Wage and Employment Equations and Empirical Results

The previous discussion indicates that M&As were not a driving force behind plant shutdown decisions. Indeed, it would not be rational to buy a plant and then shut it down. However, it may make more sense to buy a plant and then cut the workforce and reduce worker wages. Thus, we specify a model of the effects of M&As on plant employment (SIZE) and wages (WAGE) that closely follows a model of the effect of training on workers' earnings and employment used by McGuckin et al. (1997). We evaluate wages and employment plants over a 10-year period to compare pre-merger and post-merger wages and employment. For 1977-82, we use data from 1977 as a gauge of the pre-merger performance of plants that were acquired over 1977-82 and 1987 as a measure of post-merger performance.

The worker training literature indicates that better trained workers—such as nonproduction workers—earn higher incomes than production workers, training has a positive effect on employment (Block, 1979; Ashenfelter and Kruger, 1994), and plant size and age affect wage and employment (Brown and Medoff, 1988; Dunne and Roberts, 1990). Thus, our model includes the ratio of nonproduction workers to production workers, plant size, and plant age. Also, Dunne and Roberts (1990) found that capital intensity, two-digit industries, and geographic regions are important factors in determining wages. Finally, the model must account for plant specialization because greater specialization can lead to employment reductions due to combining similar tasks:

$$\text{Ln SIZE}_{t} - \text{Ln SIZE}_{t-1} = a_1 \text{ Pr } (\text{AC}_t) + a_2 \text{ BUYER_PLANT} + \\ a_3 \text{ Ln WAGE}_{t-1} + \\ a_4 \text{ Ln SIZE}_{t-1} + a_5 \text{ Ln } (\Delta \text{ NPW/PW})_t + \\ a_6 \text{ Ln } (\Delta \text{ K/S})_t + a_7 \text{ Ln } \Delta \text{ SPEC}_t + \\ a_8 \text{ AGE72} + a_9 \text{ AGE77} + a_{10} \text{ MULTI} + \\ a_{11} \text{ OUTSIDE} + \\ a_{12} \text{ NOT_FOOD} + \varepsilon,$$

and similarly for wages:

Ln WAGE_{t-1} =
$$a_1$$
 Pr (AC_t) + (7)
$$a_2$$
 BUYER_PLANT + a_3 Ln WAGE_{t-1} +
$$a_4$$
 Ln SIZE_{t-1} + a_5 Ln (Δ NPWW/PWW)_t + a_6 Ln (Δ K/S)_t +
$$a_7$$
 Ln Δ SPEC_t + a_8 AGE72 + a_9 AGE77 + a_{10} MULTI +
$$a_{11}$$
 OUTSIDE + a_{12} NOT_FOOD + ε,

where SIZE is the number of plant employees—both production and nonproduction workers. WAGE is workers' annual salaries and does not include nonwage costs because data on these costs are not available for production and nonproduction workers. Dunne and Roberts (1993) found that "non-wage costs are poorly reported in census data and are often imputed." Real wages are defined as nominal wages deflated by the Consumer Price Index as given by the Bureau of Labor Statistics (2005). The variable Δ NPW/PW is the change in the ratio of the number of nonproduction workers (NPW) to the number of production workers (PW) and is used only in the employment equation to control for changes in the composition of the labor force. The change in the capital to sales ratio (Δ K/S) is used to control for changes in capital intensity, and SPEC is percentage of plant output produced for its "home" industry (e.g., percentage of meat slaughter products produced by meat slaughter plants). In the wage equation, Δ (NPWW/PWW), the change in the ratio of nonproduction worker wages to production worker wages, is used to account for the wage differential between office workers and production workers. All other variables have been defined previously. The ε is the error term.

