Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart

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Change in Shopping Patterns

- Wal-Mart has become the largest supermarket chain in the U.S.
  - Approximately 51% larger than the runner-up Kroger
  - Larger than Albertsons and Safeway, the third and fourth largest supermarket chains, combined.
  - Nationwide Wal-Mart has a 14% market share
- WM sells 20% of many firms products
  - Gillette 16% in 2002 and 22% in 2004
  - Proctor and Gamble about 33%

Wal-Marts History of Food Sales

- Wal-Mart began selling food in 1988
  - Significant consolidation has occurred in the supermarket industry, but Wal-Mart continues to grow at a significantly faster rate than these supermarket chains.
  - The majority of Wal-Mart's grocery sales arise from its over 1400 supercenters which average 180,000 square feet per store (20,000 square meters)
- Most of the stores are in the South and Southwest.
  - Wal-Mart is increasingly moving into urban centers
  - Openings expected in Los Angeles and Chicago, along with other urban areas.

Conditions for Entry and Expansion

- Over the 10-year period from 1991-2001 margins increased in supermarkets as the price of food sold at supermarkets grew at approximately twice the rate of the PPI for food.
  - Over this period the PPI for finished food increased by 13.9% while the CPI for food at home increased by 27.7%
  - Despite significant recent research on competition among supermarkets, the importance of this factor does not seem to have been recognized.

