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# AN ANALYSIS OF WAL-MART REFRIGERATED ORANGE JUICE SALES

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# An Analysis of Wal-Mart Refrigerated Orange juice Sales

In this paper, estimates of the impacts of various factors on the refrigerated OJ sales in Wal-Mart (WM) stores are presented. Data on WM stores, as well as grocery stores doing $2 million or greater annual business, across 52 Nielsen city markets (including the remaining U.S.) were studied. Since WM does not have stores in San Diego, this market was omitted. Weekly data for each city from week ending 3/11/06 through 3/01/08 (104 weeks) were included in the analysis. The relationship between WM refrigerated OJ dollar sales per store and 1) WM and $2million store prices, $2 million store promotions, a dummy variable to test whether sales may spike during periods when some consumers receive their paychecks (middle or end of the month), the number of same and new WM stores in the city, and seasonality variables, were studied.

Descriptive statistics of basic variables are provided in Table 1 (across all cities and weeks), and Table 2 (by city). Figure 1 illustrates an important factor of this study, that WM OJ dollar sales are inversely related to $2 million grocery store OJ sales---higher OJ sales in WM stores tend to be associated with lower OJ sales in grocery stores and vice versa. Figures 2 and 3 illustrate the strong seasonality of OJ sales.

## Model

Alternative single equation models, each representing sales across all cities, were estimated. Dummy variables were used to capture city specific impacts. Impacts of prices, promotions and other variables are common across cities. With the cities analyzed having various sizes, a log model specification was used. The impacts of changes in explanatory variables indicate percentage changes in OJ dollar sales, as opposed to dollar changes which may be more city specific.

Formally the basic model can be written as

$$(1)\quad \log(d_{it}) = \alpha_0 + \sum \alpha_i D_{it} + \beta_1 \log(p1_{it}) + \beta_2 \log(p2_{it}) + \beta_3 z1_{it} + \beta_4 z2_{it} + \beta_5 z3_{it} + \beta_6 z4_{it} + \beta_7 x_{it} + \beta_8 \sin_{it} + \beta_9 \cos_{it} + \beta_{10} sn_{it} + \beta_{11} nn_{it},$$

where subscripts i and t stand for the city (i = 1,..., 52) and week (t = 1,..., 104), respectively; d is the level of refrigerated OJ dollar sales per WM store; $D_i$ is a dummy variable for city i ($D_i$=1 if city i, otherwise $D_i$=0); p1 and p2 are OJ prices in the $2 million and WM stores, respectively; z1, z2, z3 and z4 are the percentages of gallons sold in the $2 million stores accompanied with features, displays, features and displays together, and price discounts, respectively; x is the payday dummy (x=1 if a payday week); $\sin_t$ = sine((2*pi*t/52) and $\cos_t$ = cosine(2*pi*t/52) are seasonality variables with pi = 3.141...; and sn and nn are the number of same and new WM stores in the city. The $\alpha$'s and $\beta$'s are coefficients to be estimated.

WM dollar sales were chosen as the dependent variable, as opposed to unit sales, since the latter is not on a single-strength-equivalent (SSE) basis---the units are of various sizes (e.g., quarts, gallons, etc.). Nevertheless, a WM OJ price, defined as total OJ dollar sales divided by total unit sales, was used in the analysis (if each unit size has a relatively constant share of the total units, this price

may be a reasonable approximation).

The coefficient on each of the two log price variables is an elasticity, indicating the percentage change in WM dollar sales for a percentage change in price. Note that if demand is inelastic an increase in price increases OJ dollar sales, while if demand is elastic, an increase in price decreases dollar sales, and vice versa. That is, the WM own-price coefficient is positive if the demand is inelastic and negative if elastic. Moreover, the WM own-price elasticity of demand is the coefficient $\beta_2$ in equation (1) minus 1. Note that the double-log specification of demand, corresponding to equation (1), can be written as $\log(q2) = \alpha + \varepsilon \log(p2)$, where q2 is the WM units per store, $\varepsilon$ is the own-price elasticity of demand, and $\alpha$ stands for all other factors. Adding the term log(p2) to each side of this equation results in $\log(d) = \alpha + (1+\varepsilon) \log(p2)$, given $d = p2q2$ and $\log(d) = \log(p2) + \log(q2)$. This result is the same as equation (1), letting $\beta_2 = (1+\varepsilon)$. Hence, the subtraction of 1 from $\beta_2$ to obtain the elasticity of demand.

An inverse model was also estimated where prices p1 and p2 were replaced by q1 and q2, respectively, with q1 being the $2 million store SSE gallons and again q2 being the WM units per store. Similar to the above derivation of the own-price elasticity, the own-demand flexibility for WM, indicating the percentage change in the WM price for a percentage change in the WM quantity sold, is obtained as the coefficient $\beta_2$ on the log of the WM unit variable minus 1.

## Results

Estimates of equation (1) are shown in Table 3, while estimates of this equation with the price variables replaced by the corresponding quantity variables are shown in Table 4. There are two sets of results in each table. One set includes all the promotional variables as specified in equation (1), while the other set replaces these variables with the variable $z = z1+z2+z3+z4$. That is, z is the overall share of gallons promoted in the $2 million stores.

The coefficient estimates for the city dummy variables indicate various differences in WM OJ sales across cities (Tables 3 and 4). The seasonality coefficient estimates across the regressions in the two tables also reflect the seasonal pattern in WM OJ sales illustrated in Figure 3.

Focusing on the remaining variables, the results in Table 3 are first reviewed. The coefficient on the payday dummy variable indicates that WM OJ dollar sales increase by about 2% during a payday week (Table 3). It should be noted that the payday dummy roughly approximates the period when consumers get their paychecks; it is not known what percentage of the consumers get paid during the periods indicated by the payday dummy. Thus, this variable may be capturing the effects of other unknown collinear variables. Nevertheless, WM sales appear to increase in the middle and end of the month as reflected by this dummy variable.

The coefficient estimates for the numbers of WM stores indicate that increases in the number of same and new stores in a city moderately result in a decline in per-store OJ sales, apparently reflecting some competition between stores.

The own-price coefficient estimates indicate that the WM own-price elasticity is about -.36 to -

39 (the corresponding coefficients in Table 3 minus 1). The cross-price coefficient is positive and significant indicating price competition between WM and $2 million stores---as the price in the $2 million stores increases, WM sales increase, and vice versa. The cross-price impact, however, is not large, indicating that a 10% change in the $2 million store price results in a .5% to .9% change in WM sales.

