

Most Acquired Plants Have Higher Labor Productivity Growth

To see whether the transfer of plants from one firm to another is efficient, acquisitions' effect on labor productivity must be evaluated. We examined labor productivity as a measure of plant performance over two census periods. We regressed plant acquisition status, i.e., whether a plant was acquired, and several control variables on plant productivity growth. The control variables include beginning-of-period plant labor productivity (RLP), beginning-of-period plant size, $\text{Log}(\text{SIZE})$, the change in capital/sales ratio ($\Delta (\text{K/S})$), the change in human capital ($\Delta (\text{NPW/PW})$), and several dummy variables denoting plant type. For technical reasons, we use probability of being acquired ($\text{Pr}(\text{AC})$) as a measure of acquisition status. This probability was estimated earlier. See the appendix for an explanation of why this variable was used and for a complete description of the other variables and the model.

Tables 7, 8, and 9 contain the results of the labor productivity growth regressions. The R^2 statistics range from 0.19 to 0.40 over the two periods: 1977-87 and 1982-92. We are mainly interested in the performance of acquired plants. A positive sign indicates that a variable encourages labor productivity growth and a negative sign suggests the opposite. The estimated coefficient for the probability of ownership change— $\text{Pr}(\text{AC})$ —is positive and significant in six of the eight industries and positive in one of the two remaining industries over 1977-87. Similarly, it is positive and significant in four of the industries and negative in only one industry over 1982-92. This positive sign means that, at least for small plants, being acquired has a positive influence on productivity growth.

The sign on the interaction of probability of ownership change and plant size— $\text{Pr}(\text{AC}) * \text{Log}(\text{SIZE})$ —indicates how productivity growth changes for plants of different sizes. It is negative and significant in seven of the eight industries over 1977-87 and in three of eight industries over 1982-92. In four of the 1982-92 cases, $\text{Pr}(\text{AC}) * \text{Log}(\text{SIZE})$ was negative but insignificant. Taken together, the positive sign on $\text{Pr}(\text{AC})$ and the negative sign on $\text{Pr}(\text{AC}) * \text{Log}(\text{SIZE})$ means that productivity growth is lower for larger acquired plants than for smaller ones.

Results also show that initial labor productivity and changes in the capital-to-sales ratio and the ratio of nonproduction workers to production workers were negatively associated with labor productivity growth. Initial plant size had a positive effect on productivity growth. The other control variables had no significant effect. An increase in nonproduction workers decreases labor productivity if the new workers must be added to comply with new regulation or new quality concerns, such as food safety.

We were mainly interested in knowing which plants have positive productivity growth. To determine this, we further examined the coefficients on $\text{Pr}(\text{AC})$ and $\text{Pr}(\text{AC}) * \text{Log}(\text{SIZE})$. A positive coefficient on $\text{Pr}(\text{AC})$ and a negative coefficient on $\text{Pr}(\text{AC}) * \text{Log}(\text{SIZE})$ indicates that labor productivity growth diminishes with size and eventually becomes negative. The size of the transition from positive to negative is important because it may be that most plants have

Table 7

Small and medium size acquired plants have higher labor productivity growth than other meat plants, 1977-87, and than all other meat and poultry plants, 1982-92

