Mergers and Acquisitions and Productivity in the U.S. Meat Products Industries:

Evidence from the Micro Data*

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ABSTRACT

This paper investigates the motives for mergers and acquisitions in the U.S. meat products industry from1977-92. Results show that acquired meat and poultry plants were highly productive before mergers, and that meat plants significantly improved productivity growth in the post-merger periods, but poultry plants did not.

KEYWORDS: Meat product industries, mergers and acquisitions, labor productivity.

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I. Introduction

The U.S. meat products industry has undergone a dramatic business consolidation over the past two decades. The four largest firms in the meat packing industry handled 36% of all steer and heifer slaughter in 1960, but by 1994, only three firms, IBP, Excel and Monfort slaughtered 81% of all steers and heifers (see, Ingersoll, 1996). During a similar time, meat and poultry firms engaged in numerous mergers and acquisitions (M&As), peaking over the 1977-82 period. Based on data derived from the U.S. Bureau of the Census' Longitudinal Research Database (LRD), the value of acquired meat products plants between 1977 and 1982 amounted to $14.10 billion in value of shipments, i.e. 30.43% of 1977 U.S. meat products industry shipments (SIC 201). This is in sharp contrast with the 1972-77 period when acquired plants accounted for only 3.84% of the industry's 1972 total value of shipments.

Changes in industry concentration and its related M&A activity have caused concern about abuses of market power. Congressional hearings held in 1985 and 1990 focused on cattle prices and rancher losses. The 1990 hearings demonstrated the greatest concern, emphasizing packer concentration and the growing control of the three major cattle slaughter firms. Subsequent to these meetings, the U.S. Congress mandated that the U.S. Department of Agriculture (USDA) study the potential monopolistic pricing practices and M&As in the meat packing industry. The USDA used this mandate to contract with several universities to study price determination in slaughter cattle procurement, the effect of concentration on prices paid for cattle, vertical coordination in hog production, hog procurement in the Eastern corn belt, and the

role of captive supplies in beef packing. The results were inconclusive but were consistent with results obtained from previous studies (see chapter 7, USDA, 1996).

The USDA report did not examine M&A activities over time, so the report recommended a study of entry, exit, mergers, market shares, and other factors. The purpose of this paper is to partially satisfy that mandate. The paper relies on detailed plant-level data to examine the relationship between M&As and the productivity performance of plants in three 4-digit SIC meat product industries: meat packing (SIC 2011), sausages and other prepared meats (SIC 2013), and poultry slaughtering and processing (SIC 2015) for the period 1977-92. Specifically, it investigates the underlying motives for M&A and how acquired plants perform after acquisition. The effort relies on an unbalanced panel of the more than 6,000 plants owned by meat product firms in 1977 and included in the LRD and Manufacturing Plant Ownership Change Database (OCD). The paper proceeds by first estimating plant relative labor productivity for the years 1977, 1982, 1987 and 1992. It then uses these productivity estimates, plant size and other plant characteristics to identify the types of plants that are most likely to be M&A targets and examines the impact of M&As on plant productivity performance in the post-merger period.

Empirical results indicate that both initial plant size and productivity are positively related to ownership change. This result is generally consistent with Ravenscraft and Scherer's (1986) and McGuckin and Nguyen's (1995) finding that corporate acquirers purchase productive firms (or plants). Except for poultry products, regression analyses also provide strong evidence that plant productivity growth is positively related to M&As. These findings do not rule out monopolistic or monopsonistic pricing after an acquisition, but do suggest that firms merge for synergetic purposes.

II. Mergers and Acquisitions: Motives and Consequences.

The literature on M&As is long and diverse. Some economists view M&As as a method for furthering antisocial activity such as monopoly power (Mueller, 1969; Roll, 1986). Others focus on whether mergers are undertaken by opportunistic managers whose motive is to achieve their own objectives, such as empire building (Baumol, 1967; Mueller, 1969) and management entrenchment (Shleifer and Vishny, 1989), rather than profit maximization. A third group of researchers asserts that acquisitions are undertaken because managers of acquiring firms underestimate their ability to improve the acquired firms' performance (Roll, 1986). Still another group of researchers contend that firm efficiency is the motive for M&As. These researchers argue that only efficient firms survive while inefficient ones are taken over (Manne, 1965; Mead, 1968; Jensen, 1988).

Agricultural economists have become increasingly concerned about possible monopolistic or monopsonistic motives of large meat slaughter plants. Under this theory, firms combine in order to gain market share so they can either charge high prices to buyers or pay low input prices to suppliers. Empirically, a firm would buy a large competitor to remove them from the market. The target firm may or may not have productive plants and there is no reason why the acquiring firm should be able to improve productivity growth.

Two "efficiency" theories often cited in recent empirical studies are "disciplinary mergers" and "synergistic" mergers. The theory of disciplinary mergers asserts that M&As are designed to discipline target firms' managers who pursue objectives other than profit maximization. The theory of synergistic mergers, on the other hand, asserts that firm mangers achieve efficiency gains by combining the businesses of the acquired and acquiring firm. Empirically, the theory of disciplinary mergers suggests that acquiring firms merge with poorly

performing firms and improve their performance, while the synergistic theory implies that target firms (or plants) perform well both before and after mergers. Under either theory, gains could be achieved by improving productivity in manufacturing plants or combining marketing, research and development, or other activities.