Additional competition between WM and $2 million stores is reflected by the coefficient estimates for some, but not all, of the promotional variables. $2 million store price discounts ($z_4$) and promotions in general (z) have negative impacts on WM OJ sales. Based on the individual promotional tactic estimates in Table 3, Regression 2, price discounts in $2 million stores reduce WM sales by about 9%. On the other hand, the coefficients for deals and features are positive, suggesting possible generic effects. The coefficient for features, however, is insignificant, but those for deals and deals and features together are significant. Overall, competitive and generic promotions together as captured by variable z (Regression 1 in Table 3) result in a 3% decrease in WM OJ sales.

Treating prices as exogenous, as in the Table 3, is consistent with the view that prices in a week are fixed and consumers can purchase as much as desired at the given prices. Alternatively, to examine the robustness of the findings, we treat quantities as exogenous, replacing prices by quantities in equation (1). Estimates for this specification are provided in Table 4. These results are not meant to replace those in Table 3, given the assumption that quantities are exogenous is not acceptable; the alternative estimates are simply provided to examine the robustness of the findings. In Table 4, the coefficient estimates on gallon sales in $2 million stores are negative directly indicating competition, while those on the WM quantity are positive indicating a flexibility of -.12 (.88-1)---a 1.2% change in the WM price in response to a 10% change in the WM units. Generally, the promotional variables have similar impacts as shown in Table 3. The overall promotion coefficient is negative indicating competition. The results for features alone, and features and displays together are similar to those in Table 3, but displays alone now have a negative impact. The seasonality estimates in Table 4 are similar to those in Table3, but the payday coefficient in Table 4 is now negative and the numbers of same and new WM stores now have positive impacts. Overall, the results of Tables 3 and 4 indicate a general robustness in findings, particularly those reflecting competition between $2 million and WM stores.

Assuming the treatment of prices as exogenous is more accurate than that of treating quantities as exogenous, the findings of this study are summarized by focusing on the results in Table 3. First, WM refrigerated OJ demand was found to be relatively price inelastic with an own-price elasticity in the range of -.36 to -39. Second, the cross-price elasticity, with respect to the $2 million store price for OJ, although not large, is significantly different from zero and positive indicating price competition between stores. Third, additional competition was found to occur through promotions in the $2 million stores. Price discounts were estimated to reduce WM OJ sales by about 9%. It appears, however, that some promotions may have a generic impact. Overall across tactics, $2 million store OJ promotions were found to reduce WM sales by about 3%. Other results indicate that OJ sales increase by about 2% during payday periods, increasing the number of WM stores in a city may slightly reduce per-store OJ sales, and sales over time are subject to seasonality.

Table 1. Descriptive Statistics, across 52 Cities including remaining U.S. (excludes San Diego), 3/11/06 through 3/01/08.

| Variable | N | Mean | Std Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| $2 Mil. Refrig. OJ SSE Ga. Sales | 5408 | 173,890 | 237,181 | 22,704 | 1,937,971 |
| $2 Mil. Refrig. OJ $ Sales | 5408 | 990,876 | 1,333,475 | 136,918 | 10,237,448 |
| Wal-Mart Refrig. OJ Unit Sales | 5408 | 57,461 | 128,275 | 1,813 | 1,122,059 |
| Wal-Mart Refrig. OJ $ Sales | 5408 | 4,161 | 1,545 | 1,211 | 10,818 |
| $2 Mil. Refrig. $/SSE Ga. | 5408 | 5.67 | 0.69 | 3.61 | 7.81 |
| Wal-Mart Refrig. $/Unit | 5408 | 3.05 | 0.33 | 2.43 | 3.78 |
| $2 Mil. SSE Ga. Sales W Promo | 5408 | 88,043 | 126,049 | 3,082 | 1,005,838 |
| $2 Mil. SSE Ga. Sales W Feature | 5408 | 43,691 | 74,176 | 260 | 659,112 |
| $2 Mil. SSE Ga. Sales W Display | 5408 | 4,065 | 6,423 | - | 59,784 |
| $2 Mil. SSE Ga. Sales W Feature & Display | 5408 | 9,240 | 12,773 | - | 100,420 |
| $2 Mil. SSE Ga. Sales W Price Discount | 5408 | 31,046 | 43,346 | 808 | 405,974 |
| Number of Wal-Mart Stores | 5408 | 44.95 | 109.34 | 2.00 | 827.00 |
| Number of Wal-Mart Same Stores | 5408 | 43.83 | 109.36 | 2.00 | 827.00 |
| Number of Wal-Mart New Stores | 5408 | 1.13 | 2.11 | 0.00 | 14.00 |
| Payday (1=payday; else 0) | 5408 | 0.46 | 0.50 | 0.00 | 1.00 |

Table 2. Sample Means, by 52 City including remaining U.S. (excludes San Diego), 3/11/06 through 3/01/08.

