11	.71
3321	Gray and ductile iron foundries	-1.8	-2.8	.21**	.13
3322	Malleable iron foundries	-2.0	-2.9	.12***	.29**
3325	Steel foundries, nec	-.5	-2.5	.002	.18
3334	Primary aluminum	-1.0	-4.1	.18	.36
3339	Primary nonferrous metals, nec	-2.1	-2.3	-.34	.64
3356	Nonferrous rolling and drawing, nec	-.2	-1.1	-.45	.35
3441	Fabricated structural metal	-1.9	-2.1	.51*	1.28
3443	Fabricated plate work (boiler shops)	-1.7	-2.5	.099	.43
3463	Nonferrous forgings	1.1	-.5	-.56**	.083*
3484	Small arms	2.6	-.9	-.071	.005
3489	Ordnance and accessories, nec	-2.2	-.2	.26	.078
3493	Steel springs, except wire	-4.5	-2.6	.36***	.15
3494	Valves and pipe fittings, nec	-1.2	1.5	.30	-.072
3511	Turbines and turbine generator sets	-.7	-.6	.095	.041
3523	Farm machinery and equipment	.5	-.2	-.040**	.13***
3532	Mining machinery	.7	-1.3	-.021	.27*
3533	Oil and gas field machinery	-2.0	-3.9	.084	.13
3541	Machine tools, metal cutting types	-.6	-.3	.039***	.029
3542	Machine tools, metal forming types	1.2	-.8	-.11*	.033
3556	Food products machinery	-.5	.7	.065	-.20*
3579	Office machines, nec	-2.5	-4.3	.12*	.19
3592	Carburetors, pistons, rings, and valves	-1.7	-2.5	.13***	.26***
3594	Fluid power pumps and motors	-2.1	-1.1	.31**	.15
3613	Switchgear and switchboard apparatus	.1	-.8	-.03	.14
3641	Electric lamp bulbs and tubes	-.6	-2.7	.21	.58
3644	Noncurrent-carrying wiring devices	-.5	0	.064	.27
3645	Residentail lighting fixtures	-.9	-.8	.21**	.072
3671	Electron tubes	1.9	-1.3	-.63***	.24***
3731	Ship building and repairing	-1.0	-.3	.12***	.019
3795	Tanks and tank components	3.1	-.3	-.18*	.16*
3931	Musical instruments	-1.6	-.9	.29***	.21
3942	Dolls and stuffed toys	-3.0	-1.5	.22***	.093**
3944	Games, toys, and children's vehicles	-1.1	-1.7	.12	-.021
Avg.		-1.0	-1.3	0.10***	0.18*
S.D.		1.7	1.5		
V(Avg.)				0.00070	0.0012