

## Is Productivity a Factor in Supermarket Ownership Changes and Restructuring?

Wonho Chung and Glenn Pederson

We examine the relationship between productivity characteristics and the process of restructuring and ownership changes in the supermarket industry. Contrary to studies in the manufacturing sector, ownership changes alone do not improve productivity. Rather, a change from wholesaler-distribution to self-distribution does significantly improve productivity. Logically, management would be motivated to acquire both the stores and the distribution centers owned by large firms in order to increase productivity as part of a strategy to improve competitiveness and market access.

**Key words:** distribution system, ownership change, supermarket productivity

Increasing competition continues to drive restructuring decisions and changes in ownership in the supermarket industry. The number of mergers and acquisitions in the industry increased from 50 to 226 and the total values of those transactions increased from \$10 billion to \$52 billion between 1997 and 2007 (Duff and Phelps, 2009 and 2010). It is also interesting to note that since 1990, the average size of these deals has increased with several large firms being acquired by smaller firms. Albertson, the nation's fourth-largest supermarket company, was acquired by SUPERVALU, Inc. the ninth largest supermarket company (Supermarket News, 2006). Winn-Dixie, Inc. was one of the larger grocery companies with 920 chain stores. In 2005, Winn-Dixie sold or closed more than 300 stores as part of its bankruptcy reorganization plan. Both of these events raise questions: what role might productivity characteristics have played in the outcomes, and are there lessons for managers who are making similar types of decisions?

It is reasonable to consider ownership changes at both the company-level and the store-level, since both occur regularly. It is likely that company-level mergers and acquisitions are motivated primarily by the objectives of increasing market penetration and market access. However, it is also likely that store-level ownership changes depend

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to a large extent on store productivity differences. Using the job matching model of Lichtenberg and Siegel (1987) we develop two hypotheses for analysis. First, if stores exhibit initial low productivity they are more likely to be involved in ownership changes. Second, if stores change ownership they are more likely to experience an increase in productivity after the change. As in the matching model, stores and their owners are assumed to match continuously through time, while match quality and productivity vary randomly. The implication of matching theory is that a low level of productivity indicates a poor match, which induces a change in ownership and an increase in productivity. The quality of each match is measured by the level of store productivity, which is randomly distributed. The expected value of a new match (from an identical distribution) is higher, given that the first match was low.

In addition there are three reasons why we might observe a significant relationship between store-level productivity and either ownership changes or restructuring. First, many supermarket stores are acquired at the store-level. Based on supermarket panel data about 40% of the ownership changes during 2002-2007, involve either independent stores or small group chains with less than 11 stores (Chung et al., 2010). Some independent stores are acquired by other independent stores or small supermarket firms in that locality, while other stores are either not acquired or eventually closed. This motivates an analysis of ownership changes based on store characteristics and store-level productivity differences. Second, previous studies have assessed the productivity of individual plants both before and after ownership changes occurred in order to explain ownership changes in the manufacturing sector (Lichtenberg and Siegel, 1987 and 1990; McGuckin and Nguyen, 1995; Baldwin, 1998; Maksimovic and Gordon, 2001; Schoar, 2002; and Harris, Siegel and Wright 2005). Finally, where policy is involved, decisions regarding ownership change might consider an analysis of the effects of these transactions on economic efficiency in the industry.

Contrary to work on the manufacturing sector, little research has been done to understand the relationship between ownership changes and/or restructuring and productivity characteristics in the service sector, and specifically the supermarket industry. The supermarket industry is differentiated somewhat from other manufacturing and service industries. There are various ownership groups with several different banners under the same parent company. Unique store formats and business strategies exist in the industry, so that store ownership changes occur at different levels; individual store, regional, banner, or whole company. King and Park (2004) find that the supermarket industry shows constant returns to scale and that large-scale and small-scale firms can coexist and be successful. Yet, evidence from the U.S. manufacturing industry suggests that increasing economies of scale exist in that sector and those firms may have expanded through mergers and acquisitions in order to increase profitability. These apparent



differences motivate us to investigate the causes and consequences of acquisitions, restructuring and ownership changes in the supermarket industry.

Studies in the manufacturing industry examine the relationship between productivity and ownership changes based on a two-stage regression analysis of the residuals from Cobb-Douglas production functions (Lichtenberg and Siegel, 1987 and 1990; McGuckin and Nguyen, 1995; Maksimovic and Gordon, 2001; and Schoar, 2002). These studies provide answers to two questions: how does the initial level of productivity affect the probability of ownership changes, and do ownership changes improve productivity? Most studies answer the second question consistently, as plants involved in ownership changes do experience a productivity improvement.