Empirical studies offer sharply differing perspectives. Early empirical studies in the fields of industrial organization and finance found little evidence of efficiency gains from M&As[1]. With the development of the LRD at the U.S. Bureau of the Census, comprehensive data have been available on the operations of U.S. manufacturing plants both before and after mergers. Using these data, researchers have conducted a number of empirical studies. Lichtenberg and Siegel (1992) used a balanced panel of large continuous U.S. manufacturing plants to study the relationship between ownership changes (through M&As) and the productivity performance of acquired plants before and after acquisitions. They found that ownership changes are negatively related to plants' initial (pre-acquisition) productivity. They also found that acquired plants improve their productivity significantly after mergers. Based of these results, they concluded that ownership change is motivated by lapses in the productive efficiency of firms.

McGuckin and Nguyen's (1995) study used plant-level data taken from the LRD for the entire U.S. food and beverage industry (SIC 20) to study the relationship between ownership change and productivity for the period 1977-87. They found that ownership change is typically *positively* related to both initial productivity and productivity growth after acquisitions. Their results for a sample of large continuous plants are consistent with Lichtenberg and Siegel's (1992) finding that ownership change is negatively related to initial productivity for large firms, but for smaller plants, they found a positive relationship. Like Lichtenberg and Siegel (1992), they also found a positive relationship between productivity growth and ownership change. They

concluded that firms acquire small and large targets for different reasons, acquiring poorly performing large targets in order to discipline managers and making smaller acquisitions for synergistic reasons.

While the above studies are important, they either used data for the entire U.S. manufacturing sector (Lichtenberg and Siegel, 1992) or for a broadly defined industry, such the U.S. food and beverage industry (McGuckin and Nguyen, 1995). Thus, their "representative" results may not hold for more narrowly defined industries. In this paper we look at three meat products industries separately: meat and poultry slaughter and processed meat products.

III. Empirical Model

According to the theory of disciplinary mergers, firms with incompetent managers perform poorly before a merger and, under a more competent management, have improved performance afterwards. If a merger is motivated by synergy, on the other hand, the acquiring firm targets only productive firms. After the merger, synergies between the firms improve the performance of the combined firm. Finally, if a merger is undertaken for purposes of building empires or obtaining monopoly power, target firms' performance should not matter and the performance of the combined firm is not necessarily improved after a merger.

1. A Probit Model of M&As:

The foregoing discussion suggests that the probability of a firm being acquired is a function of its pre-merger performance and other characteristics. In keeping with previous studies

(McGuckin and Nguyen, 1995; Lichtenberg and Siegel, 1992), we specify the following probit model:

$$(1) \qquad AC_{t,\,t+1} = a_0 + a_1 Log(P_t) + a_2 Log(S_t) + a_3 Log(SR_t) + a_4 OM + a_5 NF + a_6 Log(P_t).Log(S_t) + a_7 Log(P_t).Log(SR_t) + a_8 Log(P_t).OM_t + a_8 Log(P_t).NF_t + u_i,$$

where $AC_{t,\,t+1}$ is a dummy variable with values equal to one if the plant was acquired during the period t, t+1 and zero if not acquired. P and S denote the plant's pre-merger performance and plant size. SR denotes plants' primary specialization ratio. Two dummy variables NF and OM represent plants that produce non-food products (i.e., not in SIC 20) or other meat products.

Equation (1) is similar to those used by McGuckin and Nguyen (1995) and Lichtenberg and Siegel (1992) in that it includes P and S as independent variables. Following McGuckin and Nguyen (1995), we use pre-merger relative labor productivity (P) as a measure of performance. A positive coefficient for P suggests that acquirers purchased efficient plants and supports the synergy hypothesis. Conversely, a negative coefficient on P would support the managerial discipline theory. Finally, P could be positive or negative if building empires or monopolistic or monopsonistic power is management's goal.

In keeping with McGuckin and Nguyen (1995) and Lichtenberg and Siegel (1992), we use total employment as a measure of size, S. The size variable represents various factors that may affect plant dynamics. Indeed, previous empirical studies have provided convincing evidence that size is an important determinant of plant growth, entry, exit and ownership change. For example, McGuckin and Nguyen (1995) found that size is an important factor affecting the likelihood of a plant being acquired. Dunn, Roberts and Samuelson (1989) found that larger plants have lower failure rates than small plants.

MacDonald et al (2000) and Ollinger et al (2000) found that plants made dramatic changes in plant output mix over the 1967-92 period, thus we include the specialization ratio (SR) to control for plant product mix. The other variables are used to control for plant type differences.

2. M&A and Productivity Change:

Consistent with previous studies, we examine the change in productivity with the following equation:

$$(2) \quad \Delta P = a_0 + a_1 Pr(AC_t) + a_2 O_t + a_3 Log(P_t) + a_4 Log(S_t) + a_5 \Delta(K/L)_t + a_6 Age + a_7 MULTI_t + a_8 OM_t + a_{10} NF_t + a_{11} \Delta(NW/PW)_t + a_{12} Log(S_t).Log(P_t) + a_{13} Log(S_t).Pr(AC_t) + a_{14} Log(S_t).O_t + u_t.$$

where ΔP, is the change in the plant's relative labor productivity; Pr (AC) is an instrumental variable for the probability of a plant being acquired. The instrumental variable is the fitted value of AC estimated using equation (1). Denote ACHAT as the fitted value of AC, this instrumental variable is constructed as Pr(AC) = q(- ACHAT), where q is the cumulative density function for the standard normal variable. For comparison, we include the dummy variable O, which identifies whether the plant was originally owned by an acquiring firm in 1977 (for the period 1977-82) or in 1982 (for the period 1982-87). Change in the plant's capital/labor ratio $\Delta(K/L)$ is used to control for the impact of possible changes in the plant's capital intensity on the change in productivity. Change in the non-production (white collar) worker to production worker ratio

(Δ(NW/PW)) controls for the potential effect of skill mix on the change in productivity. Age is plant age. Other variables are defined above.