Columns 1-3 of tables 7, 8, and 9 show the regression estimates of the employment growth equations for the meat, dairy, and grains industries for 1977-87, while columns 4-6 present the estimates for the same industries for 1982-92. The instrumental variable Pr (AC) is positive and statistically significant for the meat, dairy, and feed industries over the 1977-87 period, but negative for flour milling and oilseed crushing. Quite a departure from this finding occurs for 1982-92, with only cheese being significant and positive.

A dramatic consolidation (Ollinger et al., 2005) in the earlier period may account for the changes. During 1977-82, the number of fluid milk, meatpacking, poultry slaughter and processing and cheese plants dropped by more than 25 percent and the number of flour and feed plants declined by more than 10 percent. Consolidation slowed to less than half this rate, and some industries, such as poultry, began to grow over 1982-87. For the earlier period, consolidation enabled some firms to combine output in some plants to enhance productivity in those facilities while closing others. If acquired plants tended to be better assets than the plants the firms held prior to the merger, then output and employment would have grown in these plants and shrunk elsewhere. In the later period, this structural shift had pretty much played itself out, providing fewer opportunities to shift output from less productive existing plants to newly acquired more efficient ones. Thus, acquired plants tended to add employees at a greater rate than plants in the rest of the industry in the first period but not in the second one.

Other results are generally consistent with previous research. Economic theory suggests that higher-than-average wages attract more workers, causing employment to grow. The wage effect holds for meatpacking, meat processing, dairy, and feed but not for poultry and grain industries. An increase in nonproduction workers relative to production workers should cause employment to rise relative to production because nonproduction workers do not directly contribute to output. Results bear this out, showing that a higher ratio of nonproduction workers to production workers caused employment growth in all industries, except poultry. Additionally, larger and older plants in all industries grew more slowly than other plants in their

Table 7 Employment equation for meat and poultry, 1977-87 and 1982-92

Dependent variable	1977-82				1982-87	
	Meatpacking	Meat processing	Poultry slaughter	Meatpacking	Meat processing	Poultry slaughter
Intercept	0.478***	0.264	0.700**	-0.318	-0.008	0.846**
	(0.229)	(0.234)	(0.292)	(0.188)	(0.158)	(0.314)
Pr (AC)	1.529***	1.391***	.558**	436	.248	053
	(.290)	(.466)	(.250)	(.359)	(.415)	(.678)
Buyer_Plant	.076	063	.046	005	185***	067
	(.082)	(.097)	(.063)	(.070)	(.055)	(.057)
Ln WAGES _{t-1}	.084	.256***	115***	.197***	.162***	101
	(.086)	(.092)	(.129)	(.068)	(.052)	(.101)
Ln SIZE _{t-1}	284***	457***	.075	256***	249***	.045
	(.088)	(.097)	(.128)	(.072)	(.058)	(.093)
Δ NPW/PW	.076*	.077**	023	.092**	.031	.039
	(.042)	(.033)	(.018)	(.049)	(.030)	(.034)
Δ K/S	010***	.015	009***	0005	0003	00005
	(.002)	(.011)	(.002)	(.0008)	(.0005)	(.0005)
Δ SPEC	003	.017**	129**	.021	.035	.025
	(.014)	(.008)	(.065)	(.054)	(.051)	(.079)
AGE72	094	233***	240***	187***	222***	172*
	(.062)	(.069)	(.080)	(.069)	(.059)	(.090)
AGE77	n.a.	n.a.	n.a.	071 (.083)	070 (.069)	049 (.097)
MULTI	.117	.001	.096	.410***	.307***	.285***
	(.096)	(.089)	(.090)	(.081)	(.064)	(.100)
OUTSIDE ¹	.119	.111	282***	.232*	.098	171
	(.081)	(.139)	(.109)	(.121)	(.112)	(.184)
NOT_FOOD	252**	232	350**	.265*	.186	210*
	(.127)	(.148)	(.145)	(.139)	(.110)	(.118)
R ²	.140	.142	.104	.045	.061	.100
Observations	916	654	553	850	1,033	605

n.a. = Not applicable.