The first question has generated mixed results. This could be due to differences in the nature of the data, variations in the types of ownership change, and varying time frame of the analyses. Several studies find that plants with low productivity are more likely to be involved in ownership changes than those with high productivity (Lichtenberg and Siegel, 1987; Maksimovic and Gordon, 2001; and Harris, Siegel, and Wright, 2005). Lichtenberg and Siegel use the matching theory of job turnover developed by Jovanovic (1979) to show that low productivity is an indicator of a poor match between the plant and its management, which leads to an ownership change. McGuckin and Nguyen (1995), Baldwin (1998), and Schoar (2002) show that plants involved in ownership changes are more productive than comparable plants before the ownership change. McGuckin and Nguyen suggest that the matching model is too restrictive and there are many motives for acquisition that are compatible with obtaining good performing plants (e.g., synergies, monopoly power, tax incentives).

### Performance Measures

We measure store performance using labor productivity (LP), multi-factor productivity (MFP), and technical efficiency (TE). Store efficiency can be measured as the ratio of output to inputs. Productivity can be measured for single inputs (e.g., labor productivity), for multiple inputs (multi-factor productivity), and for all inputs (total factor productivity). Several previous studies in the manufacturing sector have analyzed productivity performance using TFP for three inputs - labor, capital, and materials (Lichtenberg and Siegel, 1987 and 1990; McGuckin and Nguyen, 1995; and Maksimovic and Phillips, 2001). The TFP index is a conceptual construct rather than a practical reality because in practice it is not possible to get a comprehensive accounting of all the inputs used in production. In addition, the construction of a measure for capital inputs is a critical issue when calculating TFP in the service sector.



We estimate a Cobb-Douglas production function with average weekly store sales as the output measure with store selling area and weekly labor hours as the two variable inputs. Store selling area is selected as a measure of the capital in the supermarket industry, since store energy costs and other major capital inputs such as refrigeration equipment, shelving and front-end checkout equipment are highly correlated with store selling area. Weekly labor hours are the sum of full-time and part-time labor hours. Preliminary analysis indicates that full-time and part-time labor hours can be aggregated without loss of explanatory power (King and Park, 2004). Thus, we measure MFP as

$$(1) \quad MFP_i = A_i = Q_i / (K_i^{\beta_1} * L_i^{\beta_2}), \text{ for store } i$$

where  $A$  is a Hicks-neutral measure of technical change,  $Q$  is weekly store sales,  $K$  is store selling area, and  $L$  is weekly labor hours. Average weekly store sales are used as the output measure since that data is relatively more reliable and it is readily provided by store managers. Labor productivity (LP) is measured as store sales per hour of labor and is calculated by dividing average weekly store sales by total weekly hours of labor.

Technical efficiency (TE) is measured using stochastic frontier analysis as proposed by Aigner, Lovell, and Schmidt (1977); and Meeusen and Broeck (1977). The production function is assumed to take the log-linear Cobb-Douglas form,

$$(2) \quad \ln Q_i = \beta_0 + \beta_1 K_i + \beta_2 L_i + \varepsilon_i, \text{ for store } i.$$

The error term in (2) is composed of two components ( $\varepsilon_i = v_i - u_i$ ) where  $v_i$  represents the random errors which are assumed to be independently and identically distributed normal random variables with zero mean and variance,  $\sigma_v^2$ . Here  $u_i$  represents technical inefficiency, which is assumed to be an independently and identically distributed half-normal random variable with zero mean and variance,  $\sigma_u^2$ . The technical efficiency of store  $i$  is defined as  $TE_i = \exp(-u_i|\varepsilon_i)$  which is greater than zero and less than 1. Estimation of the stochastic frontier model is done using the maximum likelihood method and STATA version 10.0.