| | $2 Mil. Refrig. OJ | | | | | | Wal-Mart Refrig. OJ Sales | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| City | OJ SSE Ga. Sales | OJ $ Sales | Feature SSE Ga. | Display SSE Ga. | Feature & Display SSE Ga. | Price Discount SSE Ga. | Same Store $ Sales | Same Store Unit Sales | New Store $ Sales | New Store Unit Sales | No. of Same Stores | No. of New Stores |
| ALBANY | 80493 | 446273 | 20773 | 3839 | 7405 | 10559 | 63122 | 20755 | 1760 | 537 | 11 | 1 |
| ATLANTA | 183582 | 1014043 | 36138 | 2232 | 1950 | 27250 | 287274 | 96102 | 25582 | 8223 | 67 | 9 |
| BALTIMORE | 123007 | 718629 | 28256 | 5114 | 17467 | 23683 | 13191 | 4357 | 722 | 223 | 4 | 0 |
| BIRMINGHAM | 66028 | 345771 | 7796 | 553 | 321 | 7176 | 217671 | 74785 | 6238 | 1989 | 58 | 3 |
| BOSTON | 424005 | 2388935 | 109626 | 10798 | 22976 | 74042 | 56065 | 18166 | 1807 | 539 | 13 | 1 |
| BUFFALO/ROCHESTER | 119868 | 627412 | 18679 | 4457 | 11737 | 10773 | 52397 | 18339 | 4223 | 1360 | 13 | 2 |
| CHARLOTTE | 79927 | 451469 | 13377 | 4102 | 7699 | 14026 | 98946 | 34271 | 8626 | 2881 | 24 | 3 |
| CHICAGO | 316257 | 1780926 | 78763 | 26345 | 42084 | 83998 | 27956 | 8836 | 10667 | 3218 | 8 | 4 |
| CINCINNATI | 119092 | 610664 | 27296 | 2284 | 5928 | 22374 | 67241 | 21790 | 5821 | 1817 | 29 | 4 |
| CLEVELAND | 154786 | 851823 | 30872 | 7027 | 16797 | 17914 | 83925 | 27954 | 7286 | 2273 | 26 | 4 |
| COLUMBUS | 78974 | 398510 | 17137 | 3744 | 4664 | 11892 | 90795 | 29910 | 5089 | 1571 | 28 | 3 |
| DALLAS/FT. WORTH | 129522 | 710488 | 24289 | 3103 | 4422 | 26754 | 359397 | 113095 | 13499 | 3996 | 81 | 5 |
| DENVER | 118677 | 721098 | 21706 | 2887 | 5894 | 31941 | 149837 | 46715 | 8985 | 2650 | 39 | 5 |
| DES MOINES | 32487 | 170360 | 3184 | 1398 | 488 | 4872 | 37981 | 12579 | 2158 | 698 | 15 | 1 |
| DETROIT | 217191 | 1161696 | 52759 | 5849 | 16510 | 32467 | 47473 | 15574 | 4120 | 1344 | 23 | 3 |
| GRAND RAPIDS | 78836 | 420309 | 25827 | 876 | 6278 | 10351 | 51979 | 17251 | 2148 | 701 | 20 | 2 |
| HARTFORD/NEW HAVEN | 140312 | 821237 | 55054 | 1688 | 16934 | 26139 | 33372 | 11014 | 0 | 0 | 6 | 0 |
| HOUSTON | 152188 | 793928 | 23032 | 2248 | 3220 | 28453 | 243035 | 78818 | 6437 | 2048 | 57 | 3 |
| INDIANAPOLIS | 92125 | 487120 | 19427 | 1118 | 3235 | 20177 | 142629 | 45845 | 13111 | 4105 | 36 | 5 |
| JACKSONVILLE | 56427 | 327853 | 13023 | 728 | 705 | 7938 | 78497 | 26864 | 6927 | 2274 | 20 | 2 |
| KANSAS CITY | 64824 | 357293 | 10471 | 2355 | 2413 | 7913 | 103947 | 33034 | 5061 | 1486 | 32 | 0 |
| LAS VEGAS | 52608 | 296920 | 12162 | 351 | 1014 | 12091 | 58473 | 18308 | 8200 | 2371 | 10 | 0 |
| LITTLE ROCK | 31392 | 165040 | 6236 | 245 | 296 | 5100 | 131592 | 42718 | 0 | 0 | 39 | 0 |
| LOS ANGELES | 498307 | 2971374 | 114022 | 4142 | 11198 | 118055 | 41101 | 13011 | 11185 | 3387 | 11 | 0 |
| LOUISVILLE | 71712 | 357708 | 11755 | 2339 | 4355 | 9848 | 122070 | 40786 | 2719 | 820 | 36 | 0 |
| MEMPHIS | 48880 | 251673 | 8011 | 509 | 481 | 8907 | 140115 | 47151 | 0 | 0 | 47 | 0 |
| MIAMI | 267340 | 1640853 | 66494 | 1135 | 1040 | 37361 | 153961 | 51662 | 18266 | 5822 | 19 | 0 |
| MILWAUKEE | 80006 | 446584 | 15770 | 4170 | 11352 | 12882 | 44982 | 14362 | 0 | 0 | 12 | 0 |
| MINNEAPOLIS | 128560 | 742045 | 23456 | 6027 | 13601 | 24368 | 54642 | 17412 | 1776 | 525 | 21 | 0 |
| NASHVILLE | 77284 | 400891 | 10645 | 2802 | 4707 | 10157 | 164335 | 53965 | 2035 | 598 | 47 | 0 |

Table 2 cont'd.

| City | $2 Mil. Refrig. OJ | | | | | | Wal-Mart Refrig. OJ Sales | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OJ SSE Ga. Sales | OJ $ Sales | Feature SSE Ga. | Display SSE Ga. | Feature & Display SSE Ga. | Price Discount SSE Ga. | Same Store $ Sales | Same Store Unit Sales | New Store $ Sales | New Store Unit Sales | No. of Same Stores | No. of New Stores |
| NEW ORLEANS/MOBILE | 79304 | 459479 | 10032 | 1220 | 1253 | 13210 | 309141 | 101473 | 3150 | 961 | 63 | 0 |
| NEW YORK | 793032 | 4763044 | 418111 | 4359 | 37029 | 130160 | 20965 | 6730 | 0 | 0 | 3 | 0 |
| OKLAHOMA CITY/TULSA | 59573 | 341149 | 12153 | 407 | 705 | 8307 | 176308 | 56131 | 3082 | 969 | 57 | 0 |
| OMAHA | 39661 | 188220 | 7417 | 917 | 933 | 5566 | 57364 | 18589 | 1183 | 346 | 15 | 0 |
| ORLANDO | 111471 | 657428 | 27716 | 1101 | 1491 | 14977 | 261792 | 91806 | 6160 | 1988 | 36 | 0 |
| PHILADELPHIA | 372504 | 2081969 | 140458 | 4499 | 31560 | 54485 | 92425 | 31035 | 2533 | 802 | 16 | 0 |
| PHOENIX | 162005 | 956390 | 39467 | 2238 | 4889 | 41158 | 180733 | 57304 | 13678 | 4016 | 47 | 0 |
| PITTSBURGH | 131810 | 717171 | 26074 | 8450 | 12551 | 15551 | 173440 | 58142 | 3089 | 978 | 39 | 0 |
| PORTLAND | 97861 | 613066 | 25418 | 3260 | 5368 | 25045 | 28815 | 9455 | 0 | 0 | 11 | 0 |
| RALEIGH/DURHAM | 127170 | 724002 | 21260 | 4965 | 9361 | 24849 | 192242 | 66668 | 11073 | 3744 | 46 | 0 |
| RICHMOND/NORFOLK | 113734 | 656228 | 21287 | 3440 | 5553 | 17834 | 201503 | 68876 | 6772 | 2178 | 34 | 0 |
| SACRAMENTO | 94543 | 598891 | 26367 | 2009 | 4796 | 19169 | 20301 | 6833 | 6617 | 2155 | 4 | 0 |
| ST. LOUIS | 96749 | 551231 | 16039 | 4031 | 8881 | 18706 | 95207 | 31045 | 0 | 0 | 34 | 0 |
| SALT LAKE CITY/BOISE | 81891 | 465429 | 17561 | 1561 | 1954 | 14129 | 148205 | 47543 | 4756 | 1410 | 41 | 0 |
| SAN ANTONIO | 124366 | 592073 | 17318 | 1381 | 1441 | 11750 | 112429 | 37367 | 5870 | 1853 | 38 | 0 |
| SAN FRANCISCO | 211246 | 1480592 | 60058 | 2934 | 7627 | 65391 | 8028 | 2429 | 0 | 0 | 3 | 0 |
| SEATTLE | 123617 | 790121 | 30328 | 3897 | 7355 | 36350 | 23307 | 7298 | 3321 | 978 | 8 | 0 |
| SYRACUSE | 78782 | 426879 | 17381 | 1402 | 2733 | 8765 | 71298 | 24428 | 0 | 0 | 17 | 0 |
| TAMPA | 187223 | 1138847 | 42334 | 1465 | 1329 | 24949 | 258076 | 89565 | 16086 | 5431 | 44 | 0 |
| WASHINGTON D.C. | 275668 | 1650960 | 69765 | 7243 | 23614 | 58724 | 116326 | 39099 | 5101 | 1619 | 23 | 0 |
| WEST TEXAS | 29650 | 174074 | 3199 | 205 | 650 | 6400 | 142189 | 44674 | 3642 | 1078 | 34 | 0 |
| REMAINING U.S. | 1565714 | 8619388 | 316167 | 35932 | 62256 | 259467 | 2796596 | 926660 | 68635 | 21445 | 814 | 0 |