IV. Data and Performance Measurement

1. Firm versus Plant-level:

Mergers and acquisitions can take many forms. Acquiring firms can buy an entire firm, all of the plants a firm owns in a particular industry, some plants in various or a single industry, or a single plant. An acquiring firm can also sell plants in the same industry in which they make acquisitions or industries outside the one in which they make acquisitions. Additionally, firm productivity is a measurement of average plant productivity across all of its plants in all of its industries. Thus, a firm could be a both a buyer and a seller in the same industry, could perform superbly in one industry and poorly in another, and could have a relatively low average firm productivity but high productivity in one industry. Thus, a plant-level analysis is the appropriate unit of analysis for this type of study.

2. Data Sources:

The plant level data used in this study are taken from the LRD and the Ownership Change Database (OCD). LRD data includes data on the total value of shipments, capital investments, labor, energy, materials, and selected purchased services. The LRD also contains information on classification and identification, such as plant location, products, and primary industry, as well as various status codes, which identify, among other things, birth,

death, and ownership changes. These identifying codes are used in developing both the longitudinal plant linkages and ownership linkages among plants.[2]

The OCD is also a plant-level database that was constructed by linking data in the U.S. Census of Manufactures and Annual Survey of Manufactures for the period 1963-92. This database contains U.S. manufacturing plants that were acquired at least once during this period.[3]

3. Sample Coverage:

We examine three 4-digit industries (SICs 2011, 2013 and 2015) over the 1977-87 period. Evaluation of their productivity performance before and after merger is based on comparisons of 1977 and 1982 productivity with that achieved in 1987 and 1992, respectively.

There are several reasons for focusing on mergers occurring over the 1977-92 period. First, the period encompasses four censuses of manufactures so that we are confident of correctly identifying all acquired plants -- information is available only for a sample of plants in non-census years. Second, the period encompasses the beginning years of the latest merger movement, one which extended until 1987. Third, and perhaps most important, the use of the 1977-92 period allows us to evaluate the performance of plants and firms 5 to 9 years after acquisitions. This provides sufficient time for the acquiring firm to integrate acquired plants into their operations, or to dispose of them.

4. M&As in the Meat Products Industry:

Using the OCD, we identified every meat and poultry plant that was acquired during the 1977-82 and 1982-87 periods and noted firm ownership. Next, using these firms, we identified all manufacturing plants owned by acquiring and acquired firms at the beginning of the period (1977 or 1982), whether or not they were located in the meat products industry. This provided our population of meat and poultry producing firms and the plants that they acquired for the periods under study.

For 1977-82, we identified 251, 178 and 312 plants acquired by firms that had operations in SICs 2011, 2013, and 2015. The corresponding numbers of all plants owned by acquirers before their mergers are 684, 412 and 518, respectively. These plants may or may not have been in SICs 2011, 2013, or 2015. We also identified the firms owning the plants in SICs 2011, 2013, and 2015 and that were not acquired over 1977-82. These non-acquiring firms owned 2,042, 1,214 and 442 plants in 1977. Thus our 1977-82 sample consists of 6,053 plants.

For the period 1982-87, we identified firms that bought the 226, 353 and 316 plants in SICs 2011, 2013 and 2015. These acquiring firms owned 315, 580 and 560 plants. The numbers of plants owned by non-acquiring firms are 1,326 for firms with operations in SIC 2011 and 1,155 and 359 for those with plants in SICs 2013 and 2015. Thus, the 1977-82 sample consists of 5,190 plants.

5. Productivity:

Productivity can either be measured for each single input, such as labor (labor productivity), or for all inputs, total factor productivity (TFP). Theoretically, TFP is superior to labor

productivity because it takes into account all inputs. However, like most other researchers, we use labor productivity because plant capital data are not available.

Measurement problems still arise with labor productivity measures. We would like to define labor productivity as real output divided by labor inputs. However, we must use relative labor productivity (RLP) -- the ratio of plant labor productivity (LP) to average industry labor productivity (ALP) – because we do not have output prices and the value of output varies across plants and over time due to price dispersion and inflation.[4]

$$(3) \qquad RLP_{ij} = LP_{ij} / ALP_{j} ,$$

where i and j denote plant i and four-digit SIC industry j, respectively. Plant labor productivity, LP and ALP are measured as value of output in current dollars, divided by the total work hours.[5]

V. Empirical Results

1. Productivity and M&As:

Tables 1 and 2 contain the 1977 relative labor productivity of acquired plants and non-acquired plants by their status in 1987 and 1992 (e.g., kept, sold and closed). All figures are normalized to the sample mean. Several points of interest should be noted. First, acquired plants have labor productivity well above their industry averages -- ranging from 1.03-1.30 -- suggesting that, on average, the pre-merger labor productivity of acquired plants exceeded the industry average. These findings are consistent with McGuckin and Nguyen's (1995) results for the entire food and beverage industry (SIC 20) who found that average pre-merger labor productivity of acquired plants was about 20 percent higher than the industry average.

