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WEB APPENDIX

"If You Think 9-Ending Prices Are Low, Think Again"

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APPENDIX A. DOMINICK'S STORE LOCATIONS, DOMINICK'S PRICE ZONES, AND DESCRIPTIVE STATISTICS

In this appendix we offer details about the geographical location of Dominick's stores, in the Chicago Metro area. In addition, we offer information about Dominick's price zones, and to which price zone each of the stores belong. Finally, we present descriptive statistics of the Dominick's retail price data.

A.1. Dominick's Store Locations in the Chicago Metropolitan Area, and Dominick's Price Zones

According to Hoch et al (1995) and Ellickson and Misra (2008), 95 percent of Dominick's stores follow a Hi-Lo ("Promo") pricing format. Dominick's groups its stores into 16 pricing zones, maintaining uniform regular prices within each pricing zone, but the same promoted prices chain-wide (Dominick's Data Manual 2018, p. 19). Figure A1 shows the location of the stores on the Chicago area map, and indicates the price zone number to which each store belongs. See Section 3 in the paper for more details.

A.2. Descriptive Statistics of Dominick's Retail Price Data by Product Categories

Table 1 offers descriptive statistics about the retail price data, by product categories. The table lists 29 product categories, which include a total of 18,036 individual products, and 98,914,300 weekly price observations.

Among the 29 product categories, the smallest category in terms of the total number of observations we have, Bath Soaps, has 418,097 weekly price observations, and the largest, Soft Drinks, has 10,741,742 weekly price observations.

In terms of the number of products, the Oatmeal category is the smallest, containing 96 different products, and Shampoos category is the largest, containing 2,930 different products. The average price in the data is $2.59.

Figure A1. Dominick's Store Locations in Chicago Metropolitan Area and their Price Zone Category

Source: Chintagunta, et al (2003, Figure 1, p. 128)

Table A1. Descriptive Statistics of Dominick's Retail Scanner Price Data, by Product Categories, September 14, 1989–May 8, 1997

Category	Number of Observations	Proportion of the Total	Number of Products	Mean Price ($)	Std. Dev.	Min. Price ($)	Max. Price ($)
Analgesics	3,040,172	3.07%	638	5.18	2.36	0.02	23.69
Bath Soaps	418,097	0.42%	579	3.16	1.60	0.01	28.00
Beer	1,966,148	1.99%	787	5.69	2.70	0.01	29.64
Bottled Juices	4,325,024	4.37%	506	2.24	0.97	0.19	9.41
Cereal	4,707,776	4.76%	489	3.12	0.76	0.05	26.02
Cheese	6,752,326	6.83%	657	2.42	1.12	0.05	84.72
Cigarettes	1,801,444	1.82%	793	7.69	7.90	0.01	25.65
Cookies	7,568,428	7.65%	1,124	2.10	0.63	0.02	10.99
Crackers	2,228,269	2.25%	330	2.01	0.57	0.01	7.29
Canned Soups	5,504,492	5.56%	445	1.13	0.49	0.19	8.00
Dish Detergents	2,164,793	2.19%	287	2.34	0.90	0.25	15.89
Front-End-Candies	4,437,054	4.49%	503	0.61	0.24	0.01	6.99
Frozen Dinners	1,654,053	1.67%	266	2.37	0.89	0.12	72.47
Frozen Entrees	7,172,075	7.25%	898	2.33	1.06	0.10	15.99
Frozen Juices	2,368,157	2.39%	175	1.39	0.45	0.10	6.57
Fabric Softeners	2,278,995	2.30%	318	2.82	1.45	0.01	9.99
Grooming products	4,065,689	4.11%	1,380	2.94	1.37	0.01	41.70
Laundry Detergents	3,277,444	3.31%	581	5.61	3.22	0.04	24.49
Oatmeal	981,037	0.99%	96	2.65	0.66	0.25	5.00
Paper Towels	940,757	0.95%	163	1.50	1.41	0.23	13.99
Refrigerated Juices	2,166,755	2.19%	225	2.24	0.91	0.10	7.05
Soft Drinks	10,741,742	10.86%	1,608	2.34	1.89	0.01	55.55
Shampoos	4,676,790	4.73%	2,930	2.95	1.86	0.02	54.99
Snack Crackers	3,487,564	3.53%	420	2.18	0.57	0.02	8.00
Soaps	1,835,196	1.86%	334	2.51	1.48	0.01	10.99
Toothbrushes	1,839,536	1.86%	491	2.18	0.85	0.20	27.52

Tuna	2,382,983	2.41%	278	1.80	1.07	0.11	12.89
Toothpastes	2,981,532	3.01%	608	2.43	0.89	0.10	19.95
Toilet papers	1,149,972	1.16%	127	2.10	1.68	0.19	11.99
Total	**98,914,300**	**100.00%**	**18,036**	**2.59**			

Notes

The price data are weekly. The figures in the table are based on all price observations of Dominick's, in all its 93 stores, for 400 weeks, from September 14, 1989 to May 8, 1997. We exclude 40 observations with prices higher than $100.

APPENDIX B. ADDITIONAL TESTS

To assess the robustness of our findings, we run several sensitivity tests which we present below as follows. In section B.1, we compare 9-ending prices to 0-ending prices. In section B.2, we explore the effect of 9 as the highest possible right-most digit. In section B.3, we assess the effect of the log-transformation of prices by redoing the analyses using the level of prices. In section B.4, we rerun the analyses by excluding outlier observations. Finally, in section B.5, we compare again regular and sale prices, but this time using Dominick's sale dummy instead of a sale filter.

B.1. Comparison of 9-Ending and 0-Ending Prices

It is often argued that consumers interpret 9-ending prices as if they come with a small gain relative to the nearby round price (Schindler and Kirby, 1997). In addition, it has been suggested that 9-endings signal low prices, whereas 0-endings signal quality (Schindler and Kirby 1997, Stiving and Winer 1997, Stiving 2000, Schindler and Kibarian 2001, Schindler 2006). It is therefore possible that the low-price image that 9-ending prices have, stems from consumers' practice of interpreting 9-ending prices relative to, or in comparison to, the nearby 0-ending prices, and judging them accordingly. Schindler (2001) examines this hypothesis by comparing 99-ending prices to 00-ending prices.

We explore this hypothesis with our data by repeating the analyses that we report in Tables 1 and 3 in the paper. This time, however, we compare 9-ending prices to 0-ending prices only, excluding from our analyses all other non 9-ending prices. In Table B1, which is equivalent to Table 1, we report for each product category, the average of 9-ending prices in column (1), the average of 0-ending prices in column (2), and the percentage differences between the two, computed as a log-difference, in column (3).

According to the figures in the table, the average 9-ending prices are higher than the average 0-ending prices in 20 of the 29 product categories. The average percentage difference computed across these 20 product categories is 10.84%. In some product categories, the size of this difference is particularly large, including Cigarettes (32.54%), Grooming Products (20.26%), Soft Drinks (21.84%), and Toilet Papers (30.63%).

Thus, even when we restrict the sample of non 9-ending prices to 0-ending prices only, we find that although 0-endings might be perceived as a signal of quality, in most product categories 0-ending prices are still lower than 9-ending prices, on average.

As a formal test, in Table B2, we report the estimation results of a series of regressions of the differences between 9-ending and 0-ending prices by product categories. These OLS regressions are similar to the ones that we report in Table 3. This time, however, the data include only 9-ending and 0-ending prices.

The estimation results of this regression further strengthen the results we reported in Table 5. In the regression in column (1), which includes dummies for weeks and for subcategories-store, we find that in only five product categories (Bath Soaps, Cookies, Frozen Dinners, Frozen Entrees, and Frozen Juices), the coefficient of 9-ending price dummy is negative and statistically significant. In 21 of the 29 product categories, the coefficient is positive and statistically significant. Thus, the expected 9-ending prices are significantly higher than the expected 0-ending prices in 21 product categories. In three product categories (Crackers, Canned Soup, and Paper Towels), the differences are not statistically significant.

In column (2), where we add fixed effects for subcategory-store-weeks, we find that the coefficient estimate of the 9-ending price dummy is again negative and statistically significant in only five product categories (Bath Soaps, Cookies, Frozen Dinners, Frozen Entrees, and Frozen Juices). The coefficient estimate of the 9-ending price dummy is positive and statistically significant in 20 product categories. Thus, in this specification, we find that the expected 9-ending prices are higher than the expected 0-ending prices in 20 of the 29 product categories. In four product categories (Crackers, Canned Soup, Fabric Softeners, and Paper Towels), the differences are not statistically significant.

In column (3), where we add fixed effects for weeks and for products within stores, we find that the coefficient of the 9-ending price dummy is positive and statistically significant in 21 of the 29 product categories. In other words, we find that even when we restrict the sample to 9-ending and 0-ending prices, in 21 of the 29 product categories, a consumer who buys the same good at the same store, is expected to get a better deal if the price s/he pays ends with a 0 than with a 9. This finding is consistent with Schindler

(2001), who finds that in his data, 99-ending price were not, on average, lower than 00-ending prices.

B.2. Could It Be the Rightmost Digit Effect?

A possible explanation for the finding that 9-ending prices are higher than the prices that end with other digits, is that the difference might be due to 9 being the largest digit. Thus, it is possible that 9-ending prices are higher, on average, than other prices for a technical reason: A price that ends with 9 is greater than any price with the same left most digits but that ends with any digit between 0 and 8. That is, 9.99 is higher than all the prices in the range 9.90–9.98.

To test this possibility, we first truncate all price endings so that the right most digits are now all set equal to 0. To keep track of the original prices, we use an indicator variable which identifies the prices that were 9-ending prior to the truncation. In column (1) of Table B3, we report the average 9-ending prices after-truncation, in column (2) we report the average non 9-ending prices after-truncation, and in column (3) we report the percentage difference between them, computed as a log-difference.

We find that the truncation decreases, as expected, the differences between the average 9-ending and non 9-ending prices. Yet in 21 product categories, the average 9-ending prices are still higher than the average non 9-ending princes. Even after the truncation, the average percentage difference computed across the 21 product categories in which the average 9-ending prices exceed the corresponding average non 9-ending prices is 17.31%.

In Table B4, we report the estimation results of a series of regressions of the differences between 9-ending and non 9-ending prices by product categories, when we use the truncated data. These are OLS regressions with the same fixed effects as the ones we report in Table 3.

In the regression in column (1), which includes dummies for weeks and for subcategories-store, we find that the coefficient of the 9-ending price dummy is negative

and statistically significant in only 8 product categories (Cereal, Cookies, Frozen Dinners, Frozen Juices, Fabric Softeners, Oatmeal, Toothbrushes and Toothpastes). In 16 of the 29 product categories, the coefficient of the 9-ending price dummy is positive and statistically significant. In five categories, the differences are not statistically significant (Bath Soaps, Beer, Bottled Juices, Dish Detergents, and Snack Crackers).

In the regression in column (2), which includes fixed effects for subcategory-store-weeks, we find that the coefficient estimate of the 9-ending price dummy is negative and statistically significant in 8 product categories (Cereal, Cookies, Frozen Dinners, Frozen Juices, Fabric Softeners, Oatmeal, Toothbrushes and Toothpastes). The coefficient estimate of the 9-ending price dummy is positive and statistically significant in 17 product categories. In four categories, the differences are not statistically significant (Bath Soaps, Bottled Juices, cigarettes, Snack Crackers).

In the regression in column (3), which includes fixed effects for weeks and for products within stores, we find that the coefficient of the 9-ending price dummy is positive and statistically significant in 17 of the 29 product categories. In other words, we find that even after we truncate all prices to have a 0-ending, we find that in 17 of the 29 product categories, a consumer who buys the same good at the same store, is expected to get a better deal if the price s/he pays does not end with a 9.

B.3. Average 9-Ending and Non 9-Ending Prices in Levels

In the regression analyses conducted in the paper, we use the log of the prices as the dependent variable. To check that our results do not depend on this transformation, we re-estimate the same OLS regressions with the same fixed effects that we reported in Table 3, but this time we use the level of the prices rather than their logs. The coefficient estimates we report here, should therefore be interpreted as the expected differences in dollars rather than in percentages. The estimation results are reported in Table B5.

In the regression in column (1), which includes dummies for weeks and for subcategories-store, we find that in 21 out of the 29 product categories, the expected 9-ending prices are higher than the expected non 9-ending prices. The differences are

statistically significant ($p < 0.01$) in 20 of the cases.

In the regression in column (2), which includes subcategories-store-week dummies, we find that the expected 9-ending prices are higher than the corresponding expected non 9-ending prices in 19 of the 29 product categories. In four more product categories (Beer, Cigarettes, Frozen Entrees, Toothbrushes), the differences are not statistically significant. Thus, in 23 of 29 product categories, the expected 9-ending prices are either higher or no different than the expected non 9-ending prices.

In the regression in column (3), which includes fixed effects for weeks and for products at the store-level, we find that in 24 out of the 29 product categories, the expected 9-ending prices are higher than corresponding non 9-ending prices. In only 5 product categories (Beer, Cookies, Frozen Entrees, Frozen Juices, Toothpastes), the expected 9-ending prices are lower than the expected non 9-ending prices.

Thus, using the level of the prices instead of their logs, does not change the main conclusion we reported above: in great majority of the product categories, the expected 9-ending prices are higher than the expected non 9-ending prices, regardless of the additional controls that we include in the regressions.

B.4. Analysis of the Data with Outliers Excluded

One possible explanation for our results is that they are driven by outliers. To explore this possibility, in each category we exclude from the sample the observations that are more than 2-standard-deviations away from the category mean. Using the restricted sample, we rerun the analyses we reported in Tables 1 and 3.

In columns (1) and (2) of Table B6, we report the average 9-ending and non 9-ending prices in the restricted sample. In column (3), we report the percentage difference between them, computed as a log-difference. Inspecting the figures in the table, we find that the exclusion of the outlier observations does not change the main finding we reported for the entire sample: in 22 product categories, 9-ending prices are on average higher than non 9-ending princes. The average percentage difference computed across

these 22 product categories is 16%.

In Table B7, we report the estimation results of a series of regressions of the differences between 9-ending and non 9-ending prices by product categories, when the outlier observations are excluded. These are OLS regressions, similar to the regressions we reported in Table 3.

In the regression in column (1), which includes dummies for weeks and for subcategories-store, we find that the coefficient of the 9-ending dummy is negative and statistically significant in 8 product categories (Cereal, Cookies, Frozen Juices, Fabric Softeners, Oatmeal, Snack Crackers, Toothbrushes and Toothpastes). In 19 of the 29 product categories, the coefficient of the 9-ending price dummy is positive and statistically significant. In two categories, the estimated coefficients are not statistically significant (Dish Detergents and Frozen Dinners).

In the regression in column (2), which includes fixed effects for subcategory-store-weeks, we find that the coefficient estimate of the 9-ending price dummy is negative and statistically significant in five product categories (Cereal, Frozen Juices, Fabric Softeners, Toothbrushes and Toothpastes). The coefficient estimate of the 9-ending price dummy is positive and statistically significant in 20 product categories. In four product categories, the estimated coefficients are not statistically significant (Cookies, Frozen Dinners, Oatmeal and Snack Crackers).

In the regression in column (3), which includes fixed effects for weeks and for products within stores, we find that the coefficient of the 9-ending price dummy is negative and statistically significant in 6 product categories (Beer, Cheese, Frozen Juices, Fabric Softeners, Paper Towels, Toothpastes). The coefficient is positive and statistically significant in the remaining 23 of the 29 product categories.

Thus, in comparison to the results we reported for the full sample, when outliers are excluded, we still find that in a large majority of the product categories, the expected 9-ending prices are on average higher than non 9-ending prices.

B.5. Regular and Sale Prices Using Dominick's Sale Dummy

In the paper, we identify sales by using a sale filter (Nakamura and Steinsson 2008, 2011). Sale filters are not foolproof, however. Their disadvantage is that they can occasionally lead to false positives, that is, they can wrongly identify a regular price as a sale price (Nakamura and Steinsson 2008, Ray et al 2019). This issue is less relevant in the case of Dominick's however, because Ray et al (2019) find that sale filters tend to correctly identify most of the sales in case of Hi-Lo pricing format, which is the format Dominick's follows. Another weakness of sale filters is that they cannot identify the sale price if the sale occurs in the proximity of the end points of the time series. The sale filters are nevertheless used extensively, because in many scanner datasets, sale indicator variables are not available. For an example and discussion, see Nakamura and Steinsson (2008).

As a robustness check, we rerun the regular and sale price analyses as discussed and presented in Tables 4 and 5 in section 5.4. The difference is that this time we identify sale prices by using the Dominick's sale dummy ("sale flag"), which is included in the Dominick's dataset. This sale indicator variable, however, has an important disadvantage because according to Dominick's Data Manual (2018, p. 10), the sale dummy was not set by Dominick's on a regular basis, and consequently there are instances were a good was offered at a sale price, but the Dominick's sale dummy indicates no sale price. Thus, Dominick's sale dummy is not accurate. According to Peltzman (2000), this is a major drawback. Nevertheless, we use the sale dummy as a robustness check for the results presented in the paper. We identify a sale if the Dominick's sale indicator is marked as "S" (sale) or "B" (bonus sale).

The figures reported in column (1) of Table B8 show the percentage of sale prices that are 9-ending. Column (2) reports the percentage of regular prices (the prices that are not flagged by the sale dummy) that are 9-ending. Column (3) reports the difference between the shares of 9-ending prices among sale and regular prices.

We find that in 25 out of the 29 product categories (the categories of Cereals, Cigarettes, Frozen Juices, and Toothpastes being the exception), the values in column (3) are negative, with an average of −18.5%. In other words, in these categories, 9-ending

prices are more common among regular prices than among sale prices. Furthermore, in the Cigarettes category, there are only 21 observations that Dominick's sale dummy marks as sale prices, and thus the results in that category are based on a very small sample of sale prices. Therefore, consumers' tendency to associate 9-endings with low prices cannot be explained by 9-ending prices being sale prices. That is because the shoppers are more likely to encounter 9-ending prices when they buy the goods at a regular price than at a sale price.

There is another possibility, however. Even if 9-endings are not more common among sale prices than among regular prices, the belief of the consumers that 9-ending prices are low, could perhaps still be rationalized. If 9-ending prices are lower on average than non-9 ending prices *among sale prices*, then it is possible that consumers associate 9-endings with price cuts. Indeed, Schindler (2001) offers this as a possible explanation for his finding that 99-ending prices are not as low as is commonly believed.

To explore this possibility, we run the same OLS regressions with the same fixed effects, as the ones we presented in Table 5. The only exception is that we now estimate separate regressions for regular prices and for sale prices. We report the estimation results in Table B9. The figures that we report in the table are the coefficient estimates of the 9-ending price dummy, which equals 1 if the price ends with 9, and 0 if the price ends with any other digit.

In columns (1)–(3) of the table, we report the estimation results for regular prices, and in columns (4)–(6) for sale prices. In columns (1) and (4), we report the estimation results of regressions where we include controls for weeks and for subcategories-store. In columns (2) and (5), we report the estimation results of regressions that include controls for subcategories- store-weeks. In columns (3) and (6), we report the estimation results of the regressions that include controls for weeks and for products-store.

For regular prices, the estimation results in column (1) suggest that the expected 9-ending prices are lower than the expected non 9-ending prices (that is, the estimated coefficient is negative and statistically significant) in 10 product categories. In one category (Toothpastes), however, the difference is only marginally significant. In column (2), the coefficient of the 9-ending dummy in the regression for the Toothpastes' category

is not significant and, consequently, the expected 9-ending prices are lower than the expected non 9-ending prices in 9 product categories.

In column (3), where we use dummies for products-store, we find that the expected 9-ending prices are lower than the expected non 9-ending prices in only four product categories. Thus, when we focus on regular prices, and include dummies for products in specific stores, we find that in 24 out of 29 product categories, the expected 9-ending prices are higher than the expected non 9-ending prices, and in one category, there are no statistically significant differences between 9-ending and non 9-ending prices.

For sale prices, we cannot estimate the regressions for the Cigarettes' category because the Dominick's sale dummy identifies only 21 prices as sale prices and all of them are 9-ending. For the remaining 28 categories, we find in column (4) that the expected 9-ending prices are lower than the expected non 9-ending prices in 13 product categories, higher in 14 product categories, and there is no statistically significant difference in one product category. According to the figures in column (5), the expected 9-ending prices are lower than the expected non 9-ending prices in 10 product categories, higher in 12 categories, and there are no statistically significant differences in six product categories.

In column (6), where we use dummies for products-store, we find that the expected 9-ending prices are lower than the expected non 9-ending prices in 17 categories, higher in 9 product categories, and there are no statistically significant differences in two categories.

Thus, to summarize the results on regular and sale prices, we find that for regular prices, which in our data are the bulk of the prices (82.2%), 9-endings are not indicative of a better deal than non 9-ending prices. For sale prices, the results are more mixed. At least according to column (6), which focuses on the difference between 9- and non 9-ending prices of products within stores, in 19 out of 28 product categories, the expected 9-ending prices are either lower or not higher than the expected non 9-ending prices.

This suggests that although 9-ending prices are in general higher, not lower, than non 9-ending prices, it might be that Dominick's helps to maintain the image of 9-ending

prices as low prices by setting sale prices at 9-endings in the case of price cuts. Such behavior by the retailer can perhaps explain how consumers learn to associate 9-endings with low prices.

Table B1. Average 9-Ending and 0-Ending Prices, and Percentage Difference between Them, Dominick's, September 14, 1989–May 8, 1997

Category	(1) 9-Ending	(2) 0-Ending	(3) % Difference
Analgesics	***5.33***	***4.21***	***10.24%***
Bath Soaps	3.15	4.54	−15.92%
Beers	***5.68***	***4.67***	***8.52%***
Bottled Juices	***2.27***	***2.21***	***1.12%***
Cereals	***3.08***	***2.85***	***3.37%***
Cheese	***2.53***	***2.11***	***7.88%***
Cigarettes	***11.93***	***5.64***	***32.54%***
Cookies	2.06	2.36	−5.99%
Crackers	2.08	2.14	−1.24%
Canned Soups	1.21	1.36	−5.15%
Dish Detergents	***2.36***	***2.30***	***1.14%***
Front End Candies	***0.74***	***0.55***	***13.00%***
Frozen Dinners	2.33	3.07	−11.98%
Frozen Entrees	2.34	3.47	−17.10%
Frozen Juices	1.32	1.82	−13.83%
Fabric Softeners	***2.88***	***2.58***	***4.77%***
Grooming products	***3.02***	***1.89***	***20.26%***
Laundry Detergents	***5.76***	***5.33***	***3.39%***
Oatmeal	***2.65***	***2.36***	***5.00%***
Paper Towels	1.69	1.71	−0.40%
Refrigerated Juices	***2.281***	***2.280***	***0.02%***
Soft Drinks	***2.53***	***1.53***	***21.84%***
Shampoos	***3.00***	***2.19***	***13.67%***
Snack Crackers	2.20	2.20	0.00%
Soaps	***2.74***	***2.18***	***9.97%***
Toothbrushes	***2.21***	***1.85***	***7.72%***

Tuna	***1.99***	***1.48***	***12.93%***
Toothpastes	***2.53***	***2.07***	***8.78%***
Toilet papers	***2.51***	***1.24***	***30.63%***
Average of the Positive % Differences			**10.84%**

Notes

In columns (1) and (2), we report the average 9-ending and 0-ending prices, respectively, in each one of the 29 Dominick's product categories, calculated over all stores and weeks. In column (3), we report the percentage difference between the average 9-ending and the average 0-ending prices computed as a log-difference. The 20 product categories with positive values in column (3) are indicated in italic boldface. All the differences are statistically significant based on the Mann-Whitney test with $p < 0.01$.

