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M&A AND PRODUCTIVITY IN THE U.S. MEAT PRODUCT INDUSTRIES: EVIDENCE FROM 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 handled 81% of all slaughter (see, Ingersoll, 1996). During a similar time frame, the industry experienced extensive merger and acquisition (M&A) activity. Based on data derived from the U.S. Bureau of the Census' Longitudinal Research Database (LRD), the value of acquired meat product plants between 1977 and 1982 amounted to $14.10 billion in value of shipments, i.e. 30.43% of the 1977 total value of shipments of the entire U.S. meat product industry (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 from both policy makers and the general public 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) must study the potential monopolistic pricing practices and M&As in the meat packing industry.[1] Using this mandate, the USDA contracted 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 did not ask researchers to study entry, exit and M&A activities over time. However, these are important factors driving changes in concentration and give rise to potential noncompetitive behavior. In line with these concerns, the USDA report recommended the study of entry, exit, mergers, market shares, and other factors.

The purpose of this study is to partially satisfy that mandate. It 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 type of plant that is most likely be a target of M&As. Finally, it examines the impact of M&As on plants' 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 generally 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.

II. MERGERS AND ACQUISITIONS: MOTIVES AND CONSEQUENCES

The literature on mergers and acquisitions is long and diverse. Some economists view M&As as a method for furthering antisocial activity such as monopoly power (Mueller; Roll). Others focus on whether mergers are undertaken by opportunistic managers whose motive is to achieve their own objectives, such as empire-building (Baumol; Mueller) and management entrenchment (Shleifer and Vishny), rather than profit maximization. A third group of researchers assert that acquisitions are undertaken because managers of acquiring firms underestimate their ability to improve the acquired firms' performance (Roll). 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: Mead; Jensen).

Two "efficiency" theories often cited in recent empirical studies are "disciplinary mergers" and "synergistic" merges. The theory of disciplinary mergers asserts that M&As are designed to discipline target firms' managers who pursue objectives other than profit maximization. This theory suggests that firm performance should improve after the acquisition. The theory of synergistic mergers, on the other hand, suggests that mangers achieve efficiency gains by combining the businesses of the acquired firm and the acquiring firm. These gains could be achieved by improving productivity in manufacturing plants or combining marketing, research and development, or other activities. This theory implies that target firms perform well both before and after mergers.

Empirical studies offer sharply differing perspectives. Early empirical studies in the fields of industrial organization and finance did not find much efficiency gains from M&As[2]. 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 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 plant 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 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. For a sample of large continuous plants, as with Lichtenberg and Siegel, McGuckin and Nguyen found that ownership change is negatively related to initial productivity, but it is positively related to productivity growth. They therefore concluded that firms acquire small and large targets with different motives: The evidence that firms acquired poor-performing large targets is consistent with the matching and managerial-discipline theories, while the fact that most firms acquired productive targets supports synergy theories.

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

III. AN EMPIRICAL MODEL

If the motive for mergers is to discipline incompetent (or self-interested) managers of a target firm, then one would expect that the target firm performs poorly before a merger. After the merger, under competent management, the acquired firm's performance should improve. On the other hand, if a merger is motivated by synergy, then the acquiring firm targets only productive firms. After merger, synergy would help to improve the performance of the combined firm. Finally, if a merger is undertaken for purposes of building empires or obtaining monopoly power, then 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; Lichtenberg and Siegel), 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; it equals zero, otherwise. 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) and plants produce other meat products, respectively.

Equation (1) is similar to those in McGuckin and Nguyen and Lichtenberg and Siegel in that it includes P and S as independent variables. Following McGuckin and Nguyen, we use pre-merger relative labor productivity as a measure of performance, P. This variable is included in the equation to

test two competing hypotheses of M&A motives. A positive estimated coefficient for P suggests that acquirers purchased efficient plants and, thereby, supports the managerial synergy hypothesis. Conversely, if this coefficient is negative the managerial discipline is supported by the data: unproductive plants must be taken over to discipline inefficient managers.

In keeping with McGuckin and Nguyen and Lichtenberg and Siegel, we use total employment as a measure of size, S. The size variable represents various factors that may affect the dynamics of firms and plants. 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 found that size is an important factor affecting the likelihood of a plant being acquired. Dunn, Roberts and Samuelson found that larger plants have lower failure rates than small plants.