**Figure 1. Dollar Sales: Wal-Mart Vs. $2 Million, By City**

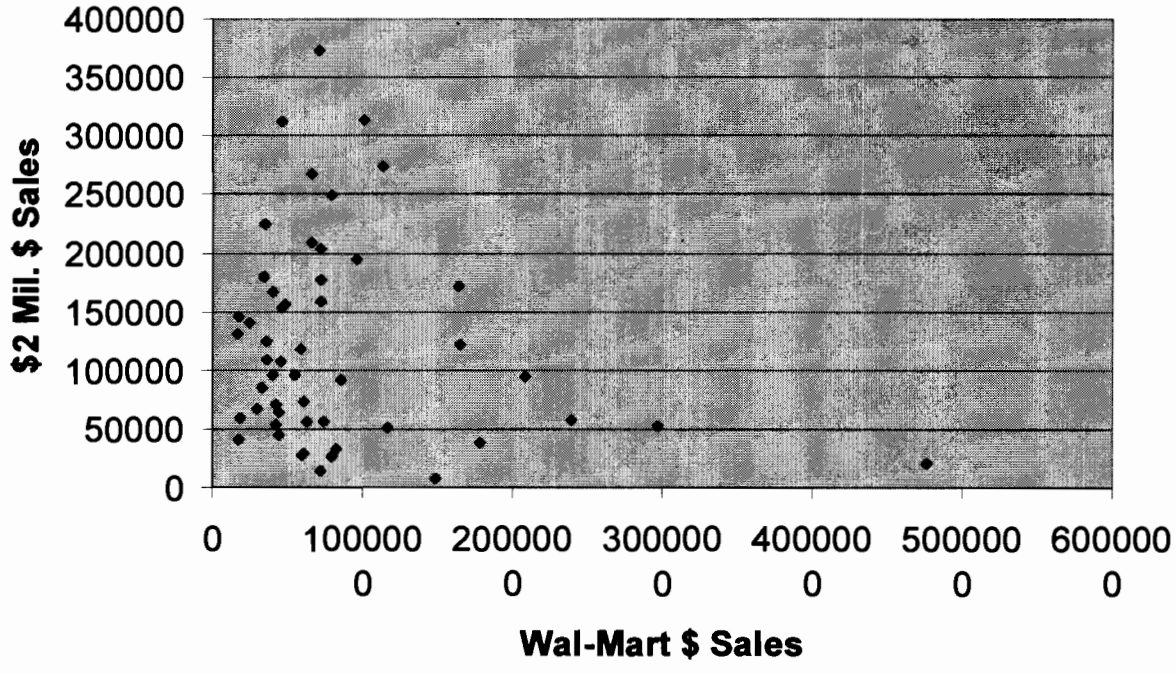

**Figure 2. $2Mil. Store OJ Dollar Sales, By Week (All Cities)**

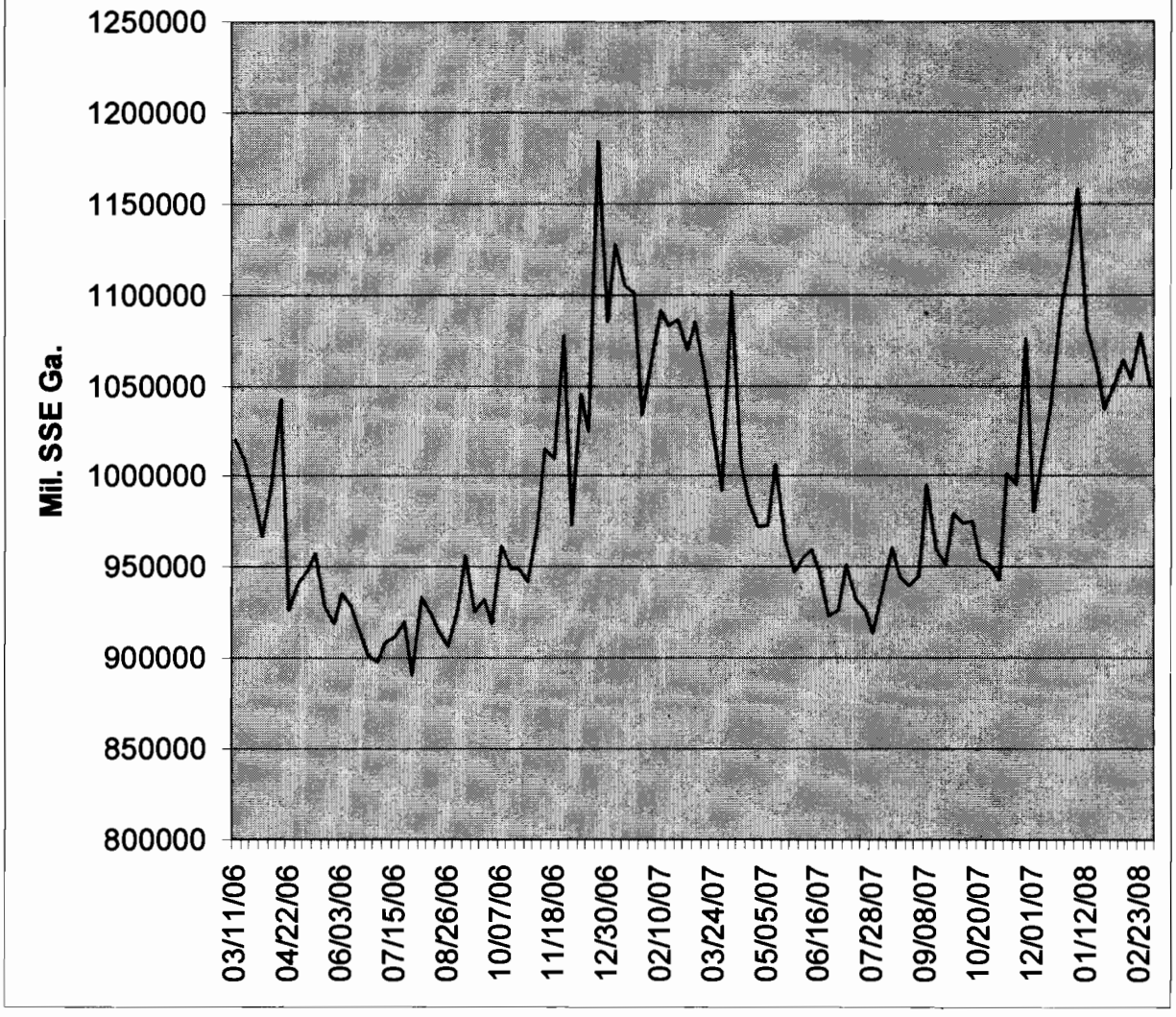