### Empirical Model

We examine the empirical relationship between productivity and three event categories: no change, store acquisition, and store closure. A multinomial probit/logit model is estimated to determine whether initial productivity levels and selected store characteristics affect the probability of ownership changes. The estimating equation is



$$(3) \quad OC0207_i = \beta_0 + \beta_1 LP02_i + \beta_2 THour02_i + \beta_3 Age02_i + \beta_4 GSize02_i \\ + \beta_5 SMSA02_i + \beta_6 Format02_i + \varepsilon_i$$

where ownership change between 2002 and 2007 ( $OC0207_i$ ) is a dummy variable (value = 0 if store  $i$  is unchanged during 2002-2007, = 1 if the store experiences ownership change, and = 2 if the store has been closed).  $LP02_i$  denotes store initial labor productivity in 2002. Total labor hours in 2002 ( $THour02_i$ ) is included to control for the effect of store size on ownership change. Store age ( $Age02_i$ ) is used to determine if older stores under the same owner are less likely to be changed, under the assumption that ownership changes are comparable to worker separation in the job matching model. Ownership group size ( $GSize02_i$ ), which represents the size of the parent company, is the number of stores owned by the same company that owns store  $i$ . Store location in an SMSA ( $SMSA02_i$ ) is a binary variable (value = 1 if the store  $i$  is located in a metropolitan area, and = 0 otherwise). Store format binary variables ( $Format02_i$ ) are included to examine the effects of each of the six different store formats (see Table 1 for the store format definitions) on the probability of ownership changes. The equation is estimated in three forms by substituting initial labor productivity ( $LP02_i$ ), initial multifactor productivity ( $MFP02_i$ ), and initial technical efficiency ( $TE02_i$ ) into (3), as alternative productivity measures.

We expect that stores experiencing ownership changes will also experience productivity improvements relative to stores without ownership changes. To test that proposition we estimate a model that captures the relationship between the growth rate of productivity and selected independent variables as in (4).

$$(4) \quad \{(RLP07_i - RLP02_i) / 0.5(RLP07_i + RLP02_i)\} = \beta_0 + \beta_1 OC0207_i + \beta_2 LP02_i \\ + \beta_3 DC0207_i + \beta_4 Age02_i + \beta_5 RM0207_i + \beta_6 SMSA02_i + \varepsilon_i$$

Here RLP is labor productivity adjusted for inflation (using the Personal Consumption Expenditure index) and  $DC0207_i$  is a dummy variable that indicates if a store changed its distribution system from wholesaler supplied to self-distribution (=1), or the store changed from self-distribution to wholesaler supplied (= -1), or no change occurred between 2002 and 2007 (= 0).  $RM0207_i$  is a dummy variable with value = 1 if store  $i$  has remodeled between 2002 and 2007, and =0 otherwise. Equation (4) is also re-estimated after substituting adjusted  $MFP$  and  $TE$  for  $RLP$  as alternative productivity measures.



**Data**

Store-level data are taken from the Supermarket Panel conducted by The Food Industry Center (TFIC) at the University of Minnesota. TFIC established the Supermarket Panel in 1998 as the basis for an ongoing study of the supermarket industry. Since 2000, the core

**Table 1. Store Format Definitions**

<i>Format</i>	<i>Selling Area (000 sq.ft.)</i>	<i>Bagging</i>	<i>Pharmacy</i>	<i>Grocery Sales (%)</i>
Conventional	<25	Yes/No	No	-
	or 25-40	Yes	No	-
Superstore	>40	Yes	No	-
Food/Drug	20-75	Yes	Yes	-
	or 75-100	Yes	Yes	> 30%
Warehouse	25-100	No	No	-
Super Warehouse	25-100	No	Yes	-
	75-100	Yes	Yes	< 30%
Supercenter /Hypermarket	or >100	Yes/No	Yes	-

of the Panel has been a random sample of stores drawn from the approximately 32,000 supermarkets in the U.S. that accept food stamps. The Panel is an annual survey of supermarkets where store managers provide information on store characteristics, operations, and performance. We focus on the 2002 and 2007 panel data to evaluate the productivity performance before and after ownership change. The 2002 panel data set is



composed of 866 stores, the largest number of participants since the Panel was established. About 145 stores in the 2002 Panel also participated in the 2007 Panel.