*, **, and ***Significant at 90-, 95-, and 99-percent levels.

Note: Dependent variable = Ln(SIZE_t) - Ln(SIZE_{t-1}).

OUTSIDE = One for plants outside the industry in question (meatpacking, meat processing, and poultry slaughter and processing) and zero otherwise.

Table 8 Employment equation for dairy, 1977-87 and 1982-92

	1977	7-82	1982-87		
Dependent variable	Cheese	Fluid milk	Cheese	Fluid milk	
Intercept	-0.278	0.410**	0.357	-1.015***	
	(0.207)	(0.184)	(0.273)	(0.219)	
Pr (AC)	.752***	1.064***	.622**	302	
	(.250)	(.314)	(.307)	(.406)	
BUYER_PLANT	0005	013	.019	041	
	(.063)	(.048)	(.090)	(.054)	
Ln WAGES _{t-1}	.049	.535***	.243***	.483***	
	(.087)	(.077)	(.092)	(.067)	
Ln SIZE _{t-1}	642***	710***	252***	512***	
	(.095)	(.088)	(.098)	(.075)	
Δ NPW/PW	.074**	.094***	.073*	.039***	
	(.031)	(.015)	(.045)	(.010)	
Δ K/S	001	021***	0005	.0009	
	(.007)	(.006)	(.0009)	(.005)	
Δ SPEC	.046	.015	.115	030	
	(.045)	(.012)	(.101)	(.030)	
AGE72	262***	193***	348***	207***	
	(.066)	(.065)	(.100)	(.077)	
AGE77	n.a.	n.a.	089 (.118)	.042 (.105)	
MULTI	269***	182***	.020	.067	
	(.089)	(.060)	(.127)	(.065)	
OUTSIDE ¹	114*	109*	287*	.035	
	(.070)	(.064)	(.150)	(.065)	
NOT_FOOD	116	.146**	.183	.021	
	(.087)	(.071)	(.149)	(.082)	
West	011	.019	.067	.048	
	(.076)	(.053)	(.111)	(.055)	
R ²	.210	.177	.072	.097	
Observations	574	974	457	758	

n.a. = Not applicable.

^{*, **,} and ***Significant at 90-, 95-, and 99-percent levels.

Note: Dependent variable = $Ln(SIZE_t)$ - $Ln(SIZE_{t-1})$. ¹OUTSIDE = One for plants outside the industry in question (cheese or fluid milk) and zero otherwise.

Table 9 Employment equation for grains, 1977-87 and 1982-92

Dependent variable		1977-82			1982-87	
	Flour milling	Feed	Oilseeds ¹	Flour milling	Feed	Oilseeds ¹
Intercept	0.818***	0.327*	0.888**	0.206	-0.067	0.725***
	(0.210)	(0.172)	(0.444)	(0.238)	(0.158)	(0.232)
Pr (AC)	094	1.403***	601*	.139	226	-1.128***
	(.250)	(.326)	(.337)	(.402)	(.374)	(.290)
BUYER_PLANT	011	.036	010	077	180***	.012
	(.048)	(.047)	(.059)	(.060)	(.056)	(.045)
Ln WAGES _{t-1}	094	.111***	082	.022	.186***	.040
	(.078)	(.069)	(.135)	(.071)	(.053)	(.065)
Ln SIZE _{t-1}	.015	287***	.014	09 (070)	266***	.069
	(.084)	(.078)	(.138)	(.070)	(.066)	(.069)
Δ NPW/PW	.028	.085***	.079	.119***	.025	.120***
	(.024)	(.024)	(.036)	(.029)	(.030)	(.024)
Δ K/S	009***	0006	024***	0001	0004	0004**
	(.003)	(.0004)	(.006)	(.0004)	(.0005)	(.0002)
Δ SPEC	.0003	008	.009	097*	.017	046
	(.009)	(800.)	(.013)	(.060)	(.051)	(.034)
AGE72	295***	221*** (054)	251***	262 (075)	225***	218*** (.073)
	(.063)	(.054)	(.084)	(.075)	(.059)	(.073)
AGE77	n.a.	n.a.	n.a.	144	062 (060)	094 (.087)
				(.090)	(.069)	
MULTI	051 (066)	291*** (.063)	.029 (.087)	021 (095)	.304	128* (.077)
_	(.066)	(.063)	(.087)	(.085)	(.251)	(.077)
OUTSIDE ²	.055	.243***	n.a.	.217***	.035	n.a.
	(.062)	(.064)		(.109)	(.165)	
Corn	n.a.	n.a.	030 (.135)	n.a.	n.a.	142 (.106)
Cotton	n.a.	n.a.	228* (123)	n.a.	n.a.	478*** (.138)
			(.133)			
Soy	n.a.	n.a.	008 (.104)	n.a.	n.a.	236*** (.074)
NOT_FOOD	091 (.058)	561*** (.082)	024 (.062)	026 (.061)	.268 (.345)	033 (.047)
					, ,	, ,
R ² Observations	.095 730	.125 982	.107 479	.070 807	.059	.080 768
	730	302	4/8	007	1,033	100