**Figure 3. Wal-Mart OJ Dollar Sales, By Week (All Cities)**

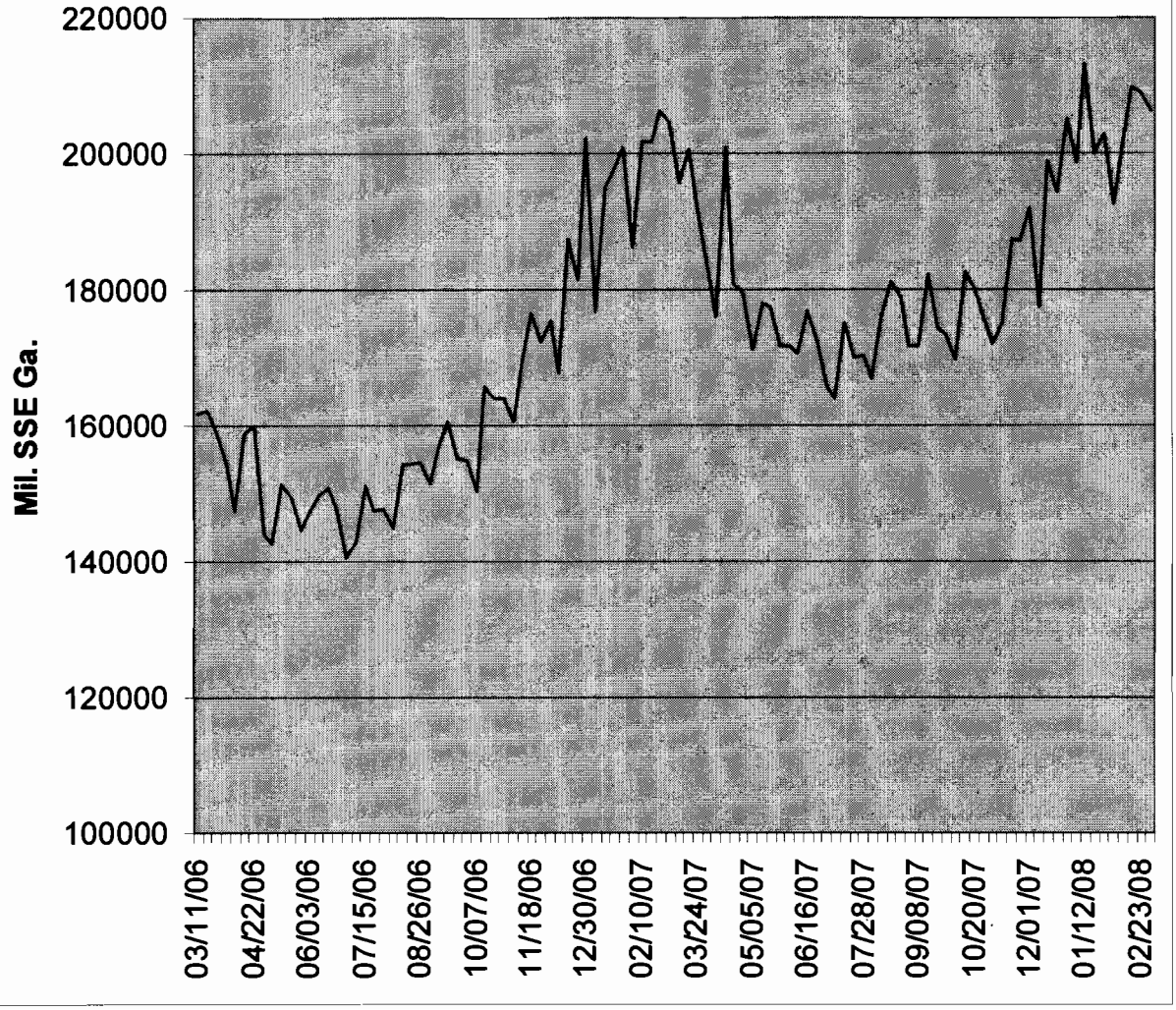

Table 3. OLS Regression Estimates for Direct Demand Revenue Specification: Based on 52 Cities (Incl. Remaining U.S.) times 104 observations per city—5408 total observations.