**Table 2. Number of Stores Grouped by Ownership Changes, 2002**

	<i>Unchanged (%)</i>	<i>Changed (%)</i>	<i>Closed (%)</i>
Number of stores	622	112	132
Group size:			
1 store	185 (70)	21(8)	59(22)
2-10	117(67)	24(14)	34(19)
11-50	75(84)	9(10)	5(6)
51-750	193(79)	30(12)	20(8)
>750	52(55)	28(30)	14(15)
Format category:			
Conventional	381(70)	63(12)	101(18)
Superstore	17(50)	9(26)	8(24)
Food/drug	149(74)	36(18)	16(8)
Warehouse	23(77)	2(7)	5(16)
Super warehouse	39(95)	2(5)	-
Supercenter	13(87)	-	2(13)
Region:			
Northeast	112(79)	14(10)	16(11)
South	110(66)	27(16)	30(18)
Midwest	321(74)	43(10)	67(16)
West	79(64)	26(21)	19(15)

In Table 2 we report the distribution of store ownership group size, store format, and region for 2002 Panel stores grouped by ownership changes. Among the 866 stores in the 2002 Panel, 112 stores experienced ownership changes and 132 stores closed between 2002 and 2007. Store ownership group size is defined as the number of stores owned by the same parent company. Stores in larger groups show a different distribution between



the “changed” and “closed” groups when compared with stores in smaller groups (group size with less than 11 stores). For example, 30% of the stores in ownership groups with more than 750 stores experienced ownership changes, while only 15% of these stores closed during 2002-2007. Just 8% of single stores changed ownership, while 22% of the stores were closed.

Six store formats are defined in Table 1 following the definitions developed by King, Jacobson, and Seltzer (2002). We note that super warehouses and supercenters or hypermarket stores are more likely to be unchanged compared with other formats, as reported in Table 2. About 50% of the superstores either experienced ownership changes or were closed. Differences in the regional distribution for stores grouped by ownership changes are relatively small, though a higher percentage of stores located in the western U.S. region changed their ownership compared with stores in other regions.

In Table 3 we find that the median population density of locations with stores in the closed group is significantly lower than that in either the unchanged or changed groups. Yet, the median population density is not significantly different between the unchanged and changed groups. Overall, it is evident that most characteristics and performance measures of the closed stores are significantly different from the other two groups, while there is no notable difference between the unchanged and changed groups. Stores in the closed group are significantly older and smaller, they are more likely to be supplied by a wholesaler rather than self-distributed, they are less likely to be located in a metropolitan area, and their weekly sales are lower than the other two groups at the 10% confidence level. It is noteworthy that the mean ownership group size of stores in the changed group is significantly larger than that for stores in the unchanged group. This suggests that stores owned by large firms, which usually have a self-distribution system, are more likely to be acquired.

Performance measures in Table 3 show also that closed stores report lower productivity (sales per hour of labor, sales per transaction, and gross profit as a percent of sales) compared with stores in the other two groups. Stores in the unchanged group have significantly higher weekly sales per square foot of selling area, annual inventory turns, and annual percentage sales growth than stores in the other two groups. Therefore, stores which have not experienced any changes in their ownership tend to perform better based on these indicators of productivity and growth. Also, we observe that stores experiencing ownership changes improved their performance after the event. To identify this result we compare the performance measures during 2002-2007 for the 145 stores that participated in both panels, grouped by ownership changes. Key performance measures such as sales per hour of labor, sales per transaction, gross profit as a percent of sales, and payroll as a





**Table 3. Store Characteristics and Performance by Ownership Changes, 2002**

	<i>Unchanged</i>	<i>Changed</i>	<i>Closed</i>
Median pop. density/sq. mi.	257 <sup>b</sup>	332 <sup>b</sup>	116 <sup>a</sup>
Median household income (\$)	44,795 <sup>b</sup>	43,766 <sup>b</sup>	42,334 <sup>a</sup>
% located in SMSA	62 <sup>b</sup>	65 <sup>b</sup>	48 <sup>a</sup>
Store characteristics:			
Median selling area (sq. ft.)	25,000 <sup>b</sup>	29,000 <sup>b</sup>	12,000 <sup>a</sup>
Median weekly sales (\$)	170,400 <sup>b</sup>	171,954 <sup>b</sup>	62,068 <sup>a</sup>
Median store age (year)	22 <sup>a</sup>	22 <sup>a</sup>	32 <sup>b</sup>
Mean ownership (stores)	278 <sup>a</sup>	513 <sup>b</sup>	249 <sup>a</sup>
Percent wholesaler supplied	59 <sup>b</sup>	46 <sup>a</sup>	76 <sup>c</sup>
Percent with unions	27 <sup>b</sup>	26 <sup>b</sup>	17 <sup>a</sup>
Performance measures (median):			
Weekly sales/sq. ft. (\$)	7.52 <sup>b</sup>	6.21 <sup>a</sup>	5.83 <sup>a</sup>
Sales/labor hour (\$)	105.72 <sup>b</sup>	114.71 <sup>b</sup>	97.50 <sup>a</sup>
Sales/transaction (\$)	19.77 <sup>b</sup>	20.57 <sup>b</sup>	15.01 <sup>a</sup>
Annual inventory turns	18.0 <sup>b</sup>	13.0 <sup>a</sup>	13.0 <sup>a</sup>
Percentage employee turnover	42.1 <sup>a</sup>	41.7 <sup>a</sup>	40.8 <sup>a</sup>
Gross profit (% of sales)	24.0 <sup>b</sup>	24.5 <sup>b</sup>	23.0 <sup>a</sup>
Payroll (% of sales)	10.0 <sup>a</sup>	10.0 <sup>a</sup>	10.0 <sup>a</sup>
Annual % Sales Growth	2.0 <sup>b</sup>	0.0 <sup>a</sup>	0.0 <sup>a</sup>