Second, average 1977 relative labor productivity of all plants owned by acquiring firms in SICs 2011, 2013 and 2015 varied from about 1.11-1.45 while for non-acquiring firms plant productivity varied from 0.85-0.92. Finally, the tables show that acquirers kept the most productive plants and closed or resold less productive ones while non-acquiring firms sold their most productive plants[6]. Acquirers in the 1977-82 period resold or closed about 50% or more of the total plants they acquired after operating them for 5 to 10 years.

The foregoing data strongly suggests that acquirers purchased relatively productive plants. Even plants that were closed after mergers had higher than industry-average initial labor productivity. These results are consistent with findings of Ravenscraft and Scherer (1987), Matsusaka (1993), and McGuckin and Nguyen (1995) but differ from Lichtenberg and Siegel's (1992) general conclusion that low productivity leads to ownership change. Note that Lichtenberg and Siegel (1992) did find that plants undergoing a Leveraged Buyout had above-average productivity three years before the buyout, so our findings do not entirely differ from their evidence.

Tables 3 and 4 contain the estimates of the probit regressions for the motives for M&As during the 1977-82 and 1982-87 periods. Columns (1), (3) and (5) have linear estimates, while columns (2), (4) and (6) contain the non-linear results. Both tables show that initial plant size (S) and relative labor productivity (P) have significantly positive effects on M&As. For 1982-87, these results are consistent for both linear and non-linear models. For 1977-82, the estimated productivity coefficients for the linear model for industries 2013 and 2015 are statistically insignificant, while the estimated coefficients for the same variable in the non-linear model are highly significant and much greater in magnitude. We speculate that the linear model estimates are downward biased because the model fails to account for the interactions between productivity

and the other explanatory variables. Results of the nonlinear model are consistent with those of McGuckin and Nguyen (1995). Their estimated coefficients for productivity for the entire food and beverage industry in 1977 equaled .1292 and .4537 for the linear and non-linear models.

We found the coefficient of the interaction between productivity and size to be significantly positive in all three industries in 1977 and in SIC 2013 and SIC 2015 in 1982. This finding suggests that M&As become more likely as both productivity and plant size grow and differs from McGuckin and Nguyen (1995) who found the interaction term to be significantly negative.

Results reported here strongly support a synergistic efficiency purpose for M&As and differ sharply from results required to support a monopoly power or empire motive for acquisitions. For one of these theories to be correct, a firm's objective would be to remove competitors from the industry through acquisition. Thus, there would not necessarily be a significant linkage between plant productivity and ownership change. Results also differ from Lichtenberg and Siegel's (1992) finding supporting a managerial discipline argument. We suspect this happens because Lichtenberg and Siegel's (1992) results were based on all manufacturing plants and included mainly plants with at least 250 employees while our results are for all meat products plants, most of which have fewer than 250 employees.

To better assess the impact of productivity and size on the probability of a plant being acquired, we use the parameter estimates of the non-linear probit models reported in tables 3 and 4 to calculate the probabilities of plant acquisitions. Tables A.1-A.3 in the appendix have those probabilities for varying levels of plant productivity and size. The numbers in the cells indicate the probability (in percentage points) of ownership change. The first number in each cell is for 1977 data and the second number is for 1982.

The probability of an acquisition changes dramatically with both average labor productivity and plant size. For 2011 (beef packing), the probability of plant ownership change ranges from less than 1% for plants in the 10th percentile for relative labor productivity and plant size for 1977-82 and 1982-87 to almost 50% and 25% for plants with relative labor productivity and size in the 95th percentile during the 1977-82 and 1982-87 periods. For meat sausages (SIC 2013), probability of ownership change ranged from less than 1% at the 10th percentile for both periods to 25% and 50% at the 95th percentile for both periods. Finally, for poultry slaughter (SIC2015), the probability of ownership change ranged from about 3% at the 10th percentile for both periods to about 50% at the 95th percentile for both periods.

Summarizing, our regression and probability analyses indicate that M&As are positively correlated with productivity and plant size. These results suggest that a synergistic efficiency motive explains mergers in the meat products industry. Although we find no evidence that mergers and acquisitions were motivated by empire building or monopoly power, we cannot rule out the possibility that acquiring firms were able to convert improved plant efficiency into market share gains that permitted them to behave as monopolists or monopsonists after the merger.

2. Post-Merger Productivity Performance:

Now consider whether M&As improve plant productivity. Table 5 contains the results of productivity growth regressions for the three meat products industries. Columns 1, 3, and 5 show the results for 1977-87 and columns 2, 4, and 6 contain the estimates for 1982-92.

We are mainly interested in how plants likely to be acquired performed. The estimated coefficient for the probability of ownership change -- Pr(AC) – is positive and significant and the

interaction of probability of ownership change and plant size -- Pr(AC).Log(S) -- is negative and significant in the meat packing (SIC 2011) and sausages & other prepared meat (SIC2013) industries. These estimates suggest that only small, acquired plants outperformed non-acquired plants in the post-merger periods. Acquired plants with more than about 250 employees in SIC 2011 and more than about 350 employees in SIC 2013 had lower growth than their nonacquired competitors.

Results for the poultry slaughtering and processing industry, columns 5 and 6, tell a different story. The estimated coefficient for Pr(AC) is negative and insignificant for both periods, while that for the interaction term Pr(AC)*Log(S) is positive for both the 1977-87 and 1982-92 periods but significant only in 1977-87. This result suggests that large acquired plants in 1977-87 and less conclusively in 1982-92 improved their productivity relative to nonacquired competitors. Small, acquired plants with total employment less than 46 employees, on the other hand, fared poorly against their nonacquired rivals.