Dependent variable	1977-87			1982-92		
	Meat-packing	Meat processing	Poultry slaughtering	Meat-packing	Meat processing	Poultry slaughtering and processing
Intercept	-0.53*** (0.05)	-0.59*** (0.06)	0.32*** (0.12)	-0.61*** (0.08)-	0.25* (0.07)	0.05 (0.12)
Log (RLP)	-0.74*** (0.06)	-0.89*** (0.10)	0.11 (0.13)	-0.40*** (0.08)	-0.70*** (0.07)	-0.20* (0.11)
Log (SIZE)	0.11*** (0.015)	0.13*** (0.02)	-0.08*** (0.03)	0.12*** (0.02)	0.04** (0.02)	0.003 (0.02)
Pr. (AC)	1.07*** (0.27)	2.48*** (0.53)	-0.73* (0.43)	0.94** (0.46)	0.76* (0.44)	0.33 (0.42)
BUYER_PLANT	0.56*** (0.14)	-0.08 (0.27)	0.21 (0.15)	0.09 (0.17)	0.01 (0.13)	-0.32** (0.13)
OUTSIDE ¹	0.012** (0.055)	-0.07 (0.08)	-0.05 (0.07)	0.27*** (0.08)	0.22*** (0.06)	0.15** (0.06)
NOT_FOOD	-0.04 (0.07)	-0.07 (0.13)	-0.15* (0.09)	-0.007 (0.10)	0.01 (0.07)	-0.09 (0.07)
MULTI	0.04 (0.05)	0.07 (0.06)	0.02 (0.06)	0.02 (0.06)	-0.02 (0.04)	-0.11** (0.05)
AGE72	-0.07* (0.04)	-0.06 (0.04)	0.01 (0.05)	-0.04 (0.05)	0.05 (0.04)	-0.07 (0.05)
AGE77	---	---	---	-0.08 (0.06)	0.06 (0.05)	-0.11 (0.065)
△ (K/S)	-0.49*** (0.07)	-0.50*** (0.07)	-0.59*** (0.08)	-0.56*** (0.06)	-0.53*** (0.06)	-0.53*** (0.07)
△ (NPW/PW)	-0.11*** (0.03)	-0.09*** (0.03)	-0.08** (0.04)	0.03 (0.04)	0.01 (0.02)	0.0001 (0.02)
Log (RLP)*	0.09*** (0.016)	0.10*** (0.025)	-0.11*** (0.03)	0.01 (0.02)	0.058*** (0.016)	0.02 (0.02)
Pr. (AC)*	-0.21*** (0.05)	-0.47*** (0.09)	0.19** (0.08)	-0.20*** (0.07)	-0.12* (0.07)	-0.03 (0.07)
BUYER_PLANT*	-0.10*** (0.027)	-0.018 (0.05)	-0.03 (0.03)	-0.02 (0.03)	-0.01 (0.03)	0.06** (0.025)
Adj. R ²	0.31	0.37	0.30	0.21	0.32	0.23
N	922	658	554	843	1035	609

--- = Not applicable. T-statistics are in parentheses.

* = significant at 10-percent level; ** = significant at 5-percent level; *** = significant at 1-percent level.

Dependent variable: $(RLPt - RLPt-1) / (RLPt / 2 + RLPt-1/2)$

¹OUTSIDE equals 1 for plants outside the industry in question (meatpacking, meat processing, and poultry slaughtering and processing) and 0 otherwise.

Source: ERS estimates based on U.S. Census Bureau data.

Table 8

Small and medium size acquired plants have higher labor productivity growth than other plants in cheesemaking and fluid milk, 1977-87 and 1982-92

Dependent variable	Cheese making		Fluid milk processing	
	1977-87	1977-87	1982-92	1982-92
Intercept	-0.60*** (0.08)	-0.27*** (0.07)	-0.27*** (0.08)	-0.02 (0.07)
Log (RLP)	-0.61*** (0.10)	-0.66*** (0.02)	-0.50*** (0.04)	-0.41*** (0.03)
Log (SIZE)	0.13*** (0.02)	0.07*** (0.02)	0.002 (0.04)	0.006 (0.03)
Pr. (AC)	1.02** (0.43)	0.48 (0.39)	0.55** (0.25)	0.53* (0.32)
BUYER_PLANT	0.40** (0.18)	0.08 (0.13)	0.09 (0.06)	0.04 (0.05)
OUTSIDE ¹	0.025 (0.06)	0.20*** (0.05)	0.03 (0.11)	-0.02 (0.05)
NOT_FOOD	0.01 (0.08)	-0.13** (0.05)	-0.45*** (0.17)	-0.07 (0.07)
WEST	0.18 (0.24)	0.04 (0.12)	-0.025 (0.07)	0.09** (0.04)
MULTI	0.10 (0.08)	0.13** (0.05)	0.21** (0.09)	0.10* (0.054)
AGE72	-0.00 (0.06)	-0.10** (0.05)	0.04 (0.06)	-0.19*** (0.06)
AGE77	---	---	0.03 (0.08)	-0.19** (0.08)
△ (K/S)	-0.63*** (0.10)	-0.39*** (0.05)	-0.70*** (0.10)	-0.51*** (0.08)
△ (NPW/PW)	-0.07** (0.03)	-0.04*** (0.01)	-0.09*** (0.03)	-0.01 (0.01)
Log (RLP)*	0.06** (0.025)	0.06*** (0.02)	0.08** (0.03)	0.05** (0.02)
Log (SIZE)				
Pr. (AC)*	-0.23*** (0.07)	-0.16** (0.07)	-0.22** (0.10)	0.07 (0.14)
Log (SIZE)				
BUYER_PLANT*	-0.10** (0.04)	-0.03 (0.03)	-0.02 (0.05)	-0.03 (0.04)
Log (SIZE)				
WEST*	-0.04 (0.06)	-0.01 (0.03)	0.03 (0.06)	0.09** (0.04)
Log (SIZE)				
Adj. R ²	0.28	0.28	0.40	0.27
N	575	981	462	759

--- = Not applicable. T-statistics are in parentheses. Standard errors are in parentheses.