Dependent Variable: Log of Wal-Mart Dollar Sales Per Store: (same + new store $ sales)/(number of same stores + number of same stores)

| | Regression 1 | | | | Regression 2 | | | |
|---|---|---|---|---|---|---|---|---|
| Independent Variable | Parameter Est. | Standard Error | t Value | Pr > \|t\| | Parameter Est. | Standard Error | t Value | Pr > \|t\| |
| Intercept (Remaining U.S) | 12.4112 | 1.0234 | 12.130 | <.0001 | 12.3585 | 1.0210 | 12.100 | <.0001 |
| city1 | -4.5108 | 1.0120 | -4.460 | <.0001 | -4.5229 | 1.0096 | -4.480 | <.0001 |
| city2 | -4.3848 | 0.9410 | -4.660 | <.0001 | -4.3750 | 0.9387 | -4.660 | <.0001 |
| city3 | -5.1531 | 1.0209 | -5.050 | <.0001 | -5.1684 | 1.0185 | -5.070 | <.0001 |
| city4 | -4.5925 | 0.9520 | -4.820 | <.0001 | -4.5809 | 0.9497 | -4.820 | <.0001 |
| city5 | -4.7869 | 1.0095 | -4.740 | <.0001 | -4.7883 | 1.0071 | -4.750 | <.0001 |
| city6 | -4.8560 | 1.0092 | -4.810 | <.0001 | -4.8646 | 1.0068 | -4.830 | <.0001 |
| city7 | -4.7264 | 0.9952 | -4.750 | <.0001 | -4.7350 | 0.9928 | -4.770 | <.0001 |
| city8 | -5.0655 | 1.0157 | -4.990 | <.0001 | -5.0792 | 1.0133 | -5.010 | <.0001 |
| city9 | -5.3009 | 0.9890 | -5.360 | <.0001 | -5.2934 | 0.9866 | -5.370 | <.0001 |
| city10 | -4.9891 | 0.9927 | -5.030 | <.0001 | -5.0007 | 0.9903 | -5.050 | <.0001 |
| city11 | -4.9591 | 0.9904 | -5.010 | <.0001 | -4.9595 | 0.9880 | -5.020 | <.0001 |
| city12 | -4.3191 | 0.9233 | -4.680 | <.0001 | -4.3095 | 0.9211 | -4.680 | <.0001 |
| city13 | -4.7667 | 0.9766 | -4.880 | <.0001 | -4.7589 | 0.9742 | -4.880 | <.0001 |
| city14 | -5.2718 | 1.0072 | -5.230 | <.0001 | -5.2628 | 1.0048 | -5.240 | <.0001 |
| city15 | -5.4622 | 0.9967 | -5.480 | <.0001 | -5.4654 | 0.9943 | -5.500 | <.0001 |
| city16 | -5.2500 | 1.0005 | -5.250 | <.0001 | -5.2556 | 0.9980 | -5.270 | <.0001 |
| city17 | -4.5408 | 1.0185 | -4.460 | <.0001 | -4.5558 | 1.0160 | -4.480 | <.0001 |
| city18 | -4.4979 | 0.9539 | -4.720 | <.0001 | -4.4841 | 0.9516 | -4.710 | <.0001 |
| city19 | -4.7165 | 0.9799 | -4.810 | <.0001 | -4.7045 | 0.9775 | -4.810 | <.0001 |
| city20 | -4.7960 | 1.0004 | -4.790 | <.0001 | -4.7932 | 0.9979 | -4.800 | <.0001 |
| city21 | -4.9122 | 0.9852 | -4.990 | <.0001 | -4.9108 | 0.9828 | -5.000 | <.0001 |
| city22 | -4.3463 | 1.0138 | -4.290 | <.0001 | -4.3345 | 1.0113 | -4.290 | <.0001 |
| city23 | -4.8496 | 0.9767 | -4.970 | <.0001 | -4.8381 | 0.9743 | -4.970 | <.0001 |
| city24 | -4.7211 | 1.0122 | -4.660 | <.0001 | -4.7127 | 1.0097 | -4.670 | <.0001 |
| city25 | -4.8153 | 0.9808 | -4.910 | <.0001 | -4.8121 | 0.9784 | -4.920 | <.0001 |
| city26 | -4.8993 | 0.9667 | -5.070 | <.0001 | -4.8857 | 0.9644 | -5.070 | <.0001 |
| city27 | -3.9739 | 1.0021 | -3.970 | <.0001 | -3.9718 | 0.9996 | -3.970 | <.0001 |
| city28 | -4.9228 | 1.0108 | -4.870 | <.0001 | -4.9377 | 1.0084 | -4.900 | <.0001 |
| city29 | -5.2194 | 0.9991 | -5.220 | <.0001 | -5.2271 | 0.9967 | -5.240 | <.0001 |
| city30 | -4.7495 | 0.9663 | -4.920 | <.0001 | -4.7483 | 0.9640 | -4.930 | <.0001 |
| city31 | -4.3116 | 0.9470 | -4.550 | <.0001 | -4.3032 | 0.9447 | -4.560 | <.0001 |
| city32 | -4.3475 | 1.0223 | -4.250 | <.0001 | -4.3589 | 1.0198 | -4.270 | <.0001 |
| city33 | -4.8312 | 0.9538 | -5.070 | <.0001 | -4.8243 | 0.9515 | -5.070 | <.0001 |
| city34 | -4.8522 | 1.0069 | -4.820 | <.0001 | -4.8409 | 1.0044 | -4.820 | <.0001 |
| city35 | -4.0316 | 0.9805 | -4.110 | <.0001 | -4.0316 | 0.9781 | -4.120 | <.0001 |
| city36 | -4.4095 | 1.0056 | -4.390 | <.0001 | -4.4202 | 1.0031 | -4.410 | <.0001 |
| city37 | -4.6088 | 0.9674 | -4.760 | <.0001 | -4.6011 | 0.9651 | -4.770 | <.0001 |
| city38 | -4.5331 | 0.9768 | -4.640 | <.0001 | -4.5465 | 0.9745 | -4.670 | <.0001 |

Table 3 cont'd.