The positive and significant results for small meat slaughter and sausage and large poultry plants suggest that there were efficiency reasons for acquisitions. Firms aiming to gain monopoly power would not necessarily improve the operations of a plant that they acquire. Thus, we conclude that a desire to gain manufacturing efficiencies and not monopoly power motivates M&As.

VI Discussion:

This paper has two primary findings. First, during both the1977-82 and 1982-97 periods, acquired plants in all three meat product industries were highly productive before mergers.

Second, smaller acquired plants in the meat packing industry (SIC 2011) and sausages and other prepared meat product industry (SIC 2013) and larger plants in the poultry slaughtering and processing industry (SIC 2015) in 1977-87 improved their productivity growth after mergers.

Based on these results, it appears that firms in all three meat and poultry products industries prefer to acquire productive targets and is consistent with McGuckin and Nguyen's (1995) finding for the food and beverage industry (SIC 20). Other studies have reported similar results. For example, using plant-level data, Baldwin (1991) found that acquired Canadian manufacturing plants of all types had higher average productivity than other Canadian plants. Additionally, Lichtenberg and Siegel (1992) found that plants involved in leverage buyouts in U.S. manufacturing had above average relative productivity during the three years before their buyouts. These results support the hypothesis that synergy is a central motive for M&As. If plants made acquisitions in order to build an empire or generate monopolistic (or monopsonistic) profits, then there would be no consistent relationship between plant productivity and M&As. Our results indicate no such relationship. If the motive was managerial discipline, then firms would buy under-performing plants and improve upon them. This also was not the case.

The second result generally supports the results of previous studies'. These findings suggested that M&As lead to acquired plants' productivity growth improvement (Baldwin; Lichtenberg and Siegel, 1992; McGuckin and Nguyen, 1995). It is also consistent with both synergy and managerial-discipline theories, which predict that M&As improve firm performance in the post-acquisition period. If monopolistic (or monopsonistic) motives drove mergers, we should find no relationship between productivity growth and M&As. This was not the case.

Notice that our results for M&As and productivity growth are not entirely consistent with previous studies. Our results for the poultry slaughtering and processing industry (SIC 2015)

detect no improvement in productivity after M&As for small plants during 1982-87 and all plants during 1987-92. Lichtenberg and Siegel (1992) for the entire manufacturing sector and McGuckin and Nguyen (1995) for the food industry, on the other hand, found a positive and significant relationship. This inconsistency leads to conclude that conduct and performance of an individual industry can and does differ from that of a broadly defined industry. Thus, studies at the individual industry level, such as this one, are necessary to evaluate the impact of certain types economic activity, such as M&As, on the performance of an individual industry.

We speculate that industry characteristics differentiate meat slaughter and processing from poultry slaughter and processing. One important difference is that poultry commonly employs brand marketing, while meat does not, suggesting that poultry mergers may have been driven by improvements in marketing performance. Another difference is that the meat industry is much more heterogeneous than the poultry industry in terms of plant size and productivity performance. Cattle slaughter, for example, is dominated by a few very large firms that increased their size dramatically during the 1977-92, yet the industry still has hundreds of plants with less than 20 employees. Additionally, over the same time period, union representation of industry workers declined precipitously, per capita beef consumption dropped by about 15 percent, and the one dollar wage differential between large and small plants disappeared (MacDonald, et al, 2000). Poultry slaughter and processing, on the other hand, has very few plants with less than 100 employees and experienced a 50 percent increase in per capita consumption over the 1977-92 period (MacDonald et al, 2000). We speculate that acquiring meat slaughter and processing firms could be selective in the type of plant that they bought because of excess capacity, while poultry firms needed more capacity. Thus, meat slaughter and processing firms may have bought underused assets that they could better exploit while poultry slaughter firms bought fully utilized plants that they used for their own purposes.

VII. Concluding Comments

This analysis provides evidence that firms in the meat and poultry products industries preferred to acquire highly productive plants. Moreover, except for those in industry 2015, these acquired plants experienced significant improvements in productivity during the post-merger period. These results suggest that synergies and related efficiencies are important motives for M&As and casts doubt on the proposition that a drive for monopoly power encourages M&As.

Note that our analysis of the impact of M&As on plants' productivity performance is based on surviving plants. Yet, tables 1 and 2 make it clear that acquiring firms did close and resell a significant number of plants that they acquired, raising the possibility that productivity gains arise in M&As because of the displacement of jobs and plant closings. If this is the case, the overall benefits of M&As are not so clear. Our future work will take a close look at the impact of M&As on employment, wages and plant closings.

VIII. Endnotes

1. See Jensen and Ruback (1983), Smith (1986), and Jerell, Brickley and Netter (1998) for finance study reviews and Mueller (1993) for industrial organization reviews.

2. A more complete description of the LRD is given in McGuckin and Pascoe (1988).

3. For a detailed description of the OCD, see Nguyen, 1998

4. Using plant-level 1982 Census of Manufactures data, Abbott (1989) found that 7-digit product level prices vary substantially across plants,

5. This relative productivity ranking approach was suggested by Christensen, Cummings, and Jorgenson (1981), and has been applied in recent productivity analyses using plant level data from the LRD (e. g., Olley and Pakes, 1990; Bartelsman and Dhrymes, 1992; Bailey et al., 1992, McGuckin and Nguyen, 1995). An important property of this productivity measure is that it does not depend on an output deflator because output in all plants is measured in current year dollars. Accordingly, it can be used in intertemporal comparisons (see Bailey et al., 1992, p.192).