*a/ indicates significant difference at the 10% level. An "a" indicates the variable in the "closed" group is less than that in either the "unchanged" or "changed" groups, b/ indicates the median density is not different between the groups.*

percent of sales are significantly improved for stores involved in ownership change. Annual percentage sales growth also improves for the stores experiencing ownership changes, although it is not statistically significant. In contrast, sales per square foot of selling area decreases after stores are involved in ownership changes.



**Table 4. Mean Performance Measures by Ownership Changes**

	<i>Unchanged</i>		<i>Changed</i>	
	2002	2007	2002	2007
Number of stores	130	130	13	13
Performance measures:				
Weekly Sales/sq.ft. (\$)	8.44	8.80	8.17*	6.94
Sales/labor hour (\$)	159.38	107.68	114.76	128.86*
Sales/transaction (\$)	19.45	22.24*	23.97	27.80*
Gross profit (% sales)	22.6	22.8	22.0	28.2*
Payroll (% sales)	11.2	11.5	10.3	9.2*
Annual % sales growth	1.0	3.9*	1.0	3.8

\* difference is statistically significant at the 10% level.

## Results

In Table 5 we present the estimated multinomial probit model for store ownership change using standard maximum likelihood methods. A multinomial logit model was also estimated assuming the error term follows a logistic distribution. The results are similar to those reported in Table 5. For ease of interpretation, the estimated coefficients are reported as elasticities. Each of the three equations has two columns for two different ownership statuses (ownership change or closure) with no change of ownership as the base outcome. Wald test statistics indicate that in all three equations we can reject the null hypothesis that all coefficients of the independent variables are equal to zero. The first two equations indicate that the effect of initial productivity (*LP02* and *MFP02*, respectively) is negative for both ownership change and store closure, but it is statistically significant only for store closure. This is an important result for the manager of a store with low initial labor productivity because those stores face a higher probability of being closed rather than being acquired. When technical efficiency (*TE02*) is used to measure productivity, there is no significant effect of initial productivity on either ownership change or store closure. In comparison previous studies in the manufacturing sector have shown mixed results for the relationship between initial productivity and ownership change.



**Table 5. Probit Regressions (Base: No change of ownership)**

OC0207	<i>LP measure</i>		<i>MFP measure</i>		<i>TE measure</i>	
	Change	Closure	Change	Closure	Change	Closure
LP02 <sup>c/</sup>	-0.023 <sup>a/</sup> (0.048) <sup>b/</sup>	-0.134 <sup>***</sup> (0.049)				
MFP02			-0.007 (0.005)	-0.010 <sup>*</sup> (0.005)		
TE02					-0.153 (0.357)	-0.382 (0.334)
THour02 <sup>c/</sup>	-0.002 (0.002)	-0.007 <sup>***</sup> (0.002)	-0.002 (0.002)	-0.008 <sup>***</sup> (0.002)	-0.002 (0.002)	- 0.007 <sup>***</sup> (0.002)
GSize02 <sup>c/</sup>	0.007 <sup>*</sup> (0.003)	0.009 <sup>***</sup> (0.004)	0.007 <sup>**</sup> (0.003)	0.008 <sup>**</sup> (0.004)	0.007 <sup>**</sup> (0.003)	0.007 <sup>*</sup> (0.004)
Age02	-0.002 <sup>**</sup> (0.001)	0.0001 (0.0008)	-0.003 <sup>**</sup> (0.001)	0.0003 (0.0009)	-0.003 <sup>**</sup> (0.001)	0.0002 (0.0009)
SMSA02 <sup>d/</sup>	0.035 (0.033)	-0.045 (0.032)	0.038 (0.032)	-0.055 (0.034)	0.038 (0.032)	-0.051 (0.034)
ConvFormat02 <sup>d/</sup>	0.075 (0.057)	-0.224 <sup>***</sup> (0.080)	0.080 (0.052)	-0.183 <sup>**</sup> (0.079)	0.087 <sup>*</sup> (0.052)	-0.155 <sup>**</sup> (0.075)
FDFormat02 <sup>d/</sup>	0.052 (0.072)	-0.144 <sup>***</sup> (0.030)	0.041 (0.067)	-0.142 <sup>***</sup> (0.035)	0.059 (0.071)	- 0.131 <sup>***</sup> (0.037)
		N = 448 Chi2(14) = 47.9 Prob > Chi2 = 0.00		N = 439 Chi2(14) = 48.0 Prob > Chi2 = 0.00		N = 439 Chi2(14) = 43.3 Prob > Chi2 = 0.00