Table B2. Regression Analyses of the Percentage Difference between 9-Ending and 0-Ending Prices, Dominick's, September 14, 1989–May 8, 1997

	(1)	(2)	(3)	*N*
Analgesics	0.18 (0.009)***	0.18 (0.009)***	0.15 (0.003)***	2,627,640
Bath Soaps	−0.16 (0.035)***	−0.14 (0.035)***	0.31 (0.002)***	382,106
Beers	0.33 (0.018)***	0.31 (0.018)***	0.22 (0.003)***	1,889,570
Bottled Juices	0.08 (0.011)***	0.08 (0.011)***	0.02 (0.001)***	2,400,064
Cereals	0.05 (0.002)***	0.05 (0.003)***	0.05 (0.001)***	2,061,159
Cheese	0.23 (0.003)***	0.18 (0.002)***	0.17 (0.001)***	4,426,654
Cigarettes	1.10 (0.080)***	0.03 (0.035)***	0.55 (0.003)***	452,873
Cookies	−0.10 (0.013)***	−0.05 (0.012)***	−0.04 (0.001)***	5,758,138
Crackers	0.01 (0.005)	0.01 (0.006)	−0.00 (0.001)**	1,491,464
Canned Soups	−0.00 (0.015)	−0.02 (0.015)	−0.03 (0.001)***	1,858,854
Dish Detergents	0.07 (0.006)***	0.05 (0.006)***	0.09 (0.002)***	1,483,456
Front End Candies	0.35 (0.003)***	0.34 (0.003)***	0.22 (0.001)***	2,800,489
Frozen Dinners	−0.25 (0.08)***	−0.29 (0.09)***	−0.06 (0.001)***	1,157,152
Frozen Entrees	−0.27 (0.012)***	−0.29 (0.012)***	−0.28 (0.000)***	4,962,968
Frozen Juices	−0.23 (0.010)***	−0.24 (0.011)***	−0.17 (0.001)***	1,253,120
Fabric Softeners	0.02 (0.006)***	0.01 (0.006)	0.02 (0.001)***	1,418,673
Grooming products	0.44 (0.002)***	0.34 (0.001)***	0.31 (0.001)***	3,665,407
Laundry Detergents	0.09 (0.012)***	0.09 (0.010)***	0.11 (0.000)***	2,545,027
Oatmeal	0.11 (0.007)***	0.10 (0.007)***	0.07 (0.001)***	534,846
Paper Towels	0.01 (0.015)	−0.02 (0.016)	−0.03 (0.003)***	496,075
Refrigerated Juices	0.02 (0.006)***	0.02 (0.006)***	0.06 (0.001)***	1,301,869
Soft Drinks	0.48 (0.013)***	0.11 (0.013)***	0.09 (0.001)***	9,342,891
Shampoos	0.26 (0.007)***	0.21 (0.005)***	0.28 (0.001)***	4,383,314
Snack Crackers	0.08 (0.010)***	0.09 (0.010)***	0.06 (0.001)***	2,635,531
Soaps	0.14 (0.007)***	0.14 (0.006)***	0.17 (0.002)***	1,188,833
Toothbrushes	0.15 (0.006)***	0.16 (0.006)***	0.18 (0.001)***	1,392,950

Tuna	0.27 (0.004)***	0.27 (0.005)***	−0.01 (0.001)***	1,250,726
Toothpastes	0.19 (0.006)***	0.19 (0.006)***	0.15 (0.001)***	1,973,223
Toilet papers	0.66 (0.018)***	0.65 (0.019)***	0.14 (0.002)***	662,257
Dummies for weeks	√		√	
Dummies for product-store			√	
Dummies for sub-categories-store	√			
Dummies for sub-categories-store-weeks		√		

Notes

In the table, we report the coefficient estimates of a 9-ending dummy in OLS regressions with fixed effects, where the dependent variable is the log of the prices. The sample includes only 9-ending and 0-ending prices. The 9-ending dummy equals 1 if the price ends with 9, and 0 if the price ends with 0. In column (1), the regression includes controls for weeks and for subcategories-store. In column (2), the regression includes controls for subcategories-stores-weeks. In column (3), the regression includes dummies for weeks and for product-store. In parentheses, we report robust standard errors, clustered at the store level. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$.

Table B3. Average Truncated 9-Ending and non 9-Ending Prices, and the Percentage Differences between Them, Dominick's, September 14, 1989–May 8, 1997

Category	(1) 9-Ending	(2) Non 9-Ending	(3) % Difference
Analgesics	***5.24***	***4.26***	***20.71%***
Bath Soaps	3.06	3.21	−4.79%
Beers	5.59	5.79	−3.52%
Bottled Juices	***2.18***	***2.17***	***0.46%***
Cereals	2.99	3.10	−3.61%
Cheese	***2.50***	***2.23***	***11.43%***
Cigarettes	***11.84***	***6.81***	***55.31%***
Cookies	1.97	2.18	−10.13%
Crackers	***1.99***	***1.86***	***6.76%***
Canned Soups	***1.12***	***1.05***	***6.45%***
Dish Detergents	***2.27***	***2.26***	***0.44%***
Front End Candies	***0.65***	***0.50***	***26.24%***
Frozen Dinners	2.24	2.38	−6.06%
Frozen Entrees	2.25	2.28	−1.32%
Frozen Juices	1.23	1.40	−12.95%
Fabric Softeners	***2.79***	***2.69***	***3.65%***
Grooming products	***2.93***	***2.38***	***20.79%***
Laundry Detergents	***5.67***	***5.06***	***11.38%***
Oatmeal	2.56	2.61	−1.93%
Paper Towels	***1.60***	***1.26***	***23.89%***
Refrigerated Juices	***2.19***	***2.14***	***2.31%***
Soft Drinks	***2.44***	***1.40***	***55.55%***
Shampoos	***2.91***	***2.41***	***18.85%***
Snack Crackers	***2.11***	***2.09***	***0.95%***
Soaps	***2.65***	***2.07***	***24.70%***

Toothbrushes	***2.12***	***2.04***	***3.85%***
Tuna	***1.90***	***1.58***	***18.44%***
Toothpastes	***2.44***	***2.21***	***9.90%***
Toilet papers	***2.42***	***1.60***	***41.38%***
Average of the Positive % Differences			**17.31**

Notes

Columns (1) and (2) report the average truncated 9-ending and non 9-ending prices, respectively, in each of the 29 Dominick's product categories, calculated over all stores and weeks. Column (3) reports the percentage difference between them computed as a log-difference. The 21 product categories with positive values in column (3) are indicated in italic boldface. All the differences are statistically significant based on the Mann-Whitney test, with $p < 0.01$.

Table B4. Regression Analyses of the Percentage Difference between Truncated 9-Ending and Non 9-Ending Prices, Dominick's, September 14, 1989–May 8, 1997

	(1)	(2)	(3)	*N*
Analgesics	0.12 (0.005)***	0.12 (0.005)***	0.14 (0.001)***	3,040,159
Bath Soaps	−0.00 (0.010)	0.00 (0.009)	0.09 (0.001)***	418,096
Beers	0.02 (0.010)	0.02 (0.009)**	−0.03 (0.001)***	1,966,147
Bottled Juices	0.00 (0.003)	0.00 (0.003)	−0.00 (0.000)***	4,325,024
Cereals	−0.04 (0.001)***	−0.04 (0.001)***	−0.01 (0.000)***	4,707,772
Cheese	0.08 (0.002)***	0.06 (0.002)***	0.12 (0.003)***	6,752,325
Cigarettes	0.58 (0.059)***	0.00 (0.006)	0.26 (0.001)***	1,801,443
Cookies	−0.12 (0.003)***	−0.03 (0.002)***	−0.03 (0.000)***	7,568,350
Crackers	0.04 (0.001)***	0.05 (0.001)***	0.01 (0.000)***	2,228,268
Canned Soups	0.05 (0.006)***	0.04 (0.006)***	0.01 (0.000)***	5,504,492
Dish Detergents	0.01 (0.007)	0.01 (0.004)**	−0.01 (0.000)***	2,164,793
Front End Candies	0.33 (0.002)***	0.31 (0.003)***	0.16 (0.000)***	4,436,801
Frozen Dinners	−0.04 (0.007)***	−0.04 (0.007)***	0.02 (0.000)***	1,654,053
Frozen Entrees	0.03 (0.005)***	0.03 (0.005)***	−0.02 (0.000)***	7,172,075
Frozen Juices	−0.12 (0.003)***	−0.12 (0.003)***	−0.10 (0.000)***	351,519
Fabric Softeners	−0.05 (0.003)***	−0.06 (0.003)***	−0.01 (0.000)***	2,278,536
Grooming products	0.19 (0.002)***	0.14 (0.002)***	0.15 (0.000)***	4,065,687
Laundry Detergents	0.08 (0.003)***	0.12 (0.002)***	0.11 (0.001)***	3,277,442
Oatmeal	−0.04 (0.006)***	−0.03 (0.006)***	−0.01 (0.000)***	981,037
Paper Towels	0.10 (0.001)***	0.09 (0.001)***	−0.00 (0.001)**	940,757
Refrigerated Juices	0.04 (0.004)***	0.04 (0.004)***	0.04 (0.001)***	2,166,755
Soft Drinks	0.69 (0.010)***	0.27 (0.005)***	0.27 (0.000)***	10,741,681
Shampoos	0.14 (0.012)***	0.09 (0.009)***	0.09 (0.000)***	4,666,564
Snack Crackers	0.00 (0.005)	0.01 (0.004)	0.02 (0.000)***	3,487,548
Soaps	0.13 (0.004)***	0.12 (0.004)***	0.09 (0.001)***	1,835,196
Toothbrushes	−0.06 (0.005)***	−0.04 (0.005)***	−0.01 (0.000)***	1,772,158
Tuna	0.16 (0.003)***	0.16 (0.003)***	0.07 (0.001)***	2,382,983

Toothpastes	−0.02 (0.004)***	−0.01 (0.004)***	−0.03 (0.000)***	2,981,532
Toilet papers	0.39 (0.008)***	0.39 (0.008)***	0.07 (0.001)***	1,149,972
Dummies for weeks	√		√	
Dummies for product-store			√	
Dummies for sub-categories-store	√			
Dummies for sub-categories-store-weeks		√		

Notes

The table reports the coefficients of a 9-ending dummy in OLS regressions with fixed effects, where the dependent variable is the log of the prices. The sample includes truncated 9-ending and non 9-ending prices. In column (1), the regression includes controls for weeks and for subcategories-store. In column (2), the regression includes controls for subcategories-stores-weeks. In column (3), the regression includes dummies for weeks and for product-store. Robust standard errors, clustered at the store level are reported in parentheses. *** $p < 1\%$. ** $p < 5\%$

Table B5. Regression Analyses of the Level Difference between 9-Ending and Non 9-Ending Prices, Dominick's, September 14, 1989–May 8, 1997

	(1)	(2)	(3)	*N*
Analgesics	0.64 (0.025)***	0.65 (0.026)***	0.72 (0.004)***	3,040,172
Bath Soaps	−0.19 (0.49)***	−0.16 (0.47)***	0.33 (0.004)***	418,097
Beers	−0.07 (0.040)*	0.00 (0.039)	−0.22 (0.006)***	1,966,148
Bottled Juices	0.06 (0.007)***	0.06 (0.007)***	0.04 (0.001)***	4,325,024
Cereals	−0.06 (0.003)***	−0.06 (0.003)***	0.03 (0.001)***	4,707,776
Cheese	0.25 (0.004)***	0.21 (0.003)***	0.33 (0.001)***	6,752,326
Cigarettes	4.83 (0.472)***	−0.02 (0.036)	2.16 (0.010)***	1,801,444
Cookies	−0.20 (0.037)***	−0.02 (0.005)***	−0.00 (0.000)***	7,568,352
Crackers	0.13 (0.003)***	0.14 (0.002)***	0.04 (0.001)***	2,228,268
Canned Soups	0.10 (0.006)***	0.10 (0.006)***	0.06 (0.000)***	5,504,492
Dish Detergents	0.09 (0.014)***	0.10 (0.010)***	0.05 (0.001)***	2,164,793
Front End Candies	0.23 (0.002)***	0.22 (0.002)***	0.13 (0.000)***	4,437,054
Frozen Dinners	−0.06 (0.017)***	−0.06 (0.017)***	0.04 (0.001)***	1,654,053
Frozen Entrees	0.02 (0.015)	0.01 (0.016)	−0.08 (0.001)***	7,172,075
Frozen Juices	−0.12 (0.004)***	−0.12 (0.004)***	−0.10 (0.001)***	2,368,157
Fabric Softeners	0.07 (0.008)***	0.06 (0.007)***	0.16 (0.002)***	2,278,995
Grooming products	0.58 (0.008)***	0.38 (0.006)***	0.42 (0.001)***	4,065,689
Laundry Detergents	0.62 (0.015)***	0.86 (0.011)***	0.77 (0.004)***	3,277,444
Oatmeal	−0.04 (0.014)***	−0.03 (0.001)*	0.02 (0.001)***	981,037
Paper Towels	0.43 (0.021)***	0.42 (0.021)***	0.28 (0.003)***	940,757
Refrigerated Juices	0.11 (0.008)***	0.11 (0.008)***	0.12 (0.001)***	2,166,755
Soft Drinks	1.08 (0.13)***	0.35 (0.007)***	0.41 (0.001)***	10,741,742
Shampoos	0.52 (0.032)***	0.37 (0.024)***	0.30 (0.001)***	4,666,565
Snack Crackers	0.03 (0.008)***	0.04 (0.008)***	0.09 (0.001)***	3,487,564
Soaps	0.49 (0.012)***	0.49 (0.012)***	0.43 (0.002)***	1,835,196
Toothbrushes	−0.03 (0.008)***	−0.01 (0.008)	0.05 (0.001)***	1,772,158
Tuna	0.47 (0.005)***	0.37 (0.005)***	0.21 (0.001)***	2,382,983

Toothpastes	0.05 (0.009)***	0.06 (0.008)***	−0.03 (0.001)***	2,981,532
Toilet papers	0.75 (0.004)***	0.75 (0.004)***	0.26 (0.002)***	1,149,972
Dummies for weeks	√		√	
Dummies for product-store			√	
Dummies for sub-categories-store	√			
Dummies for sub-categories-store-weeks		√		

Notes

In the table, we report the coefficient estimates of a 9-ending dummy in OLS regressions with fixed effects, where the dependent variables are the prices. The 9-ending dummy equals 1 if the price ends with 9, and 0 if the price ends with any other digit. In column (1), the regression includes controls for weeks and for subcategories-store. In column (2), the regression includes controls for subcategories-stores-weeks. In column (3), the regression includes dummies for weeks and for product-store. In parentheses, we report robust standard errors, clustered at the store level. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$.

Table B6. Average 9-Ending and Non 9-Ending Prices, and Percentage Difference between Them, Outliers Excluded, Dominick's, September 14, 1989–May 8, 1997

Category	(1) 9-Ending	(2) Non 9-Ending	(3) % Difference
Analgesics	***4.95***	***4.16***	***7.55%***
Bath Soaps	***2.88***	***2.60***	***4.40%***
Beers	***1.58***	***1.54***	***1.14%***
Bottled Juices	***2.13***	***2.12***	***0.20%***
Cereals	3.08	3.17	−1.20%
Cheese	***2.34***	***2.16***	***3.52%***
Cigarettes	***11.92***	***6.80***	***24.39%***
Cookies	0.67	0.74	−4.10%
Crackers	***2.05***	***1.87***	***3.91%***
Canned Soups	***1.16***	***1.05***	***4.37%***
Dish Detergents	0.74	0.75	−0.58%
Front End Candies	***0.74***	***0.51***	***16.18%***
Frozen Dinners	2.29	2.31	−0.46%
Frozen Entrees	***2.25***	***2.03***	***4.56%***
Frozen Juices	1.31	1.39	−2.48%
Fabric Softeners	2.58	2.63	−0.75%
Grooming products	***2.78***	***2.31***	***8.07%***
Laundry Detergents	***4.72***	***5.14***	***3.70%***
Oatmeal	2.68	2.69	−0.09%
Paper Towels	***1.28***	***1.22***	***1.93%***
Refrigerated Juices	***0.72***	***0.64***	***5.41%***
Soft Drinks	***2.16***	***1.30***	***22.13%***
Shampoos	***2.75***	***2.39***	***6.15%***
Snack Crackers	***2.20***	***2.14***	***1.15%***
Soaps	***2.33***	***2.07***	***5.05%***

Toothbrushes	***2.13***	***2.01***	***2.54%***
Tuna	***1.80***	***1.52***	***7.34%***
Toothpastes	***0.84***	***0.79***	***2.80%***
Toilet papers	***2.10***	***1.55***	***13.21%***
Average of the Positive % Differences			**15.96%**

Notes

In columns (1) and (2), we report the average 9-ending and non 9-ending prices, respectively, in each one of Dominick's 29 product categories, calculated over all stores and weeks. In column (3), we report the percentage difference between them computed as a log-difference. For each product category, we exclude from the sample the observations that are more than two standard deviations away from the category mean. The 22 product categories with positive values in column (3) are indicated in italic boldface. All the differences are statistically significant based on the Mann-Whitney test with $p < 0.01$.

Table B7. Regression Analysis of the Percentage Difference between the 9-Ending and Non 9-Ending Prices, Outliers Excluded, Dominick's, September 14, 1989–May 8, 1997

	(1)	(2)	(3)	*N*
Analgesics	0.11 (0.004)***	0.11 (0.004)***	0.12 (0.001)***	2,893,605
Bath Soaps	0.10 (0.005)***	0.10 (0.004)***	0.11 (0.001)***	392,621
Beers	0.06 (0.001)***	0.06 (0.001)***	−0.02 (0.001)***	1,858,635
Bottled Juices	0.02 (0.002)***	0.01 (0.002)***	0.01 (0.000)***	4,166,948
Cereals	−0.03 (0.001)***	−0.03 (0.001)***	0.01 (0.000)***	4,478,505
Cheese	0.08 (0.002)***	0.06 (0.001)***	−0.03 (0.001)***	6,487,618
Cigarettes	0.60 (0.006)***	0.02 (0.005)***	0.28 (0.001)***	1,796,262
Cookies	−0.10 (0.002)***	0.00 (0.001)	0.01 (0.000)***	7,308,003
Crackers	0.07 (0.001)***	0.07 (0.001)***	0.03 (0.000)***	2,151,818
Canned Soups	0.09 (0.005)***	0.09 (0.005)***	0.06 (0.000)***	5,345,950
Dish Detergents	0.00 (0.007)	0.01 (0.005)**	0.00 (0.000)***	2,087,095
Front End Candies	0.40 (0.002)***	0.39 (0.002)***	0.24 (0.000)***	4,397,689
Frozen Dinners	−0.00 (0.007)	0.00 (0.006)	0.07 (0.000)***	1,617,178
Frozen Entrees	0.11 (0.003)***	0.12 (0.003)***	0.08 (0.000)***	6,832,117
Frozen Juices	−0.06 (0.002)***	−0.07 (0.002)***	−0.05 (0.000)***	2,319,924
Fabric Softeners	−0.07 (0.003)***	−0.07 (0.004)***	−0.01 (0.000)***	2,161,634
Grooming products	0.19 (0.003)***	0.15 (0.003)***	0.16 (0.000)***	3,872,011
Laundry Detergents	0.07 (0.003)***	0.09 (0.002)***	0.08 (0.001)***	3,087,133
Oatmeal	−0.01 (0.006)*	−0.01 (0.006)	0.01 (0.000)***	926,918
Paper Towels	0.04 (0.007)***	0.04 (0.008)***	−0.06 (0.001)***	903,436
Refrigerated Juices	0.10 (0.003)***	0.10 (0.003)***	0.09 (0.001)***	2,064,972
Soft Drinks	0.63 (0.009)***	0.31 (0.005)***	0.28 (0.000)***	1,0091,205
Shampoos	0.12 (0.010)***	0.11 (0.008)***	0.11 (0.000)***	4,462,260
Snack Crackers	−0.00 (0.002)**	0.00 (0.002)	0.05 (0.000)***	3,361,275
Soaps	0.08 (0.003)***	0.07 (0.002)***	0.04 (0.000)***	1,722,143
Toothbrushes	−0.05 (0.005)***	−0.04 (0.005)***	0.02 (0.000)***	1,713,069

Tuna	0.16 (0.002)***	0.16 (0.002)***	0.09 (0.000)***	2,285,445
Toothpastes	−0.02 (0.002)***	−0.02 (0.002)***	−0.02 (0.000)***	2,878,058
Toilet papers	0.36 (0.007)***	0.35 (0.007)***	0.08 (0.001)***	1,091,805
Dummies for weeks	√		√	
Dummies for product-store			√	
Dummies for sub-categories-store	√			
Dummies for sub-categories-store-weeks		√		

Notes

The table reports the coefficients of a 9-ending dummy in OLS regressions with fixed effects, where the dependent variable is the log of the prices. For each product category, we exclude from the sample the observations that are more than two standard deviations away from the category mean. In column (1), the regression includes controls for weeks and for subcategories-store. In column (2), the regression includes controls for subcategories-stores-weeks. In column (3), the regression includes dummies for weeks and for product-store. The estimated coefficients in the Oatmeal category in columns (1) and (2) look equal because of the rounding. Without rounding, only one of them is statistically significant. Robust standard errors, clustered at the store level are reported in parentheses. *** $p < 1\%$. ** $p < 5\%$

Table B8. The Share of 9-Ending Prices by Product Categories,
Using Dominick's Sale Dummy, September 14, 1989–May 8, 1997

Category	(1) Sale Prices	(2) Regular Prices	(3) Difference
Analgesics	69.2%	87.6%	−18.4%
Bath Soaps	61.8%	91.6%	−29.8%
Beers	95.6%	95.8%	-0.2%
Bottled Juices	42.3%	52.7%	−10.4%
Cereals	41.1%	39.6%	1.6%
Cheese	46.5%	64.6%	−18.1%
Cigarettes	100.0%	16.5%	83.6%
Cookies	45.2%	79.8%	−34.6%
Crackers	35.5%	72.3%	−36.8%
Canned Soups	26.3%	31.7%	−5.4%
Dish Detergents	57.7%	68.8%	−11.1%
Front End Candies	21.8%	40.7%	−18.9%
Frozen Dinners	28.9%	65.7%	−6.8%
Frozen Entrees	25.6%	67.8%	−42.2%
Frozen Juices	48.8%	45.8%	3.0%
Fabric Softeners	54.4%	60.3%	−5.9%
Grooming products	60.0%	92.2%	−32.2%
Laundry Detergents	64.2%	78.6%	−14.4%
Oatmeal	37.1%	53.9%	−16.8%
Paper Towels	45.0%	51.4%	−6.4%
Refrigerated Juices	55.9%	57.1%	−1.2%
Soft Drinks	69.3%	88.6%	−19.3%
Shampoos	79.3%	94.2%	−14.9%
Snack Crackers	43.1%	81.3%	−38.2%
Soaps	44.2%	66.2%	−22.0%
Toothbrushes	70.0%	79.2%	−9.2%
Tuna	33.7%	52.4%	−18.7%

Toothpastes	65.4%	63.5%	1.9%
Toilet papers	52.0%	53.7%	−1.7%
Average of the Negative Differences			**−18.5%**

Notes

We use Dominick's sale dummy indicator to identify sale prices. In column (1), we report the percentage of 9-ending prices among sale prices. In column (2), we report the percentage of 9-ending prices among regular prices. In column (3), we report the difference between the percentage of 9-ending prices among sale prices and among regular prices. All differences are statistically significant with $p < 0.01$, based on the *z*-scores proportions test.