6. The productivity of closed plants could be overstated because plants could be identified as "closed" that actually were reclassified as non-manufacturing plants. These plants would have disappeared from the Census of Manufacturers and would have been counted as closed. In addition, it is likely that sales from inventory and labor reductions around the time of closing may have "inflated" labor productivity.

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Table 1 : **Average Initial Productivity (RLP77): 1977 – 87 Sample**

Type of Plants	SIC 2011		SIC 2013		SIC 2015	
	Number of plants	RLP77	Number of plants	RLP77	Number of plants	RLP77
Acquired plants (1977-82)	251	1.3022	178	1.0699	312	1.0334
Kept in 1987	118	1.4804	70	1.0998	157	1.0949
Sold by 1987	56	1.0122	66	1.0351	94	.9366
Closed by 1987	77	1.2401	42	1.0824	61	1.0247
Buying firms' plants (1977)	684	1.2899	412	1.4498	518	1.1117
Kept in 1987	210	1.3413	65	1.3513	235	1.1220
Sold before 1987	209	1.2865	168	1.1847	135	1.1819
Closed by 1987	265	1.2519	179	1.1614	148	1.0284
Non-buying firms' plants (1977)	2,042	.8654	1,214	.9217	442	.8453
Kept through 1987	610	.8250	539	.8986	169	.8274
Sold before 1987	35	1.2723	29	.9586	26	.8314
Closed by 1987	1,397	.8713	646	.9351	147	.8442
All Plants	2,977	1.0000	1,804	1.0000	1,272	1.0000

93 D indicates the number is suppressed to avoid possible disclosure problems

Table 2: Average Initial Productivity (1982): 1982-92 Sample

Type of Plants	SIC 2011		SIC 2013		SIC 2015	
	Number of plants	RLP82	Number of plants	RLP82	Number of plants	RLP82
Acquired plants (1982-87)	226	1.5024	353	1.1352	316	.9539
Kept in 1992	145	1.5552	195	1.1705	191	.9903
Sold by 1992	21	1.1329	60	1.0035	43	.8234
Closed by 1992	60	1.5934	98	1.1456	82	.9377
Buying firms' plants (1982)	315	1.6308	580	1.4940	560	1.1227
Kept in 1992	195	2.19611.	276	1.6947	271	1.3092
Sold before 1992	33	6588	103	1.4896	83	.9583
Closed by 1992	87	1.6670	202	1.2146	206	.7786
Non-buying firms' plants (1982)	1,326	.7646	1,155	.7134	359	.8518
Kept through 1992	541	.7691	598	.6913	180	.8549
Sold before 1992	(D)*	1.8034	(D)	1.2392	(D)	.8668
Closed by 1992	(D)	.7248	(D)	.7528	(D)	.8061
All Plants	1,867	1.0000	2,088	1.0000	1,235	1.000

93 D indicates the number is suppressed to avoid possible disclosure problems

Table 3: PROBIT REGRESSION OF ACQUISITIONS (1977-82)

(X^2 in parentheses)

Variable	Meat Packing Products (SIC 2011)		Sausages & Other Prepared Meat Products (SIC 2013)		Poultry slaughtering and Processing (SIC 2015)	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-2.581**	-2.548**	-2.772**	-2.590**	-2.195**	-2.097**
	(4537.50)	(4170.30)	(2546.39)	(18367.46)	(1575.37)	(11139.49)
Log(P)	.250**	.268**	-.013	.298**	.011	.414**
	(133.83)	(11.40)	(.19)	(57.85)	(.20)	(139.07)
Log(S)	.322**	.304**	.303**	.282**	.249**	.230**
	(1428.88)	(1227.90)	(598.85)	(4582.70)	(629.99)	(4383.44)
Log(SR)	.394**	.270**	.436**	.384**	.229**	.285**
	(111.09)	(50.55)	(74.94)	(558.34)	(27.76)	(362.24)
OM	.197**	.247**	.779**	.670**	.718**	.739**
	(48.50)	(72.42)	(457.79)	(3144.68)	(496.66)	(4517.26)
NF	.204**	.209**	.255**	.061**	.512**	.470**
	(35.39)	(34.64)	(29.56)	(13.86)	(153.60)	(1165.29)
Log(P) x Log(S)		.102**		.023**		.010
		(37.78)		(7.36)		(2.61)
Log(P) x Log(SR)		.153**		.022		-.160**
		(8.72)		(.49)		(47.04)
Log(P) x OM		-.616**		-.495**		-.552**
		(144.83)		(458.85)		663.53)
Log(P) x NF		-1.102**		-1.034**		-.703**
		(326.86)		(1011.79)		(666.95)
N	2,977	2,977	1,804	1,804	1,272	1,272

*, ** denote "significant" at the 5 and 1 percent level, respectively.