a/ The estimated coefficients are reported as elasticities.

b/ Standard errors are in parentheses.

c/ Units of LP02, THour02, and GSize02 are \$100, 100 hours, and 100 stores.

d/ The marginal impact for discrete change of dummy variable.

\*\*\* = 1% level, \*\* = 5% level, \* = 10% level

Store or market characteristics generate similar results across all three equations. The total labor hours variable (*THour02*) has a negative effect on ownership change and store closure, but it is significant only for store closure. This result is not consistent with reported findings in the manufacturing sector, where smaller plants with less total labor hours are more likely to be acquired. This may be due to the fact that supermarkets have



additional characteristics that affect ownership changes (e.g., store location, unique store formats, or ownership group size) that are not present with manufacturing plants.

Ownership group size (*GSize02*) has a positive effect on the probability of ownership changes. This suggests that supermarkets tend to acquire both stores and distribution centers owned by large firms through company-level acquisitions in order to acquire their efficient self-distribution system. Another possibility is that larger companies (e.g., chains) with many stores are more likely to either sell or close their stores from the perspective of management and/or marketing strategy of the company. We also find that independent stores or small regional chains, which are usually owned by family members, are not more likely to either sell or close. This may be driven by the need to realize a minimum margin in order to survive. The implication is that the productivity of supermarket stores significantly depends on the company's distribution system and not on individual store efficiency.

Store age (*Age02*) has a negative effect on ownership change. This confirms our expectation that longer tenure (as in the job matching model) has a negative structural effect on the probability of ownership change. Conventional (*ConvFormat02*) and food/drug combination (*FDFormat02*) store format variables are included in the regression equation due to adequate sample size. We find a significant negative relationship between these store formats and the probability of store closure, even though store formats do not significantly affect ownership change. This implies that conventional stores and food/drug combination stores are not more likely to be closed when compared with other store formats.

In Table 6 we report the estimated impact of multifactor productivity (MFP) on ownership changes while controlling for selling area and group size. Stores are divided into two selling area groups (using the median selling area of 22,500 square feet). Store group size is divided into a large group (stores owned by companies with more than 11 chain stores) and a small group (10 or fewer stores). Regression results for stores in the large selling area group indicate that MFP does not have a significant effect on either store closure or ownership change. One interpretation is that owners of stores in the large group category find it more difficult to either sell or close, even if the stores exhibit low productivity. In the case of a sale this may be because large store size implies the need for greater liquidity to carry out the transaction. In the case of a store closure this may be because large store owners do not want to realize a loss on their accumulated capital and this delays the closure, as one might expect in a real option decision. The results do make it clear that stores in the small-selling area group with lower productivity are more likely to be closed.



