Two Census Bureau Datasets

Census of Manufacturers data from the U.S. Census Bureau's Longitudinal Research Database (LRD) and Ownership Change Database (OCD) are used for 1972, 1977, 1982, 1987, and 1992. Only census years are used because these data contain all plants (non-census year data include only a sample of plants). The years 1977-92 were chosen because this period encompasses the beginning and ending years of the latest merger movement for which all data were available.

Longitudinal Research Database: The LRD is a powerful and unique dataset that permits researchers to conduct a wide variety of analyses based on detailed, plant-level data. The data include the value of shipments and units produced at up to the seven-digit SIC code level of detail, material inputs at the six-digit level (e.g., cattle inputs for beef packing), wages and other labor costs, the number of production and total employees, production hours, material and other nonlabor costs, value-added, historical values of property, plant, and equipment, capital purchases, energy consumption and costs, and selected purchased services. An important feature of the LRD is its plant classification and identification information: firm affiliation, location, product and industry, and various status codes that identify birth, death, and ownership changes. Researchers can use these identifying codes to link plants across time and determine plant ownership. For a more complete description of the LRD, see McGuckin and Pascoe (1988). For a detailed discussion of the identification of ownership changes through mergers and acquisitions, see Nguyen (1998).

Ownership Change Database: The OCD contains U.S. manufacturing plants that were acquired at least once over 1963-92. The OCD was used to identify all meat, poultry, dairy, and grain plants acquired during the 1977-82 and 1982-87 periods. After noting firm ownership, all manufacturing plants were identified that were owned by acquiring (buyer) and nonacquiring (nonbuyer) firms at the beginning of each period (1977 or 1982). This identification included all plants owned by firms with meat, poultry, dairy, or grain operations, regardless of whether they were in the target industry or not. Thus, the sample of plants owned by firms in each target industry is greater than the number of plants in that industry because plants owned by target industry firms include food plants in the target industry, food plants outside the target industry, and nonfood plants. Nonfood plants were included in the analysis in order to account for complete divestitures.

Five-Year and 10-Year Study Periods Used

We analyzed differences in pre-merger labor productivity between acquired and nonacquired plants for 1977-82 and 1982-87. In Census Bureau files, plants acquired over 1977-82 appear in the 1977 data as being owned by one firm and appear in the next census (1982) as being owned by a different firm. Since there are no data for the intervening years, the plant could have been acquired in 1977, 1978, 1979, 1980, or 1981. Pre-merger labor productivity for all firms would be labor productivity for 1977 for all plants. Similarly, plants acquired over 1982-87 would appear in the 1982 census as being owned by one firm and in the 1987 census as being owned by a

different firm. The acquisition could take place in 1982, 1983, 1984, 1985, or 1986. Pre-merger labor productivity would be labor productivity of 1982 for all plants.

In the second analysis, we assessed the effect of being acquired on labor productivity growth over 1977-87 for plants acquired over 1977-82 and on labor productivity growth over 1982-92 for plants purchased from 1982-87. The 1977-87 and 1982-92 time periods were used because these periods give firms 6 to 10 years to close, sell, or retain plants they acquire. A 6-year time period occurs for plants acquired in 1981 for the 1977-82 merger wave or 1986 for the merger wave of 1982-87. Similarly, a 10-year period occurs for plants in either 1977 for the 1977-82 merger wave or 1982 for the merger wave of 1982-87. If only a 5-year period were used and a plant were acquired in 1981, which is in the first merger wave, then the firm might have only 1 year until the next census in 1982 to determine about what to do with the plant (close, sell, or keep it). By extending the study period to the 1987 census year, we give firms at least 6 years to decide what to do with an acquisition.

A rationale similar to that used for choosing the 1977-87 study period for the 1977-82 merger wave guides the use of the 1982-92 study period for plants acquired over 1982-87. Given a 1982-92 period, firms would have 6 years to consider the viability of plants acquired in 1986 and 10 years for plants obtained in 1982.

In the analyses of the labor productivity of acquired plants, all variables were defined in terms of pre-acquisition values and were taken from the 1977 census for the 1977-82 merger wave and 1982 for the 1982-87 merger wave. In the productivity growth analysis, productivity growth over 1977-87 and 1982-92 was examined. For the 1977-87 analysis, pre-acquisition conditions are taken from the 1977 census and post-acquisition characteristics are taken from the 1987 census. Changes are the differences between final and initial values, i.e., differences in 1987 and 1977 values. Similarly, for the 1982-92 analysis, pre-acquisition conditions from the 1982 census and final values from the 1992 census were taken. Changes are differences between the final values from the 1992 census and initial values from 1982 census.