| | Regression 1 | | | | Regression 2 | | | |
|---|---|---|---|---|---|---|---|---|
| Independent Variable | Parameter Est. | Standard Error | t Value | Pr > \|t\| | Parameter Est. | Standard Error | t Value | Pr > \|t\| |
| city39 | -5.2484 | 1.0126 | -5.180 | <.0001 | -5.2514 | 1.0101 | -5.200 | <.0001 |
| city40 | -4.4986 | 0.9678 | -4.650 | <.0001 | -4.5023 | 0.9655 | -4.660 | <.0001 |
| city41 | -4.2561 | 0.9831 | -4.330 | <.0001 | -4.2581 | 0.9807 | -4.340 | <.0001 |
| city42 | -4.3714 | 1.0210 | -4.280 | <.0001 | -4.3770 | 1.0185 | -4.300 | <.0001 |
| city43 | -5.0681 | 0.9830 | -5.160 | <.0001 | -5.0730 | 0.9806 | -5.170 | <.0001 |
| city44 | -4.7480 | 0.9743 | -4.870 | <.0001 | -4.7428 | 0.9719 | -4.880 | <.0001 |
| city45 | -4.9201 | 0.9779 | -5.030 | <.0001 | -4.9070 | 0.9755 | -5.030 | <.0001 |
| city46 | -5.2434 | 1.0229 | -5.130 | <.0001 | -5.2409 | 1.0204 | -5.140 | <.0001 |
| city47 | -5.0914 | 1.0161 | -5.010 | <.0001 | -5.0912 | 1.0136 | -5.020 | <.0001 |
| city48 | -4.7451 | 1.0041 | -4.730 | <.0001 | -4.7451 | 1.0017 | -4.740 | <.0001 |
| city49 | -4.1723 | 0.9704 | -4.300 | <.0001 | -4.1712 | 0.9680 | -4.310 | <.0001 |
| city50 | -4.4809 | 0.9970 | -4.490 | <.0001 | -4.4875 | 0.9946 | -4.510 | <.0001 |
| city51 | -4.6694 | 0.9832 | -4.750 | <.0001 | -4.6557 | 0.9808 | -4.750 | <.0001 |
| Log $2 Mil. Price | 0.0511 | 0.0359 | 1.430 | 0.1541 | 0.0938 | 0.0366 | 2.560 | 0.01 |
| Log WM Price | 0.6373 | 0.0317 | 20.120 | <.0001 | 0.6091 | 0.0320 | 19.010 | <.0001 |
| Promo Share of $2 Mil. Ga. | -0.0301 | 0.0183 | -1.650 | 0.0996 | | | | |
| Features Share of $2 Mil. Ga. | | | | | 0.0119 | 0.0234 | 0.510 | 0.61 |
| Display Share of $2 Mil. Ga. | | | | | 0.1316 | 0.0808 | 1.630 | 0.10 |
| Fea./Disp. Sh. of $2 Mil. Ga. | | | | | 0.1018 | 0.0487 | 2.090 | 0.04 |
| Disc. Share of $2 Mil. Ga. | | | | | -0.0912 | 0.0220 | -4.140 | <.0001 |
| Pay Day | 0.0187 | 0.0023 | 8.270 | <.0001 | 0.0200 | 0.0023 | 8.810 | <.0001 |
| Sine (seasonality | -0.0697 | 0.0017 | -41.850 | <.0001 | -0.0707 | 0.0017 | -41.920 | <.0001 |
| Cosine (seasonality) | 0.0619 | 0.0017 | 37.340 | <.0001 | 0.0620 | 0.0017 | 37.410 | <.0001 |
| Number of Same Stores | -0.0062 | 0.0013 | -4.910 | <.0001 | -0.0062 | 0.0013 | -4.920 | <.0001 |
| Number of New Stores | -0.0084 | 0.0013 | -6.260 | <.0001 | -0.0087 | 0.0013 | -6.490 | <.0001 |
| R-Square | 0.9441 | | | | R-Square | 0.9444 | | |

Table 4. OLS Regression Estimates for Inverse Demand Revenue Specification: Based on 52 Cities (Incl. Remaining U.S.) times 104 observations per city—5408 total observations.

Dependent Variable: Log of Wal-Mart Dollar Sales Per Store: (same + new store $ sales)/(number of same stores + number of same stores)

| | Regression 3 | | | | Regression 4 | | | |
|---|---|---|---|---|---|---|---|---|
| Independent Variable | Parameter Est. | Standard Error | t Value | Pr > \|t\| | Parameter Est. | Standard Error | t Value | Pr > \|t\| |
| Intercept (Remaining U.S) | 5.9114 | 0.8167 | 7.240 | <.0001 | 6.1989 | 0.8124 | 7.630 | <.0001 |
| city1 | 3.0551 | 0.7759 | 3.940 | <.0001 | 2.9343 | 0.7709 | 3.810 | 0.000 |
| city2 | 3.0172 | 0.7207 | 4.190 | <.0001 | 2.9216 | 0.7161 | 4.080 | <.0001 |
| city3 | 3.2837 | 0.7824 | 4.200 | <.0001 | 3.1649 | 0.7774 | 4.070 | <.0001 |
| city4 | 2.5147 | 0.7307 | 3.440 | 0.001 | 2.4023 | 0.7260 | 3.310 | 0.001 |
| city5 | 4.0537 | 0.7718 | 5.250 | <.0001 | 3.9605 | 0.7668 | 5.160 | <.0001 |
| city6 | 3.1502 | 0.7735 | 4.070 | <.0001 | 3.0338 | 0.7685 | 3.950 | <.0001 |
| city7 | 2.8282 | 0.7633 | 3.710 | 0.000 | 2.7145 | 0.7584 | 3.580 | 0.000 |
| city8 | 3.8330 | 0.7771 | 4.930 | <.0001 | 3.7419 | 0.7721 | 4.850 | <.0001 |
| city9 | 3.0220 | 0.7585 | 3.980 | <.0001 | 2.9133 | 0.7536 | 3.870 | 0.000 |
| city10 | 3.2199 | 0.7606 | 4.230 | <.0001 | 3.1086 | 0.7558 | 4.110 | <.0001 |
| city11 | 2.8286 | 0.7598 | 3.720 | 0.000 | 2.7157 | 0.7550 | 3.600 | 0.000 |
| city12 | 2.8430 | 0.7077 | 4.020 | <.0001 | 2.7456 | 0.7032 | 3.900 | <.0001 |
| city13 | 3.0438 | 0.7485 | 4.070 | <.0001 | 2.9431 | 0.7437 | 3.960 | <.0001 |
| city14 | 2.3517 | 0.7741 | 3.040 | 0.002 | 2.2328 | 0.7692 | 2.900 | 0.004 |
| city15 | 3.4282 | 0.7635 | 4.490 | <.0001 | 3.3226 | 0.7586 | 4.380 | <.0001 |
| city16 | 2.8526 | 0.7677 | 3.720 | 0.000 | 2.7240 | 0.7628 | 3.570 | 0.000 |
| city17 | 3.4427 | 0.7799 | 4.410 | <.0001 | 3.3170 | 0.7749 | 4.280 | <.0001 |
| city18 | 3.1161 | 0.7308 | 4.260 | <.0001 | 3.0186 | 0.7261 | 4.160 | <.0001 |
| city19 | 2.8747 | 0.7515 | 3.830 | 0.000 | 2.7654 | 0.7467 | 3.700 | 0.000 |
| city20 | 2.6660 | 0.7677 | 3.470 | 0.001 | 2.5455 | 0.7628 | 3.340 | 0.001 |
| city21 | 2.7722 | 0.7560 | 3.670 | 0.000 | 2.6573 | 0.7512 | 3.540 | 0.000 |
| city22 | 2.8838 | 0.7777 | 3.710 | 0.000 | 2.7641 | 0.7727 | 3.580 | 0.000 |
| city23 | 2.2577 | 0.7508 | 3.010 | 0.003 | 2.1315 | 0.7460 | 2.860 | 0.004 |
| city24 | 4.2080 | 0.7735 | 5.440 | <.0001 | 4.1222 | 0.7685 | 5.360 | <.0001 |
| city25 | 2.7731 | 0.7526 | 3.680 | 0.000 | 2.6577 | 0.7478 | 3.550 | 0.000 |
| city26 | 2.4417 | 0.7425 | 3.290 | 0.001 | 2.3254 | 0.7378 | 3.150 | 0.002 |
| city27 | 3.8075 | 0.7661 | 4.970 | <.0001 | 3.7086 | 0.7612 | 4.870 | <.0001 |
| city28 | 3.0300 | 0.7752 | 3.910 | <.0001 | 2.9065 | 0.7703 | 3.770 | 0.000 |
| city29 | 3.2289 | 0.7658 | 4.220 | <.0001 | 3.1196 | 0.7609 | 4.100 | <.0001 |
| city30 | 2.7661 | 0.7414 | 3.730 | 0.000 | 2.6535 | 0.7366 | 3.600 | 0.000 |
| city31 | 2.7348 | 0.7263 | 3.770 | 0.000 | 2.6280 | 0.7216 | 3.640 | 0.000 |
| city32 | 4.5951 | 0.7803 | 5.890 | <.0001 | 4.4972 | 0.7753 | 5.800 | <.0001 |
| city33 | 2.5548 | 0.7323 | 3.490 | 0.001 | 2.4378 | 0.7276 | 3.350 | 0.001 |
| city34 | 2.5685 | 0.7733 | 3.320 | 0.001 | 2.4442 | 0.7684 | 3.180 | 0.002 |
| city35 | 3.0972 | 0.7511 | 4.120 | <.0001 | 2.9861 | 0.7463 | 4.000 | <.0001 |
| city36 | 3.9817 | 0.7687 | 5.180 | <.0001 | 3.8743 | 0.7638 | 5.070 | <.0001 |
| city37 | 3.2894 | 0.7409 | 4.440 | <.0001 | 3.1907 | 0.7362 | 4.330 | <.0001 |
| city38 | 3.1623 | 0.7484 | 4.230 | <.0001 | 3.0547 | 0.7437 | 4.110 | <.0001 |

