

Supermarket Characteristics and Operating Costs in Low-Income Areas

Robert P. King

Ajay Behl

The Food Industry Center

University of Minnesota

Ephraim Leibtag

USDA/ERS



Introduction

- This study assesses how supermarket characteristics and operating costs differ in relation to the percentage of sales derived from food stamp redemptions.
- We are using unique store-level data set that combines data from the Supermarket Panel and the USDA STARS food stamp redemption database.

Presentation Outline

- Data for the Study
- A Descriptive Profile of Supermarkets
- Cost Function Analysis
 - Conceptual Framework
 - Findings
- Concluding Remarks

Data for the Study

- The Supermarket Panel is an annual survey of supermarkets conducted by The Food Industry Center at the University of Minnesota since 2000.
- Stores are selected at random from the 32,000 supermarkets that accept food stamps.
- In 2002, the study year for this analysis, 866 stores participated in the Panel.

Data for the Study

- Data from the Panel were merged with zip-code specific data from the U.S. Census.
 - population density
 - median household income
 - racial composition of local population
- Data from the Panel were also merged with store-level data on food stamp redemptions from the STARS database.

A Descriptive Profile of Supermarkets

- Panel stores were grouped in quartiles based on the percentage of revenues from food stamp redemptions, which ranges from zero to over 30%.
- Stores were also grouped by location in or outside of a MSA.

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
NUMBER OF STORES	3,868	7,673	5,575	2,695	5,228	768
STORE CHARACTERISTICS						
Median Selling Area (sq. ft.)	29,000	35,000	32,000	22,000	21,000	13,000
Median Store Age (years)	25	18	22	23	24	30
Median Adj. Store Age (years)	8	6	5	8	6	5
Median Hours Open per Week	112	119	112	102	112	100
Median # Checkout Lanes	8	9	10	6	7	5
Median # Parking Spaces	200	300	260	150	150	120
ORGANIZATIONAL CHARACTERISTICS						
Median Ownership Group Size	22	180	65	22	15	1
Percent Wholesaler Supplied	55	34	50	65	53	66

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
MARKET CHARACTERISITICS						
Median Population Density	975	848	1563	68	74	75
Median Household Income	\$42,654	\$48,894	\$61,182	\$34,547	\$38,242	\$43,562
% of Sales from Food Stamps	7.4	1.8	0.3	6.8	2.3	0.3
% of Population - White	66.4	86.7	84.9	80.7	93.9	96.3
% of Population - Black	8.7	3.7	2.1	6.1	0.4	0.3
% of Population - Hispanic	4.5	2.8	3.4	2.6	1.6	1.2
Median Distance to Nearest Competitor	1.5	1.0	1.0	1.0	2.0	4.0
% Facing Supercenter Competition	53.0	53.6	31.6	59.7	44.4	23.0

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
DISTRIBUTION SERVICE OFFERINGS (% of Stores Offering)						
Bagging	70	91	94	90	98	99
Carryout	62	83	83	82	90	96
Service Meat	69	75	84	88	95	85
In-Store Bakery	69	86	78	71	80	63
Post Office/Mailing Services	24	20	15	28	35	36
In-Store Banking	17	40	30	18	15	6
Customer Web Site	60	72	73	60	52	22

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
PRODUCT MIX						
Median % of Sales - Produce	8	8	10	7	8	8
Median % of Sales - Meat	18	13	11	17	15	14
Median % of Sales - Dry Groceries	54	49	47	62	50	51
% of Stores with a Pharmacy	25	44	44	17	28	11
Median % of Sales - Private Label	17	15	11	18	20	12
Median Number of SKUs	19,000	25,000	35,000	31,000	20,000	28,000