* = significant at 10-percent level; ** = significant at 5-percent level; *** = significant at 1-percent level.

Dependent variable: $(RLPt - RLPt-1) / (RLPt / 2 + RLPt-1/2)$.

¹OUTSIDE equals 1 for plants outside the industry in question (cheese and fluid milk) and 0 otherwise.

Source: ERS estimates based on U.S. Census Bureau data.

Table 9

Small and medium size acquired plants have higher labor productivity growth than other plants in flour milling and oilseeds, 1977-87, and in flour milling, feed processing, and oilseed processing, 1982-92

Dependent variable	1977-87			1982-92		
	Flour milling	Feed processing	Oilseed processing	Flour milling	Feed processing	Oilseed processing
Intercept	-0.52*** (0.08)	-0.31*** (0.06)	0.15 (0.31)	-0.17* (0.10)	-0.10* (0.06)	-0.26 (0.44)
Log (RLP)	-0.32*** (0.08)	-0.46*** (0.07)	-0.34*** (0.12)	-0.44*** (0.08)	-0.31*** (0.03)	-0.35*** (0.11)
Log (SIZE)	0.10*** (0.024)	0.07*** (0.02)	-0.01 (0.07)	0.001 (0.03)	0.09*** (0.03)	0.04 (0.21)
Pr. (AC)	1.60*** (0.44)	0.75** (0.38)	0.65* (0.40)	0.44 (0.40)	-0.61** (0.30)	0.32 (1.17)
BUYER_PLANT	0.048 (0.13)	0.22* (0.12)	0.05 (0.20)	0.05 (0.19)	-0.01 (0.04)	-0.07 (0.16)
OUTSIDE ¹	0.015 (0.05)	-0.08 (0.09)	---	0.10 (0.06)	0.20*** (0.05)	---
CORN	---	---	-0.53 (0.43)	---	---	-0.74** (0.32)
COTTONSEED	---	---	-0.39 (0.42)	---	---	0.64 (-0.62)
SOY	---	---	0.19 (0.33)	---	---	-0.27 (0.32)
NOT_FOOD	0.21*** (0.05)	-0.01 (0.06)	-0.44** (0.23)	-0.11** (0.05)	-0.08 (0.05)	-0.03 (0.18)
MULTI	0.11* (0.06)	0.12** (0.05)	-0.16 (0.31)	0.16*** (0.06)	0.27*** (0.07)	0.17 (0.29)
AGE72	0.03 (0.05)	-0.09** (0.04)	-0.09 (0.06)	0.05 (0.06)	-0.05 (0.04)	-0.07 (0.06)
AGE77	---	---	---	-0.02 (0.07)	-0.04 (0.05)	-0.09 (0.07)
△ (K/S)	-0.26*** (0.04)	-0.33*** (0.04)	-0.28*** (0.04)	-0.38*** (0.04)	-0.27*** (0.04)	-0.23*** (0.03)
△ (NPW/PW)	-0.03 (0.018)	-0.05** (0.02)	-0.03 (0.03)	-0.07*** (0.02)	-0.06*** (0.02)	0.0001 (0.03)
Log (RLP)*	0.01 (0.02)	0.02 (0.02)	0.005 (0.03)	0.02 (0.02)	-0.2 (0.02)	0.02 (0.02)
Log (SIZE)	0.01 (0.09)	0.02 (0.06)	0.005 (0.076)	0.02 (0.07)	-0.03 (0.09)	-0.03 (0.19)
Pr. (AC)*	-0.35*** (0.09)	-0.14** (0.06)	-0.13* (0.076)	-0.02 (0.07)	-0.03 (0.09)	-0.03 (0.19)
BUYER_PLANT*	0.003 (0.03)	-0.03 (0.03)	-0.02 (0.05)	-0.003 (0.04)	-0.02 (0.04)	0.00 (0.03)
CORN*	---	---	0.07 (0.07)	---	---	0.10* (0.06)
COTTONSEED	---	---	0.11 (0.10)	---	---	-0.01 (0.13)
* Log (SIZE)	---	---	-0.03 (0.08)	---	---	0.10 (0.08)
SOY*	---	---	---	---	---	---
Log (SIZE)	---	---	---	---	---	---
Adj. R ²	0.29	0.23	0.27	0.27	0.19	0.30
N	730	988	476	810	1092	771

--- = Not applicable. T-statistics are in parentheses.

* = significant at 10-percent level; ** = significant at 5-percent level; *** = significant at 1-percent level.