2. M&A and Productivity Change: Following previous studies, we examine the change in productivity with the following equation:

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

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

IV. DATA AND PERFORMANCE MEASUREMENT

1. Data Sources: The plant level data used in this study are taken from the LRD and the Ownership Change Database (OCD). LRD data include total value of shipments and value added. Data on inputs include information on capital, labor, energy, materials, and selected purchased services. The LRD also contains information on classification and identification such as plants' ownership, location, product and 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.[3]

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.[4]

2. Sample Coverage: We examine three 4-digit industries (SICs 2011, 2013 and 2015) transferred in 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 in the 1977-87 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 the firm, or to dispose of them.

3. M&As in the Meat Product Industry: Using the OCD, we identified every plant that was acquired during the 1977-82 and 1982 periods and all manufacturing plants owned by acquired firms at the beginning of the period (1977 or 1982) whether or not they were located in the meat product industry. This provided our population of meat producing firms and the plants that they acquired during the periods under study.

For the period 1977-82, we identified 251, 178 and 312 plants acquired by firms that had operations in SICs 2011, 1013 and 2015. The corresponding numbers of plants owned by acquirers before merger are 684, 412 and 518, respectively. For control purposes of the analysis, we next identified all plants that were owned by firms that did not experience any M&A activity period 1977-82. We then identified the companies that owned these plants in 1977 and all the plants owned by the identified companies. For this control group, in 1977 we identified 2,042, 1,214 and 442 plants owned by non-acquiring firms that had operations in SICs 2011, 2013 and 2015, respectively. Thus our 1977-82 sample consists of 6,053 plants.

For the period 1982-87, we identified 226, 353 and 316 plants acquired by firms that had operations in SICs 2011, 1013 and 2015. The numbers of plants owned by acquirers in the three industries are 315, 580 and 560, respectively. The numbers of plants owned by the firms in the control group are 1,326 in SIC 2011, 1,155 in SIC 2013 and 359 in SIC. Thus, the 1977-82 sample consists of 5,190 plants.

4. 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, but labor productivity is often used in empirical studies at the plant level because plant-level data on some inputs, such as capital, which are required for the measurement of TFP, are not available. Data on output and labor, on the other hand, are available in most micro-data sets. This study uses labor productivity.

Measurement problems still arise with labor productivity measures. This is particularly true for making comparisons across plants and over time because output prices and the value of output varies across plants and over time due to price dispersion and inflation, but data on output prices at the plant level required for estimating plants' real output are not available.[5] To mitigate this problem, we use relative labor productivity (RLP) -- the ratio of plant labor productivity (LP) to average industry labor productivity (ALP),

$$(1) \qquad RLP_{ij} = LP_{ij} / ALP_{j} ,$$

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.[6]

V. EMPIRICAL RESULTS

1. Productivity and M&As: Tables 1 and 2 report initial relative labor productivity of acquired plants and non-acquired plants y their status in 1987 and 1992 (e.g., kept, sold and closed). All figures are normalized to the mean of the whole sample. The tables show that acquirers are the most productive firms, while non-acquirers are the least productive firms. Most notably, the average labor productivity of acquired plants is well above their industry averages. For example, the average 1977 relative labor productivity for acquired plants in SICs 2011, 2013 and 2015 are 1.3022, 1.0699 and 1.0334, respectively. These figures imply that, on average, the pre-merger labor productivity of acquired plants in these industries was well above their industry average, ranging from 3.34% to 30.22%. These numbers are quite consistent with McGuckin and Nguyen's finding for the entire food and beverage industry (SIC 20). Using 1977 data for SIC 20, they found that the pre-merger labor productivity of acquired plants are approximate 20% above the industry average.

The tables also show that acquirers kept the most productive plants and closed or resold less productive ones[7]. Acquirers in 1977-82 period resold or closed about 50% or more of the total plants they acquired after operating them for 5 to 10 years. As for the plants owned by non-acquiring firms, we find that their average relative labor productivity. For example, the 1977 average productivity estimates for non-acquiring firms' plants in SICs 2011, 2013 and 2015 are .8654, .9217 and .8453, respectively (i.e., ranging from 8% to 15% below industry averages). The tables also show that non-acquiring firms sold their most productive plants.