 $\label{eq:Numbers} Numbers \ in \ parentheses = Standard \ errors.$

n.a. = Not applicable.

^{`*, **,} and ***Significant at 90-, 95-, and 99-percent levels.

Note: Dependent variable = $Ln(SIZE_t) - Ln(SIZE_{t-1})$.

¹Oilseeds include corn, cottonseed, and soy.

²OUTSIDE = One for plants outside the industry in question (flour or feed) and zero otherwise. Several dummy variables are used to control for different types of oilseeds.

industries over both periods. These results are consistent with Brown and Medoff (1988) and Dunn and Roberts (1990). The negative effect of capital intensity (K/S) on employment (all industries) is consistent with Dunne and Roberts (1990). Finally, being part of a multiplant firm had a positive effect on employment growth in meat and poultry but not in the other industries.

The regression results for the wage growth equations are in tables 10, 11, and 12, columns 1-3 for 1977-82 and columns 4-6 for 1982-92. The probability of being acquired, Pr (AC), negatively affected wage growth in the meat and poultry industries, both dairy industries, and the feed industry during 1977-87, but reversed its sign for all of these plants, except cheese and feed, during 1982-92. Over each period, the coefficient is significant in two of six cases. Oilseeds were negative in both periods. These results differ markedly from those of McGuckin et al. (1997) who found a significantly positive effect of acquisitions on wage growth over 1977-87.

Two phenomena likely had important effects on wages. In industries, such as meatpacking and meat processing, worker bargaining power diminished due to falling demand, competition from nonunion plants, and the availability of low-cost immigrant labor. Meanwhile, greater scale economies from newer plants in all industries due to organizational and technological changes pressured existing plants, including newly acquired ones, to reduce costs, particularly wages (MacDonald et al., 2000) or face a loss of profitability.

Other results in the wage growth equation are more consistent with previous research. As economic theory would suggest, initial wages are consistently significant and negative across industries, suggesting that high initial wages cause wages to grow at a slower rate. Consistent with Dunne and Roberts (1990), plant size is positive in all but two cases over both periods and significant in six cases (meat and poultry and grain) over 1977-87. The oldest plant age variable (AGE72) has a negative impact on wage growth in 13 of the 16 cases and is negative and significant in 10 instances. The later plant age variable (AGE77) had no effect.

Consistent with Block (1979) and Ashenfelter and Kruger (1994), wage costs rose as the ratio of nonproduction to production worker wages rose. Previous work by Dunne and Roberts (1990) suggested that capital intensity has a negative impact on plant wages, but our results are mixed. In six cases, we find a negative and significant effect, but we also have eight positive but insignificant instances. The multiplant variable and the other variables are generally insignificant.