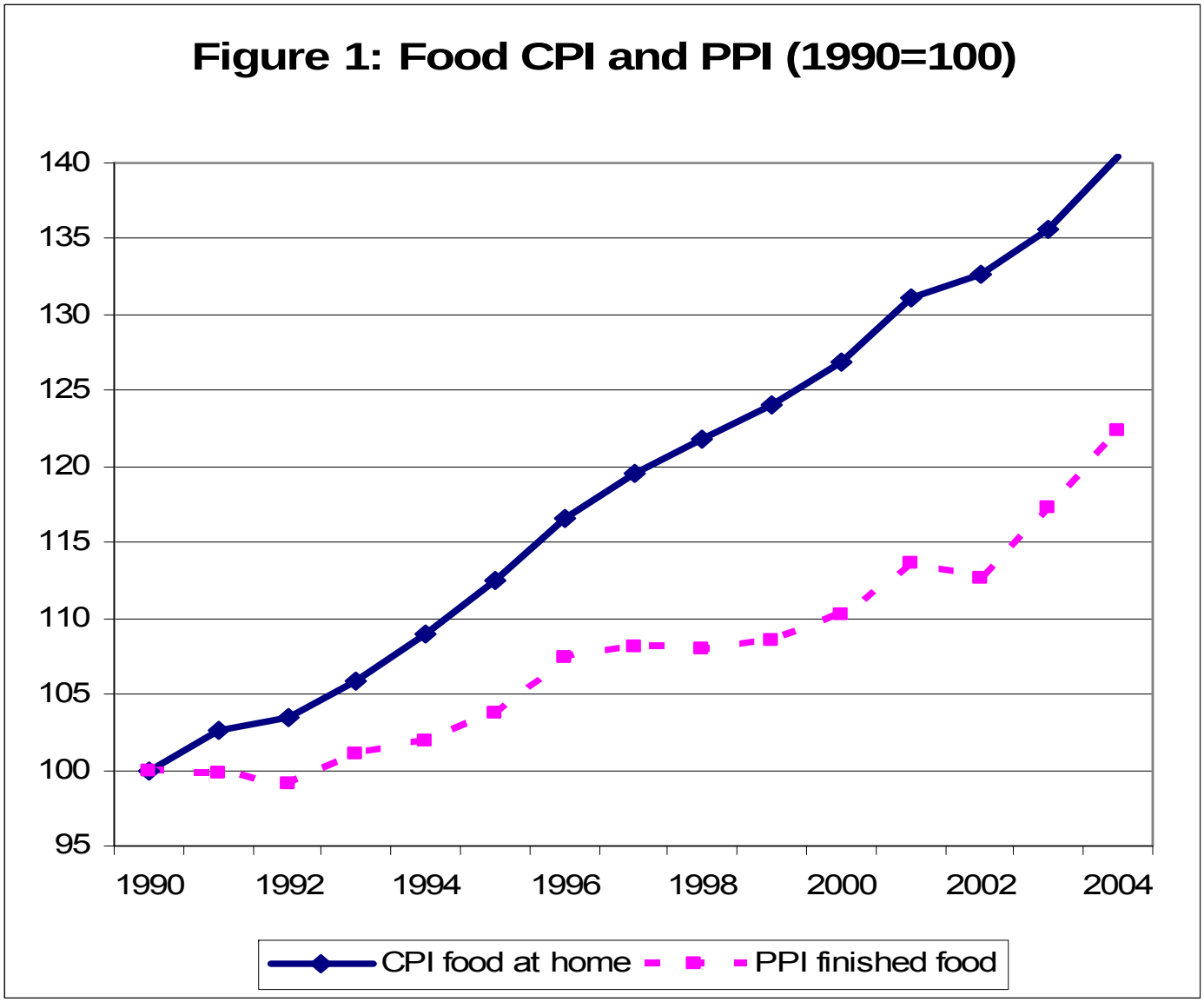


Figure 1: Food CPI and PPI (1990=100)
140
135
130
125
120
115
110
105
100
95
1990
1992
1994
1996
1998
2000
2002
2004
CPI food at home
PPI finished food

Wal-Mart Decreases Gross Margins

- The CPI for food at home is the portion of the consumer price index that measures price change for food items primarily consumed at home most of which is purchased at supermarkets
- The PPI for finished food products is the portion of the producer price index which approximates wholesale prices for the majority of supermarket food sales.
  - Very likely that gross margins (price minus average variable cost) increased significantly during the 1990s.
  - This increased gross margin presented supercenters, and especially Wal-Mart, an invitation to enter markets and to expand with their lower than supermarket prices.
  - Profit margins at Kroger's (3.3%-4.7%) and Safeway (3.6%-7.9%) increased significantly over the period.

WM Is Lower Price than Supermarkets

- Various studies have demonstrated that food items at Wal-Mart are 8%-27% lower priced that at the large supermarket chains, even after discounts for loyalty card and other special are taken into account.
- After entry by Wal-Mart conventional supermarkets typically decrease their prices (or do not increase them as much as in non-Wal-Mart markets) because of the increased competition.

Consumer Benefits from WM Expansion

- Consumers benefit from the "direct price effect" of lower prices at supercenters.
- Consumers also benefit from the "indirect price effect" of lower prices at competing outlets due to the entry and expansion of supercenters.
  - We measure the consumer welfare effects of both the direct price effect and indirect price effect in our empirical results.
  - BLS assumption of complete "compensating service differential" is incorrect
    - Leads to result that consumers are not made better off by WM entry and expansion

$$y = e(p_{0,} p_1^{\ j}, p_2^{\ j}, \ldots, p_n^{\ j}; \bar{u}) = e(p, \bar{u})$$

$$x_i^{\ j} = \frac{\partial e(p_0, p^j, \bar{u})}{\partial p_i^{\ j}} = \frac{-\dfrac{\partial v(p_0, p^j, y)}{\partial p_i^{\ j}}}{\dfrac{\partial v(p_0, p^j, y)}{\partial y}} \quad i = 1 \ldots, n$$

$$\Pi(p^j, \bar{u}) = e(p^j, \bar{u}) = y^j(p^j, \bar{u}) = y^j = \sum_i p_i^{\ j} x_i^{\ j}$$

$$pr(j=1)=pr(U_{i1}>U_{i2})=\alpha_i+(X_{i1}-X_{i2})\beta+\varepsilon_{i1}-\varepsilon_{i2}$$

$$pr(j=1)=\frac{1}{1+\exp(\alpha_i+\beta_1(\overline{p}^1-\overline{p}^2))}$$

Product	Supermarkets/ SMC	All Other/SMC
Apples	1.55	1.53
Apple Juice	1.59	1.60
Bananas	1.38	1.37
Bread	1.11	1.10
Butter/Margarine	1.10	1.10
Cereal	1.17	1.17
Chicken Breast	1.41	1.41
Coffee	1.37	1.38
Cookies	1.22	1.21
Eggs	1.31	1.31
Ground Beef	1.37	1.37
Ham	1.97	1.98
Ice Cream	1.32	1.33
Lettuce	2.12	2.11
Milk	1.21	1.20
Potatoes	1.41	1.40
Soda	0.89	0.97
Tomatoes	1.36	1.32
Bottled Water	1.06	1.17
Yogurt	1.41	1.41
Average	1.30	1.31

$$p_{it} = \alpha_i + \delta_t + \beta e_{it} + \varepsilon_{it} \qquad i = 1,34 \quad t = 1,48$$