**Table 6. Probit Regressions (Base: No change of ownership)**

	<i>Selling Area</i>				<i>Ownership group size</i>			
	Large group		Small group		Large group		Small group	
	Change	Closure	Change	Closure	Change	Closure	Change	Closure
OC0207								
MFP02	-0.007 <sup>a/</sup> (0.008) <sup>b/</sup>	-0.006 -0.005	-0.003 -0.008	-0.020 <sup>**</sup> -0.009	-0.008 -0.008	-0.009 -0.006	-0.005 -0.007	-0.009 -0.008
THour02 <sup>c/</sup>	-0.003	-0.0003	-0.0004	-0.038 <sup>***</sup>	-0.003	-0.002	0.003	-0.020 <sup>***</sup>
GSize02 <sup>c/</sup>	-0.002 0.007 <sup>*</sup> -0.004	-0.001 0.005 <sup>**</sup> -0.002	-0.0048 0.0001 -0.0174	-0.007 0.056 <sup>**</sup> -0.023	-0.002 0.008 <sup>**</sup> -0.003	-0.002 0.006 <sup>*</sup> -0.003	-0.002 0.007 -0.011	-0.004 -0.014 -0.017
Age02	-0.005 <sup>**</sup> -0.002	-0.001 -0.001	-0.002 -0.001	0.001 -0.001	-0.001 -0.002	-0.001 -0.002	-0.003 <sup>**</sup> -0.001	0.0002 -0.0011
SMSA02 <sup>d/</sup>	-0.046 -0.062	-0.110 <sup>*</sup> -0.067	0.093 <sup>**</sup> -0.042	-0.013 -0.053	-0.008 -0.046	-0.125 <sup>***</sup> -0.045	0.075 <sup>*</sup> -0.045	0.002 -0.048
ConvFormat02 <sup>d/</sup>	0.043 -0.072	-0.086 <sup>***</sup> -0.032			0.154 -0.103	-0.126 <sup>***</sup> -0.045		
FDFormat02 <sup>d/</sup>	0.037 -0.061	-0.096 <sup>***</sup> -0.034			0.098 -0.079	-0.140 <sup>***</sup> -0.045	0.011 -0.083	-0.062 -0.085
	N = 214		N = 225		N = 210		N = 229	
	Chi2(14) = 27.9		Chi2(10) = 34.1		Chi2(14) = 32.3		Chi2(12) = 30.6	
	Prob > Chi2 = 0.01		Prob > Chi2 = 0.00		Prob > Chi2 = 0.00		Prob > Chi2 = 0.00	

a/ The estimated coefficients are reported as elasticities.

b/ Standard errors are in parentheses

c/ Units of THour02 and GSize02 are, respectively, 100 hours and 100 stores.

d/ The marginal impact (dy/dx) is for discrete change of dummy variable from 0 to 1.

\*\*\* = 1% level, \*\* = 5% level, \* = 10% level

Total labor hours (*THour02*) for large selling area group does not have a significant impact on either ownership change or store closure because most stores in the large group are similarly hard to sell or close regardless of store size. Conversely, stores in the small selling area group are more likely to be closed because there is less concern over losing capital accumulation when compared with the large store group.



Ownership group size (*GSize02*) is positive and significant for both ownership change and store closure in the large selling area group. Stores owned by a larger company in the large store group are usually self-distributed and are more likely to be acquired by another firm that is pursuing a self-distribution system. In addition, larger firms may have more management expertise related to selling or closing an inefficient large store. This could partially explain the positive effect of ownership group size on ownership changes. Older stores are less likely to be acquired, and either conventional or food/drug combination stores are less likely to be closed in the large selling area group. These results are consistent with those reported for all stores in Table 5. In addition, stores located in an SMSA in the large selling area group are less likely to be closed, which may imply relatively higher performance among stores located in those high population density areas. Similarly, stores located in an SMSA in the small selling area group (typically a conventional store format) are more likely to be acquired, rather than closed. Thus, stores located in an SMSA are preferred regardless of store size due perhaps to higher expected performance or growth opportunities in those areas.

The regression results for stores in the large ownership group indicate that group size (*GSize02*) has a positive impact on the likelihood of both ownership change and store closure, while it is not a significant factor for ownership change or store closure in the small ownership group. Individual stores in the large ownership group are more likely to depend on the company-level decisions, such as mergers and acquisitions, rather than store-level productivity characteristics as the ownership group size increases. In the small ownership group equations not many variables are significant predictors on the likelihood of being acquired or closed. Neither productivity (*MFP02*) nor ownership group size (*GSize02*) has an effect on ownership change or store closure. Other variables, with the exception of total labor hours (*THour02*), do not explain the possibility of store closure. Only store age (*Age02*) is a significant predictor of being acquired, and it has a negative effect on the likelihood of an ownership change. This implies that the longer a store operates under the same owner the less likely it is to be acquired.

