Supplementary Online Web Appendix

Retail Pricing Format and Rigidity of Regular Prices

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June 29, 2023

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APPENDIX A. ROBUSTNESS CHECK: CATEGORY-LEVEL PRICES AT THE THREE STORES

In the paper, we show that when looking at the aggregate, store-level data, the High-Low (*Hi-Lo*) store has the highest regular and transaction average prices. We also show that the price level at the Hybrid (*HYB*) store is somewhat lower than at the Every Day Low Price (*EDLP*) store. Below, we show that the same pattern holds when we focus on prices at the category level as well.

Table A1 reports the average regular and transaction prices in each of the three stores. Panel A reports the average regular prices and panel B reports the average transaction prices.

The results are similar for regular and transaction prices, and therefore we discuss only the regular prices. Comparing the EDLP store with the Hi-Lo store, we find that in all the categories, the average prices at the EDLP store are lower than at the Hi-Lo store. In 9 of the 11 categories, the differences are statistically significant. In one additional category, the differences are marginally significant. Thus, the prices at the EDLP store are lower than at the Hi-Lo store not only at the aggregate level. They are lower also when we consider individual categories.

Comparing the EDLP store with the HYB store, we find that in 5 categories, the average prices at the EDLP store are lower than at the HYB store. In 2 categories, the differences are statistically significant. In 6 categories, the average prices at the HYB store are lower than at the EDLP store. In 5 of these categories, the differences are statistically significant. Thus, it seems that in some categories, prices at the EDLP store are below those at the HYB store, in some categories the prices in the two stores are quite similar, and in some categories, prices at the HYB store are lower than at the EDLP store. However, there are more categories in which prices are lower at the HYB store than categories in which the prices are lower at the EDLP store. Overall, therefore, the average price at the HYB store is below the average price at the EDLP store.

Comparing the Hi-Lo store with the HYB store, we find that in all the categories, the average prices at the HYB store are lower than at the Hi-Lo store. In 9 of the 11 categories, the differences are statistically significant. Thus, the prices at the HYB store

are lower than at the Hi-Lo store not only at the aggregate level. They are lower also at the level of individual categories.

Table A1. Category Level Summary Statistics on Average Prices

A. Regular Prices						
Product Category	**EDLP (Loblaw's)**	**Hi-Lo (Provigo)**	**HYB (Super-C)**	**EDLP vs Hi-Lo *Wilcoxon***	**EDLP vs HYB *Wilcoxon***	**Hi-Lo vs HYB *Wilcoxon***
Baby Products & Foods	1.96 (1.129)	2.30 (1.099)	2.05 (1.103)	5.46***	2.90***	5.40***
Beverages	6.54 (8.126)	7.00 (8.565)	5.95 (7.915)	4.16***	5.23***	8.31***
Breakfast/Cereals	3.94 (1.060)	4.37 (0.981)	4.10 (1.001)	13.56***	0.84	9.79***
Condiments, Sauces & Spread	2.53 (0.908)	2.91 (1.160)	2.63 (1.0125)	4.68***	0.66	3.42***
Dairy Products	3.79 (1.657)	3.96 (1.743)	3.84 (1.562)	1.17	0.08	0.78
Frozen Food	4.47 (2.279)	5.11 (2.621)	4.44 (2.298)	5.12***	0.72	5.01***
Health & Beauty Aid	3.28 (1.268)	3.61 (1.182)	3.50 (1.220)	4.05***	3.30***	1.27
Household	5.40 (1.995)	6.32 (2.246)	4.86 (2.015)	8.96***	4.81***	14.00***
Juices	2.93 (1.179)	3.03 (1.140)	2.60 (1.156)	1.84*	4.58***	6.09***
Paper Towel, Tissue & Pet Supplies	6.58 (4.695)	7.32 (5.141)	5.86 (3.952)	4.84***	3.71***	6.66***
Soup / Canned Foods	1.61 (0.665)	1.78 (0.685)	1.33 (0.609)	4.89***	8.89***	12.32***
Overall	4.12 (3.500)	4.58 (3.764)	3.98 (3.356)	8.66***	3.16***	11.42***
B. Transaction Prices						
Baby Products & Foods	1.96 (1.129)	2.29 (1.108)	2.04 (1.100)	5.22***	2.84***	5.02***
Beverages	6.54 (8.127)	6.77 (8.480)	5.90 (7.875)	2.35***	5.76***	6.89***
Breakfast/Cereals	3.94 (1.060)	4.22 (1.019)	4.04 (1.015)	9.57***	0.75	7.48***
Condiments, Sauces & Spread	2.53 (0.908)	2.80 (1.127)	2.61 (1.013)	3.10***	0.31	2.26**
Dairy Products	3.78 (1.650)	3.91 (1.709)	3.79 (1.531)	0.65	0.39	0.66
Frozen Food	4.47 (2.281)	4.96 (2.588)	4.39 (2.313)	4.11***	1.02	4.23***
Health & Beauty Aid	3.21 (1.238)	3.59 (1.191)	3.47 (1.219)	4.64***	3.37***	1.50
Household	5.40 (1.995)	6.20 (2.247)	4.80 (1.990)	7.90***	5.73***	13.51***
Juices	2.93 (1.179)	2.93 (1.153)	2.56 (1.138)	0.10	5.18***	5.02***
Paper Towel, Tissue & Pet Supplies	6.58 (4.695)	7.27 (5.134)	5.85 (3.947)	4.45***	3.84***	6.49***
Soup / Canned Foods	1.61 (0.665)	1.71 (0.706)	1.31 (0.608)	2.88***	9.49***	10.57***