Table 4: PROBIT REGRESSION OF ACQUISITIONS (1982-87)

(X^2 in parentheses)

Variable	Meat Packing Products (SIC 2011)		Sausages & Other Prepared Meat Products (SIC 2013)		Poultry slaughtering and Processing (SIC 2015)	
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-2.622**	-2.514**	-2.530*	-2.443**	-2.229**	-2.270**
	(2755.65)	(2398.85)	(3612.83)	(3196.99)	(1598.76)	(1412.47)
Log(P)	.236**	.252**	.156**	.321**	.085**	.223*
	(94.49)	(91.38)	(57.53)	(18.94)	(12.84)	(4.51)
Log(S)	.261**	.252**	.230**	.287**	.266**	.269**
	(680.05)	(609.34)	(1114.57)	(978.66)	(758.59)	(675.27)
Log(SR)	-.125**	-.193**	.168**	.173**	.007	.045
	(6.58)	(14.39)	(15.05)	(15.63)	(.02)	(.76)
	.972**	.941**	.605**	.598**	.578**	.596**
OM	(863.17)	(774.53)	(427.00)	(412.52)	(338.89)	(325.82)
	.984**	.941**	.604**	.576**	.333**	.326**
NF	522.38)	(471.71)	(256.89)	(231.45)	(64.39)	(57.37)
		-.113**		.042**		.037*
Log(P) x log(S)		(36.11)		(6.47)		(3.91)
		-.567**		.168*		-.124
Log(p) x Log(SR)		(44.25)		(5.18)		(2.13)
		-.387**		-.421**		-.261**
Log(p) x OM	1,867	(50.47)	2,078	(75.95)	1,207	17.43
		-.203**		-.743**		-.895**
log(P) x NF		(7.88)		(111.73)		(116.76)
		1,867		2,078		1,207
N						

*, ** denote "significant" at the 5 and 1 percent level, respectively.

Table 5: **PRODUCTIVITY GROWTH REGRESSIONS**
(T-statistics in parentheses)

Variable	Meat Packing Products (SIC 2011)		Sausages & Other Prepared Meat Products (SIC 2013)		Poultry slaughtering and Processing (SIC 2015)	
	(1)	(2)	(3)	(4)	(5)	(6)
	1977-87	1982-92	1977-87	1982-92	1977-87	1982-92
Intercept	-0.417**	-0.651**	-0.494**	-0.147	0.419**	0.234
	(5.22)	(5.02)	(6.92)	(1.84)	(2.65)	(1.51)
Log(P)	-0.567**	-0.407**	-0.813**	-0.631**	0.125	0.096
	(6.35)	(4.20)	(8.27)	(8.40)	(0.92)	(0.94)
Log(S)	0.083**	0.131**	0.088**	0.014	-0.096**	-0.037
	(3.85)	(4.82)	(4.99)	(0.64)	(2.80)	(1.17)
Pr(AC)	1.165**	0.928*	3.300**	0.938*	-1.065	-0.186
	(2.84)	(1.94)	(4.87)	(1.90)	(1.66)	(0.33)
O	0.542**	0.154	0.141	-.013	0.057	0.361**
	(3.47)	(0.89)	(0.54)	(0.10)	(0.36)	(2.58)
OM	0.101	0.288**	0.013	0.168**	-0.049	0.066
	(1.67)	(3.61)	(0.27)	(3.07)	(0.36)	(1.05)
NF	-0.041	0.003	0.025	-0.036	-0.133	-0.069
	(0.53)	(0.04)	(0.43)	(0.51)	(1.52)	(0.93)
MULTI	0.024	-0.048	0.064	-0.021	-0.002	-0.130*
	(0.41)	(0.83)	(1.24)	(-0.467)	(0.03)	(2.27)
AGE2	-0.081	-0.065	-0.006	-0.045	0.017	-0.052
	(1.82)	(1.25)	(0.16)	(1.07)	(0.30)	(0.93)
AGE3	—	-0.093	—	-0.041	—	-0.080
		(1.50)		(0.81)		(1.16)
Δ(K/Q)	-0.493**	-0.528**	-0.439**	-0.548**	-0.565**	-0.458**
	(6.45)	(8.38)	(6.94)	(9.02)	(7.03)	(7.99)
Δ(NW/PW)	-0.108**	0.042	-0.081**	0.008	-0.102**	0.003
	(3.48)	(1.19)	(3.68)	(0.39)	(2.52)	(0.01)
Log(P).Log(S)	0.058**	0.015	0.095**	0.042**	-0.112**	-0.093**
	(2.75)	(0.69)	(4.32)	(2.40)	(3.79)	(4.29)
Pr(AC).Log(S)	-0.211**	-0.204**	-0.564**	-0.099	0.278*	0.088
	(2.92)	(2.46)	(4.81)	(1.26)	(2.23)	(1.03)
Log(S).O	-0.099**	-0.033	-0.021	-0.003	0.004	0.067**
	(3.21)	(1.00)	(0.43)	(0.13)	(014)	(2.50)
Adj. R^2	0.2468	0.1959	0.2733	0.3082	0.2952	.2612
N	754	773	723	973	519	58

*, ** denote "significant" at the 5 and 1 percent level, respectively.