Acquired Plants Are More Likely To Survive Than Nonacquired Plants

Tables 1 and 2 show the disposition of plants (acquired, kept, or closed) over 1977-87 and 1982-92 by ownership type (buyer or nonbuyer firm). The first row of table 1, top panel, gives the number of plants that firms acquired over 1977-82 and kept until 1987. The next two rows provide the number of plants firms acquired over 1977-82 and either sold or closed by 1987.[3] These data indicate that buyer firms kept about half the plants they acquired, closed about 25 percent, and sold about 25 percent. Although firms held and closed higher percentages of plants over 1982-92, the overall pattern remained similar.

The second panel shows the disposition by 1987 of the plants that buyer firms owned in 1977. It indicates that, by 1987, buyer firms retained only 35 percent of the plants they had owned in 1977. Buyer firms sold about 30

[3]A plant purchased over 1977-82 could have been closed by 1982, e.g., the plant could have been acquired in 1978 and closed in 1981.

Table 1
Firms keep proportionately more acquired plants than nonacquired plants, 1977-87, in eight food industries

Disposition of plants	Meat-packing	Meat processing	Poultry	Cheese	Fluid milk	Flour	Feed	Oilseeds	Total
					Number				
Plants acquired 1977-82:									
Plants kept 1977-87[1]	118	70	157	119	197	178	215	170	1,224
Plants sold by 1987	56	66	94	43	99	38	106	55	557
Plants closed by 1987	77	42	61	59	109	67	118	66	599
Total acquired plants	251	178	312	221	405	283	439	291	2,380
Plants owned by buyer firms in 1977:									
Plants kept 1977-87	210	*	235	*	337	*	290	*	1,072[2]
Plants kept in 1982 but sold by 1987	209	*	135	*	278	*	275	*	897[1]
Plants closed by 1982[3]	187	*	85	*	216	*	171	*	659[2]
Plants closed by 1987	78	*	63	*	140	*	96	*	377[2]
Total buyer plants	684	*	518	*	971	*	832	*	3,005[2]
Plants owned by nonbuyer firms in 1977:									
Plants kept 1977-87	610	604[4]	169	482[4]	494	578[4]	628	318[4]	3,883[4]
Plants kept in 1982 but sold by 1987	35	197[4]	26	52[4]	37	266[4]	37	143[4]	793[4]
Plants closed by 1982[3]	1,073	395[4]	160	292[4]	641	319[4]	502	80[4]	3,462[4]
Plants closed by 1987	324	430[4]	87	152[4]	249	187[4]	252	152[4]	1,833[4]
Total nonbuyer plants	2,042	1,626[4]	442	978[4]	1,421	1,350[4]	1,419	693[4]	9,971[4]
Total plants	2,977	1,804	1,272	1,199	2,797	1,633	2,690	984	15,356

*Buyer and nonbuyer firms are combined due to potential disclosure violations.
[1]Plant was purchased in 1977, 1978, 1979, 1980, or 1981 and still was owned by buyer in 1987. The convention for the other entries is similar.
[2]Does not include buyer plants in which there are disclosure violations.
[3]Plants were open in 1977 but were closed in 1978 or 1979-81.
[4]Includes buyer and nonbuyer firms in instances where there were insufficient observations for one to stand alone and not be a disclosure violation.

Source: ERS estimates based on U.S. Census Bureau data. Industries include meatpacking, meat processing, poultry slaughter and processing, fluid milk processing, cheese making, flour milling, feed processing, and the combined industry of wet corn milling and cottonseed and soybean crushing.

Table 2
Firms close proportionately more nonacquired plants than acquired plants, 1982-92, in eight food industries