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
HUMAN RESOURCES						
Mean Non-Cash Benefits Score	58.7	70.8	67.1	62.6	59.2	44.7
% of Stores with Union Workforce	37.6	36.8	39.1	16.9	17.7	1.9
Median Hourly Wage	\$10.05	\$11.52	\$12.97	\$9.20	\$10.41	\$9.89
Median Hours per 1,000 Sq. Feet	55.0	68.3	84.3	63.3	62.1	85.0
SUPPLY CHAIN						
Mean Supply Chain Score	56.2	64.6	63.5	56.3	54.0	40.8

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
COMPETITIVE POSITION (% of Stores Self-Identified as)						
Price Leader	29	33	30	26	32	37
Service Leader	53	59	74	75	72	77
Quality Leader	67	65	72	74	78	78
Variety Leader	39	41	30	26	34	23

A Descriptive Profile of Supermarkets

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
PERFORMANCE MEASURES (Median)						
Sales per Square Foot	\$7.40	\$7.56	\$9.23	\$6.88	\$7.20	\$7.50
Sales per Labor Hour	\$125.71	\$123.23	\$123.60	\$103.75	\$106.19	\$94.59
Sales per Transaction	\$19.87	\$21.90	\$26.25	\$18.66	\$19.82	\$17.08
Annual Inventory Turns	15	18	17	14	16	17
Annual % Employee Turnover	55.7	39.6	32.0	54.7	35.1	51.7
Gross Profit as % of Sales	23.1	24.0	27.5	22.0	23.9	25.5
Payroll as % of Sales	9.4	10.0	10.5	9.0	10.0	9.8
COGS and Payroll as % of Sales	85.5	85.5	82.7	87.0	87.4	84.9
Annual % Sales Growth Rate	0.4	1.4	2.4	0.9	1.8	4.5

Cost Function Analysis

Conceptual Framework

- Translog specification for operating cost function
 - Two variable inputs - labor and cost of goods sold
 - Wage rate (\$/hr) derived from Panel data
 - Price for cost of good sold is \$1 for all stores
 - Store selling area is treated as a quasi-fixed input

Cost Function Analysis

Conceptual Framework

- Translog specification for operating cost function (cont.)
 - Two outputs - weekly sales and an index of distribution service offerings
 - Other variables enter as technology shifters
 - Warehouse/Supercenter format, pharmacy, adjusted store age, supply chain index
 - Ownership group size, self-distribution
 - MSA, food stamp redemption rate

Cost Function Analysis

Conceptual Framework

- Translog specification for operating cost function (cont.)
 - Weekly sales and cost shares for labor and cost of goods sold assumed to be simultaneously determined.
 - Store selling area and distribution service offerings assumed to be predetermined.
 - Wage rate and technology shifters assumed to be exogenous.

Cost Function Analysis

Conceptual Framework

- One factor share of cost equation is redundant. Labor share is retained.
- System of three equations estimated using 3SLS
 - Weekly Sales
 - Labor Share of Operating Cost
 - Operating Cost Function
- Parameter restrictions are imposed to ensure
 - cross-equation consistency
 - that cost is homogeneous of degree 1 in prices
 - that output has a constant degree of homogeneity

Cost Function Analysis

Findings

- Labor share of cost is positively related to:
 - wage
 - pharmacy
 - service offerings
 - self distribution
- Labor share of cost is negatively related to:
 - weekly sales
 - group size
 - supply chain score
 - food stamp redemptions

Cost Function Analysis

Findings

- Weekly sales level is positively related to:
 - population density
 - median household income
 - warehouse/supercenter
 - competitive position
 - group size
 - selling area
 - pharmacy
 - hours open
- Weekly sales level is negatively related to:
 - service offerings
 - food stamp redemptions
 - store age

Cost Function Analysis

Findings

- The operating cost function has numerous interactions, making it difficult to sign derivatives.
- Operating costs have statistically significant relationships with:
 - wage rate
 - service offerings
 - selling area
 - all 8 technology shifters
- We estimated elasticities for a typical store in each quartile/location combination.