Table 10 Wage equation for meat and poultry, 1977-87 and 1982-92

		1977-82		1982-87			
Dependent variable	Meatpacking	Meat processing	Poultry slaughter	Meatpacking	Meat processing	Poultry slaughter	
Intercept	1.513***	1.394***	1.871***	0.233***	0.334***	0.363***	
	(0.246)	(0.264)	(0.297)	(0.079)	(0.083)	(0.136)	
Pr (AC)	.874***	.709	.709	066	140	072	
	(.312)	(.516)	(.515)	(.151)	(.218)	(.293)	
BUYER_PLANT	.136	083	.063	.014	007	.019	
	(.088)	(.107)	(.064)	(.030)	(.029)	(.024)	
Ln WAGES _{t-1}	408***	250**	491***	047**	044*	072*	
	(.092)	(.102)	(.131)	(.029)	(.027)	(.044)	
Ln SIZE _{t-1}	.345***	.200*	.478***	.028	.027	.053	
	(.094)	(.107)	(.130)	(.030)	(.030)	(.040)	
Δ NtPWW/PWW	.084*	.078**	.004	.271***	.167***	.125***	
	(.046)	(.037)	(.018)	(.021)	(.016)	(.015)	
Δ K/S	009***	.017	009***	.0003	.0002	0002	
	(.002)	(.012)	(.002)	(.0003)	(.0003)	(.0002)	
Δ SPEC	008	.020**	155**	.030	.025	.025	
	(.015)	(.008)	(.066)	(.023)	(.027)	(.034)	
AGE72	113*	218**	192**	041	030	.005	
	(.066)	(.076)	(.081)	(.029)	(.031)	(.039)	
AGE77	n.a.	n.a.	n.a.	.021 (.035)	.014 (.035)	.044 (.042)	
MULTI	.138	017	.061	.026	.032	.008	
	(.104)	(.098)	(.091)	(.034)	(.034)	(.043)	
OUTSIDE ¹	.127	.028	018	.074	.026	.008	
	(.087)	(.154)	(.111)	(.051)	(.059)	(.080.)	
NOT_FOOD	.132	044	.024	.132**	.022	.004	
	(.137)	(.163)	(.121)	(.058)	(.041)	(.063)	
R ²	.085	.059	.123	.191	.126	.139	
Observations	916	654	553	850	1,033	605	

n.a. = Not applicable.

^{*, **,} and ***Significant at 90-, 95-, and 99-percent levels.

Note: Dependent variable = Ln(WAGE_t) - Ln(WAGE_{t-1}).

OUTSIDE = One for plants outside the industry in question (meatpacking, meat processing, or poultry) and zero otherwise.

Table 11 Wage equation for dairy, 1977-87 and 1982-92

	197	7-82	1982-87		
Dependent variable	Cheese	Fluid milk	Cheese	Fluid milk	
Intercept	1.029***	1.194***	0.112	-0.037	
	(0.226)	(0.194)	(0.106)	(0.150)	
PR (AC)	.088	.213	.054	.734***	
	(.267)	(.318)	(.120)	(.277)	
BUYER_PLANT	047	018	.045	.004	
	(.068)	(.051)	(.035)	(.037)	
Ln WAGES _{t-1}	115	126	.024	.033	
	(.094)	(.080)	(.036)	(.046)	
Ln SIZE _{t-1}	.134	.101	.022	.027	
	(.102)	(.092)	(.038)	(.051)	
Δ NPWW/PWW	.079**	.098***	.217***	.062***	
	(.033)	(.016)	(.018)	(.007)	
Δ K/S	.005	013**	.0005	.002	
	(.008)	(.006)	(.0003)	(.003)	
AGE72	261***	258**	107***	101	
	(.072)	(.069)	(.039)	(.052)	
AGE77	n.a.	n.a.	079* (.046)	.035 (.072)	
MULTI	.002	010	.052	.024	
	(.095)	(.062)	(.050)	(.045)	
OUTSIDE ¹	071	.042	044	.034	
	(.074)	(.066)	(.058)	(.044)	
NOT_FOOD	.001	104	.148***	.006	
	(.093)	(.075)	(.058)	(.056)	
West	.034	.092*	.017	.059	
	(.082)	(.057)	(.043)	(.037)	
R ²	.052	.072	.280	130	
Observations	566	973	455	758	

n.a. = Not applicable.