Table B9. Regression Analysis of the Percentage Difference between 9-Ending and Non 9-Ending Prices, Regular Prices vs Sale Prices, Using Dominick's Sale Dummy, September 14, 1989–May 8, 1997

	Regular Prices				**Sale Prices**			
	(1)	**(2)**	**(3)**	***N***	**(4)**	**(5)**	**(6)**	***N***
Analgesics	0.14*** (0.005)	0.14*** (0.006)	0.16*** (0.001)	2,782,538	−0.01*** (0.002)	−0.00 (0.002)	−0.00** (0.002)	257,634
Bath Soaps	−0.09*** (0.015)	−0.09*** (0.014)	0.06*** (0.001)	372,448	0.07*** (0.009)	0.06*** (0.007)	0.00 (0.002)	45,649
Beers	−0.13*** (0.006)	−0.11*** (0.006)	−0.008*** (0.001)	1,421,725	0.36*** (0.017)	0.34*** (0.017)	0.13*** (0.002)	544,423
Bottled Juices	0.04*** (0.003)	0.03*** (0.003)	0.03*** (0.00)	3,482,485	−0.02*** (0.002)	−0.03*** (0.003)	−0.03*** (0.001)	842,539
Cereals	−0.02*** (0.001)	−0.02*** (0.001)	0.01*** (0.000)	4,365,153	0.02*** (0.002)	0.00 (0.002)	−0.02*** (0.001)	342,623
Cheese	0.12*** (0.003)	0.09*** (0.002)	0.18*** (0.000)	5,559,438	−0.02*** (0.002)	−0.00 (0.002)	−0.00*** (0.001)	1,192,888
Cigarettes	0.59*** (0.058)	0.02*** (0.005)	0.27*** (0.01)	1,801,423	NA	NA	NA	21
Cookies	−0.14*** (0.003)	−0.03*** (0.006)	−0.04*** (0.000)	6,289,751	−0.09*** (0.003)	−0.06*** (0.002)	−0.07*** (0.000)	1,278,677
Crackers	0.08*** (0.001)	0.09*** (0.001)	0.02*** (0.000)	1,726,858	−0.06*** (0.002)	−0.07*** (0.001)	−0.05*** (0.001)	501,410
Canned Soups	0.10*** (0.006)	0.09*** (0.006)	0.07*** (0.000)	4,806,570	0.03*** (0.003)	0.05*** (0.003)	−0.01*** (0.000)	697,922
Dish Detergents	0.04*** (0.008)	0.05*** (0.004)	0.03*** (0.000)	1,871,492	−0.07*** (0.002)	−0.07*** (0.002)	−0.06*** (0.001)	293,301
Front End Candies	0.40*** (0.002)	0.39*** (0.003)	0.24*** (0.000)	4,025,320	0.07*** (0.004)	0.04*** (0.004)	−0.01 (0.002)	411,734
Frozen Dinners	−0.07*** (0.007)	−0.07*** (0.007)	0.01*** (0.003)	1,254,403	−0.01 (0.009)	−0.03*** (0.009)	−0.07*** (0.001)	399,650
Frozen Entrees	0.09*** (0.003)	0.08*** (0.002)	0.02*** (0.000)	5,830,824	−0.19*** (0.006)	−0.23*** (0.007)	−0.20*** (0.001)	1,341,251
Frozen Juices	−0.05*** (0.002)	−0.06*** (0.003)	−0.04*** (0.000)	1,915,472	−0.19*** (0.006)	−0.19*** (0.007)	−0.12*** (0.001)	452,685
Fabric Softeners	−0.05*** (0.003)	−0.06*** (0.003)	0.01*** (0.001)	1,947,002	0.10*** (0.004)	0.13*** (0.002)	0.00** (0.001)	331,993

Grooming products	0.07*** (0.003)	0.04*** (0.004)	0.08*** (0.001)	3,379,005	0.21*** (0.003)	0.12*** (0.002)	0.11*** (0.001)	686,684
Laundry Detergents	0.07*** (0.003)	0.11*** (0.003)	0.12*** (0.001)	2,783,222	0.20*** (0.003)	0.19*** (0.003)	0.07*** (0.001)	494,222
Oatmeal	−0.03*** (0.005)	−0.03*** (0.006)	0.00*** (0.000)	884,061	−0.03*** (0.004)	0.01 (0.004)	−0.03*** (0.001)	96,976
Paper Towels	0.15*** (0.011)	0.15*** (0.011)	0.06*** (0.001)	740,148	0.05*** (0.006)	0.04*** (0.006)	0.02*** (0.002)	200,609
Refrigerated Juices	0.09*** (0.005)	0.09*** (0.005)	0.08*** (0.001)	1,649,385	−0.01*** (0.002)	−0.02*** (0.002)	−0.00** (0.000)	517,370
Soft Drinks	0.84*** (0.011)	0.43*** (0.005)	0.42*** (0.001)	7,458,955	0.60*** (0.009)	0.11*** (0.004)	0.13*** (0.001)	3,282,787
Shampoos	0.13*** (0.017)	0.09*** (0.013)	0.05*** (0.000)	3,817,736	−0.03*** (0.004)	−0.05*** (0.003)	0.02*** (0.001)	848,829
Snack Crackers	0.01 (0.007)	0.01 (0.006)	0.04*** (0.000)	2,704,331	−0.04*** (0.003)	−0.04*** (0.003)	−0.06*** (0.000)	783,233
Soaps	0.16*** (0.005)	0.15*** (0.004)	0.12*** (0.001)	1,544,719	0.11*** (0.002)	0.12*** (0.002)	0.03*** (0.001)	290477
Toothbrushes	−0.05*** (0.005)	−0.03*** (0.005)	0.00 (0.001)	1,472,393	−0.03 (0.004)	−0.02 (0.003)	−0.04*** (0.001)	299765
Tuna	0.21*** (0.003)	0.22*** (0.003)	0.11*** (0.001)	1,950,555	−0.01*** (0.004)	−0.01 (0.004)	−0.01*** (0.002)	432,428
Toothpastes	−0.01* (0.005)	−0.00 (0.004)	−0.02*** (0.000)	2,534,793	0.02*** (0.002)	0.04*** (0.002)	−0.02*** (0.001)	446,739
Toilet papers	0.45*** (0.008)	0.45*** (0.009)	0.14*** (0.001)	920,896	0.20*** (0.007)	0.20*** (0.006)	0.01*** (0.002)	229,076
Dummies for weeks	√		√		√		√	
Dummies for product-store			√				√	
Dummies for sub-categories-store	√				√			
Dummies for sub-categories-store-weeks		√				√		

Notes

In the table, we report the coefficient estimates of a 9-ending dummy in OLS regressions with fixed effects, where the dependent variable is the log of the prices. In columns (1)–(3), we report the results when we estimate the regression using

data on regular prices only. In columns (4)–(6), we report the results when we estimate the regression using data on sale prices only. We use Dominick's sale dummy indicator to identify sale prices. In columns (1) and (4), the regression includes controls for weeks and for subcategories-store. In columns (2) and (5), the regression includes controls for subcategories-stores-weeks. In columns (3) and (6), the regression includes dummies for weeks and for product-store. We could not estimate a regression for sale prices in the Cigarettes' category because there are only 21 observations on sale prices in that category and all of them end with 9. In parentheses we report robust standard errors, clustered at the store level. * $p <$ 10%, ** $p < 5\%$, *** $p < 1\%$.

APPENDIX C. ANNUAL DYNAMICS OF 9-ENDING AND NON 9-ENDING PRICES: REGULAR PRICES VS SALE PRICES USING DOMINICK'S SALE DUMMY

In the paper, we show that there were significant changes in the shares of 9-ending prices over time among regular and sale prices. In addition, we show that the difference between the average 9- and non 9-ending prices among regular and sale prices have changed significantly over time. In this section, we replicate these calculations, this time using the Dominick's sale Dummy instead of the sale filter we use in the paper.

Table C1 gives the shares of 9-ending prices among regular and sale prices. It can be observed that among regular prices, the share of 9-ending prices increases over time: The share of 9-ending prices among regular prices was 51.66% in 1989 and 75.07% in 1997, an increase of 45%. Among sale prices, the share of 9-ending prices was relatively constant and even decreasing: it was 53.48% in 1989 and 45.00% in 1996, before recovering to 62.19% in 1997.

The changes in the shares of 9-ending prices among regular and sale prices result in 9-ending being more common among sale prices than regular prices in 1989 (53.48% vs. 51.66%). From 1990 onwards, they became more popular among regular than among sale prices.

In Table C2, we present for each year, the average price over all products, stores and weeks. In Panel A, we report the average 9- and non 9-ending prices for all the observations, and in Panels B and C for regular and sale prices, respectively. The figures indicate that the difference between 9- and non 9-ending prices has been increasing over time. When we look at all observations, the percentage difference increases from 1.75 percent in 1989, to 27.09 percent in 1997. For regular prices, we find that the difference increases from 1.28 percent in 1989, to 22.31 percent in 1997, while for sale prices its increases from 10.21 percent in 1989, to 45.33 percent in 1997

These figures are averages, however, and thus they could be affected by the heterogeneity across products. To control for that, we estimate two sets of log-linear OLS regressions, one regression equation for each year. The dependent variable in all

regressions is the log of the prices. The main independent variable in all the regressions is a 9-ending dummy. Its coefficient should capture the expected percentage difference between 9- and non 9-ending prices. A positive (negative) 9-ending dummy coefficient indicates that the expected 9-ending prices are higher (lower) than the expected non 9-ending prices. To control for heterogeneity, the first set of regressions also includes fixed effects for stores, product categories, product sub-categories, and weeks. The top panel of Table C3 reports the results.

We find that throughout the time period, the coefficients of the 9-ending dummy in the regular prices' regression are positive and significant. It therefore seems that when we control for heterogeneity by comparing products within subcategories, the expected 9-ending regular prices were always larger than the expected non 9-ending regular prices.

For sale prices, however, we find that until 1993, the coefficient of the 9-ending dummy is negative. Thus, until 1993, the expected 9-ending sale price was lower than the expected non 9-ending sale price. I.e., when we define sales by the Dominick's sale dummy, we find that in the early part of the data the expected 9-ending prices were lower than the corresponding non 9-ending prices. This has changed, however, in the later period.

The bottom panel summarizes the results of a stricter test: In the bottom panel we summarize the results of annual regressions that include, in addition to the 9-ending dummy, controls for products in stores and for weeks. Thus, the coefficient estimates of the 9-ending dummy should capture the average difference between 9-eding and non 9-ending prices at the level of an individual product, offered at a specific store. In other words, the coefficient estimate will indicate whether a consumer that has bought a product in a specific store, in a given year, got a better deal at a 9-ending or a non 9-ending price.

The results are stronger than the ones we find in Panel A: When we look at the product-store level, we find that during 1989–1990, 9-ending regular prices were usually lower than non 9-ending regular prices. Thus, in that period, 9-ending prices were indeed associated with lower regular and overall prices. In addition, during the same period, the expected 9-ending sale prices were also lower than non 9-ending sale prices.

From 1993 onwards the expected 9-ending regular price was higher than the expected non 9-ending regular prices, resulting in 9-ending prices being higher, overall, than non 9-ending prices. The expected 9-ending sale prices, however, remained lower than the expected non 9-ending sale prices until 1996. Thus, until 1991 a consumer that has bought a product in a specific store, was better off, in expected terms, if s/he bought the good when its price was 9-ending. Following that time, if s/he bought the good at a regular price, s/he was better off if s/he bought the good when its price was not 9-ending. If the consumer, however, bought the good at a sale price, then s/he made a better deal if s/he bought the product at a 9-ending price rather than a non 9-ending price.

Table C1. The Share of 9-Ending Prices in Regular and Sale Prices, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997

Year	All Observations	Regular Price	Sale Price
1989	51.91%	51.66%	53.48%
1990	54.66%	55.05%	52.49%
1991	55.76%	56.77%	50.58%
1992	63.93%	65.86%	54.77%
1993	63.82%	65.60%	55.89%
1994	67.23%	70.12%	55.12%
1995	66.67%	71.09%	48.01%
1996	68.85%	74.22%	45.00%
1997	73.05%	75.07%	62.19%

Table C2. Annual Average 9-Ending and Non 9-Ending Prices, and Percentage Difference between Them, Regular and Sale Prices, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997

Year	(1) All observations			(2) Regular Price			(3) Sale Price		
	9-Ending	Non 9-Ending	% Difference	9-Ending	Non 9-Ending	% Difference	9-Ending	Non 9-Ending	% Difference
1989	2.30	2.26	1.75%	2.35	2.32	1.28%	2.06	1.86	10.21%
1990	2.36	2.31	2.14%	2.42	2.34	3.36%	2.01	2.18	−8.12%
1991	2.67	2.46	8.19%	2.74	2.18	22.86%	2.27	2.55	−11.63%
1992	2.78	2.12	27.10%	2.83	2.10	29.83%	2.51	2.16	15.02%
1993	2.67	2.34	13.19%	2.69	2.45	9.35%	2.57	1.96	27.10%
1994	2.77	2.26	20.35%	2.78	2.41	14.28%	2.69	1.86	36.90%
1995	2.86	2.16	28.07%	2.86	2.30	21.79%	2.86	1.81	45.75%
1996	2.98	2.30	25.90%	3.02	2.46	20.51%	2.76	1.98	33.21%
1997	3.16	2.41	27.09%	3.15	2.52	22.31%	3.21	2.04	45.33%

Notes

In the three panels we report for each year the average 9-ending and non 9-ending prices, respectively, for all observations, regular prices and sale prices, calculated over all stores and all weeks. In the difference column of each panel we report the percentage difference between the average 9-ending and non 9-ending prices computed as a log-difference. We use Dominick's sale dummy indicator to identify sales.

Table C3. Annual Regressions of the Percentage Difference between 9-Ending and Non 9-Ending Prices, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997

Panel A						
Year	All Observations		Regular Prices		Sale Prices	
	9-Ending	*N*	9-Ending	*N*	9-Ending	*N*
1989	0.10*** (0.003)	2,570,474	0.12*** (0.004)	2,216,482	0.01*** (0.002)	353,992
1990	0.04*** (0.002)	9,228,965	0.08*** (0.002)	7,826,038	−0.13*** (0.001)	1,402,927
1991	0.03*** (0.003)	10,650,384	0.07*** (0.002)	8,938,168	−0.12*** (0.005)	1,712,216
1992	0.07*** (0.005)	13,731,259	0.09*** (0.003)	11,377,868	−0.04*** (0.010)	2,353,391
1993	0.07*** (0.002)	14,023,602	0.07*** (0.002)	11,486,371	0.05*** (0.003)	2,537,231
1994	0.11*** (0.001)	13,645,820	0.10*** (0.001)	10,972,699	0.05*** (0.001)	2,673,121
1995	0.14*** (0.001)	13,424,315	0.12*** (0.002)	10,854,559	0.05*** (0.001)	2,569,756
1996	0.15*** (0.001)	14,238,652	0.13*** (0.001)	11,625,293	0.03*** (0.002)	2,613,359
1997	0.14*** (0.001)	5,156,434	0.13*** (0.001)	4,3461,99	0.13*** (0.002)	810,235
Panel B						
Year	All Observations		Regular Prices		Sale Prices	
	9-Ending	*N*	9-Ending	*N*	9-Ending	*N*
1989	−0.03*** (0.005)	2,570,474	−0.01*** (0.004)	2,216,482	−0.04 (0.012)	353,992
1990	−0.04*** (0.005)	9,228,965	−0.02*** (0.003)	7,826,038	−0.13*** (0.009)	1,402,927
1991	−0.04*** (0.004)	10,650,384	0.00 (0.003)	8,938,168	−0.17*** (0.008)	1,712,216
1992	−0.00 (0.003)	13,731,259	0.01*** (0.003)	11,377,868	−0.08*** (0.004)	2,353,391
1993	0.02*** (0.002)	14,023,602	0.02*** (0.002)	11,486,371	−0.03*** (0.004)	2,537,231
1994	0.06*** (0.002)	13,645,820	0.04*** (0.002)	10,972,699	−0.01*** (0.002)	2,673,121
1995	0.07*** (0.002)	13,424,315	0.05*** (0.002)	10,854,559	−0.03*** (0.002)	2,569,756
1996	0.10*** (0.002)	14,238,652	0.04*** (0.002)	11,625,293	−0.00 (0.003)	2,613,359
1997	0.09 (0.003)	5,156,434	0.04*** (0.003)	4,346,199	0.07 (0.003)	810,235

Notes

In the table, we report the coefficient estimates of a 9-ending dummy in OLS regressions with fixed effects, where the dependent variable is the log of the prices. The regressions were estimated for each year separately over all stores and all products. The 9-ending dummy equals 1 if the price ends with 9, and 0 if the price ends with any other digit. Panel A gives the results where the regression includes controls for product category, product-subcategory and weeks. Panel B gives the results where the regressions include controls for product-store. The All Observations Panel gives the results of a regression that was estimated using all the observations. The Regular Prices Panel gives the results of a regression that was estimated

using only observations on regular prices. The Sale Prices Panel gives the results of a regression that was estimated using only observations on sale prices. We use the Dominick's sale dummy indicator to identify sale prices. The regressions also include fixed effects for stores, categories, sub−categories and weeks. ***− $p < 0.01$.

APPENDIX D. WEEKLY DYNAMICS OF 9-ENDING AND NON 9-ENDING PRICES: REGULAR PRICES VS SALE PRICES

D.1. Using a Sale Filter

The results presented in the paper suggest that Dominick's may be using low 9-ending sale prices to support consumers' belief that 9-ending prices are lower than non 9-ending prices, although on average they are higher. It might therefore be that low 9-ending sale prices are correlated with high regular 9-ending prices. In other words, it is possible that to draw the consumers' attention away from high 9-ending prices, Dominick's contemporaneously sets low 9-ending sale prices.

If this is the case, then we would expect a negative correlation between 9-ending regular and sale prices: When 9-ending regular prices are high relative to non 9-ending regular prices, we would expect 9-ending sale prices to be low relative to non 9-ending prices.

In the paper we look at these correlations at the annual frequency. Here, we reassess this possibility at the weekly frequency. We thus calculated for each product category the difference between the average 9- and non 9-ending regular prices on a weekly basis. Similarly, we calculated for each product category the difference between the average 9- and non 9-ending sale prices on a weekly basis. We used the same sale filter as in the paper to identify sale prices. We use the results to draw product category level plots of the weekly time series of the percentage difference between the average 9- and non 9-ending prices. The dark line in Figure D1 depicts the average difference between 9- and non 9-ending regular prices over the 400-week sample period. The lighter (blue) dashed line depicts the average difference between 9- and non 9-ending sale prices. Table D1 summarizes the key observations that we draw from the data depicted in the time series plots.

First, it can be observed that the average difference between the average 9- and non 9-ending sale prices is significantly more volatile over time than the difference between 9- and non 9-ending regular prices. For regular prices, the average of the standard deviations of the difference is 20.65%, compared to 34.78% for sale prices. The large variance

suggests that consumers would find it difficult to discern whether or not the 9-ending sale prices are a better deal than a non 9-ending sale prices.

Second, consistent with the findings reported in the paper, the difference between the average 9- and non 9-ending prices is more pronounced for regular than for sale prices. For regular prices the average 9-ending prices are higher than the average non 9-ending prices 63.57% of the time (weeks). For sale prices, they are higher 53.47% of the time (weeks). Thus, whereas 9-ending regular prices are higher than non 9-ending prices most of the time, among sale prices the ratio is closer to 50:50. Another way to see the same phenomenon is to note that for regular prices, in 17 product categories the average 9-ending prices are higher than the average non-9 ending prices 60% of the time (weeks). In 8 of these product categories, the average 9-ending prices are higher than non 9-ending prices more than 80% of the time (weeks).

Among sale prices, in only 6 product categories the average 9-ending prices is higher than the average non 9-endign more than 60% of the time (weeks). And, in only one product category the average 9-ending prices is higher than the average non 9-ending prices more than 80% of the time (weeks).

As for the correlation between regular and sale 9-ending prices, the final column of Table D1 gives, for each product category, the value of the contemporaneous cross-correlation between the difference of 9- and non 9-ending regular and sale prices. Figure D2 complements this information by depicting the cross-correlogram plots for 16 leads and 16 lags for each product category.

The figures in the table indicate that in only 10 of the 27 product categories, the cross-correlations are statistically significant. All the significant cross-correlations are positive. It therefore seems that in the majority of product categories, the correlation between sale and regular 9-ending prices is either weak or positive. Looking at Figure D2, we can see that this is also the case if we study more leads and lags. The weak correlations do not agree with the hypothesis that Dominick's uses low 9-ending sale prices to draw attention away from relatively high 9-ending regular prices. This suggests that Dominick's builds the image of low 9-ending prices over time, perhaps over years, rather than using low 9-ending prices in a given week to draw attention away from high 9-ending regular prices.

D.2. Using Dominick's Sale Dummy

As a robustness check of the results we report in section D.1, we replicate the weekly time series analyses using the Dominick's sale dummy, instead of the sale filter, to identify sales.

We therefore calculated for each product category the difference between the average 9- and non 9-ending regular prices on a weekly basis again, this time using the sale dummy to identify sales. Similarly, we calculated for each product category the difference between the average 9- and non 9-ending sale prices on a weekly basis. We use the results to draw product category level plots of the weekly time series of the percentage difference between the average 9- and non 9-ending prices. The dark line in Figure D3 depicts the average difference between 9- and non 9-ending regular prices over the 400-week sample period. The lighter (blue) dashed line depicts the average difference between 9- and non 9-ending sale prices. Table D2 summarizes the key observations we draw from the data depicted in the Figure.

First, it can be observed, again, that the average difference between the average 9- and non 9-ending sale prices is significantly more volatile over time than the difference between 9- and non 9-ending regular prices. For regular prices, the average of the standard deviations of the difference is 20.48%, compared to 34.50% for sale prices. The large variance suggests that consumers would find it difficult to determine whether or not the 9-ending sale prices are a better deal than a non 9-ending sale prices.

Second, consistent with the findings reported in the paper, compared to sale prices, average regular 9-ending prices are much more likely to be higher than average regular non 9-ending prices. For regular prices, the average 9-ending prices are higher than the average non 9-ending prices 62.53% of the time (weeks). For sale prices, they are higher 50.80% of the time (weeks). Thus, whereas among regular prices, 9-ending prices are higher than non 9-ending prices in the majority of the weeks, among sale prices, the ratio is close to 50:50. Another way to see the same phenomenon is to note that for regular prices, in 17 product categories the average 9-ending prices are higher than the average non-9 ending prices more than 60% of the time (weeks). In 9 of these product categories,

the average 9-ending prices are higher than the average non 9-ending prices more than 80% of the time (weeks).

Among sale prices, in only 7 product categories the average 9-ending prices is higher than the average non 9-endign more than 60% of the time (weeks). And, in only one product category the average 9-ending prices is higher than non 9-ending prices more than 80% of the time (weeks).

Thus, the dynamic behavior of the difference over time, corroborates the findings from more aggregated data analyses presented in the paper. 9-ending prices are much more likely to be higher than non 9-ending prices among regular prices than among sale prices.

As for the correlation between regular and sale 9-ending prices, the final column of Table D2 gives, for each product category, the value of the contemporaneous cross-correlation of the difference between 9- and non 9-ending regular and sale prices. Figure D4 complements this information by depicting the cross-correlogram with 16 leads and 16 lags.

The figures in the table show that in only 15 of the 27 product categories, the cross-correlations are statistically significant. Only 4 of these cross-correlations are negative. It therefore seems that in the majority of product categories, the correlation between sale and regular 9-ending prices is either weak or positive. Looking at Figure D4, we can see that this is also the case if we consider more leads and lags. Thus the conclusion that follows from the analyses of weekly time series data, is not in line with the hypothesis that Dominick's uses low 9-ending sale prices to draw attention away from relatively high 9-ending regular prices. This suggests that Dominick's builds the image of low 9-ending prices over time, at a lower frequency, rather than use low 9-ending prices in a given week to draw attention from high 9-ending regular prices.