Cost Function Analysis Findings

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
MEDIAN EXPLANATORY VARIABLE VALUES						
Wage	\$10.05	\$11.52	\$12.97	\$9.20	\$10.41	\$9.89
Median Population Density	975	848	1,563	68	74	75
Median Household Income	\$42,654	\$48,894	\$61,182	\$34,547	\$38,242	\$43,562
Service Offerings Index	5	6	6	5	6	5
Store Selling Area	29,000	35,000	32,000	22,000	21,000	13,000
Warehouse/Supercenter	0	0	0	0	0	0
Full Service Pharmacy	0	0	0	0	0	0
Adjusted Store Age	8	6	5	8	6	5
Ownership Group Size	22	180	65	22	15	1
Self-Distribution	0	1	1	0	0	0
Supply Chain Index	56.2	64.6	63.5	56.3	54.0	40.8
Food Stamp Redemption Rate	7.4%	1.8%	0.3%	6.8%	2.3%	0.3%

Cost Function Analysis Findings

	Stores in an MSA			Stores not in an MSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
ELASTICITY OF OPERATING COST WITH RESPECT TO:						
Wage	0.102	0.116	0.137	0.100	0.117	0.139
Weekly Sales	0.995	0.919	0.851	1.050	1.015	0.941
Service Offerings Index	0.218	0.109	0.076	0.186	0.169	0.141
Store Selling Area	-0.189	-0.200	-0.199	-0.192	-0.205	-0.194
Supply Chain Index	-0.045	-0.049	-0.044	-0.038	-0.036	-0.017
Food Stamp Redemption Rate	-0.015	-0.012	-0.004	-0.010	0.000	0.019
PERCENTAGE CHANGE IN OPERATING COST WITH A CHANGE IN:						
Warehouse/Supercenter	-11.3%	-7.5%	-4.9%	-14.8%	-12.2%	-11.2%

Cost Function Analysis

Findings

	Stores in an SMSA			Stores not in an SMSA		
	Q 1	Q 2&3	Q 4	Q 1	Q 2&3	Q 4
PROJECTED OPERATING COSTS AND MARGINS PER \$ OF SALES						
Payroll Cost/\$ of Sales	\$0.08	\$0.09	\$0.11	\$0.08	\$0.10	\$0.12
COGS/\$ of Sales	\$0.73	\$0.73	\$0.73	\$0.75	\$0.75	\$0.73
Operating Cost/\$ of Sales	\$0.81	\$0.82	\$0.84	\$0.83	\$0.85	\$0.84
Operating Margin/\$ of Sales	\$0.19	\$0.18	\$0.16	\$0.17	\$0.15	\$0.16

Cost Function Analysis

Findings

- We conducted cost simulations for representative stores to explore the effects of changing market conditions.
- For MSA and non-MSA, we projected operating costs for each combination of store characteristics and market characteristics.
- This simulates placing a store with characteristics of one quartile in a market with characteristics from other quartiles.

Cost Function Analysis

Findings

Cost Simulations for MSA Stores

Market Setting	Store Characteristics		
	Q1	Q2&3	Q4
	Operating Cost/\$ of Sales		
Q1	\$0.81	\$0.80	\$0.81
Q2&3	\$0.84	\$0.82	\$0.83
Q4	\$0.85	\$0.84	\$0.84

Cost Function Analysis

Findings

Cost Simulations for non-MSA Stores

Market Setting	Store Characteristics		
	Q1	Q2&3	Q4
	Operating Cost/\$ of Sales		
Q1	\$0.83	\$0.83	\$0.87
Q2&3	\$0.85	\$0.85	\$0.88
Q4	\$0.85	\$0.83	\$0.84

Concluding Remarks

- Our results do not support the hypothesis that operating costs are higher in stores serving low income consumers.
- Food stamp redemption rates do affect operating costs, but the effects are relatively small and their direction is ambiguous.
- MSA stores typical of moderate-income areas can be competitive in low-income markets.

Concluding Remarks

- Future research will focus on:
 - understanding the competitive environment for stores serving low income consumers
 - learning from retailers about the impacts of the food stamp program design on store operations

Questions ... Comments?