We derive two main results concerning firms (or stores) that are trying to acquire other stores, and firms (or stores) that are positioning themselves to be acquired. First, store-level productivity itself does not affect the possibility of ownership changes in the supermarket industry. This result differs from that reported in the manufacturing industry. Supermarkets owned by larger companies are more likely to be acquired at the company level by the firms that are planning to acquire both stores and distribution centers to improve their self-distribution system. Second, small independent stores or small stores owned by regional chains are more likely to be closed rather than acquired if they show low levels of productivity. This is an important issue for the small store managers, as they need to improve store-level productivity in order to survive during a period of restructuring and acquisitions. Store productivity does matter in these cases.



Table 7. Productivity Growth Rate Regressions

	<i>LP Growth Rate</i>	<i>MFP Growth Rate</i>	<i>TE Growth Rate</i>
OC0207	0.004 <sup>d/</sup> (0.114) <sup>b/</sup>	-0.030 (0.105)	0.008 (0.024)
LP02 <sup>c/</sup>	-0.078 <sup>***</sup> (0.011)	-0.079 <sup>***</sup> (0.009)	-0.007 <sup>***</sup> (0.002)
DC0207	0.534 <sup>**</sup> (0.264)	0.374 <sup>*</sup> (0.221)	0.105 <sup>**</sup> (0.049)
Age02	-0.004 <sup>*</sup> (0.002)	-0.004 <sup>**</sup> (0.002)	0.0001 (0.0004)
RM0207 <sup>d/</sup>	0.016 (0.090)	-0.013 (0.076)	0.023 (0.017)
SMSA02 <sup>d/</sup>	0.013 (0.077)	-0.016 (0.065)	-0.014 (0.015)
	N = 46 F(6, 39) = 10.5 Prob > F = 0.00 R-sq. = 0.618	N = 45 F(6, 38) = 14.5 Prob > F = 0.00 R-sq. = 0.695	N = 45 F(6, 38) = 3.2 Prob > F = 0.01 R-sq. = 0.339

a/ coefficients reported as elasticities.

b/ Std. Errors in parentheses.

c/ Unit of LP02 is \$100.

d/ Marginal impact for discrete change of dummy variable.

\*\*\* = 1% level, \*\* = 5% level, \* = 10% level

In Table 7 we explore the predictors of store-level productivity improvement based on the 145 stores that participated in both the 2002 panel and the 2007 panel. Only 45 out of the 145 stores provide complete information for this set of regressions. We find a negative relationship between initial productivity (*LP02*) and productivity growth across all three equations. This implies that stores with low productivity levels in 2002 are more likely to experience productivity improvement by 2007. It is noteworthy that a change in the distribution system (*DC0207*) from wholesaler to self-distribution during 2002-2007 increases labor productivity (LP) growth by 53%, multifactor productivity (MFP) growth by 37%, and technical efficiency (TE) growth by 11%. As a consequence, acquiring stores and distribution centers increased productivity overall. This likely had the additional benefit of facilitating greater market access through the acquired stores and distribution centers. Ownership change alone during 2002-2007 (*OC0207*) has a positive effect on LP growth and TE growth, but it is not significant in any of the productivity



growth equations. This finding contrasts with the manufacturing sector, but it is consistent with the findings of Peristiani (1997) and Ayadi, et al. (2010) in the banking industry. We conclude that ownership change alone does not improve productivity in the service sector. In the supermarket industry other factors such as distribution systems appear to be more critical factors.

### Conclusions

The relationship between productivity characteristics and ownership changes and/or restructuring in the supermarket industry has potentially two dimensions: productivity variation is a determinant of these changes, or it is a consequence of these changes. In this paper we look for empirical evidence that productivity differences between stores is a determinant or a consequence of changes in ownership and restructuring efforts in the industry. As a determinant of change, store-level productivity alone does not appear to affect the probability of ownership changes and restructuring in the supermarket industry. This suggests that there are other fundamental differences between the supermarket industry and the manufacturing industry which might explain these changes and why productivity characteristics are of less importance. Instead, we find that stores owned by larger companies are more likely to be acquired at the company level by firms that are planning to acquire both stores and distribution centers.

Second, ownership change alone does not appear to improve productivity. This is in contrast with results from earlier studies in the manufacturing sector. Thus, productivity improvements in the supermarket industry are not necessarily a consequence of ownership changes either. A more critical determinant of positive productivity change is a transition from wholesaler-supplied to self-distribution systems. This suggests that managers acquiring both stores and distribution centers are better able to improve productivity, facilitate improved market access, and achieve competitive advantages in the industry.

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