Dependent variable: $(RLPt - RLPt-1) / (RLPt / 2 + RLPt-1/2)$

¹OUTSIDE equals 1 for plants outside the industry in question (flour milling or feed processing) and 0 otherwise. Several dummy variables control for types of oilseed, which include corn, cottonseed, and soy.

Source: ERS estimates based on U.S. Census Bureau data.

negative productivity growth even with a positive coefficient on $\text{Pr}(\text{AC})$. Alternatively, if productivity growth becomes negative after more than 500 to 1,000 workers, then labor productivity growth is positive for nearly the entire industry.

Table 10 shows which industries and plants have positive productivity growth.⁸ Columns 2 and 4 indicate the size of plants realizing labor productivity growth after an acquisition. In order to give a basis of comparison, we noted the average plant size in columns 3 and 5. The first cell in column 2 indicates that meatpacking plants acquired over 1977-87, with fewer than 163 employees, had positive growth in relative labor productivity. A comparison of this number to the average plant size given in the next column (56.4 employees), indicates that both below-average and many above-average plants had positive productivity growth after their acquisition.

A comparison of the results shown in column 2 to the average size plant shown in column 3 indicates that small and many above-average size acquired plants in seven industries had positive labor productivity growth over 1977-87. Their sizes ranged from feed processing plants with fewer than 212 workers to fluid milk processing plants with fewer than 20 employees. Fluid milk is the only one of the industries in which some below-average size plants failed to improve labor productivity. In poultry slaughtering and processing, the one other industry in which small plants had lower productivity growth, small acquired plants did not improve their relative labor productivity but many below-average size acquired plants (those with more than 46 workers) and all above-average size acquired plants did.

The results for 1982-92 differed somewhat from the earlier period in that all plants in four industries had positive labor productivity growth and nearly all in one industry (meat processing) had positive labor productivity growth.⁹ Of the remaining three industries, all acquired feed processing plants had negative labor productivity growth, and above-average and small meatpacking plants and very small cheese making plants had positive labor productivity growth.

Overall, our results are similar to McGuckin and Nguyen (1995) but differ from those of Lichtenberg and Siegel (1992a). We found that, in most industries and time periods, only small and medium-size plants registered an increase in labor productivity after ownership change whereas Lichtenberg and Siegel (1992a) found labor productivity increased for all plants. The difference may be due to the size of plants we considered. Lichtenberg and Siegel (1992a) examined only plants with more than 250 employees while our threshold for small plants (the inflection point shown in table 10) is below 250 employees for 7 of the 8 industries during the first period and 2 of the 8 industries in the second period.

⁸To determine the point at which labor productivity growth becomes negative, we took the derivative of equation 2 with respect to $\text{Pr}(\text{AC})$ equal to 0 and solved for plant size. This means that $0 = a_1 + a_{13} \ln \text{SIZE}_{t-1}$, which in turn, means that $\ln \text{SIZE}_{t-1} = -a_1/a_{13}$. If both coefficients are negative, then labor productivity growth always decreases with size, and if both are positive, then labor productivity growth always increases with size. If a_1 is positive and a_{13} is negative, then plants with fewer than $\text{EXP}(a_1/a_{13})$ employees have positive labor productivity growth and if the signs are reversed, then plants with more than that number of employees have positive labor productivity growth.

⁹Plants with positive labor productivity growth had transition points that were either very large or the coefficient for $\text{Pr}(\text{AC}) * \text{SIZE}$ was positive.

Table 10

Most small and above-average size and some large acquired plants realized increases in labor productivity growth over 1977-87 and 1982-92 in eight food industries

Industry	1977-87		1982-92	
	Size in 1977 of plants acquired over 1977-82 with positive labor productivity growth over 1977-87	Average size plant in 1977	Size in 1982 of plants acquired over 1982-87 with positive labor productivity growth over 1982-92	Average size plant in 1982
<i>Number of employees</i>				
Meat and poultry:				
Meatpacking	Fewer than 163	56.4	Fewer than 110	75.5
Meat processing	Fewer than 196	48.3	Fewer than 563	50.0
Poultry slaughtering and processing	More than 46	146.1	All plants increase	196.4
Dairy:				
Cheese	Fewer than 84	33.8	Fewer than 12	42.0
Fluid milk	Fewer than 20	48.6	All plants increase	65.5
Grains and oilseeds:				
Flour milling	Fewer than 97	38.3	All plants increase	41.9
Feed	Fewer than 212	19.0	All plants decrease	20.5
Oilseed processing (corn, cotton, and soy)	Fewer than 148	126.9	All plants increase	117.9

Source: ERS estimates based on U.S. Census Bureau data.