Table D1. The Percentage Difference between 9 and non-9 Ending Prices, Regular and Sale Prices, Using a Sale Filter

	Regular Prices				Sale Prices				
	Average Diff.	**S.D. Diff.**	**% Greater than 0**	**% Smaller than 0**	**Average Diff.**	**S.D. Diff.**	**% Greater than 0**	**% Smaller than 0**	**Correlation**
Analgesics	17.09%	19.33%	80.77%	19.23%	-1.16%	30.53%	50.99%	49.01%	0.25**
Bath Soaps	-10.88%	27.95%	36.60%	63.40%	0.21%	28.53%	44.30%	55.70%	0.30***
Beer	7.73%	42.20%	48.33%	51.67%	11.02%	37.36%	56.12%	43.88%	0.64***
Bottled Juices	2.04%	8.00%	61.22%	38.78%	6.96%	29.86%	59.38%	40.63%	0.04
Cereal	-2.26%	3.49%	24.59%	75.41%	0.45%	23.13%	48.42%	51.58%	0.24**
Cheese	12.09%	8.95%	92.09%	7.91%	-0.95%	20.84%	47.26%	52.74%	0.21**
Cigarettes	78.13%	104.24%	68.84%	31.16%					
Cookies	-9.43%	16.25%	27.06%	72.94%	-3.90%	22.46%	42.26%	57.74%	0.14**
Crackers	7.27%	9.61%	79.74%	20.26%	-7.38%	24.81%	43.70%	56.30%	0.11
Canned Soups	9.08%	11.11%	79.37%	20.63%	11.76%	30.71%	63.37%	36.63%	0.07
Dish Detergents	1.33%	18.63%	47.70%	52.30%	-6.53%	33.38%	44.13%	55.87%	0.10
Front End Candies	39.67%	10.49%	100%	0%	11.68%	24.25%	67.23%	32.77%	-0.06
Frozen Dinners	-5.97%	18.09%	39.61%	60.39%	2.36%	33.76%	49.37%	50.63%	0.10
Frozen Entrees	2.29%	21.37%	69.95%	30.05%	5.46%	37.67%	56.91%	43.09%	-0.03
Frozen Juices	-6.28%	9.18%	19.70%	80.30%	-6.06%	24.34%	34.84%	65.16%	0.07
Fabric Softeners	-3.64%	9.72%	37.12%	62.88%	10.15%	38.49%	56.50%	43.50%	-0.02
Grooming products	17.93%	18.62%	85.61%	14.39%	11.74%	31.31%	65.28%	34.72%	0.43***
Laundry Detergents	10.67%	17.70%	74.75%	25.25%	16.13%	33.38%	66.49%	33.51%	0.08
Oatmeal	-2.90%	8.37%	33.44%	66.56%	-5.84%	28.54%	50.23%	49.79%	0.08
Paper Towels	14.80%	17.46%	81.44%	18.56%	8.34%	59.32%	51.71%	48.29%	0.08
Refrigerated Juices	8.34%	12.07%	76.01%	23.99%	0.27%	26.37%	49.48%	50.52%	0.01
Soft Drinks	77.61%	30.70%	99.74%	0.26%	60.85%	62.11%	87.12%	12.88%	-0.10
Shampoos	12.65%	25.65%	69.30%	30.70%	-7.74%	34.53%	41.26%	58.74%	0.29***
Snack Crackers	10.06%	30.69%	42.71%	57.29%	-3.56%	19.95%	43.16%	56.84%	0.02
Soaps	16.17%	14.43%	83.34%	16.36%	9.25%	31.24%	58.94%	41.06%	0.01
Toothbrushes	1.69%	23.96%	42.53%	57.47%	-3.40%	42.73%	43.61%	56.39%	0.41***
Tuna	19.89%	11.46%	95.99%	4.01%	0.56%	42.26%	51.63%	48.37%	0.10
Toothpastes	7.60%	21.27%	55.03%	44.97%	-0.08%	27.94%	46.58%	53.42%	0.19**
Toilet papers	40.08%	27.72%	90.89%	9.11%	16.99%	55.58%	62.54%	37.46%	0.02
Average	**12.86%**	**20.65%**	**63.57%**	**36.42%**	**5.50%**	**34.78%**	**53.47%**	**46.53%**	**0.14**

Notes

In the table, we summarize the results on the average differences between 9- and non 9-ending prices at a weekly frequency. The Regular prices panel summarizes the results for the differences between 9- and non 9-ending regular prices. The average column gives the average of the average percentage weekly differences between regular 9- and non 9-ending prices. The S.D. column gives the standard deviation of the average percentage weekly differences between regular 9- and non 9-ending prices. The % greater than zero column gives the percentage out of all weeks in which the average regular 9-ending prices were above the average non 9-ending regular prices. The % smaller than zero column gives the percentage out of all weeks in which the average regular 9-ending prices were below the average non 9-ending regular prices. The Sale prices panel summarizes the results for the differences between 9- and non 9-ending Sale prices. The average column gives the average of the average percentage weekly differences between Sale 9- and non 9-ending prices. The S.D. column gives the standard deviation of the average percentage weekly differences between sale 9- and non 9-ending prices. The % greater than zero column gives the percentage out of all weeks in which the average sale 9-ending prices were above the average non 9-ending sale prices. The % smaller than zero column gives

the percentage out of all weeks in which the average sale 9-ending prices were below the average non 9-ending sale prices. We use a sale filter to identify sale prices. The correlation column gives the value of the period zero cross-correlation between the average regular and sale prices percentage differences between 9- and non 9-ending prices. ** $p < 5\%$, *** $p < 1\%$.

Table D2. The Percentage Difference between 9 and non-9 Ending Prices, Regular and Sale Price, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997

	Regular Prices				Sale Prices				
	Average Diff.	**S.D. Diff.**	**% Greater than 0**	**% Smaller than 0**	**Average Diff.**	**S.D. Diff.**	**% Greater than 0**	**% Smaller than 0**	**Correlation**
Analgesics	19.43%	19.15%	83.42%	16.58%	−2.08%	30.05%	45.40%	54.60%	0.11
Bath Soaps	−21.05%	28.39%	22.64%	77.36%	7.31%	42.88%	57.30%	42.70%	0.07
Beer	−4.81%	28.32%	36.45%	63.55%	20.85%	49.64%	62.02%	37.98%	0.46***
Bottled Juices	3.48%	8.38%	66.84%	33.16%	−0.92%	23.21%	47.96%	52.04%	0.01
Cereal	−2.35%	3.24%	23.22%	76.78%	1.07%	24.78%	50.55%	49.45%	0.09
Cheese	12.25%	9.66%	87.76%	12.24%	−2.31%	24.09%	47.45%	52.55%	−0.02
Cigarettes	77.92%	104.42%	68.84%	31.16%					
Cookies	−8.96%	17.09%	27.84%	72.16%	−8.18%	21.06%	37.79%	65.21%	0.23**
Crackers	7.26%	11.22%	76.32%	23.68%	−6.63%	22.05%	40.92%	59.08%	0.13**
Canned Soups	10.20%	11.43%	80.42%	19.58%	3.78%	26.65%	55.08%	44.92%	0.04
Dish Detergents	1.69%	18.61%	47.96%	52.04%	−7.85%	29.81%	39.52%	60.48%	0.14**
Front End Candies	41.16%	9.69%	100%	0%	7.50%	36.48%	57.72%	42.28%	−0.21**
Frozen Dinners	−5.94%	16.12%	37.25%	62.75%	−1.79%	34.74%	51.50%	48.50%	−0.01
Frozen Entrees	9.26%	13.03%	85.35%	14.65%	−14.98%	50.17%	36.20%	63.80%	0.34***
Frozen Juices	−4.11%	8.14%	28.28%	71.72%	−20.82%	33.32%	24.53%	75.47%	0.16**
Fabric Softeners	−4.84%	9.98%	33.84%	66.16%	11.79%	38.23%	62.14%	37.86%	−0.15**
Grooming products	8.84%	18.52%	71.22%	28.78%	14.12%	29.14%	68.30%	31.70%	0.06
Laundry Detergents	9.57%	16.41%	74.75%	25.25%	19.05%	33.15%	76.28%	23.72%	0.23**
Oatmeal	−3.03%	9.19%	32.79%	67.21%	−3.27%	26.09%	47.51%	52.49%	−0.05
Paper Towels	14.83%	16.11%	82.47%	17.53%	5.67%	54.43%	50.68%	49.32%	0.17**
Refrigerated Juices	10.03%	12.45%	79.04%	20.96%	−2.56%	25.57%	44.42%	55.58%	0.05

Soft Drinks	87.78%	34.17%	99.49%	0.51%	54.63%	54.29%	86.12%	13.88%	−0.16**
Shampoos	13.26%	27.91%	64.65%	35.35%	−5.35%	37.92%	45.75%	54.25%	0.22**
Snack Crackers	14.35%	38.71%	43.75%	56.25%	−3.44%	21.63%	39.27%	60.73%	0.08
Soaps	16.25%	16.65%	74.91%	25.09%	9.83%	26.78%	63.50%	36.50%	−0.17**
Toothbrushes	0.84%	21.33%	39.02%	60.98%	−9.30%	44.13%	34.94%	65.06%	0.29***
Tuna	21.19%	11.47%	96.26%	3.74%	−1.37%	36.22%	46.05%	53.95%	0.12
Toothpastes	10.05%	25.18%	56.28%	43.72%	−0.01%	28.16%	45.11%	54.89%	0.17**
Toilet papers	49.94%	28.81%	92.45%	7.55%	14.10%	51.55%	61.26%	38.74%	0.06
Average	**13.26%**	**20.48%**	**62.53%**	**37.47%**	**2.82%**	**34.15%**	**50.80%**	**49.20%**	**0.08**

Notes

In the table, we summarize the results on the average differences between 9- and non 9-ending prices at a weekly frequency. The Regular prices panel summarizes the results for the differences between 9- and non 9-ending regular prices. The average column gives the average of the average percentage weekly differences between regular 9- and non 9-ending prices. The S.D. column gives the standard deviation of the average percentage weekly differences between regular 9- and non 9-ending prices. The % greater than zero column gives the percentage out of all weeks in which the average regular 9-ending prices were above the average non 9-ending regular prices. The % smaller than zero column gives the percentage out of all weeks in which the average regular 9-ending prices were below the average non 9-ending regular prices.

The Sale prices panel summarizes the results for the differences between 9- and non 9-ending Sale prices. The average column gives the average of the average percentage weekly differences between Sale 9- and non 9-ending prices. The S.D. column gives the standard deviation of the average percentage weekly differences between sale 9- and non 9-ending prices. The % greater than zero column gives the percentage out of all weeks in which the average sale 9-ending prices were above the average non 9-ending sale prices. The % smaller than zero column gives the percentage out of all weeks in which the average sale 9-ending prices were below the average non 9-ending sale prices. We use Dominick's sale dummy indicator to identify sales.

The correlation column gives the value of the contemporary cross-correlation between the average regular and sale prices percentage differences between 9- and non 9-ending prices. ** $p < 5\%$, *** $p < 1\%$.

Figure D1. The Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using a Sale Filter, Dominick's, September 14, 1989–May 8, 1997

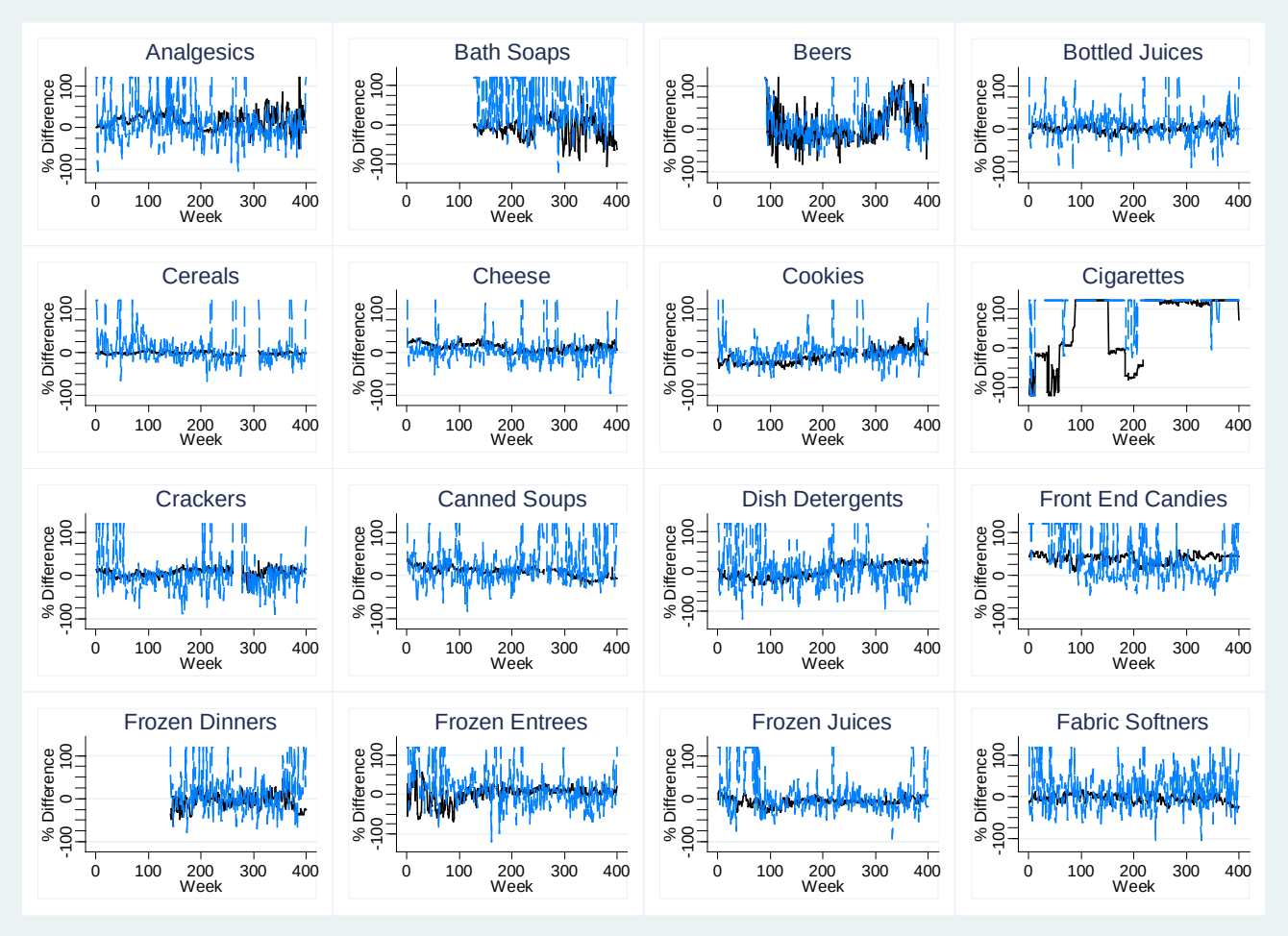


Figure D1. The Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using a Sale Filter, Dominick's, September 14, 1989–May 8, 1997 (Cont.)

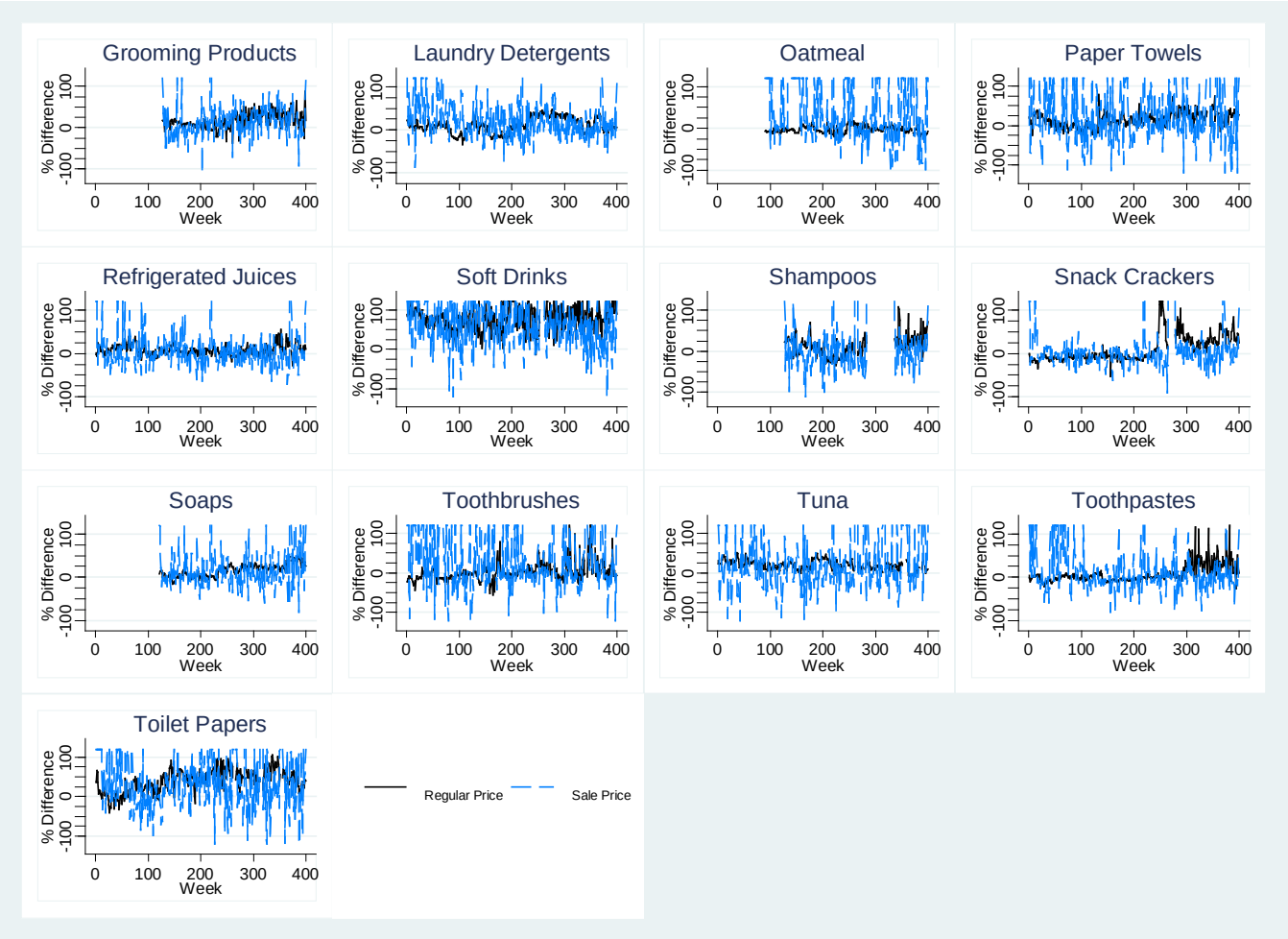


Figure D2. Cross-Correlograms of the Percentage Differences between Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using a Sale Filter, Dominick's, September 14, 1989–May 8, 1997

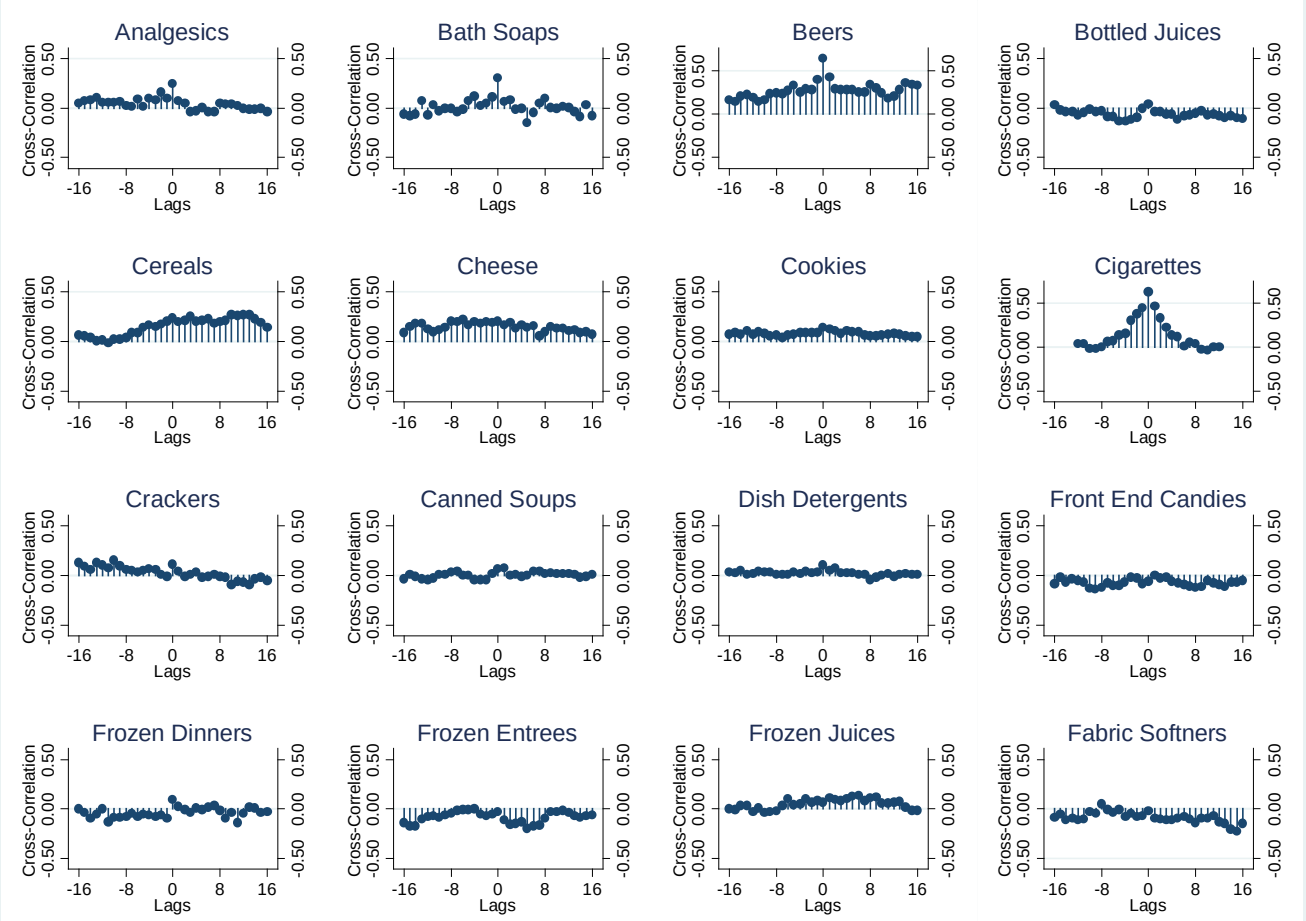


Figure D2. Cross-Correlograms of the Percentage Differences between Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using a Sale Filter, Dominick's, September 14, 1989–May 8, 1997 (Cont.)

