Productivity and Ownership Changes in the Supermarket Industry

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Introduction

The increasing degree of competition satisfying various customers' interests continues to bring about mergers and acquisition (M&A) activities in the supermarket industry in more recent years. From an economic point of view, whether store-level ownership changes by M&A are desirable depends on whether ownership changes increase or decrease efficiency (represented by store-level productivity).

Compared to various studies of this relationship in the manufacturing sector, however, little research has been done to understand the relationship in the service sector, including the supermarket industry. Many studies on the manufacturing sector showed that plants with lower productivity are more likely to be acquired by another company and experience productivity improvement after that change (McGuckin and Nguyen, 1995). This study addresses the relationship between store-level productivity and ownership changes.

U.S. Supermarket industry

- 35,000 supermarket stores.
- 11 national chains and lots of regional/local chains.

Group size	1 store	2-30	31-100	> 100
%	16.3	43.5	9.7	30.4

- Annual sales volume of $650 billion (5% of GDP).
- Gross margin 28.6 %, Net income before tax 1.8%.

Source: The Food Retailing Industry Speaks, 2007, Food Marketing Institute.

Theoretical Motivation

- **Job Matching Model** (Jovanovic, 1979)

- Low level of productivity due to poor match induces a high probability of job separation.

- Each worker's separation probability is a decreasing function of his job tenure.

- The expected value of a new match (from an identical distribution) is higher, given that the first match was low.

Main Hypotheses

- Stores with relatively low productivity are more likely to be acquired or closed than those with higher productivity.
- Stores that changed ownership experience productivity improvement after that change compared to other unchanged stores.

Data

- 2002 and 2007 store-level data from the Supermarket Panel conducted by the Food Industry Center at the U of Minnesota.
- The Supermarket Panel is an annual survey of supermarkets since 2000 where store managers provide information on store characteristics, operations, and performance.

Descriptive Profile

Table 1. Store Characteristics and Performance for the 2002 Panel Stores Grouped by Ownership Changes

	Ownership Changes		
	Unchanged	Changed	Closed
NUMBER OF STORES	622	112	132
MARKET CHARACTERISTICS			
• Median Population Density (per sq. mi.)	257[b]	332[b]	116[a]
• Median Household Income ($/year)	44,795[b]	43,766[b]	42,334[a]
• Percent Located in an SMSA	62[b]	65[b]	48[a]
STORE CHARACTERISTICS			
• Median Selling Area (sq. ft.)	25,000[b]	29,000[b]	12,000[a]
• Median Weekly Sales ($)	170,400[b]	171,954[b]	62,068[a]
• Median Store Age (year)	22[a]	22[a]	32[b]
• Mean Ownership Group Size (stores)	278[a]	513[b]	249[a]
• Percent Wholesaler Supplied	59[b]	46[a]	76[c]
• Percent with Union Workforce	27[b]	26[b]	17[a]
MANAGEMENT SCORES (MEAN)			
• Supply Chain	52.4[b]	57.4[c]	43.4[a]
• Human Resources	38.1[b]	37.1[b]	35.2[a]
• Food Handling	85.5[a]	86.1[a]	84.4[a]
• Environmental Practices	64.9[b]	63.4[b]	55.3[a]
• Quality Assurance	57.7[b]	61.1[c]	53.0[a]
• Service Offerings	39.0[b]	40.8[b]	33.3[a]
PERFORMANCE MEASURES (MEDIAN)			
• Weekly Sales per Sq. Ft. of Selling Area ($)	7.52[b]	6.21[a]	5.83[a]
• Sales per Labor Hour ($)	105.72[b]	114.71[b]	97.50[a]
• Sales per Transaction ($)	19.77[b]	20.57[b]	15.01[a]
• Annual Inventory Turns	18.0[b]	13.0[a]	13.0[a]
• Gross Profit as a Percent of Sales	24.0[b]	24.5[b]	23.0[a]
• Annual Percentage Sales Growth	2.0[b]	0.0[a]	0.0[a]

Note: 1. Superscripted letters indicate significant differences at the 0.10 level, with lower letters being associated with lower values.
2. Management scores are measured based on the Panel stores provided information on a wide range of store-level management practices.

Table 2. Store Performance for the 2002 and 2007 Panel Stores Grouped by Ownership Changes

	Ownership Changes			
	Unchanged		Changed	
	2002	2007	2002	2007
NUMBER OF STORES	130	130	13	13
MANAGEMENT SCORES (MEAN)				
• Supply Chain	46.2	44.4	68.9	67.5
• Human Resources	37.1	37.4	39.2	36.9
• Food Handling	89.3	91.1	87.5	92.6*
• Environmental Practices	61.9*	57.3	81.8	78.2
• Quality Assurance	59.9*	53.6	66.9	70.6
• Service Offerings	38.2	38.7	48.1	50.3
PERFORMANCE MEASURES (Mean)				
• Weekly Sales per Sq. Ft. of Selling Area ($)	8.44	8.80	8.17*	6.94
• Sales per Labor Hour ($)	159.38	107.68	114.76	128.86*
• Sales per Transaction ($)	19.45	22.24*	23.97	27.80*
• Gross Profit as a Percent of Sales	22.6	22.8	22.0	28.2*
• Annual Percentage Sales Growth	1.0	3.9*	1.0	3.8

Note: * indicate significant difference at the 0.10 level.