BOSTON		DENVER	HARTFORD-NEW HAVEN
CHICAGO		DETROIT	PHOENIX
HOUSTON		MIAMI	SALT LAKE CITY
INDIANAPOLIS		MILWAUKEE	COLUMBUS
KANSAS CITY		MINNEAPOLIS	CHARLOTTE
LOS ANGELES		PHILADELPHIA	DES MOINES
NEW YORK		PITTSBURGH	GRAND RAPIDS
SAN FRANCISCO		PORTLAND, OR	OMAHA
SEATTLE		ST. LOUIS	SAN ANTONIO
ATLANTA		TAMPA	SYRACUSE
CINCINNATI		BALTIMORE	
CLEVELAND		BUFFALO-ROCHESTER	

Table 5.2: Average Price for Food Products across 34 Markets

National Results

AR(1) IV Results
(Asymptotic Standard Errors)

Product	All Stores
Apples	-0.1036
	(0.2298)
Apple Juice	-0.2769
	(0.3799)
Bananas	-0.1545
	(0.1747)
Bread	-0.0642
	(0.0898)
Butter/Margarine	-0.8192
	(0.2445)
Cereal	-0.1079
	(0.1275)
Chicken Breast	-0.5597
	(0.4402)
Coffee	-0.6548
	(0.4774)
Cookies	-0.4850
	(0.1294)
Eggs	-0.4324
	(0.0995)
Ground Beef	-0.0679
	(0.1637)
Ham	-1.3032
	(0.7580)
Ice Cream	-0.3516
	(0.3053)
Lettuce	-1.6194
	(1.0106)
Milk	-0.2411
	(0.0748)
Potatoes	-0.6406
	(0.2346)
Soda	-0.3756
	(0.1489)
Tomatoes	-0.8157

National Results for Supermarkets

AR(1) IV Results
(Asymptotic Standard Errors)

Product	Supermarkets
Apples	-0.2307
	(0.2233)
Apple Juice	-0.5385
	(0.5104)
Bananas	-0.0437
	(0.1447)
Bread	0.0066
	(0.0890)
Butter/Margarine	-0.6853
	(0.2089)
Cereal	0.0832
	(0.1538)
Chicken Breast	-0.5812
	(0.5352)
Coffee	-0.4763
	(0.6005)
Cookies	-0.4366
	(0.1966)
Eggs	-0.1915
	(0.0922)
Ground Beef	-0.0303
	(0.1538)
Ham	-2.1172
	(1.2448)
Ice Cream	-0.3985
	(0.2895)
Lettuce	-2.4217
	(1.5517)
Milk	-0.1247
	(0.0887)
Potatoes	-0.5092
	(0.2244)
Soda	-0.2728
	(0.1513)
Tomatoes	-0.6956
	(0.4791)

$$CV = e(p_1, p_N, r, u_1) - e(p_0, p_N^*(p_0), r, u_1)$$

$$CV = \left[e(p_1, p_N, r, u_1) - e(p_1, p_N^*(p_1), r, u_1) \right] +$$
$$\left[e(p_1, p_N^*(p_1), r, u_1) - e(p_0, p_N^*(p_1), r, u_1) \right]$$

