

# Online Appendix for "Running on Empty? Financial Leverage and Product Quality in the Supermarket Industry"

By DAVID A. MATSA

## Economic magnitude of the increase in stockouts

The empirical analysis in the paper finds that, on average, taking on high leverage increases stockouts by about 8 to 9 percent. To put this magnitude in perspective, I construct an estimate of the profit impact of an 8 percent increase in stockouts for the average supermarket firm. The calculation, which is presented in Panel A of Table A1, trades off the benefit of reduced inventory investment for the lost profits from forgone current and future sales. The value of reduced inventory investment equals the decrease in inventories times the cost of carrying inventory, which includes storage, utilities, handling, insurance, taxes, obsolescence, and the cost of capital. On the other hand, more frequent stockouts reduce current sales when customers substitute to lower-value products or cancel their intended purchase of the out-of-stock item. The profit impact of this substitution equals the value of forgone sales (which others have estimated based on surveys of customer substitution patterns) times the gross margin on these products. More frequent stockouts also have a longer-run impact on sales in that the firm is likely to lose customers when its reputation for service deteriorates. Assuming the firm forgoes sales to a lost customer in perpetuity, the profit impact of customer switching equals the value of forgone annual sales times the gross margin divided by the appropriate discount rate for the firm's assets.<sup>1</sup>

The calculation is calibrated using estimates from various industry studies and financial data from the U.S. Internal Revenue Service for a representative sample of public and private supermarket firms. However, the calculation requires two key assumptions for which estimates are not available: (1) the percentage decrease in inventory associated with the increase in stockouts, and (2) the impact of the higher stockout rate on future sales. I proceed by making relatively conservative assumptions for these variables and then examining the sensitivity of the profit-impact estimate to these assumptions. Based on the inventory reductions achieved by Safeway (Magowan 1989, p.12), I assume that firms reduce inventories by 5 percent. I have less basis on which to estimate lost future sales due to the increase in stockouts. I assume that the 8 percent increase in stockouts leads to a 0.1 percent reduction in the customer base; that is, 1 in 1,000 customers are frustrated enough by the extra stockouts that they start shopping elsewhere.

These calculations imply that an 8 percent increase in stockouts would decrease the average

<sup>1</sup>The perpetuity assumption reflects the notion that once a consumer begins shopping at a competing establishment (and invests in learning the format of that store), she is as unlikely to switch back as any other consumer. Assuming instead that a lost customer returns with certainty after 5 years reduces the estimated decrease in the net profit margin to 4.7 percent.

firm's profits by 13 percent. The sensitivity of this estimate to the two key assumptions is shown in Panel B. The estimate is far more sensitive to assumptions regarding the magnitude of forgone future sales than to assumptions regarding the magnitude of the inventory reduction. If the firm loses 5 in 1,000 customers because of the increase in stockouts, its net profit margin would plunge by roughly 70 percent.

The calculation suggests that, for the average supermarket firm, an 8 percent increase in stockouts would increase current period cash flows but would decrease long-run value. The calculation suggests that the benefits of spending less on inventory slightly outweighs the forgone profits from current sales, but the long-run opportunity cost is significantly greater than the short-run benefit. This calculation does not prove that the additional stockouts and degraded product quality associated with high leverage necessarily have negative returns, but it does suggest that consumer demand at a typical supermarket would have to be extremely insensitive to stockouts to make the additional shortfalls profitable in the long run. For example, in the base case, fewer than 1 in 100,000 customers would have to switch stores in response to a 10 percent increase in stockouts for the firm to break even.

#### REFERENCES

- Magowan, Peter A.** 1989. "The Case for LBOs: The Safeway Experience." *California Management Review*, 32: 9-18.

Online Appendix Table A1  
Estimate of Profit Impact of an Eight Percent Increase in Stockouts

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*A. Cost-benefit analysis (as a percentage of sales)*

Benefit: Reduction in inventory investment

$$= \frac{\text{Ratio of inventory to sales (6.4\%)^1}{\times} \frac{\text{Percentage decrease in inventory after buyout (5\%)}}{\times} \frac{\text{Inventory carrying cost (25\%)^2}}{=} = +0.08\%$$

“Short-run” cost: Lost profits from forgone current sales due to increased stockouts (i.e., from customers making product substitutions)

$$= \frac{\text{Percent increase in stockouts after buyout (8\%)}}{\times} \frac{\text{Average change in sales from stockouts (-3.1\%)^3}}{\times} \frac{\text{Gross margin (25\%)^1}}{=} = -0.06 \%$$

“Long-run” cost: Lost profits from forgone future sales due to increased stockouts (i.e., from customers switching primary supermarket)

$$= \frac{\text{Change in customer base due to increased stockouts after buyout (-0.1\%)}}{\times} \frac{\text{Gross margin (25\%)^1}}{\div} \frac{\text{Discount rate (9\%)^4}}{=} = -0.28 \%$$

Overall profit impact

$$\begin{aligned} = \text{Benefit} + \text{“Short-run” cost} + \text{“Long-run” cost} &= -0.26\% \text{ of sales} \\ &= 13.0\% \text{ decrease in net profit margin}^1 \end{aligned}$$

*B. Sensitivity analysis: Decrease in net profit margin*

*Change in customer base due to increased stockouts:*

<i>Decrease in inventory after buyout:</i>	-0.05%	-0.10%	-0.25%	-0.50%
10.0%	2.0	9.0	29.8	64.5
5.0%	6.0	13.0	33.8	68.5
2.5%	8.0	15.0	35.8	70.5
1.0%	9.2	16.2	37.0	71.7

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*Notes:* This table presents an estimate of the net profit loss associated with a 10 percent increase in stockouts for the average supermarket firm. Panel A shows the assumptions behind the calculation, which trades off the benefits of reduced inventory investment with the lost profits from forgone current and future sales due to increased stockouts. Panel B shows the sensitivity of the estimate to two key assumptions in the calculation.

<sup>1</sup> Internal Revenue Service, Corporation Complete Report (Publication 16), 1994

<sup>2</sup> B.L. Brooks, University of Illinois Extension Circular 1063, 1972

<sup>3</sup> Andersen Consulting (1996)

<sup>4</sup> Damodaran Online, Costs of Capital by Industry Sector, 1998