^{*, **,} and ***Significant at 90-, 95-, and 99-percent levels.

Note: Dependent variable = $Ln(WAGE_t)$ - $Ln(WAGE_{t-1})$.

¹OUTSIDE = One for plants outside the industry in question (cheese or fluid milk) and zero otherwise.

Table 12 Wage equation for grains, 1977-87 and 1982-92

Dependent variable		1977-82			1982-87			
	Flour milling	Feed	Oilseeds ¹	Flour milling	Feed	Oilseeds ¹		
Intercept	1.770***	1.430***	2.749***	0.447***	0.343***	0.627***		
	(0.226)	(0.175)	(0.454)	(0.096)	(880.0)	(0.116)		
Pr (AC)	160	.610*	-1.231***	.293**	.263*	446***		
	(.267)	(.326)	(.344)	(.125)	(.146)	(.144)		
BUYER_PLANT	.027	.056	057	038	.033	.022		
	(.051)	(.048)	(.061)	(.027)	(.026)	(.022)		
Ln WAGES _{t-1}	396***	291***	581***	042	.028	066**		
	(.084)	(.071)	(.137)	(.031)	(.029)	(.032)		
Ln SIZE _{t-1}	.383***	.231***	.544***	035	022	.045		
	(.090)	(.079)	(.140)	(.032)	(.029)	(.034)		
Δ NPWW/PWW	031	.092***	.041	.204***	.185***	.186***		
	(.025)	(.025)	(.037)	(.013)	(.012)	(.014)		
Δ K/S	010***	.001	032***	.0002	0001	00013*		
	(.003)	(.001)	(.006)	(.0002)	(.0001)	(80000.)		
Δ SPEC	001	n.a.	.017	n.a.	n.a.	.010		
	(.009)		(.013)			(.017)		
AGE72	275***	216***	178**	.017	072**	.006		
	(.067)	(.055)	(.085)	(.035)	(.031)	(.036)		
AGE77	n.a.	n.a.	n.a.	.035	021	.025		
				(.041)	(.036)	(.043)		
MULTI	.127*	.083	.115	.0003	.034	091**		
	(.071)	(.064)	(.089)	(.036)	(.036)	(.039)		
OTUSIDE ²	017	.222***	n.a.	010	.009	n.a.		
	(.067)	(.064)		(.038)	(.032)			
Corn	n.a.	n.a.	.068	n.a.	n.a.	024		
			(.139)			(.053)		
Cotton	n.a.	n.a.	429***	n.a.	n.a.	235***		
			(.136)			(.069)		
Soy	n.a.	n.a.	097	n.a.	n.a.	061		
			(.106)			(.037)		
NOT_FOOD	.036	291***	.075	.058**	.049	033		
	(.062)	(.084)	(.063)	(.028)	(.037)	(.024)		
R^2	.088	.095	.143	.285	.230	.217		
Observations	728	981	479	806	1,087	767		

n.a. = Not applicable.

^{*, **,} and ***Significant at 90-, 95-, and 99-percent levels.

Note: Dependent variable = $Ln(WAGE_t)$ - $Ln(WAGE_{t-1})$.

¹Oilseeds include corn, cottonseed, and soy.

²OUTSIDE = One for plants outside the industry in question (flour or feed) and zero otherwise. Several dummy variables are used to control for different types of oilseeds.