Parameter Estimates

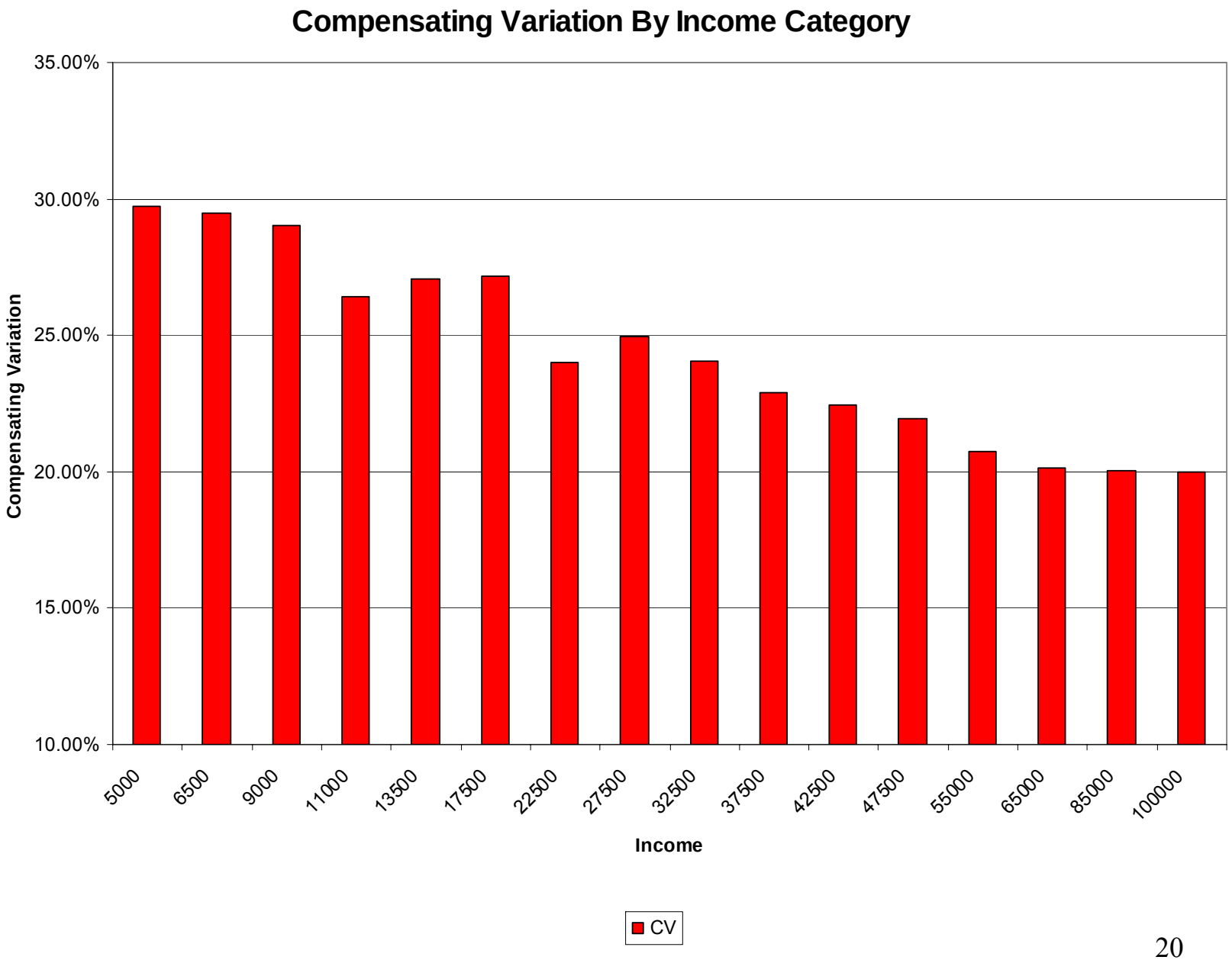
- We estimate the coefficient of the log of the price index ratio the logit model as -0.040 with an asymptotic standard error of (0.014).
  - We also include the market ratio of supercenter expenditure as another variable (which may be jointly endogenous), but we find our estimate of to remain nearly the same with an estimate of -0.035 (0.014).
- We then take each household estimated α and regress and demographic characteristics.

Table 6.2	Coefficient.	Std. Error	t statistic
Log Income	-0.0132	0.0063	-2.0993
Household size	-0.0309	0.0036	-8.6515
married	-0.0387	0.0148	-2.6225
kids	-0.0369	0.0096	-3.8457
nonwhite	0.0595	0.0080	7.4042
male employed	-0.0256	0.0102	-2.5199
female employed	-0.0004	0.0075	-0.0555
male head	-0.0322	0.0166	-1.9419
female head	0.1222	0.0184	-6.6341
male high school	0.0004	0.0089	0.0443
female high school	-0.0198	0.0080	-2.4768
constant	0.7286	0.0638	11.4284

Number of obs	10086
F(11, 10074)	89.23
R-squared	0.0888
Root MSE	0.317

Table 6.1: Exact Percentage Compensating Variation Estimates

	Average	Minimum	Max
Variety Effect	20.2%	9.6%	32.7
Indirect Price Effect	4.8%	1.3%	7.3
Total Effect	25.0%	14.9%	36.6


Compensating Variation By Income Category
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
Compensating Variation
5000
6500
9000
11000
13500
17500
22500
27500
32500
37500
42500
47500
55000
65000
85000
100000
Income
CV

Estimation of an Individual Household Logit Model

- Allow for individual coefficients

$$\min_{\beta_i}\left[\sum_t (y_{it} - \beta_i \tilde{x}_{it})^2 + \lambda(\beta_i - \hat{\beta})^2\right]$$

Table 6.3: Penalized LS Estimation

λ	Ave β	Ave CV
0.2	-0.05	0.153
0.5	-0.04	0.238
1	-0.04	0.285
2	-0.04	0.401
5	-0.04	0.36
100	-0.04	0.224

Conclusion

- Total effect is 25% of food expenditure
- Food expenditure is approximate 15% of total expenditure
- Thus overall get a 3.75% improvement in consumer welfare
- Much of compensating variation goes to low income households
- Large welfare loss created by exclusion of Wal-Mart in local markets