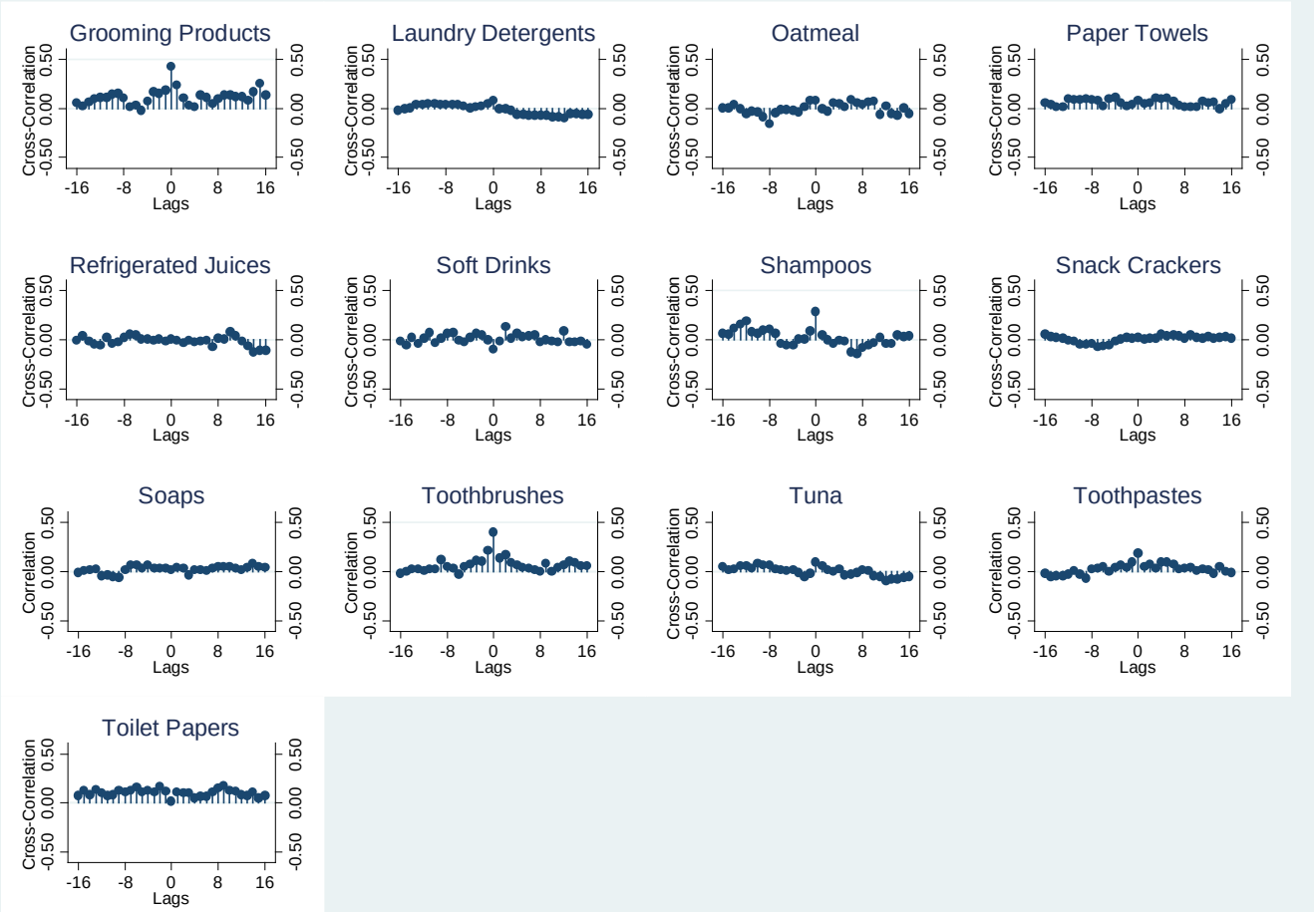


Figure D3. The Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997

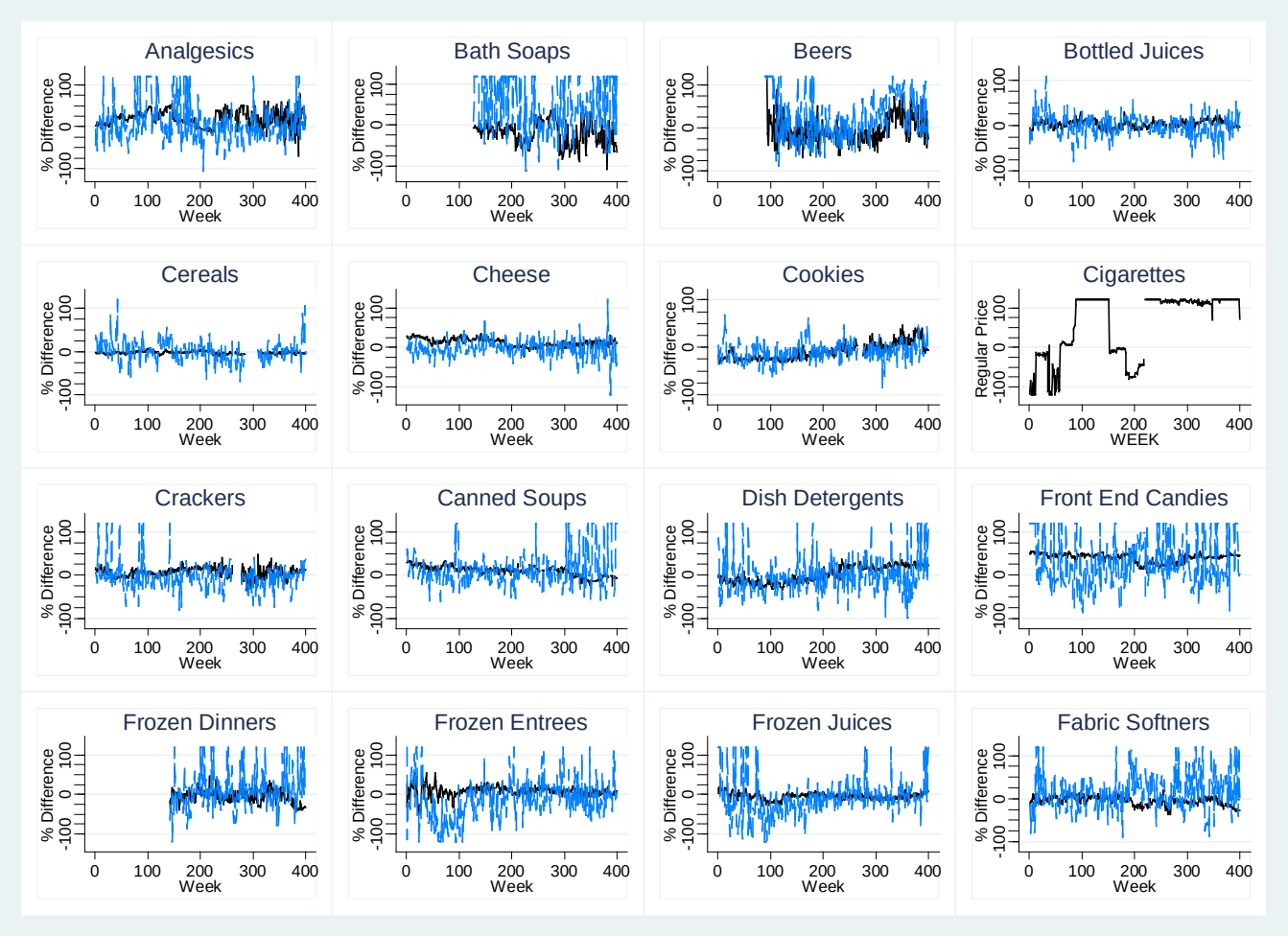


Figure D3. The Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997 (Cont.)

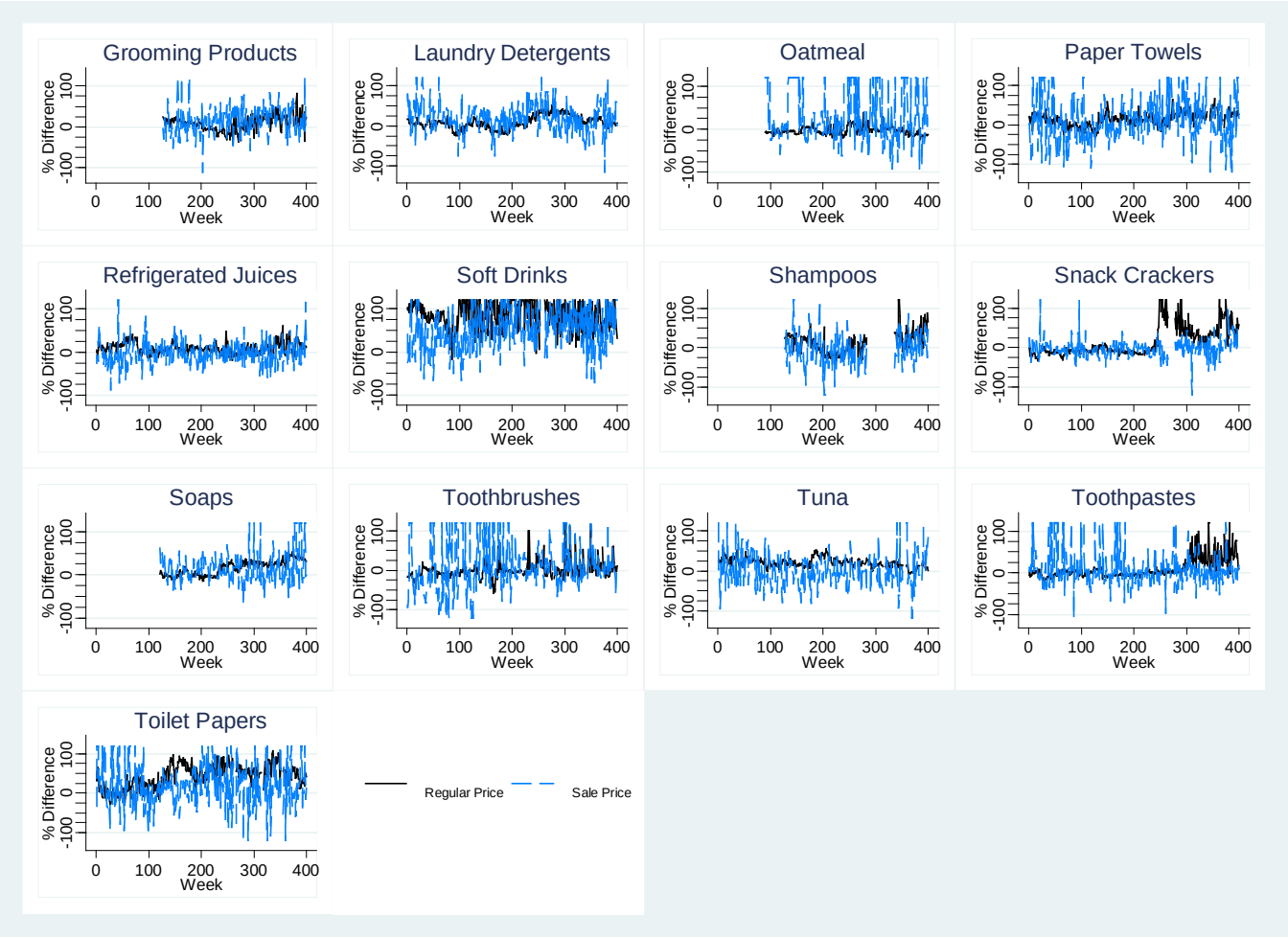


Figure D4. Cross-Correlograms of the Percentage Differences between Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997

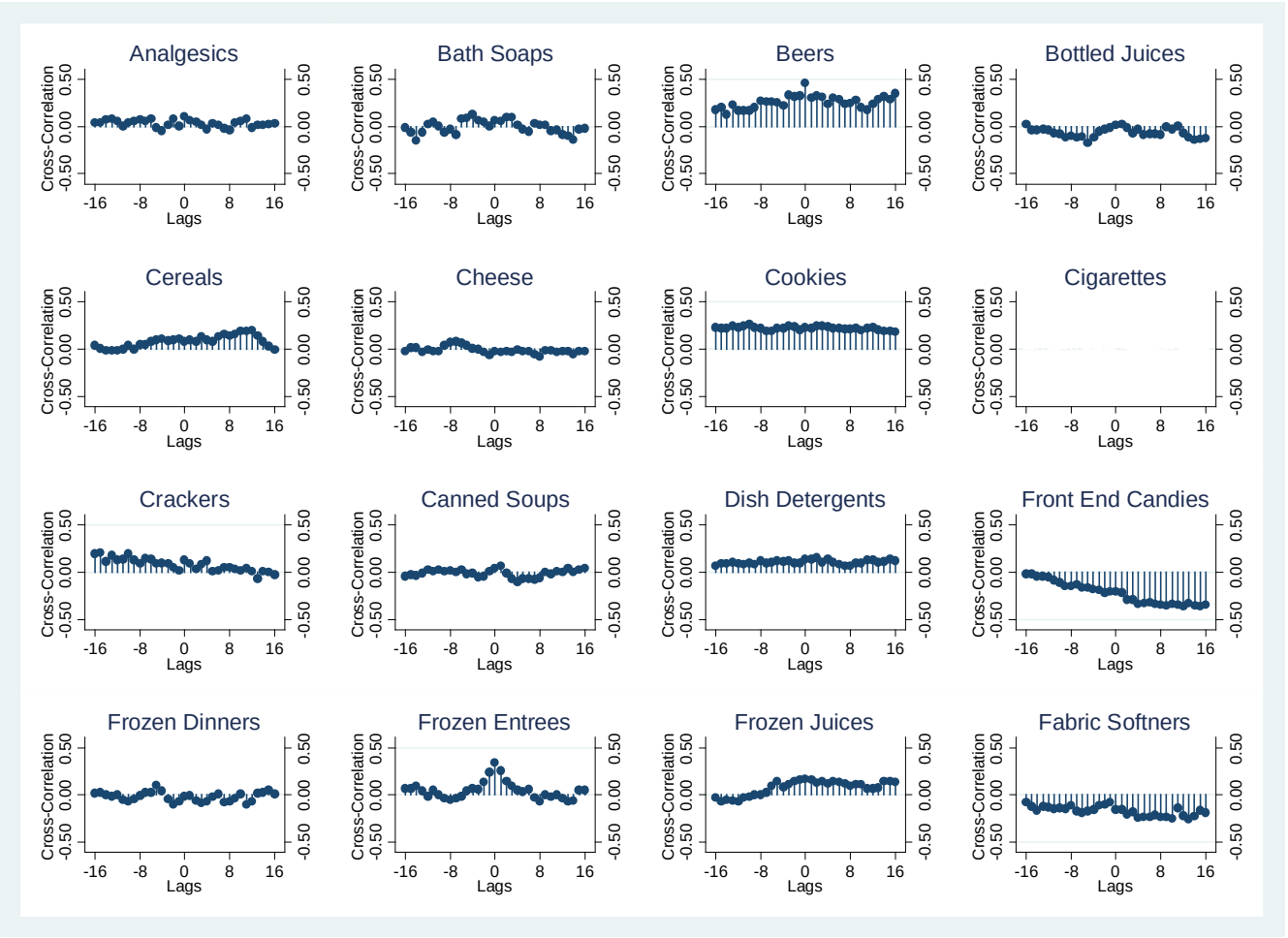
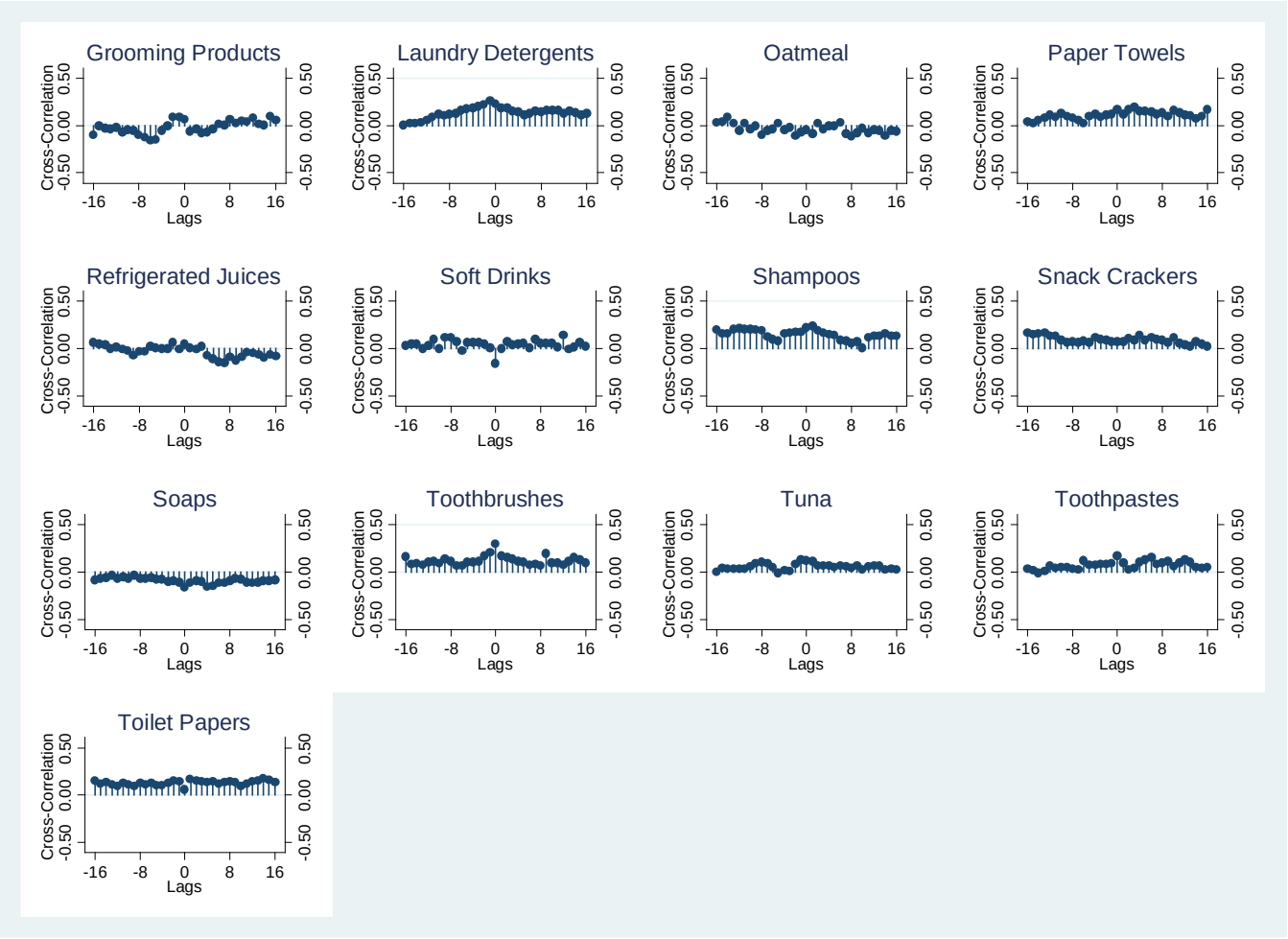


Figure D4. Cross-Correlograms of the Percentage Differences between Average 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, on a Weekly Basis, by Product Categories at the Product-Store Level, Using Dominick's Sale Dummy, Dominick's, September 14, 1989–May 8, 1997 (Cont.)



APPENDIX E. FREQUENCY DISTRIBUTION OF THE LAST DIGIT OF THE RETAIL PRICES AT DOMINICK'S BY PRODUCT CATEGORY

The frequency distribution of the last digit by product category is shown in Figure E1. According to the plots in the figure, 9 is the most frequent price ending in 28 out of the 29 categories, with the exception of the category of Cigarettes, which according to Besley and Rosen (1999) and Chen et al (2008), is subject to numerous regulatory restrictions.

In some product categories, 9-endingss are particularly dominant, comprising over 80% of the prices. These include Analgesics (86.0%), Bath Soap (88.3%), Beer (95.7%), Grooming Products (86.8%), Shampoos (91.5%) and Soft Drinks (82.7%).

Thus, the results we are reporting for the aggregated data in Figure 1 in the paper, hold for individual product categories as well.

Figure E1. Frequency Distribution of the Last Digit of the Retail Prices at Dominick's, by Product Category, September 14, 1989–May 8, 1997

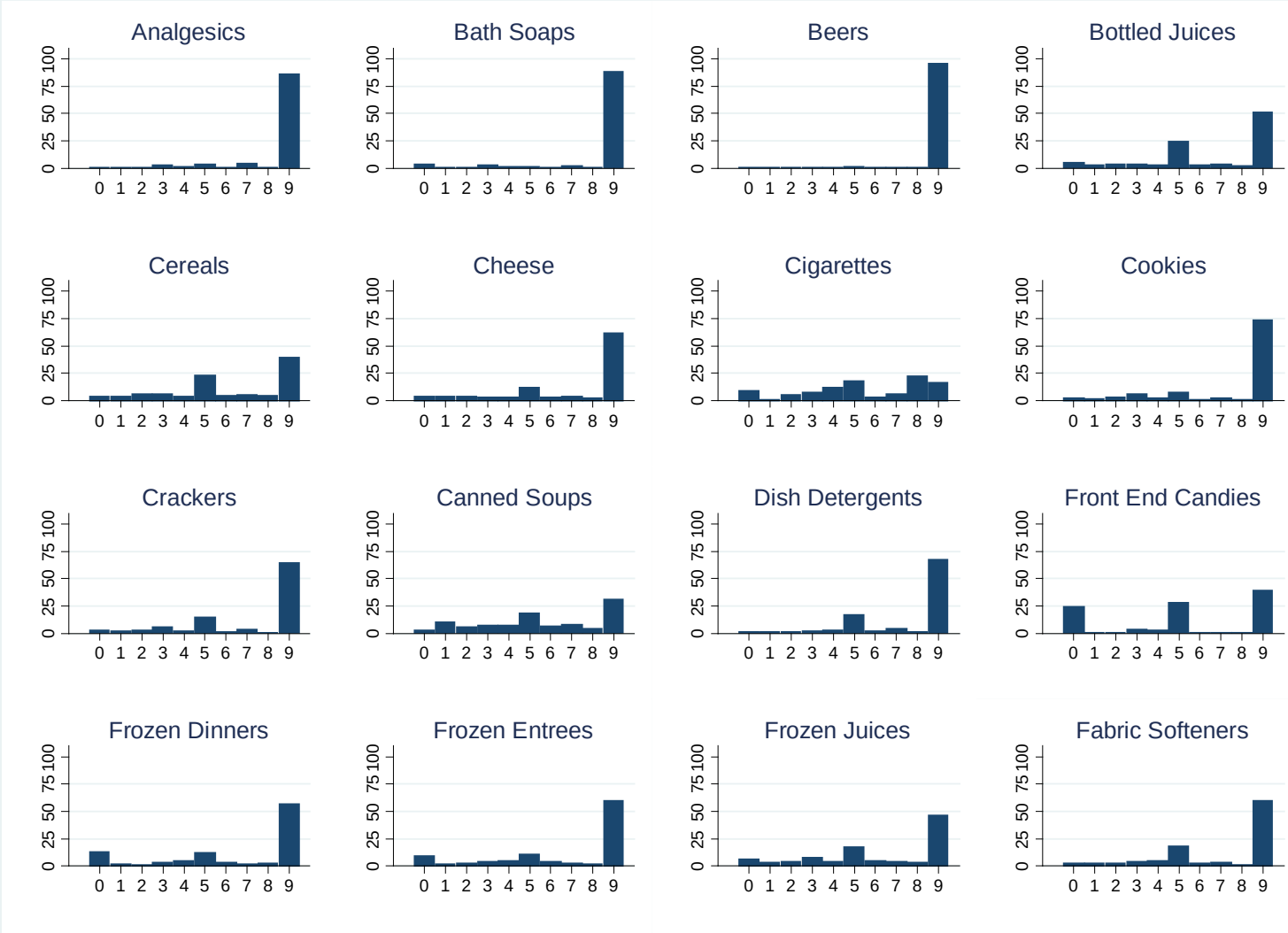
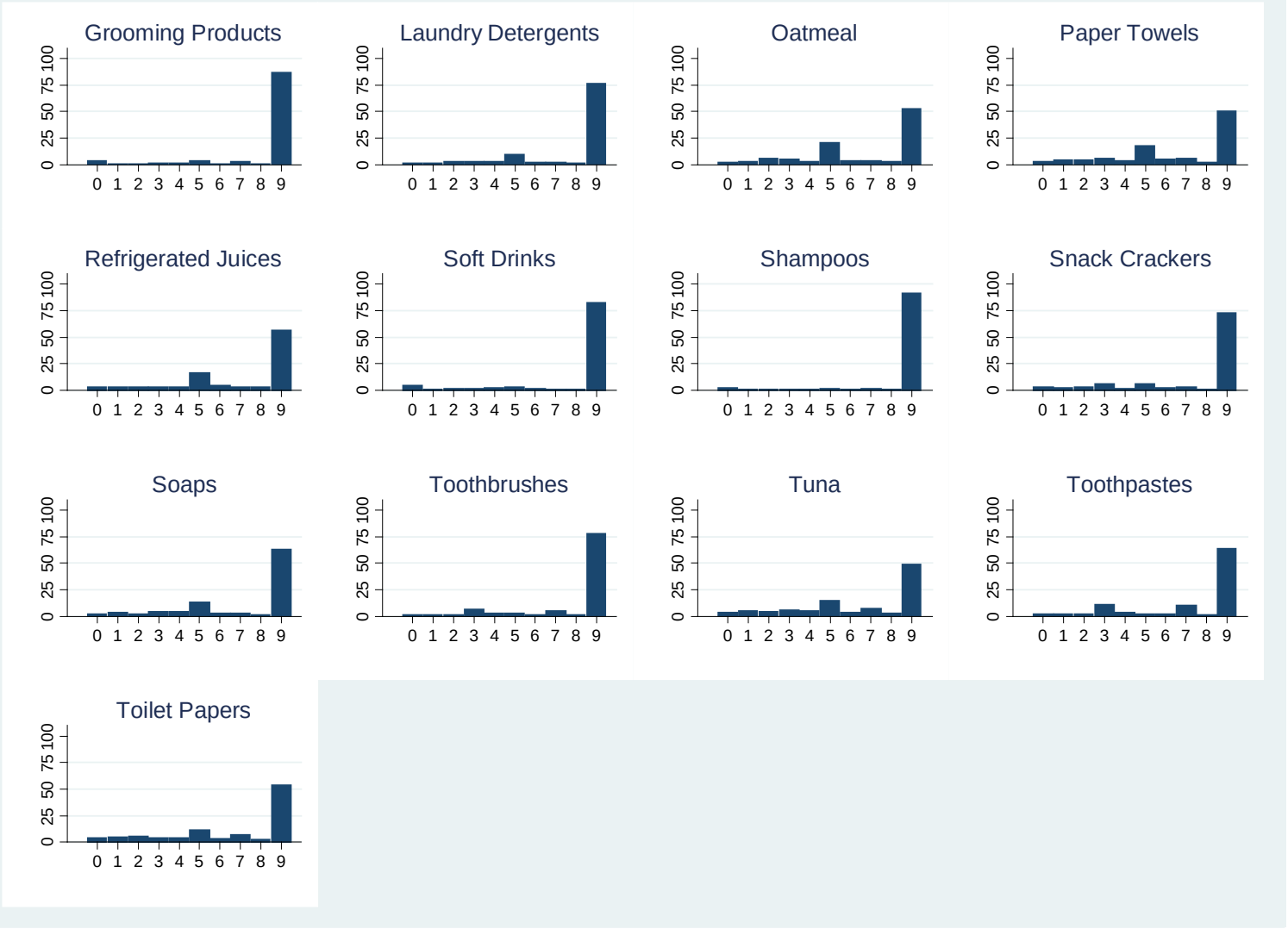


Figure E1. Frequency Distribution of the Last Digit of the Retail Prices at Dominick's, by Product Categories, September 14, 1989–May 8, 1997 (Cont.)