The foregoing results strongly suggest that acquirers purchased relatively productive plants. Even the plants that were closed after mergers had above industry average initial labor productivity. These results are consistent with the finding of Ravenscraft and Scherer, Matsusaka and McGuckin and

Nguyen. They, however, diverge from Lichtenberg and Siegel's general conclusion that low productivity leads to ownership change.[8]

Tables 3 and 4 report the estimates for the linear and non-linear probit regressions for the motives for M&As during the 1977-82 and 1982-87 periods. Columns (1), (3) and (5) report the estimates of the linear model, while columns (2), (4) and (6) show the results of the non-linear model. Both tables show that initial plant size (S) and relative labor productivity (P) have significantly positive effects on M&As. For the period 1982-87, these results are consistent for both linear and non-linear models. For the period 1977-82, the estimated coefficients for the productivity variable in 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. This result suggests that the estimates of the linear model are downward biased. This is because this model fails to take into accounts the interactions between the productivity variable and other explanatory variables. We note that this result is also consistent with McGuckin and Nguyen's results. Using data for the food and beverage industry, these authors found that the estimated coefficients of the productivity variable equal .1292 and .4537 for the linear and non-linear models, respectively.

Unlike McGuckin and Nguyen who found the coefficient for the interaction term between productivity and size, Log(P). Log(S), significantly negative, we find this coefficient significantly positive across the 3 industries under study based on 1977 data. Based on 1982 data, this coefficient is also significantly positive for industries 2013 and 2015, but it is significantly negative for industry 2011.

The above differ from Lichtenberg and Siegel's finding that low productivity generally leads to ownership change. We emphasize, however, that Lichtenberg and Siegel's results were based on a truncated sample that includes most large continuous manufacturing plants taken from several panels of

data in the Census Bureau's Annual Surveys of Manufactures (ASM) file. Specifically, their sample includes 82 percent of large plants with at least 250 employees, 28.8 percent of plants having between 250 and 499 employees, and 52.7 percent with more than 500 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 Table 3 and 4 to calculate the probabilities of plant acquisitions in response to varying levels of productivity and size. 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 10^{th} 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 95^{th} during the 1977-82 and 1982-87 periods. For meat sausages (SIC 2013), probability of ownership changed ranged from less than 1% at the 10^{th} percentile for both periods to 25% and 50% at the 95^{th} percentile for both periods. Finally, for poultry slaughter (SIC2015), the probability of ownership change ranged from about 3% at the 10^{th} percentile for both periods to about 50% at the 95^{th} percentile for both periods. Summarizing, our regression and probability analyses indicate that (1) M&As and productivity are positively correlated, and (2) M&As are strongly associated with plant size.

2. Post-Merger Productivity Performance: We now turn to the issue of whether M&As improve plant productivity. Table 5 reports the results of productivity growth regressions for the three meat product industries. Columns (1), (3) and (6) show the results for the period 1977-87 and columns (2), (4) and (6) contain the estimates for the period 1982-92.

One important result stands out. For the meat packing product industry (SIC 2011) and sausages & other prepared meat industry (SIC2013), the estimated coefficients for the Pr(AC) variable are significantly positive, while those for the interaction term Pr(AC).Log(S) are negative and significant. These estimates suggest that acquired plants outperformed non-acquiring firms' plants in terms of productivity growth in the post-merger periods. The negative estimated coefficients for the interaction term, Pr(AC).Log(S), indicate that acquired plants' productivity growth declines with plant size. This means that, for larger plants, non-acquiring firms' plants tend to improve their productivity growth a higher rate than that of acquired plants.

Results for the poultry slaughtering and processing industry (SIC 2015) reported in columns (5) and (6), table 8, 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 and significant for the period 1977-87 but insignificant for 1982-92. This result suggests that M&As did not improve productivity of acquired plants in the poultry slaughtering and processing industry (SIC 2015).

VI DISCUSSION:

The results can be summarized into two basic results. First, during both the1977-82 and 1982-97 periods, acquired plants in all three meat product industries are highly productive before mergers. Second, while acquired plants in the meat packing industry (SIC 2011) and sausages and other prepared meat product industry (SIC 2013) improved their productivity growth after mergers, those in the poultry slaughtering and processing industry (SIC 2015) did not.