Disposition of plants	Meat-packing	Meat processing	Poultry	Cheese	Fluid milk	Flour	Feed	Oilseeds	Total
					Number				
Plants acquired 1982-87:									
Plants kept 1982-92[1]	145	190	184	75	142	268	273	297	1,574
Plants sold by 1992	21	99	94	50	77	81	**	49	371
Plants closed by 1992	60	92	76	50	114	131	129	107	759
Total acquired plants	226	381	505	175	333	480	4,021	453	2,804
Plants owned by buyer firms in 1982:									
Plants kept 1982-92	195	271	260	152	221	217	274	*	1,590
Plants kept in 1987 but sold by 1992	*	99	*	*	*	*	*	*	99
Plants closed by 1987[3]	63	137	154	*	170	*	121	*	645
Plants closed by 1992	*	54	44	*	85	*	43	*	226
Total buyer plants	258[1]	561	408	152[2]	476	217[2]	438	*	2,560[2]
Plants owned by nonbuyer firms in 1982:									
Plants kept 1982-92	541	598	178	247	422	416	626	492[4]	3,520
Plants kept in 1987 but sold by 1992	454	18	97[4]	92[4]	169[4]	624	624	129[4]	674
Plants closed by 1987[3]	479	355	120	254[4]	271	265[4]	350	205[4]	2,299
Plants closed by 1992	318[4]	205	50	155[4]	152	123[4]	221	95[4]	1,319
Total nonbuyer plants	1,383[4]	1,176	4454	748[4]	1,014[4]	866[4]	1,259[4]	921[4]	7,812[4]
Total plants	1,867	2,078	1,207	1,079	1,823	1,563	2,099	1,374	13,176

* Buyer and nonbuyer firms are combined due to potential disclosure violations.
** Combined with acquired over 1982-87 and sold by 1992 due to potential disclosure violation.
[1]This means that a plant was purchased in 1982, 1983, 1984, 1985, or 1986 and still was owned by the buyer in 1992. The convention for the other entries is similar.
[2]Does not include buyer plants in which there are disclosure violations.
[3]Plants were open in 1982 but were closed in 1983 or 1984-86.
[4]Includes plants of buyer and nonbuyer firms for cells in which there were insufficient observations for one to stand alone and not be a disclosure violation.

Source: ERS estimates based on U.S. Census Bureau data. Industries include meatpacking, meat processing, poultry slaughter and processing, fluid milk processing, cheese making, flour milling, feed processing, and the combined industry of wet corn milling and cottonseed and soybean crushing.

percent of the plants they had owned in 1977 over 1982-87 after keeping them until 1982 and shut down about 35 percent of the plants they had held in 1977 by either 1982 or 1987. The third panel is similar to the second except it provides the distribution by 1987 of the plants owned in 1977 by nonbuyer firms. It reveals that nonbuyer firms kept about 40 percent of the plants they owned in 1977 over 1977-87, sold about 10 percent of the plants they had owned in 1977 over the census period from 1982-87, and closed about half the plants they had owned in 1977, by either 1982 or 1987. A similar pattern holds for 1982-92.

Labor Productivity Is Higher for Acquired Plants

Table 3 shows the 1977 and 1982 mean relative labor productivities for the same categories of plants identified in tables 1 and 2. All labor productivity values are normalized to their sample means. Normalization assigns a value of one to the industry average. Plants with normalized relative labor productivity below one have below-average labor productivity and plants with normalized labor productivity greater than one have above-average labor productivity.

The table shows that acquired plants (panel 1) and the plants of buyer firms (panel 2) had above-average labor productivity (index values greater than 1) for all categories except plants owned by buyer firms in 1977 and closed by 1982. By contrast, the plants that nonbuyer firms kept (panel 3) had below-average labor productivity and the plants they sold had above-average labor productivity. These data indicate that nonbuying firms sold their most productive plants and kept less productive ones. Buyers, in contrast, kept their most productive plants and closed or resold less productive ones.[4]

Table 3 suggests that firms purchase highly performing plants. However, since plant size and other factors could account for labor productivity differences, we conducted regression analyses to isolate labor productivity effects from other sources of change. The effect of labor productivity on whether a plant was acquired was examined and then we determined whether acquired plants improved their labor productivity over two Censuses (6-10 years). In both regressions, plant size and some other variables representing sources of change serve as control variables.

Relative Labor Productivity Removes Inflationary Biases

Labor productivity is recognized by many economists as an accurate reflection of production performance and has been used by numerous authors, including McGuckin and Nguyen (1995), to evaluate plant performance. Economists have measured labor productivity in several different ways. The two most common approaches are output per unit of input, such as labor (labor productivity), and output from all inputs, total factor labor productivity (TFP). Theoretically, TFP is superior because it takes into account all inputs, but, since plant material input data are not available for all plants, we use labor productivity.

[4]The labor productivity of closed plants could be overstated because it is likely that sales from inventory and labor reductions around the time of closing may have "inflated" labor productivity. Additionally, plants could be identified as "closed" that actually were reclassified as nonmanufacturing plants. These plants would have disappeared from the Census of Manufacturers because the majority of their output (sales) comes from nonmanufacturing. For example, cold storage plants often do some meat processing. If meat processing sales decline, the facility could be reclassified as a storage plant and disappear from the Census of Manufacturers.