APPENDIX F. RETAIL PRICES OF THE PRODUCTS IN THE SNACK CRACKERS CATEGORY AT DOMINICK'S

In the paper, in Figure 2 in section 5 of the paper, we provide as an example of our main findings, a price series of a sample product, Nabisco Wheat Thins Low Salt, 10oz, from the Snack Crackers' category. We use the figure to illustrate that (a) 9-ending prices are more common than non 9-ending prices, (b) that 9-ending prices are more common among regular prices than among sale prices, (c) that non 9-ending prices are more common among sale prices than among regular prices, and (d) that on average, 9-ending prices are higher than non 9-ending prices.

To show that these attributes are typical for a large proportion of the products in our sample, and that they are not limited to the particular product we show in Figure 2 in the paper, in Figure F1 we show the retail prices of the products in the entire Snack Crackers category during September 14, 1989–May 7, 1997, at Dominick's Store 122, located in 2575 W. Golf Rd., Hoffman Estates, IL.[1] The figure gives the prices of the 84 products for which we have at least 208 weeks of data (the equivalent of 4 years), including the prices of the product depicted in Figure 2 in the paper, Nabisco Wheat Thins Low Salt, 10oz.

Looking at the figures, we see that 9-ending prices are indeed more common than non 9-ending prices for almost all products. Out of the 84 products, there are only three products for which non 9-ending products are more common than 9-ending prices. These are Nabisco Ritz Crackers (52.79% of the prices are non 9-ending), Ry Krisp Seasoned (51.75% of the prices are non 9-ending), and Ry Krisp Natural (53.55% of the prices are non 9-ending).

9-ending prices are also more common among regular prices than among sale prices. There are only three products for which 9-ending prices comprise less than 50% of the regular prices. These are Nabisco Ritz Crackers (52.46% of the regular prices are non 9-

[1] According to Midrigan (2011), Dominick's store number 122 has the highest number of price observations.

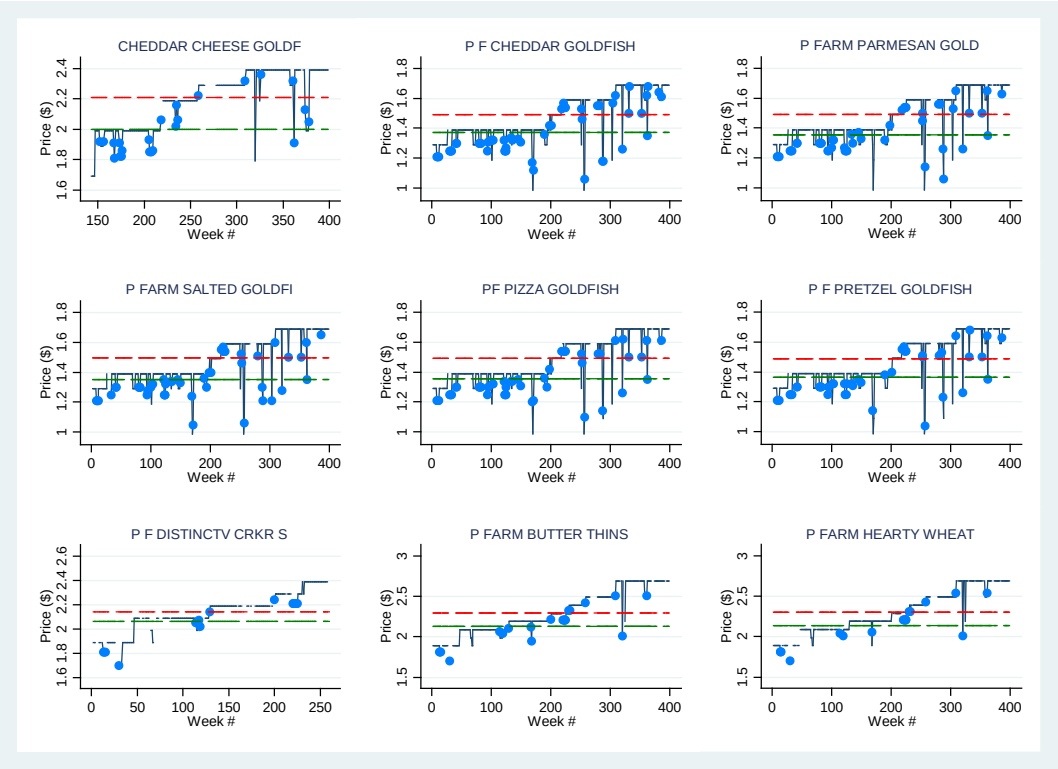
ending) Ry Krisp Seasoned (53.35% of the regular prices are non 9-ending), and Ry Krisp Natural (55.02% of the regular prices are non 9-ending).

Among sale prices, however, 9-ending prices comprise more than 50% of the prices for only 11 products. Thus, for the majority of the products shown in the figure, 9-ending prices comprise most of the regular prices, but only a minority of the sale prices. The opposite is true for non 9-ending prices: for the majority of the products shown, non 9-ending prices comprise minority of the regular prices but the majority of the sale prices.

Finally, out of the 84 products, for 82 products 9-ending prices are higher, on average, than non 9-ending prices. The only exceptions are Sunshine Cheez It and Nabisco Cheese Nips.

We therefore conclude that the example we use in the paper is not unique, and that it is representative of a large number of products sold at Dominick's.

Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997
Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL



Notes

Only products with at least 208 weeks of data (equivalent to 4 years) are included in the figure. The continuous dark line represents 9-ending prices. The blue dots represent non 9-ending prices. The red dashed line represents the average 9-ending price computed over all weeks of data. The long-dashed green line represents the average non 9-ending price, also computed over all weeks of data. We use a sales filter to identify sale prices.

Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

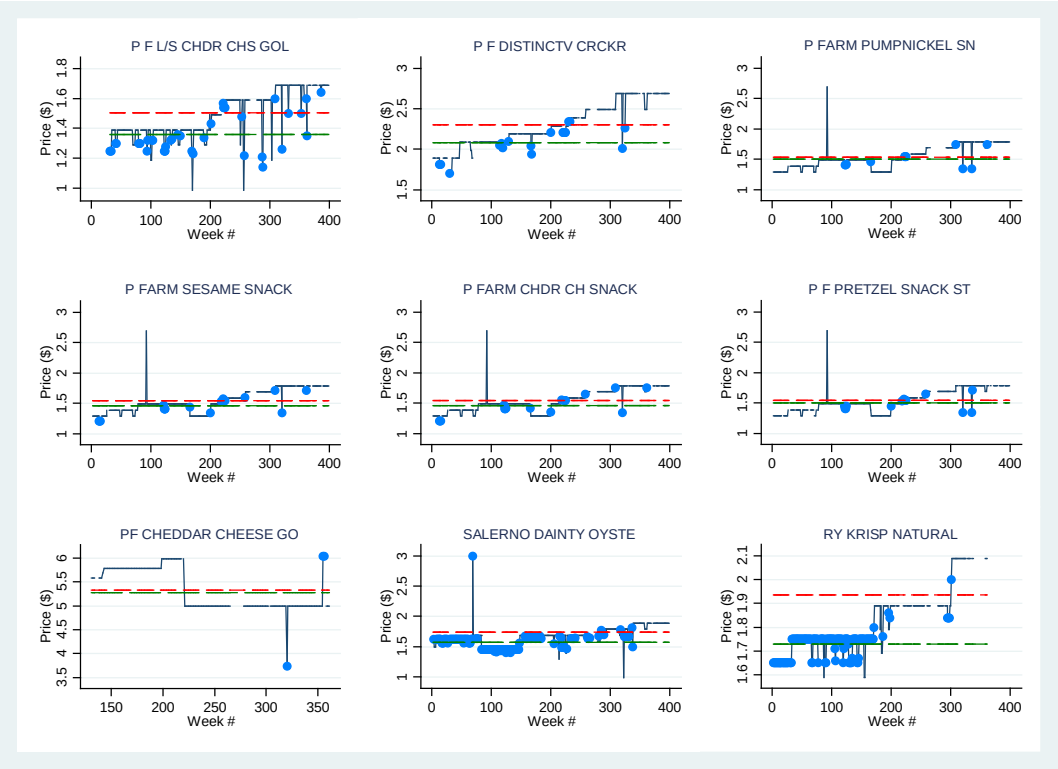


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

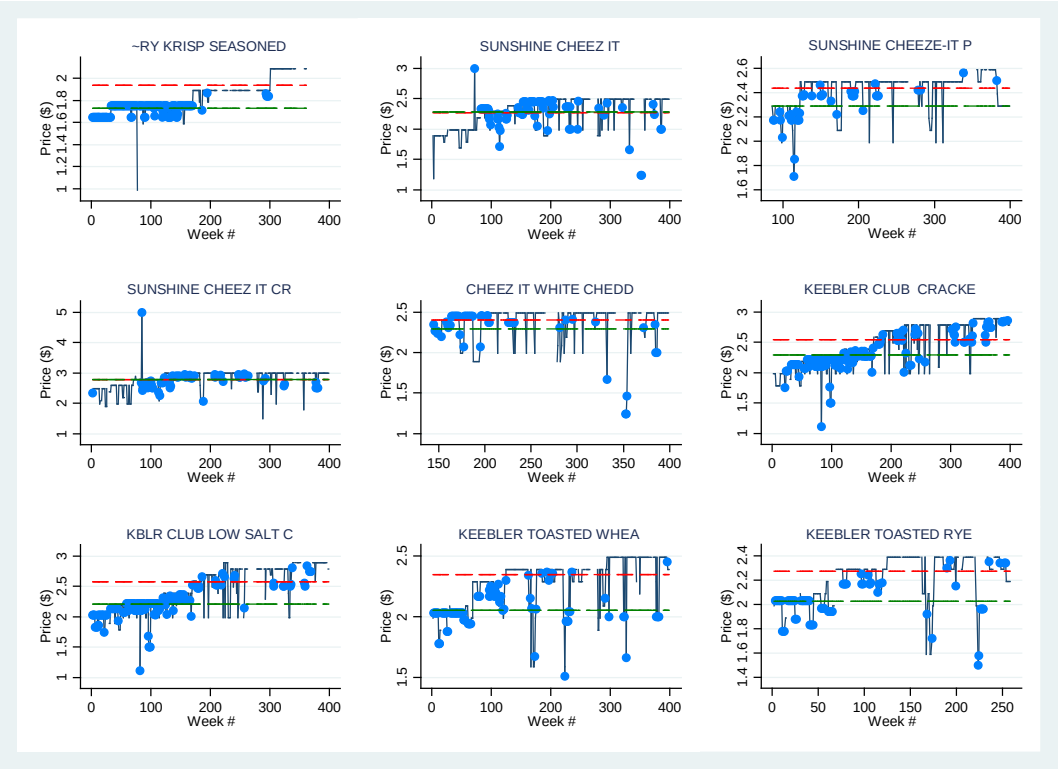


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

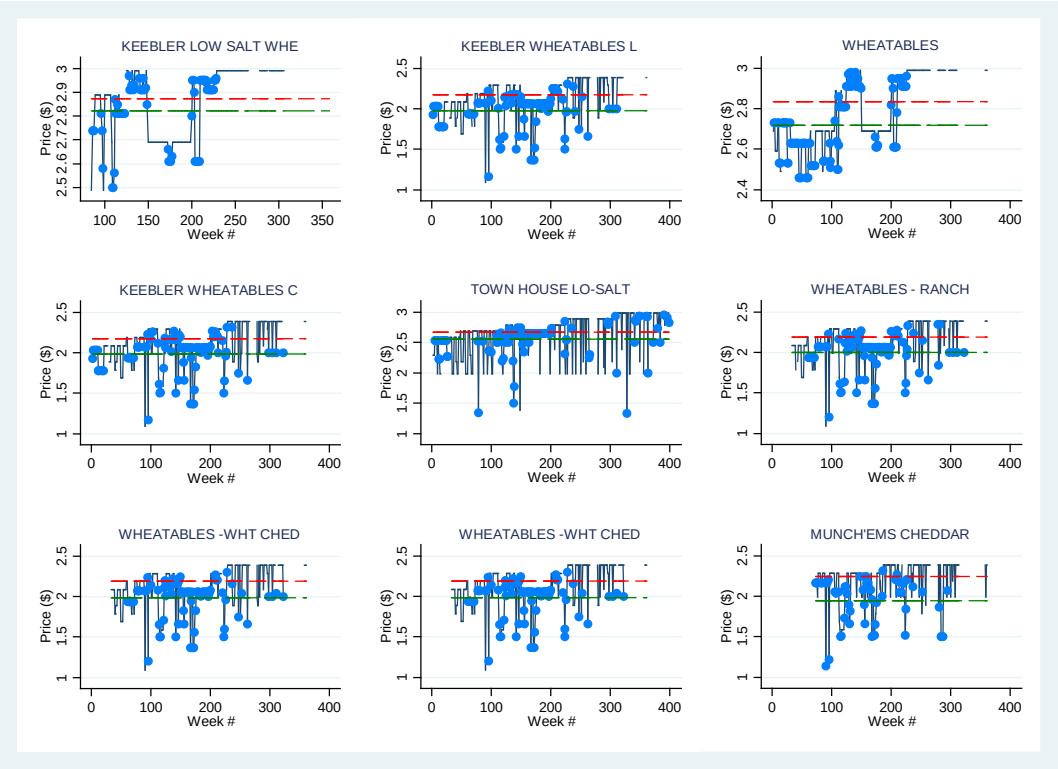


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

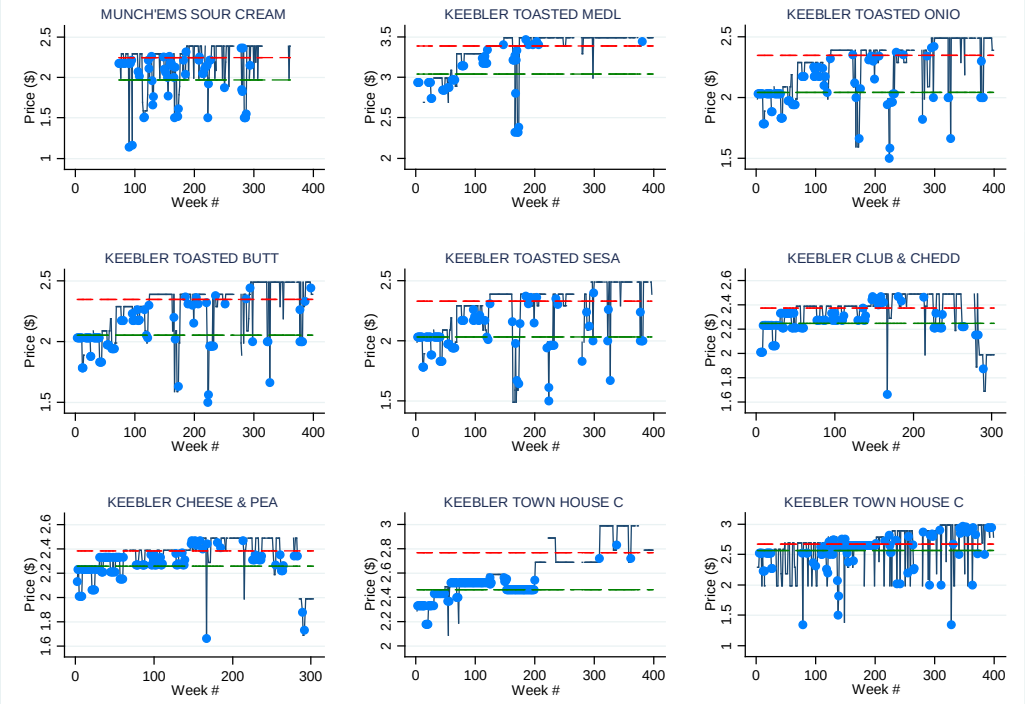


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

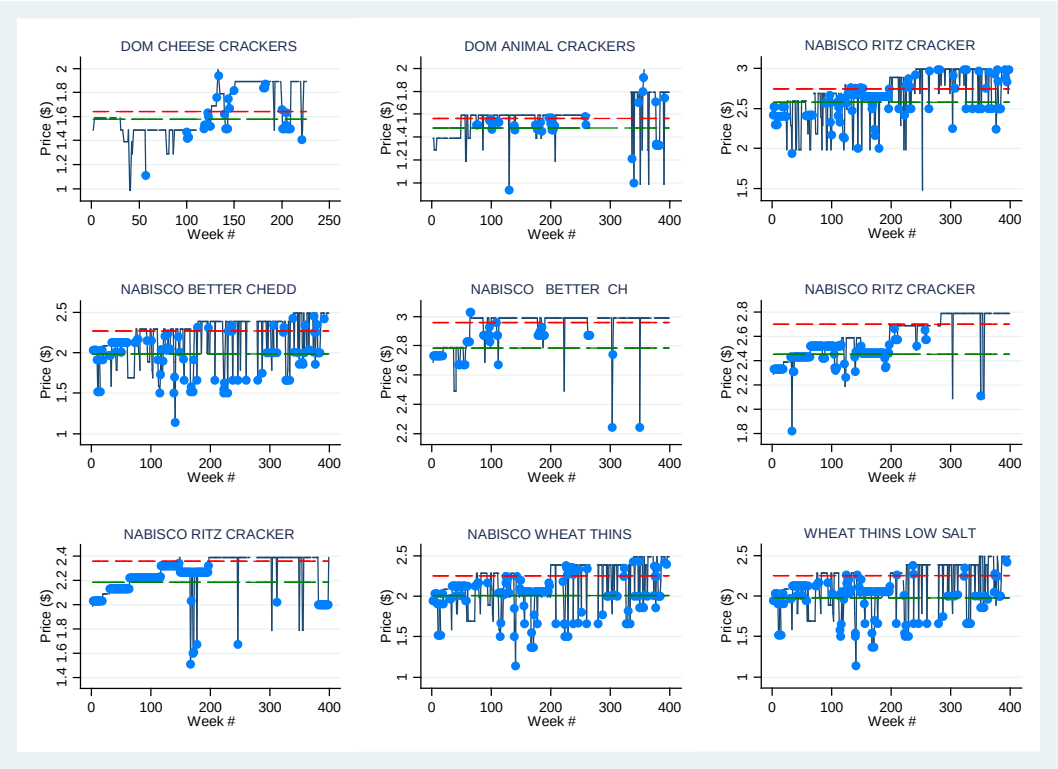


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

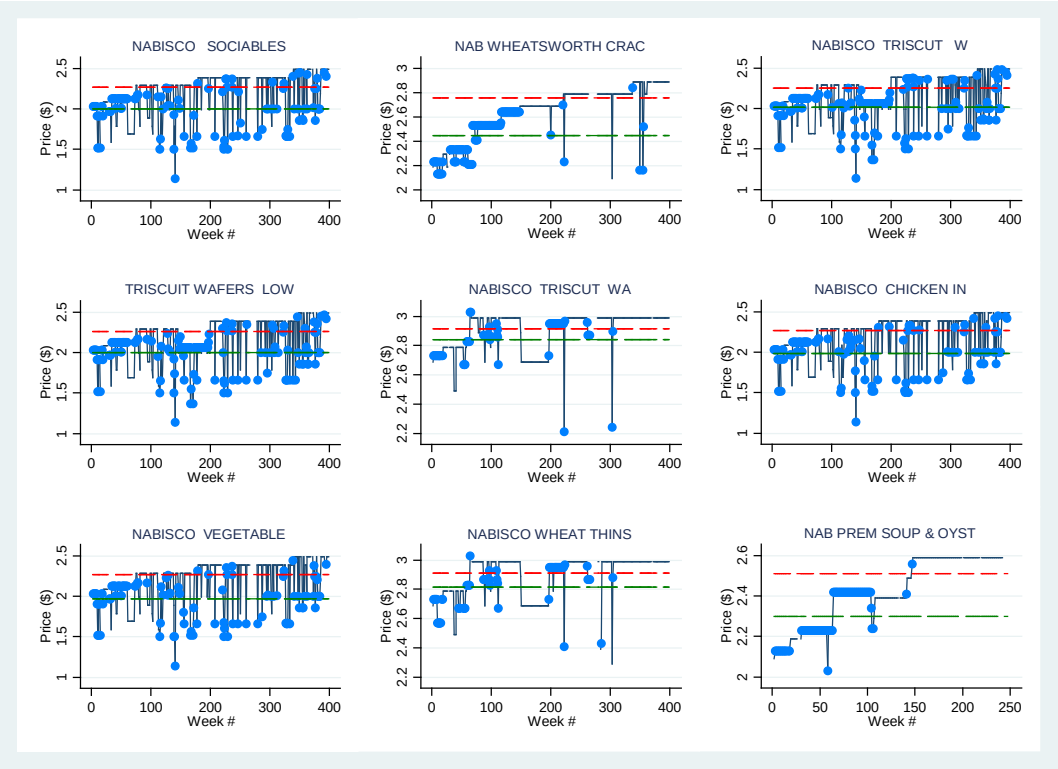


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

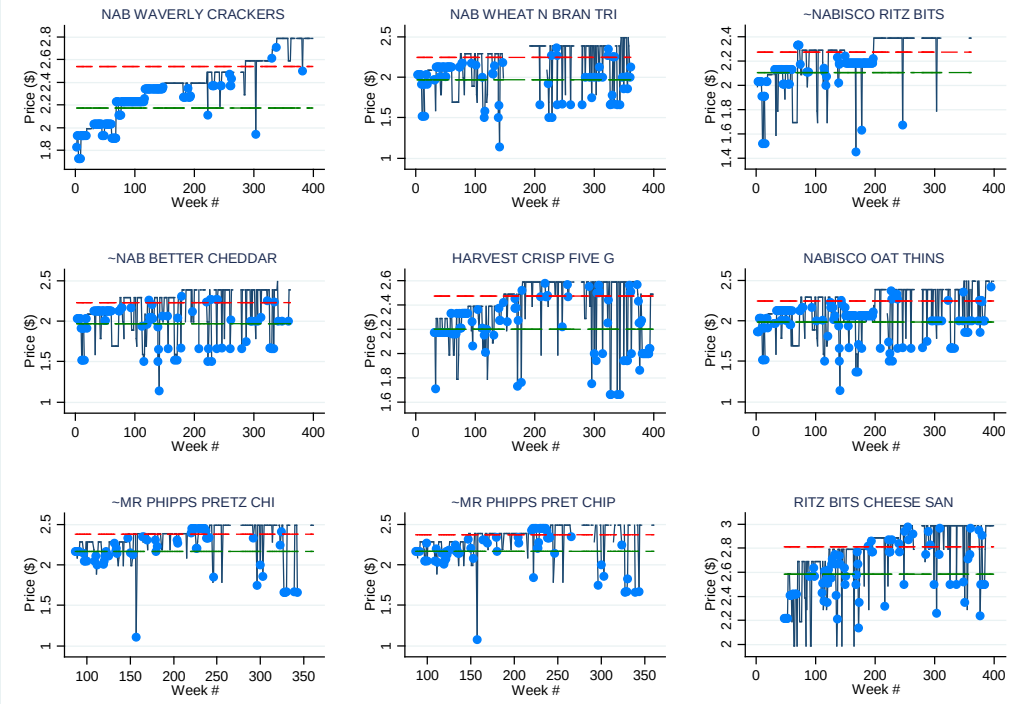


Figure F1. Retail Price of the Products in the Snack Crackers Category – Dominick's, September 14, 1989–May 7, 1997, Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)