Based on these results, it appears that beef slaughter and meat processing firms prefer to acquire productive targets. This result is consistent with confirms McGuckin and Nguyen's finding for

the food and beverage industry (SIC 20) that "firms tend to acquire good businesses." Similar results were also obtained from other studies. For example, Baldwin used plant-level data for the Canadian manufacturing sector and found that acquired plants of all types had higher average productivity than other plants. Lichtenberg and Siegel also found that plant involved in leverage buyouts in U.S. manufacturing had above average relative productivity in the three years before the buyouts. All these results support the hypothesis that synergy (not managerial discipline) is a central motives for M&As.

The second result generally supports previous studies' findings that M&As lead to acquired plants' productivity growth improvement (Baldwin; Lichtenberg and Siegel; McGuckin and Nguyen). It is also consistent with both synergy and managerial-discipline theories, which predict that M&As, improve firms and plants in the post-acquisition period.

Finally, we note that not all of our results are consistent with previous studies that use data for the entire manufacturing sector (Lichtenberg and Siegel) or a single, broadly defined industry (McGuckin and Nguyen). Specifically, our results for the poultry slaughtering and processing industry (SIC 2015) indicate that M&As did not improve productivity of target plants. This result holds for plants acquiring during both the 1977-82 and 1982-87 periods. This suggests that the conduct and performance of an individual industry can and do differ from that of the typical industry. Thus, studies at the individual industry level are necessary to evaluate the impact of certain economic activity such as M&As on the performance of an individual industry.

We did not specifically examine the differences between meat slaughter and processing relative to poultry slaughter and processing but speculate that industry factors contribute to the differences. Differences between meat and poultry slaughter and processing include how products are marketed – poultry commonly employs brand marketing, while meat does not. As a result, poultry mergers may

have been driven more by improvements in marketing performance, which could not be examined in this study.

The meat industry is also much more heterogeneous than the poultry industry in terms of plant size and productivity performance. Additionally, it is dominated by a few very large firms that increased their size dramatically during a period (1977-92) in which per capita meat consumption declined and wages in large plants dropped to those in smaller plants (MacDonald, et al). In this environment, some meat plants with above average productivity may have higher costs if they pay a wage premium and their competitors do not. Their higher costs may make their products noncompetitive even though their underlying assets are productive. These firms would be sold to an acquiring firm that could achieve lower wage costs and be better able to fill capacity.

VII. CONCLUDING REMARKS

This analysis provides evidence that firms in the meat product industries preferred to take over 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 together with recent studies based on plant-level data suggest that synergies and related efficiencies are important motives for M&As.

In concluding, we note that our analysis of the impact of M&As on plants' productivity performance is based on surviving plants. But, from tables 1 and 2, it is clear that acquiring firms did close and resell a significant number of plant that they acquired. This suggests the possibility that the productivity gains arise in M&As could come from 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.

ENDNOTES

1. The Congress included $500,000 in the U.S. Department of Agriculture's Packers and Stockyard Administration 1992 fiscal year appropriation for studying the effect of concentration in the red meat industry.

3 For a review of finance studies, see Jensen and Ruback (1983), Smith (1986), and Jerell, Brickley and Netter(1998). For a review of early industrial organization studies, see Mueller (1993).

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

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

5. Abbott (1989) used plant level data extracted from the 1982 Census of Manufactures to analyze output prices across producers. He found that prices vary substantially across plants, even at the 7-digit product level.

6. 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 output deflator because, in any given year, output in all plants is measured in the same units (i. e., dollars). Accordingly, it can be used in intertemporal comparisons (see Bailey et al., 1992, p.192).

7. We note, however, that the productivity of closed plants could be overstated because it is possible that there is a number of plants that we identified as "closed" are reclassified as non-manufacturing plants, and therefore disappeared from the 1987 CM. In addition, it is likely that sales from inventory and labor reductions around the time of closing may "inflate" labor productivity.

8. In fact, they found that plants involved in leveraged buyouts (LBOs) were efficient prior to transaction, showing above-average productivity 3 years before the buyout. In this regard, our results do not entirely contradict their findings.

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

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	2.19611.6	276	1.6947	271	1.3092
Sold before 1992	33	588	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

* 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		(50.47)		(75.95)		17.43
	---	-.203**	---	-.743**	---	-.895**
log(P) x NF		(7.88)		(111.73)		(116.76)
N	1,867	1,867	2,078	2,078	1,207	1,207

*, ** 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)
?(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)
?(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.

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