Table 4 cont'd.

| | Regression 1 | | | | Regression 2 | | | |
|---|---|---|---|---|---|---|---|---|
| Independent Variable | Parameter Est. | Standard Error | t Value | Pr > \|t\| | Parameter Est. | Standard Error | t Value | Pr > \|t\| |
| city39 | 3.1016 | 0.7764 | 4.000 | <.0001 | 2.9920 | 0.7714 | 3.880 | 0.000 |
| city40 | 3.0641 | 0.7416 | 4.130 | <.0001 | 2.9602 | 0.7369 | 4.020 | <.0001 |
| city41 | 3.1205 | 0.7531 | 4.140 | <.0001 | 3.0124 | 0.7483 | 4.030 | <.0001 |
| city42 | 3.2053 | 0.7823 | 4.100 | <.0001 | 3.0893 | 0.7772 | 3.970 | <.0001 |
| city43 | 2.9664 | 0.7538 | 3.940 | <.0001 | 2.8553 | 0.7490 | 3.810 | 0.000 |
| city44 | 2.8718 | 0.7473 | 3.840 | 0.000 | 2.7606 | 0.7425 | 3.720 | 0.000 |
| city45 | 3.0984 | 0.7496 | 4.130 | <.0001 | 2.9913 | 0.7448 | 4.020 | <.0001 |
| city46 | 3.7137 | 0.7830 | 4.740 | <.0001 | 3.6159 | 0.7779 | 4.650 | <.0001 |
| city47 | 3.3305 | 0.7785 | 4.280 | <.0001 | 3.2259 | 0.7735 | 4.170 | <.0001 |
| city48 | 2.9422 | 0.7701 | 3.820 | 0.000 | 2.8229 | 0.7651 | 3.690 | 0.000 |
| city49 | 3.3576 | 0.7427 | 4.520 | <.0001 | 3.2563 | 0.7379 | 4.410 | <.0001 |
| city50 | 3.7387 | 0.7626 | 4.900 | <.0001 | 3.6383 | 0.7577 | 4.800 | <.0001 |
| city51 | 2.3158 | 0.7555 | 3.070 | 0.002 | 2.1929 | 0.7507 | 2.920 | 0.004 |
| Log $2 Mil. Ga. | -0.6237 | 0.0109 | -57.040 | <.0001 | -0.6386 | 0.0111 | -57.540 | <.0001 |
| Log WM Units Per Store | 0.8824 | 0.0104 | 84.490 | <.0001 | 0.8821 | 0.0104 | 84.980 | <.0001 |
| Promo Share of $2 Mil. Ga. | -0.0097 | 0.0133 | -0.730 | 0.465 | | | | |
| Features Share of $2 Mil. Ga. | | | | | 0.0264 | 0.0174 | 1.520 | 0.128 |
| Display Share of $2 Mil. Ga. | | | | | -0.2022 | 0.0609 | -3.320 | 0.001 |
| Fea./Disp. Sh. of $2 Mil. Ga. | | | | | 0.1208 | 0.0362 | 3.330 | 0.001 |
| Disc. Share of $2 Mil. Ga. | | | | | -0.0668 | 0.0164 | -4.080 | <.0001 |
| Payday | -0.0094 | 0.0018 | -5.310 | <.0001 | -0.0082 | 0.0018 | -4.670 | <.0001 |
| Sine (seasonality | -0.0411 | 0.0014 | -29.060 | <.0001 | -0.0422 | 0.0014 | -29.260 | <.0001 |
| Cosine (seasonality) | 0.0655 | 0.0014 | 46.730 | <.0001 | 0.0667 | 0.0014 | 47.550 | <.0001 |
| Number of Same Stores | 0.0061 | 0.0010 | 6.290 | <.0001 | 0.0060 | 0.0010 | 6.240 | <.0001 |
| Number of New Stores | 0.0197 | 0.0010 | 19.860 | <.0001 | 0.0195 | 0.0010 | 19.750 | <.0001 |
| R-Square | 0.9673 | | | | R-Square | 0.9678 | | |