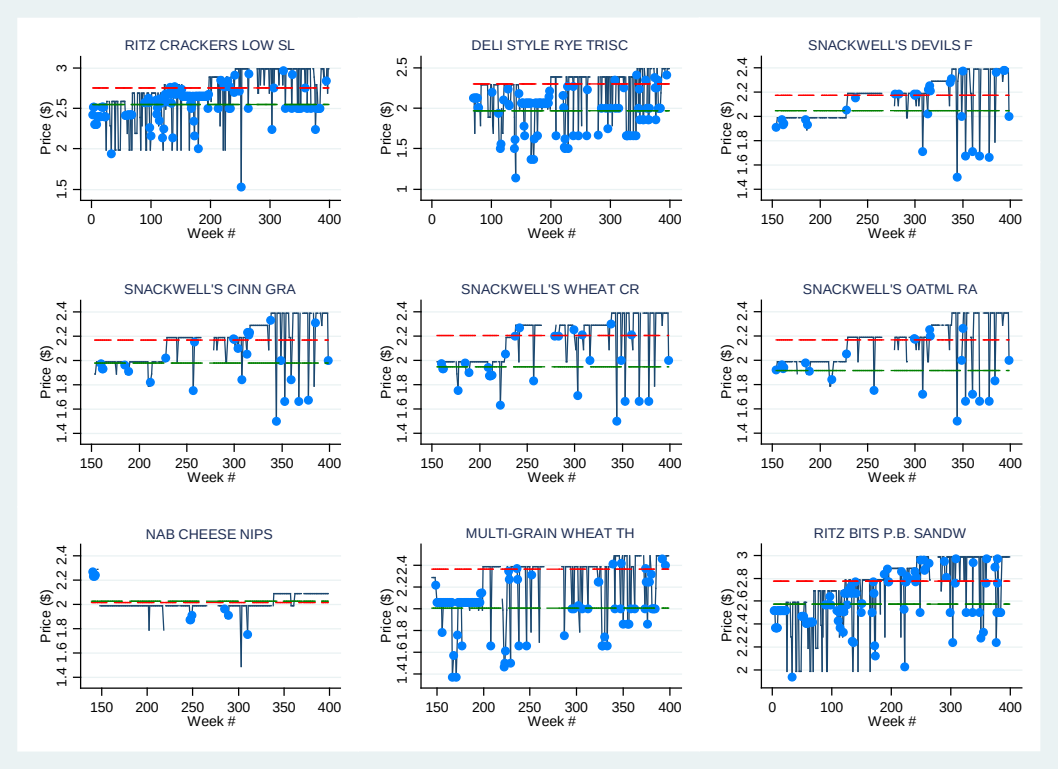
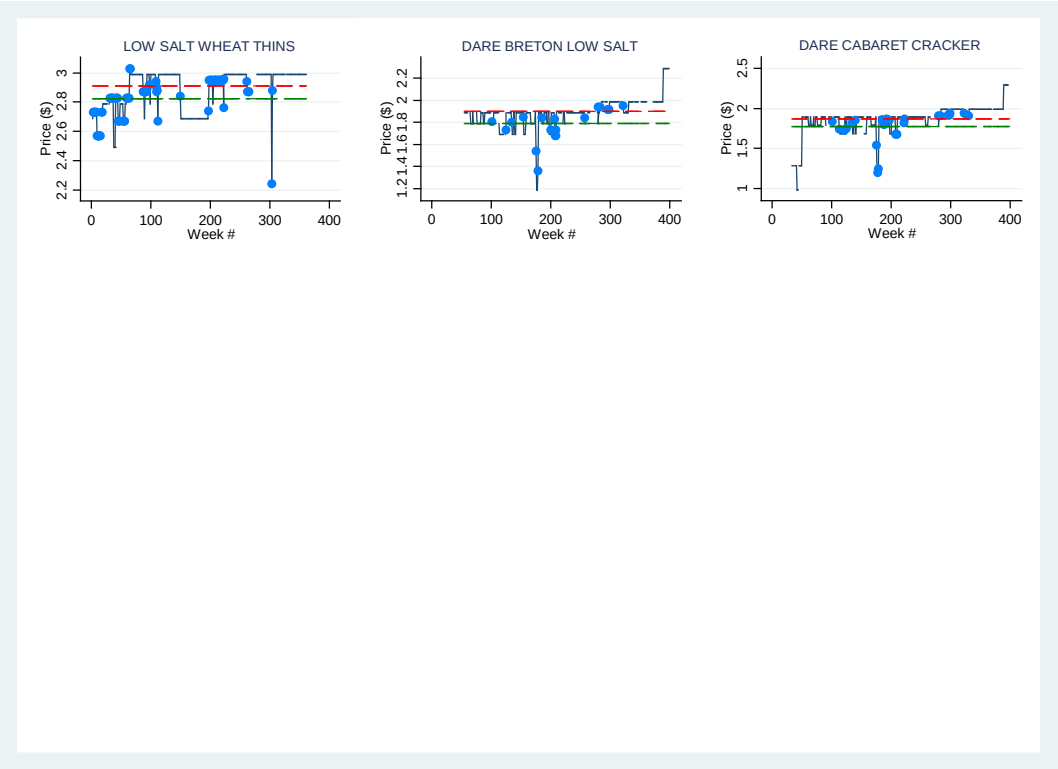


Figure F1. Retail Price of the Products in the Snack Crackers Category –
Dominick's, September 14, 1989–May 7, 1997,
Store No. 122, 2575 W. Golf Rd., Hoffman Estates, IL (cont.)



APPENDIX G. 9-ENDING VS. NON 9-ENDING PRICES, FOR INDIVIDUAL PRODUCTS AT THE STORE-LEVEL

It could be that the stores that have higher than average prices also have higher than average shares of 9-ending prices. In that case, even if 9-ending prices are the lowest within each store, we might still find that across all stores 9-ending prices are higher than the corresponding non-9 ending prices.

In addition, some of Dominick's product categories include several sub-categories. If 9-ending prices are more prevalent in sub-categories with relatively high prices than in sub-categories with lower prices, then even if 9-ending prices are the lowest within each sub-category, we might still find the opposite at the category level.

To explore these possibilities, we calculate for each product at each store, the percentage difference between the average 9-ending and non 9-ending prices. We calculate percentage differences as log-differences. In the paper, in Figure 3, we use the resulting figures to plot a histogram that shows the frequency distribution of the percentage differences for all products combined together. Here we present the frequency distribution histograms of the percentage differences at the category-level, for each one of the 29 product categories. See Figure G1. In Table G1, we report the corresponding descriptive statistics. These statistics include the median, the average, the standard deviation, the skewness, and the kurtosis for each product category.

Inspecting the plots in Figure G1, and the corresponding descriptive statistics in Table G1, we see that at the product-store level, in 25 of the 29 product categories, the average of the percentage difference is positive. Thus, in vast majority of categories, the average 9-ending prices are higher than the average non 9-ending prices even when we look at the level of a specific product, at a specific store.

We can also see that in 26 of the 29 product categories, the median of the percentage difference is positive, suggesting that the higher average 9-ending prices are not caused by outliers. Rather 9-ending prices are higher on average because more product-store combinations have higher average 9-ending than average non 9-ending prices.

According to Table G1, the skewness is positive in 18 of the 29 product categories,

which means that in these product categories, the distribution of the percentage difference is skewed to the right. Therefore, in addition to the finding that in most categories there are more product-store combinations with higher average 9-ending than average non 9-ending prices, we also find a longer tail on the right-hand side of the distribution. In other words, in these categories, we also find more extreme cases where the average 9-ending price is much higher than the average non 9-ending price than cases where the average 9-ending price is much lower than the average non 9-ending price.

The values of the kurtosis statistics are all greater than 3, meaning that the tails of the distributions of the percentage gap are thicker in comparison to the Normal Distribution, in all 29 product categories. Importantly, the kurtosis attains particularly high values in cases where the skewness is positive and large. Indeed, the correlation between the measures of skewness and kurtosis is 0.91, exceptionally high.

Figure G1. Frequency Distribution of the Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, by Product Category at the Product-Store Level, Dominick's, September 14, 1989–May 8, 1997

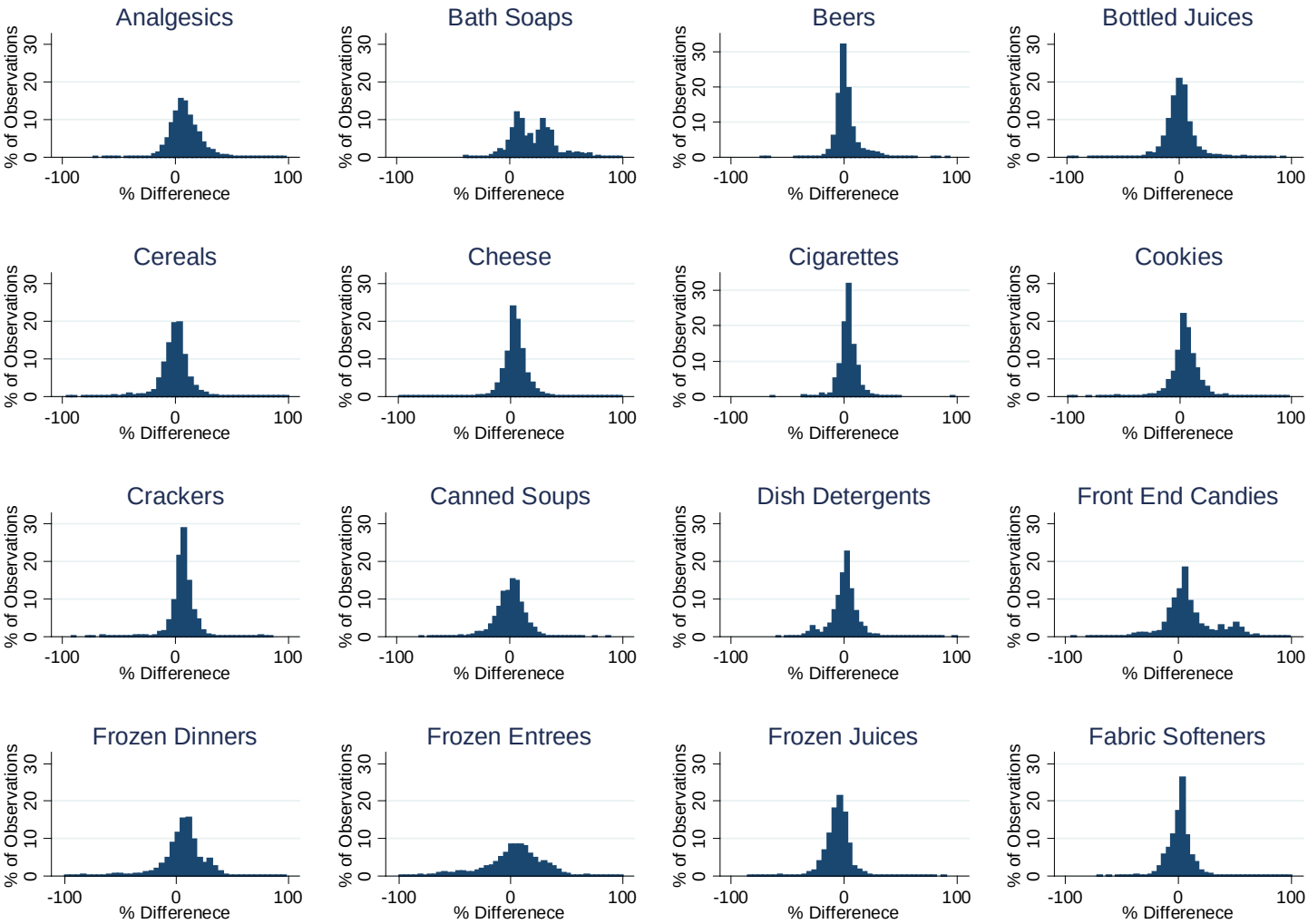


Figure G1. Frequency Distribution of the Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, by Product Category at the Product-Store Level, Dominick's, September 14, 1989–May 8, 1997 (Cont.)

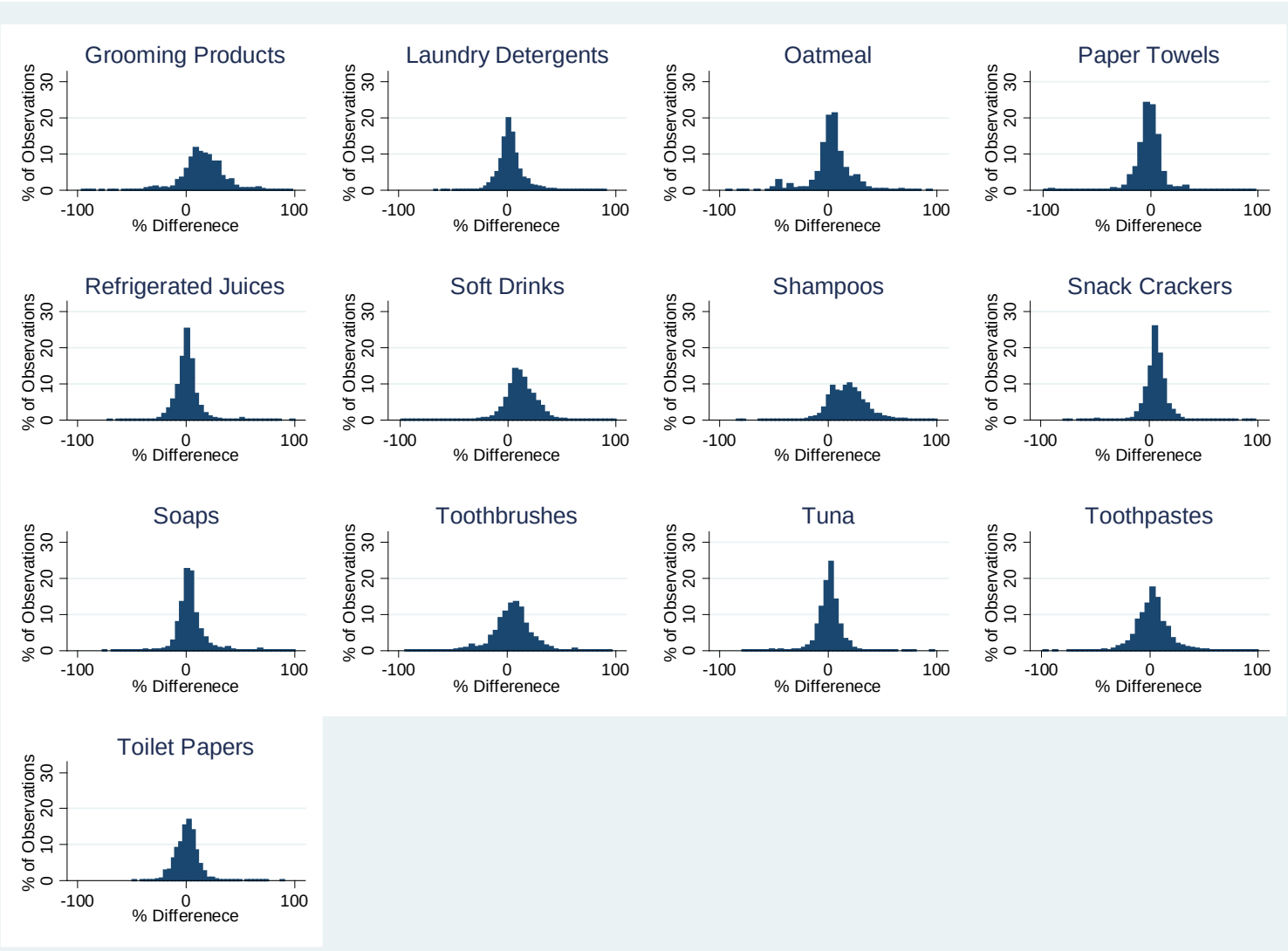


Table G1. Moments of the Distribution of the Percentage Differences between the Average 9-Ending and the Average Non 9-Ending Prices, Dominick's, September 14, 1989–May 8, 1997

Category	**Median**	**Average**	**Std. Dev.**	**Skewness**	**Kurtosis**	***N***
Analgesics	7.3%	8.8%	15.1%	5.85***	175.71***	21,360
Bath Soaps	17.9%	20.7%	20.5%	1.93***	25.78***	5,125
Beer	0.1%	1.8%	10.9%	13.87***	671.37***	12,224
Bottled Juices	−0.0%	0.4%	13.5%	0.44***	17.28***	30,962
Cereal	0.5%	−0.1%	115.5%	−0.19***	15.38***	28,530
Cheese	3.6%	4.0%	12.2%	−0.28***	20.26***	41,122
Cigarettes	3.8%	3.3%	8.2%	0.95***	43.75***	15,385
Cookies	4.9%	4.8%	14.5%	−0.35***	22.32***	57,404
Crackers	6.7%	6.2%	12.5%	−1.38***	23.37***	17,608
Canned Soups	1.3%	0.1%	12.4%	−0.67***	6.00***	29,272
Dish Detergents	1.0%	−0.5%	11.9%	−0.06***	6.89***	16,191
Front-End-Candies	6.0%	10.2%	23.7%	0.86***	6.89***	20,819
Frozen Dinners	7.0%	5.0%	21.5%	−1.03***	7.95***	17,534
Frozen Entrees	4.4%	0.3%	30.0%	−1.03***	5.47***	55,140
Frozen Juices	−5.4%	−5.8%	12.4%	0.86***	18.43***	12,269
Fabric Softeners	2.0%	1.7%	12.6%	1.78***	15.34***	19,172
Grooming products	15.1%	15.7%	19.2%	0.01	9.78***	54,048
Laundry Detergents	1.8%	3.0%	12.1%	1.30***	10.81***	33,057
Oatmeal	3.5%	3.0%	17.6%	−0.33***	7.39***	5,844
Paper Towels	−1.3%	−2.1%	15.8%	−1.48***	21.17***	7,245
Refrigerated Juices	0.5%	0.6%	11.8%	1.34***	17.75***	14,867
Soft Drinks	10.9%	12.2%	22.8%	1.86***	45.34***	74,387
Shampoos	17.1%	17.8%	18.0%	0.67***	7.16***	63,011
Snack Crackers	5.4%	5.5%	12.0%	2.02***	250.37***	25,042
Soaps	2.7%	4.1%	15.0%	2.20***	18.98***	17,442
Toothbrushes	5.3%	5.0%	17.6%	0.18***	6.02***	18,940
Tuna	1.3%	0.4%	11.0%	−1.44***	16.12***	16,324

Toothpastes	2.2%	2.7%	15.8%	1.05***	10.09***	27,731
Toilet papers	0.7%	0.4%	10.5%	0.50***	8.29***	8,252

Notes

In the table, we report the descriptive statistics of the distribution of the percentage difference between the average 9-ending and the average non 9-ending prices, at the product-store level, by product category. Skewness statistic is estimated using Fischer's Skewness Measure. Its statistical significance is based on the test of D'Agostino, et al (1990), which compares the skewness in a given sample to the skewness of the normal distribution, where the latter equals 0. Kurtosis statistic is estimated using the Moment Coefficient of Kurtosis. Its statistical significance test compares it, in a given sample, to the kurtosis of the normal distribution, which equals 3. *** indicates statistical significance at the $p < 0.01$ level.

APPENDIX H. 9-ENDING VS. NON 9-ENDING PRICES, FOR INDIVIDUAL PRODUCTS AT THE STORE-LEVEL, ENTIRE DATASET

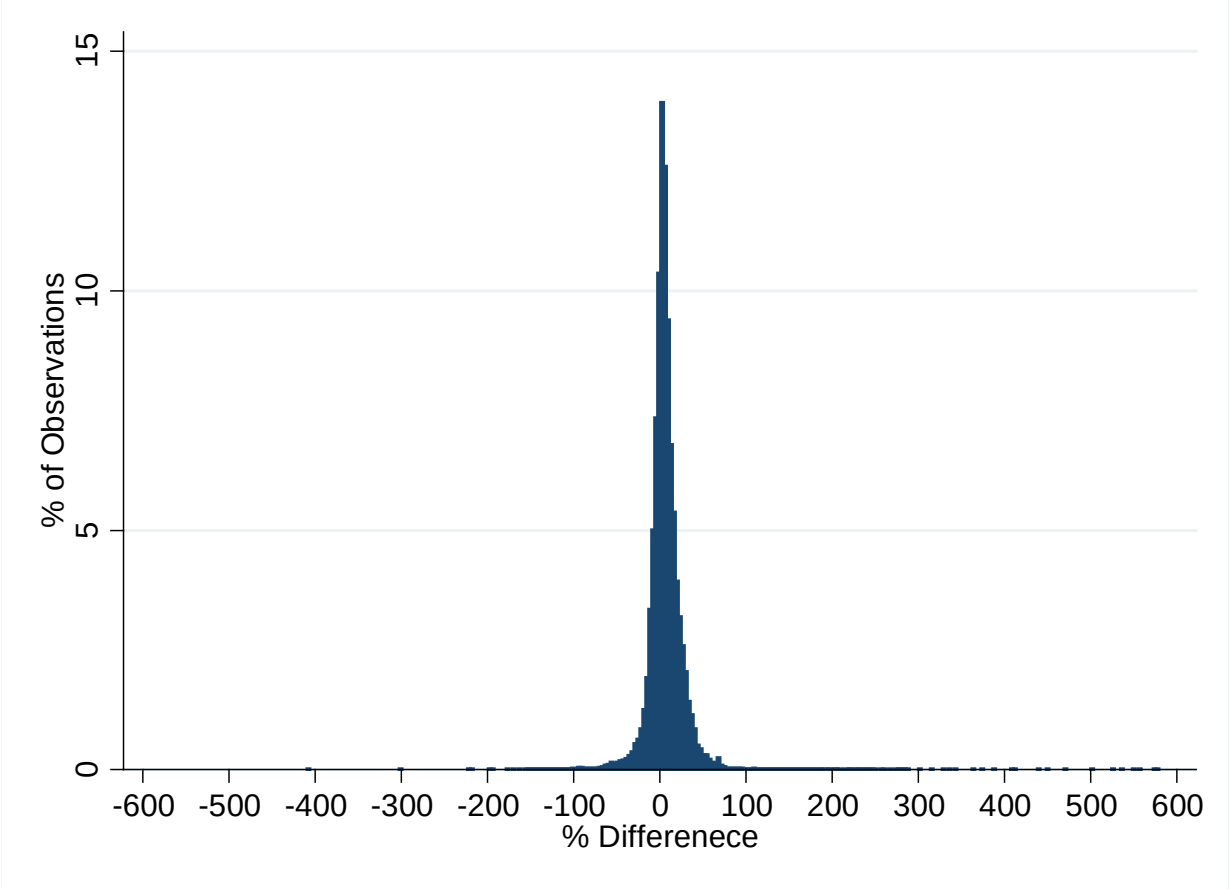
In the paper, in Figure 3, we present the frequency distribution of the % difference between the average 9-ending and non 9-ending prices for the entire dataset. The figure in the paper, however, excludes outlier observations, defined as percentage differences in excess of 100% in absolute value, i.e., on both sides of the distribution, in order to better show the mid-part of the distribution. Figure H1 below presents the same distribution, but this time with all the observations included.