Table A.1: EFFECT OF SIZE AND PRODUCTIVITY ON PROBABILITY OF ACQUISITIONS
(SIC 2011, 1977-87 Sample, n=1,676)

Relative Labor Productivity (years and values)	Total Employment (years and values)						
	10 percentile 1977: 1 1982: 8	**25 percentile 3 23**	**50 percentile 16 73**	**75 percentile 74 220**	**90 percentile 250 459**	**95 percentile 433 739**	**Mean 93 20**
	----------Percent----------						
10 percentile							
1977: .3261	0.22	0.41	1.01	2.10	3.58	4.48	2.33
1982: .2650	0.03	0.18	0.78	2.82	7.98	12.55	3.93
25 percentile							
1977: .5491	0.33	0.72	2.07	4.78	8.51	10.79	5.34
1982: .3974	0.10	0.41	1.37	3.97	9.52	14.00	5.23
50 percentile							
1977: .9478	0.51	1.25	4.09	9.96	17.87	22.48	11.18
1982: .6612	0.37	1.05	2.63	5.93	11.74	15.96	7.35
75 percentile							
1977: 1.1068	0.57	1.45	4.88	12.00	21.42	26.78	13.47
1982: 1.1340	1.23	2.56	4.88	8.75	14.47	18.23	10.24
90 percentile							
1977: 1.6463	0.77	2.10	7.50	18.52	32.14	39.40	20.71
1982: 1.7621	2.91	4.86	7.69	11.73	17.00	20.23	13.15
95 percentile							
1977: 2.1026	0.92	2.61	9.58	23.45	39.68	47.88	26.14
1982: 2.3042	4.67	6.93	9.12	13.85	18.67	21.51	15.18
Mean							
1977: .9478	0.52	1.28	4.19	10.24	18.35	23.06	11.49
1982: .8827	0.72	1.72	3.69	7.34	13.15	17.15	8.81

*Probabilities are estimated based on the parameter estimates of the non-linear probit model.

TableA.2. EFFECT OF SIZE AND PRODUCTIVITY ON PROBABILITY OF ACQUISITIONS
(SIC 2013, 1977-87 Sample, n=1,660)

Relative Labor Productivity (years and values)	**Total Employment (years and values)**						
	10 percentile 1977: 2 1982: 4	**25 percentile 1977: 7 1982: 12**	**50 percentile 1977: 32 1982: 36**	**75 percentile 1977: 94 1982: 114**	**90 percentile 1977: 258 1982: 337**	**95 percentile 1977: 420 1982: 561**	**Mean 1977: 105 1982: 130**
	----------Percent----------						
10 percentile							
1977: .4126	0.36	0.92	2.50	4.65	7.83	9.87	4.93
1982: .3522	0.74	1.50	2.85	5.25	8.75	10.90	5.61
25 percentile							
1977: 6187	0.53	1.33	3.53	6.46	10.66	13.30	6.84
1982: 5291	1.11	2.27	4.32	7.87	12.90	15.912	8.40
50 percentile							
1977: 8923	0.73	1.82	4.76	8.55	13.84	17.07	9.04
1982: 8823	1.80	3.69	6.97	12.44	19.83	24.07	18.34
75 percentile							
1977: 1.0587	0.85	2.09	5.42	9.66	15.47	19.00	10.20
1982: 1.3345	2.60	5.32	9.91	17.30	26.81	32.06	18.34
90 percentile							
1977: 1.5051	1.14	2.78	7.04	12.30	19.30	23.44	12.97
1982: 1.9777	3.62	7.34	13.46	22.91	34.44	40.52	24.20
95 percentile							
1977: 1.8768	1.36	3.30	8.23	14.20	22.00	26.49	14.95
1982: 2.5577	4.45	8.95	16.21	27.07	39.82	46.33	28.53
Mean							
1977: .9471	0.77	1.91	4.97	8.91	14.37	17.71	9.42
1982: 1.0548	2.11	4.33	8.14	14.41	22.70	27.38	15.30

*Probabilities are estimated based on the parameter estimates of the non-linear probit model.

Table A.3. EFFECT OF SIZE AND PRODUCTIVITY ON PROBABILITY OF ACQUISITIONS
(SIC 2015, 1977-87 Sample, n=1,480)

Relative Labor Productivity (Values of percentiles in parentheses)	Total Employment (Values of percentiles in parentheses						
	10 percentile 1977: 1982: 8	25 percentile 1977: 1982: 26	50 percentile 1977: 1982: 88	75 percentile 1977: 1982: 253	90 percentile 1977: 1982: 547	95 percentile 1977: 1982: 853	Mean 1977: 1982: 223
	----------Percent----------						
10 percentile							
1977: 0..5640	2.77	4.86	8.23	12.83	16.61	19.20	`11.97
1982: 0. 5526	2.92	5.43	9.21	14.81	19.63	22.35	14.10
25 percentile							
1977: 0.8182	3.99	6.80	11.18	16.91	21.47	24.53	15.85
1982: 0.8203	3.80	7.12	12.02	19.11	25.05	28.33	18.21
50 percentile							
1977: 1.0368	4.97	8.32	13.41	19.89	24.96	28.30	18.77
1982: 1.1570	4.75	8.89	14.91	23.41	30.34	34.10	22.35
75 percentile							
1977: 1.5139	6.93	11.26	17.57	25.28	31.09	34.84	23.90
1982: 1.6165	5.84	10.91	18.14	28.06	35.91	40.09	26.84
90 percentile							
1977: 2.2683	9.63	15.15	22.84	31.79	38.28	42.35	30.32
1982: 2.3686	7.32	13.60	22.32	33.86	42.66	47.22	32.47
95 percentile							
1977: 2.9644	11.80	18.17	26.76	36.45	43.29	47.50	34.77
1982: 3.1925	8.67	15.99	25.93	38.69	48.10	52.86	37.18
Mean							
1977: 1.2680	6.03	9.92	15.69	22.87	28.37	31.95	21.57
1982: 1.3580	5.25	9.82	16.40	25.58	32.96	36.93	24.44

*Probabilities are estimated based on the parameter estimates of the non-linear probit model.