Table 3

Acquired plants have higher initial labor productivity than plants owned by nonbuyer firms over 1977-87 and 1982-92 in eight food industries

Disposition of plants	1977-87		1982-92	
	Number of plants	Labor productivity relative to sample mean	Number of plants	Labor productivity relative to sample mean
Plants acquired 1977-92:				
Plants kept until 1987 or 1992	1,224	1.160	1,575	1.211
Plants sold by 1987 or 1992	567	1.020	471[1]	1.084[1]
Plants closed by 1987 or 1992	589	1.090	759[2]	1.008[2]
Total acquired plants	2,380	----	2,805	---
Plants of buyer firms:				
Plants kept until 1987 or 1992	3,054[3]	1.175[3]	2,082[4]	1.291[4]
Plants sold by 1987 or 1992	1,555[3]	1.102[3]	759[5]	1.289[5]
Plants closed by 1982 or 1987	1,817[3]	0.941[3]	1,300[6]	1.116[6]
Plants closed by 1987 or 1992	1,226[3]	1.101[3]	936[7]	1.033[7]
Total plants of buyers	7,652[3]	---	5,077	---
Plants of nonbuyer firms:				
Plants kept until 1987 or 1992	1,901[8]	0.856[8]	3,028[9]	0.896[9]
Plants sold by 1987 or 1992	135[8]	1.117[8]	18[10]	1.406[10]
Plants closed by 1982 or 1987	2376[8]	0.826[8]	1,609[11]	0.819[11]
Plants closed by 1987 or 1992	912[8]	0.863[8]	622[12]	0.861[12]
Total plants of nonbuyers	5,324[8]	---	5,277	---
All plants	15,356	---	13,159	---

--- = Not applicable.
[1]Excludes feed plants.
[2]Includes feed plants sold by the end of the period.
[3]Includes nonbuyer meat processing, cheese making, flour milling, and oilseed crushing plants due to disclosure rule conflicts.
[4]Includes nonbuyer oilseed plants.
[5]Includes nonbuyer meatpacking, poultry slaughtering and processing, fluid milk processing, cheese making, flour milling, feed processing, and oilseed crushing plants.
[6]Includes nonbuyer cheese making, flour milling, and oilseed crushing plants.
[7]Includes nonbuyer meatpacking, cheese making, flour milling, and oilseed crushing plants.
[8]Excludes nonbuyer meat processing, cheese making, flour milling, and oilseed crushing plants due to disclosure rules.
[9]Excludes oilseed crushing plants.
[10]Only meat processing plants included.
[11]Excludes cheese making, flour milling, and oilseed crushing plants.
[12]Excludes meatpacking, cheese making, flour milling, and oilseed crushing plants.

Source: ERS estimates based on U.S. Census Bureau data. Industries include meatpacking, meat processing, poultry slaughter and processing, fluid milk processing, cheese making, flour milling, feed processing, and the combined industry of wet corn milling and cottonseed and soybean crushing.

We would like to define labor productivity as real output divided by labor inputs. However, the only available measure of output—the total value of shipments—is in nominal dollars, and varies with inflation. To account for inflation, it would be ideal to adjust the nominal values with a deflator that is based on a portfolio of products that do not change over time. Unfortunately, output prices are not available, and we cannot construct such a deflator.[5] As an alternative, we use relative labor productivity (RLP)—the ratio of plant labor productivity (LP) to average industry labor productivity (ALP). Labor productivity equals the value of total value of shipments, in current dollars, divided by plant production worker hours. Relative labor productivity deflates the plant's value of shipments by the price changes encountered by the entire industry, and, since different portfolios of products have different values, it also adjusts for industrywide changes in output mix. Thus, above-average plants must produce more of the same type of output per worker, the same quantity of higher value products per worker, or both more and higher value output per worker. Mathematically, it is defined as:

(1) $RLP_{ij} = LP_{ij} / ALP_j$,

where i and j denote plant i and four-digit SIC industry j, respectively. Plant labor productivity (LP) is defined as the total value of shipments in current dollars divided by total work hours for plant i in industry j and ALP is the sum of all labor productivities of all plants in an industry divided by the number of plants in that industry, $\left(\sum LP_{ij} / N_j \right)^6$.