The descriptive statistics of the distribution shown in Figure H1 are identical, up to three digits after the decimal point, to the descriptive statistics that we report for the distribution shown in Figure 3 in the paper for the data with outliers excluded. That is because the number of outlier observations, 1,654, comprise about 0.2% of the total number of observations.

Thus, the descriptive statistics are as follows. The average of the distribution is 5.97 (standard deviation = 18.68), confirming that 9-ending prices exceed non 9-ending prices on average. The median of the distribution is 4.74, suggesting that the higher average 9-ending prices are not caused by outliers. The skewness is 0.43, meaning the distribution of the % difference is skewed to the right. Kurtosis of the distribution, 23.7 > 3, implying that the tail of the distribution is thicker in comparison to the Normal Distribution. Formal skewness and kurtosis tests reject the null of normality at 1%. This confirms that 9-ending prices exceed non 9-ending prices at the level of individual products and stores.

We thus rule out the possibility that 9-ending prices are lower than non 9-ending prices at the level of individual products and stores. In Web Appendix G, we present the same frequency distributions at the category level, with similar findings.

Figure H1. Frequency Distribution of the Percentage Differences between the Average 9-Ending and Non 9-Ending Prices, Entire Dataset, at the Product-Store Level, Dominick's, September 14, 1989–May 8, 1997



Note

The figure is based on all 98,914,300 weekly retail price observations of Dominick's, at 93 stores for 400 weeks, from September 14, 1989 to May 8, 1997.

APPENDIX I. ESTIMATING PRICE DIFFERENCES BETWEEN 9-ENDING AND NON 9-ENDING PRICES USING PRICE ZONES AS CLUSTERS

To formally test whether 9-ending prices are higher or lower on average than non 9-ending prices, while controlling for the effect of time trend, we estimate in the paper a series of log-linear OLS regressions with fixed effects at the category level. The dependent variable in these regressions is the log of the price, which allows us to interpret the estimated coefficients in percentage terms. The main independent variable in all the regressions is a dummy for 9-ending prices, which equals 1 if the price is 9-ending, and 0 if the price ends with any other digit. The coefficient of the 9-ending price dummy therefore gives the expected percentage difference between 9-ending and non 9-ending prices.

In the analyses that we report in the paper, we cluster the standard errors at the store level. However, Dominick's data manual suggests that stores were divided into zones depending on their location and the level of local competition, and that the prices within each zone were usually the same. This suggests that a suitable level for clustering might be the level of price zones, rather than individual stores. We therefore replicate the estimations we perform in the paper, but this time we are clustering the errors at the level of the price zones, as given by the Dominick's data manual. We report the results in Table I1.

In column (1) of the table, we report the estimation results of a regression, which includes dummies for weeks and for subcategories-store. Thus, we control for the effects of different subcategories at the store level, and for the overall price trend. In 22 out of the 29 product categories, the expected 9-ending prices are higher than the expected non 9-ending prices. The differences are statistically significant at the 1% level in 19 of the cases, and in one more, the difference is significant at the 10% level.

In column (2), we use a stronger test. Here we add subcategories-store-week dummies. Thus, we control for inflation at the subcategory-store level. The 9-ending price dummy should therefore capture the differences between goods that belong to the

same subcategory at the same store and on the same week. In other words, the differences that we find between the expected values of the 9-ending and non 9-ending prices, represent the expected differences that exist within a store on a given week between the prices of goods that belong to the same product subcategories.

Using this specification, we find that the expected 9-ending prices are higher than the corresponding expected non 9-ending prices in 23 of the 29 product categories. The differences are statistically significant at the 1% level in 20 of the cases.

As an additional test, we perform an even more restrictive analysis, by looking at the prices of individual products within individual stores over time and compare the prices when each good is sold at 9-ending and at non 9-ending prices. It might be that even if 9-ending prices are not necessarily the lowest within each sub-category, they still represent a good purchase opportunity because they are associated with times when individual goods are offered at low prices.

In column (3) of the table, we report the estimation results of this test. The independent variables are a dummy for 9-ending prices, and fixed effects for products at the store-level, and for weeks. Here we find that in 25 out of the 29 product categories, the expected 9-ending prices are higher than corresponding non 9-ending prices. Thus, even for individual goods at individual stores, in almost all product categories, 9-ending prices are expected to be higher than non 9-ending prices.

To summarize, the results of the three regressions suggest that even after we control for time trend by using week fixed effects, we still find that the expected 9-ending prices are higher than the expected non 9-ending prices in the majority of product categories. This is true whether we compare the prices of products within the same sub categories and controlling for stores, when we compare the prices of products within the same subcategory in the same store and on the same week, and even when we compare the 9- and non 9-ending prices of individual products at an individual store.

In the paper, we also estimate a series of OLS regressions after separating the data into observations on regular and sale prices, using a sale filter that identifies a sale if the price decreases and then returns to the same level or above. Below we replicate the same

regressions but this time we cluster the standard errors at the price zone level rather than the store level.

We report the estimation results in Table I2. The figures in the table are the coefficient estimates of the 9-ending dummy, which equals 1 if the price ends with 9, and 0 otherwise. A positive coefficient indicates that 9-ending prices are on average higher than non 9-ending prices.

In columns (1)–(3), we report the estimation results for regular prices, and in columns (4)–(6) for sale prices. In columns (1) and (4), the regressions include controls for weeks and for subcategories-store. In columns (2) and (5), the regressions include controls for subcategories- store-weeks. In columns (3) and (6), the regressions include controls for weeks and for products-store.

For regular prices, in column (1) the coefficient estimate is positive and statistically significant for 18 product categories. In one more category, bottled juices, it is marginally significant. In column (2), it is positive and statistically significant for 18 product categories. In column (3), it is positive and statistically significant for 22 product categories, and negative but statistically insignificant in one category (Frozen Dinners). Thus, for regular prices, at the level of individual products within stores, in 23 out of 29 product categories, the expected 9-ending prices are either higher, or no different, than the expected non 9-ending prices.

For sale prices, in column (4), the coefficient estimate is positive and statistically significant for 14 product categories, negative and statistically significant for 9 product categories, negative and marginally significant for one product category, and there is no statistically significant difference in five product categories. In column (5), it is positive and statistically significant for 15 product categories, positive and marginally significant for one category, negative and statistically significant for 9 product categories, and there is no statistically significant difference in four product categories. In column (6), it is positive and statistically significant for 12 product categories, negative and statistically significant for 15 product categories, and there is no statistically significant difference in two product categories.

Overall, the results are consistent with the results we report in Table 5 in the paper. We find that for regular prices, which in our data comprise 88.68 percent of all prices, 9-ending prices are higher than non 9-ending prices in the majority of the product categories, irrespective of which regression we estimate.

For sale prices, the results are more mixed. According to column (6), which compares the prices of products within stores, the expected 9-ending sale prices are higher than the expected non 9-ending sale prices in only 12 categories. That is, in most categories, 9-ending sale prices are either lower than, or no different from, non 9-ending sale prices.

Table I1. Regression Analyses of the Percentage Difference between 9-Ending and Non 9-Ending Prices, Dominick's, September 14, 1989–May 8, 1997

	(1)	**(2)**	**(3)**	***N***
Analgesics	0.13 (0.008)***	0.13 (0.008)***	0.15 (0.001)***	3,040,172
Bath Soaps	0.02 (0.020)	0.03 (0.019)	0.12 (0.001)***	418,097
Beer	0.03 (0.007)***	0.03 (0.006)***	−0.02 (0.001)***	1,966,148
Bottled Juices	0.03 (0.009)***	0.03 (0.009)***	0.02 (0.000)***	4,325,024
Cereal	−0.02 (0.001)***	−0.02 (0.001)***	0.01 (0.000)***	4,707,776
Cheese	0.11 (0.003)***	0.08 (0.003)***	0.15 (0.000)***	6,752,326
Cigarettes	0.59 (0.085)***	0.02 (0.002)***	0.27 (0.001)***	1,801,444
Cookies	−0.09 (0.07)***	0.00 (0.006)	−0.00 (0.000)***	7,568,352
Crackers	0.06 (0.002)***	0.07 (0.002)***	0.03 (0.000)***	2,228,268
Canned Soups	0.09 (0.016)***	0.09 (0.016)***	0.06 (0.000)***	5,504,492
Dish Detergents	0.03 (0.016)*	0.03 (0.010)***	0.02 (0.000)***	2,164,793
Front-End-Candies	0.39 (0.004)***	0.38 (0.004)***	0.24 (0.000)***	4,437,054
Frozen Dinners	−0.01 (0.019)	−0.01 (0.019)	0.04 (0.000)***	1,654,053
Frozen Entrees	0.06 (0.011)***	0.05 (0.013)***	0.01 (0.000)***	7,172,075
Frozen Juices	−0.07 (0.007)***	−0.08 (0.007)***	−0.06 (0.000)***	2,368,157
Fabric Softeners	−0.03 (0.007)***	−0.03 (0.007)***	0.02 (0.000)***	2,278,995
Grooming products	0.21 (0.003)***	0.16 (0.003)***	0.17 (0.000)***	4,065,689
Laundry Detergents	0.10 (0.005)***	0.13 (0.005)***	0.12 (0.001)***	3,277,444
Oatmeal	−0.02 (0.015)	−0.01 (0.015)	0.02 (0.000)***	981,037
Paper Towels	0.14 (0.024)***	0.14 (0.024)***	0.05 (0.001)***	940,757
Refrigerated Juices	0.06 (0.001)***	0.06 (0.001)***	0.06 (0.001)***	2,166,755
Soft Drinks	0.69 (0.015)***	0.30 (0.009)***	0.30(0.000)***	10,741,742
Shampoos	0.16 (0.022)***	0.12 (0.014)***	0.12 (0.000)***	4,666,565
Snack Crackers	0.03 (0.009)***	0.03 (0.008)***	0.05 (0.000)***	3,487,564
Soaps	0.15 (0.009)***	0.15 (0.009)***	0.11 (0.001)***	1,835,196
Toothbrushes	−0.03 (0.009)***	−0.01 (0.009)	0.02 (0.000)***	1,772,158

Tuna	0.19 (0.007)***	0.19 (0.007)***	0.10 (0.001)***	2,382,983
Toothpastes	0.01 (0.010)	0.01 (0.009)	−0.01 (0.000)***	2,981,532
Toilet papers	0.41 (0.015)***	0.41 (0.015)***	0.11 (0.001)***	1,149,972
Dummies for weeks	√		√	
Dummies for product-store			√	
Dummies for sub-categories-store	√			
Dummies for sub-categories-store-weeks		√		

Notes

In the table, we report the coefficient estimates of a 9-ending dummy in log-linear OLS regressions with fixed effects, where the dependent variable is the log of the prices. The 9-ending dummy equals 1 if the price ends with 9, and 0 if the price ends with any other digit. In column (1), the regression includes controls for weeks and for subcategories-store. In column (2), the regression includes controls for subcategories-stores-weeks. In column (3), the regression includes dummies for weeks and for product-store. In parentheses, we report robust standard errors, clustered at the zone level. * $p < 0.10$ ** $p < 0.05$, *** $p < 0.01$.

Table I2. Regression Analysis of the Percentage Difference between 9-Ending and Non 9-Ending Prices, Regular and Sale Prices, Dominick's, September 14, 1989–May 8, 1997

	Regular Prices				Sale Prices			
	(1)	**(2)**	**(3)**	***N***	**(4)**	**(5)**	**(6)**	***N***
Analgesics	0.13*** (0.008)	0.13*** (0.008)	0.15*** (0.001)	2,924,303	0.00 (0.003)	0.01* (0.003)	−0.01*** (0.002)	115,869
Bath Soaps	−0.01 (0.023)	−0.01 (0.022)	0.11*** (0.001)	405,439	0.02 (0.015)	0.03** (0.012)	−0.04*** (0.003)	12,658
Beer	0.02** (0.008)	0.02** (0.008)	−0.04*** (0.001)	1,660,236	0.11*** (0.009)	0.09*** (0.008)	−0.03*** (0.002)	305,912
Bottled Juices	0.02* (0.011)	0.02 (0.011)	0.02*** (0.000)	3,753,608	0.06*** (0.010)	0.05*** (0.009)	−0.00*** (0.001)	571,416
Cereal	−0.02*** (0.001)	−0.02*** (0.001)	0.01*** (0.000)	4,379,009	−0.01* (0.005)	−0.02*** (0.007)	−0.03*** (0.001)	328,767
Cheese	0.12*** (0.005)	0.08*** (0.004)	0.16*** (0.000)	5,684,114	−0.01*** (0.002)	−0.01*** (0.002)	0.03*** (0.001)	1,068,212
Cigarettes	0.59*** (0.085)	0.02*** (0.003)	0.27*** (0.001)	1,793,459	0.01 (0.258)	−0.05** (0.019)	0.21*** (0.019)	7,985
Cookies	−0.13*** (0.008)	−0.03*** (0.006)	−0.04*** (0.000)	6,725,729	−0.06*** (0.001)	−0.03*** (0.001)	−0.03*** (0.001)	842,623
Crackers	0.07*** (0.003)	0.07*** (0.002)	0.02*** (0.000)	1,943,794	−0.08*** (0.003)	−0.07*** (0.001)	−0.06*** (0.001)	284,474
Canned Soups	0.09*** (0.017)	0.08*** (0.017)	0.06*** (0.000)	5,018,750	0.12*** (0.004)	0.11*** (0.004)	0.01*** (0.001)	485,742
Dish Detergents	0.03*** (0.018)	0.04*** (0.011)	0.02*** (0.000)	1,973,399	−0.04*** (0.004)	0.05*** (0.005)	−0.04*** (0.001)	191,394
Front-End-Candies	0.39*** (0.004)	0.38*** (0.004)	0.24*** (0.000)	4,189,543	0.18*** (0.007)	0.20*** (0.005)	0.06*** (0.001)	247,511
Frozen Dinners	−0.06*** (0.017)	−0.07*** (0.017)	−0.01 (0.000)	1,391,236	0.07*** (0.014)	0.04*** (0.018)	0.01*** (0.001)	262,817
Frozen Entrees	0.01 (0.012)	0.00 (0.013)	−0.05*** (0.000)	6,289,007	0.00 (0.000)	−0.01 (0.009)	0.00 (0.001)	883,068

Frozen Juices	−0.07*** (0.007)	−0.08*** (0.007)	−0.06*** (0.000)	2,016,638	−0.07*** (0.003)	−0.09*** (0.004)	−0.02*** (0.001)	351,519
Fabric Softeners	−0.04*** (0.007)	−0.05*** (0.007)	0.01*** (0.001)	2,101,762	0.10*** (0.003)	0.15*** (0.004)	0.01*** (0.002)	177,233
Grooming products	0.20*** (0.003)	0.14*** (0.002)	0.16*** (0.004)	3,806,684	0.18*** (0.008)	0.08*** (0.004)	0.07*** (0.001)	259,005
Laundry Detergents	0.08*** (0.006)	0.12*** (0.005)	0.12*** (0.001)	3,002,713	0.18*** (0.013)	0.17*** (0.012)	0.07*** (0.001)	274,731
Oatmeal	−0.03*** (0.015)	−0.03*** (0.014)	−0.01*** (0.000)	898,099	−0.05*** (0.004)	0.00 (0.007)	−0.03*** (0.002)	82,938
Paper Towels	0.15*** (0.003)	0.15*** (0.003)	0.07*** (0.001)	807,388	0.03** (0.011)	0.01 (0.011)	0.01*** (0.002)	133,369
Refrigerated Juices	0.07*** (0.011)	0.08*** (0.011)	0.07*** (0.001)	1,702,858	0.01 (0.005)	0.01** (0.005)	0.01*** (0.001)	463,897
Soft Drinks	0.76*** (0.021)	0.34*** (0.016)	0.30*** (0.001)	8,516,259	0.56*** (0.012)	0.14*** (0.006)	0.20*** (0.001)	2,225,483
Shampoos	0.15*** (0.024)	0.11*** (0.016)	0.10*** (0.000)	4,416,767	−0.08*** (0.009)	−0.05*** (0.004)	−0.00 (0.001)	249,798
Snack Crackers	0.01** (0.011)	0.02*** (0.011)	0.03*** (0.000)	3,019,467	−0.03*** (0.003)	−0.03*** (0.003)	−0.04*** (0.001)	468,097
Soaps	0.16*** (0.010)	0.15*** (0.010)	0.12*** (0.001)	1,662,739	0.07*** (0.008)	0.07*** (0.007)	0.01*** (0.001)	172,457
Toothbrushes	−0.04*** (0.008)	−0.02** (0.009)	0.02*** (0.000)	1,662,831	0.01** (0.004)	0.00 (0.005)	−0.07*** (0.001)	109,327
Tuna	0.20*** (0.007)	0.20*** (0.007)	0.10*** (0.001)	2,183,367	−0.03*** (0.007)	−0.05*** (0.006)	−0.01*** (0.002)	199,616
Toothpastes	−0.00 (0.010)	0.00 (0.009)	−0.02*** (0.000)	2,709,365	0.01*** (0.003)	0.03*** (0.002)	−0.03*** (0.001)	272,167
Toilet papers	0.43*** (0.017)	0.43*** (0.017)	0.13*** (0.001)	983,422	0.20*** (0.009)	0.23*** (0.010)	−0.03*** (0.002)	166,550
Dummies for weeks	√		√		√		√	
Dummies for product-store			√				√	
Dummies for sub-categories-store	√				√			

Dummies for sub-categories-store-weeks	√	√

Notes

In the table, we report the coefficient estimates of a 9-ending dummy in a number of log-linear OLS regressions with fixed effects, where the dependent variable is the log of the prices. In columns (1)–(3), we report the results when we estimate the regression using data on regular prices only. In columns (4)–(6), we report the results when we estimate the regression using data on sale prices only. We identify sale prices using a sale filter that identifies a price as a sale if the price decreases and then increases to the same level or above. In columns (1) and (4), the regression includes controls for weeks and for subcategories-store. In columns (2) and (5), the regression includes controls for subcategories-stores-weeks. In columns (3) and (6), the regression includes dummies for weeks and for product-store. In the parentheses we report robust standard errors, clustered at the zone level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

APPENDIX J. DYNAMICS OF 9-ENDING AND NON 9-ENDING PRICES: REGULAR PRICES VS SALE PRICES USING STORE, PRODUCT CATEGORIES AND PRODUCT SUB CATEGORIES DUMMIES

In the paper, in Table 6 we report results of regressions testing the differences between 9- and non 9-ending prices among regular and sale prices over time. In this appendix, we estimate the same regressions. However, instead of controlling for individual products in individual stores, the regressions we estimate here include dummy controls for stores, product categories, product sub-categories, and weeks. The independent variable is the log of the prices. The main independent variable in all the regressions is a 9-ending dummy. Its coefficient should capture the expected percentage difference between 9- and non 9-ending prices. A positive (negative) 9-ending dummy coefficient indicates that the expected 9-ending prices are higher (lower) than the expected non 9-ending prices. Table J1 reports the results.

We find that until 1993, with the exception of 1990, the expected difference between 9- and non 9-ending prices was larger among sale prices than among regular prices. In other words, while 9-endings were more common among sale prices than among regular prices, 9-ending prices tended to exceed non 9-ending prices among sale prices more than among regular prices. Thus, although 9-ending prices were common in that period among sale prices, 9-ending prices were not associated with particularly large price cuts on average.

After 1993, the expected difference between 9- and non 9-ending prices among regular prices increased, reaching 12–14 percent during 1995–1997. In parallel, the expected difference between 9- and non 9-ending prices decreased to 2–6 percent in that period.

It therefore seems that while Dominick's was increasing the prices of regular 9-ending prices relative to non 9-ending regular prices, it was at the same time decreasing the 9-ending sale prices relative to non 9-ending sale prices. In other words, as 9-ending regular prices were increasing, noticing that 9-ending sale prices are frequently higher than non 9-ending prices, was getting harder. These results are consistent with the pattern we report in the paper.

Table J1. Annual Regressions of the Percentage Difference between 9-Ending and Non 9-Ending Prices, Dominick's, September 14, 1989–May 8, 1997

	All Observations		Regular Prices		Sale Prices	
Year	**9-Ending**	***N***	**9-Ending**	***N***	**9-Ending**	***N***
1989	0.10*** (0.003)	2,570,474	0.10*** (0.004)	2,362,875	0.17*** (0.004)	207,599
1990	0.04*** (0.002)	9,228,965	0.04*** (0.002)	8,366,677	0.02*** (0.002)	862,288
1991	0.03*** (0.003)	10,650,384	0.02*** (0.003)	9,552,147	0.06*** (0.001)	1.098.237
1992	0.07*** (0.005)	13,731,259	0.06*** (0.005)	12,343,849	0.07*** (0.004)	1,387,410
1993	0.07*** (0.002)	14,023,602	0.06*** (0.002)	12,549,782	0.06*** (0.002)	1,473,820
1994	0.11*** (0.001)	13,645,820	0.10*** (0.001)	11,905,363	0.03*** (0.001)	1,740,457
1995	0.14*** (0.001)	13,424,315	0.13*** (0.002)	11,544,459	0.03*** (0.001)	1,879,856
1996	0.15*** (0.001)	14,238,652	0.14*** (0.001)	12,524,236	0.02*** (0.001)	1,714,416
1997	0.13*** (0.001)	5,156,434	0.12*** (0.001)	4,769,776	0.06*** (0.001)	386,658

Notes.

The table reports the coefficient estimates of a 9-ending dummy in fixed effect log-linear OLS regressions, where the dependent variable is the log of the prices. The regressions are estimated for each year over all stores and products. 9-ending dummy equals 1 if the price ends with 9, 0 otherwise. The regressions include controls for stores, product categories, product sub-categories, and years. We identify sale prices using a sales filter that identifies a sale if the price decreases and then increases back to the previous level or above. The regressions also include fixed effects for stores, categories, sub−categories and weeks. *** $p < 0.01$.

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