Performance Measurement

- **Labor Productivity (LP)** = Q_i / L_i
- **Multi-factor Productivity (MFP)** = $A_i = Q_i / (L_i^{\beta_L} \times K_i^{\beta_K})$

where $\mathbf{Q_i}$: weekly sales for store i
$\mathbf{L_i}$: weekly labor hours for store i
$\mathbf{K_i}$: store selling area for store i
$\mathbf{A_i}$: Hicks-neutral measure of technical change

- **Technical Efficiency (TE)**

$$\ln Q_i = \beta_0 + \beta_1 \ln L_i + \beta_2 \ln K_i + v_i - u_i \quad \text{or}$$
$$Q_i = \exp(\beta_0 + \beta_1 \ln L_i + \beta_2 \ln K_i + v_i - u_i)$$

$$TE_i = \frac{\exp(\beta_0 + \beta_1 \ln L_i + \beta_2 \ln K_i + v_i - u_i)}{\exp(\beta_0 + \beta_1 \ln L_i + \beta_2 \ln K_i + v_i)} = \exp(-u_i)$$

where $\mathbf{v_i}$: random error with $E(v_i) = 0$, $E(v_i^2) = \sigma_v^2$, and $E(v_i v_j) = 0$ for all $i \neq j$

$\mathbf{u_i}$: non-negative random variable associated with technical inefficiency with $E(v_i^2) = \sigma_v^2$ and $E(v_i v_j) = 0$ for all $i \neq j$.

Empirical Model

- **Multinomial Probit/Logit Regression** (To test the first hypothesis)

$$OC0207_i = b_0 + b_1 LP02_i + b_2 THour02_i + b_3 GSize02_i + b_4 Age02_i + b_4 Format02_i + b_5 SMSA02_i + \varepsilon_i$$

where $\mathbf{OC0207_i}$: dummy variable with 1 if the store i changed ownership, 2 if the store closed, and 0 if the store has been unchanged during 2002-07

$\mathbf{LP02_i}$: labor productivity of the store i in 2002

$\mathbf{THour02_i}$: total labor hours of the store i in 2002

$\mathbf{GSize02_i}$: ownership group size of the store i in 2002

$\mathbf{Age02_i}$: years since the current owner acquired

$\mathbf{Format02_i}$: dummy variable with 1 if the store i's format is warehouse, super warehouse, or supercenter and 0 if not

$\mathbf{SMSA02_i}$: dummy variable with 1 if the store i is located in SMSA and 0 if not

$\boldsymbol{\varepsilon_i}$: normally distributed error term

- **Regression of Growth Rate of Productivity** (To test the second hypothesis)

$$\{(LP07_i - LP02_i)/0.5(LP07_i + LP02_i)\} = b_0 + b_1 OC0207_i + b_2 LP02_i + b_3 SDist\_Ch0207_i + b_4 Age02_i + b_5 Remodel0207_i + b_6 SMSA02_i + \varepsilon_i$$

where $\mathbf{SDist\_Ch0207_i}$: dummy variable with 1 if the store i changed from wholesaler supplied to self-distributed, -1 if changed from self-distributed to wholesaler supplied, and 0 if no change between 2002 and 2007

$\mathbf{Remodel0207}i$: dummy variable with 1 if the store i has remodeled between 2002 and 2007 and 0 if not.

Estimation Results

Table 3. Multinomial Logit Regression Results (base: OC0207 = 0)

	All Stores		Stores with Larger Selling Area		Stores with Smaller Selling Area	
OC0207	1	2	1	2	1	2
LP02	-3.083	-13.766***	-2.611	-13.373	-4.076	-16.041**
THour02	-3.319**	-9.332***	-2.369	-1.433	-6.368	-30.269***
GSize02	7.242**	10.500***	7.217*	9.532**	6.349	43.543***
Age02	-2.212**	-0.288	-5.054**	-3.001	-1.989	0.172
Format02	-1.295	1.926***	-1.235	1.602**		
SMSA02	2.560	-2.114	-6.596	-9.613	9.925**	0.974
Intercept	-0.841	0.993*	-0.102	-0.203	-0.982	2.564***

*Significant at 10% level, **Significant at 5% level, ***Significant at 1% level

Table 4. Multinomial Logit Regression Results (base: OC0207 = 0)

	Stores in Larger Group Sizes		Stores in Smaller Group Sizes	
OC0207	1	2	1	2
LP02	2.833	-12.433	-9.945	-19.306***
THour02	-4.736**	-3.715*	-1.302	-27.026***
GSize02	6.522*	8.246**	7.903	1.070
Age02	0.336	-1.349	-2.990*	-0.031
Format02	-39.314	1.470**	34.261	7.626
SMSA02	-0.382	-1.088**	6.873	2.333
Intercept	-1.018	0.582	-0.734	2.582***

Table 5. Regression Results of Productivity Growth Rate

	LP Growth Rate	MFP Growth Rate	TE Growth Rate
OC0207	0.540	-0.112	0.802
Initial LP (or MFP or TE)	-0.825***	-0.101***	-0.688***
Sdist_Ch0207	0.525*	0.452*	0.104**
Age02	-0.394*	-0.376*	0.130
Remodel0207	0.133	-0.190	0.229
SMSA02	0.159	-0.265	-0.137
Intercept	0.254**	0.289***	0.159***

Summary and Future Research

- Stores with lower productivity are not more likely to be acquired but more likely to be closed.
- Stores with lower initial productivity that changed to self-distribution system experienced productivity growth, but ownership change itself did not improve productivity.
- Wider time span with more store observations for the panel data will be helpful to generate statistically significant results.
- Supply chain-level or company-level efficiency will be considered as a potential factor for ownership changes for future study.

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