Overall	4.11 (3.501)	4.47 (3.728)	3.94 (3.340)	6.60***	3.99***	10.18***

Notes: The table reports the category-level average prices. The prices are in Canadian Dollars (C$). The EDLP column gives the average prices at the EDLP store. The Hi-Lo column gives the average prices at the Hi-Lo store. The HYB column gives the average prices at the HYB store. The "EDLP vs Hi-Lo" column gives the values of Wilcoxon rank sum *z*-test statistics for comparing the EDLP and Hi-Lo store prices. The "EDLP vs HYB" column gives the values of Wilcoxon rank sum *z*-test statistics for comparing the EDLP and HYB store prices. The "Hi-Lo vs HYB" column gives the values of Wilcoxon rank sum *z*-test statistics for comparing the Hi-Lo and HYB stores. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX B. ROBUSTNESS CHECK: COMPARISON OF THE WEEKLY FREQUENCY OF PRICE CHANGES ACROSS STORES, AT THE CATEGORY LEVEL

In the paper, we compare the weekly frequencies of price changes at the store level. In this appendix, we show that the results remain unchanged if we conduct the comparisons at the category level.[1]

In Table B1, we report Pearson χ^2 test statistics for comparing the frequencies of price changes at the EDLP and Hi-Lo stores. Column 1 reports the results of comparing the frequencies of the transaction price changes, Column 2 reports the results of comparing the frequencies of the regular price changes (as defined and classified by the store), Column 3 reports the results of comparing the frequencies of the filtered price changes, and Column 4 reports the results of comparing the frequencies of the reference price changes.[2]

In each cell, the name of the store indicates the name of the store that has the higher frequency of price changes. In the transaction prices column, we find that in 10 categories, the Hi-Lo store has a higher frequency of price changes than the EDLP store. In 8 of these 10 categories, the differences are statistically significant.

When we consider the regular prices, we find that in all 11 categories, the frequency of price changes is higher at the EDLP store. In 9 of the 11 categories, the differences are statistically significant.

When we consider filtered prices, we find that the frequency of price changes is higher at the EDLP store in 9 of the 11 categories, but only in one category is the difference statistically significant, and in one additional category, it is marginally significant.

[1] The weekly frequency of price changes is given by the ratio of the total number of price changes per week in the category, to the number of products in the category (Levy et al., 1997, Table 1, p. 797, Gorodnichenko and Talavera 2017).

[2] We obtain the filtered series by using the Nakamura and Steinsson's (2008) sales filter A to remove temporary price reductions from the series of transaction prices. We apply Chahrour's (2011) sales filter to the series of transaction prices to obtain the reference prices.

When we consider reference prices, we find that the frequency of price changes is higher at the EDLP store than at the Hi-Lo store in 7 of the 11 categories. Only one of the differences is statistically significant.

Thus, when we look at the category level, we find the same pattern as at the overall store level, as discussed in the paper. If we focus on transaction prices, the Hi-Lo store has a higher frequency of price changes. When we focus on regular prices, in all categories the EDLP store has a higher frequency of price changes. When we focus on filtered prices, the EDLP store has the higher frequency of price changes in 8 out of 11 categories, with one of the differences being statistically significant and another one being marginally significant. When we look at the reference prices, only one of the category level differences is statistically significant.

In Table B2, we report the Pearson χ^2-test statistics for comparing the frequencies of price changes at the EDLP and HYB stores. In each cell, we note the name of the store that has the higher frequency of price changes.

In the transaction prices column, we find that in 4 of the 11 categories, the EDLP store has a higher frequency of price changes than the HYB store. One of the differences is significant statistically and one is marginally significant. In 7 categories, the HYB store has a higher frequency of price changes, where in one case the difference is statistically significant, and in another, the difference is marginally significant.

When we consider regular prices, we find that in all categories, the frequency of price changes is higher at the EDLP store. In 9 of the categories, the differences are statistically significant.

In the filtered prices column, the frequency of price changes is higher at the EDLP store in 4 categories. None of these differences is statistically significant. At the HYB store, the frequency of price changes is higher in 7 categories. One of the differences is statistically significant.

When we look at the column of reference prices, we find that the frequency of price changes is higher at the HYB store than at the EDLP store in 10 categories. Three of the differences are statistically significant, and one additional difference is marginally significant.

Thus, our findings at the category level are similar to our findings at the store level. When we look at the transaction and filtered prices, in some categories the EDLP store has a higher frequency of price changes than the HYB store, but the differences are at best marginally significant. When we look at the regular prices, in all categories the EDLP store has the higher frequency of price changes. When we look at the reference prices, in 10 of the 11 categories, the frequency of price changes is higher at the HYB store than at the EDLP store.

In Table B3, we report the χ^2 test statistics for comparing the average prices at the Hi-Lo and HYB stores. In each cell, the name of the store indicates the name of the store that has the higher frequency of price changes.

In the transaction prices column, we find that in 10 of the 11 categories, the Hi-Lo store has a higher frequency of price changes than the HYB store. In 8 categories, the differences are statistically significant, and in one additional category, it is marginally significant.

When we study the regular prices, we find that in 10 of the 11 categories, the frequency of price changes is higher at the HYB store. In two of the categories, the differences are statistically significant, and in two additional categories, the differences are marginally significant.

In the filtered prices column, the frequency of price changes is higher at the Hi-Lo store in 2 categories. One of the differences is statistically significant. The frequency of price changes is higher at the HYB store in 9 categories. In 2 categories, the differences are statistically significant and in 2 additional categories, the differences are marginally significant.

When we look at the column of reference prices, we find that the frequency of price changes is higher at the HYB store than at the Hi-Lo store in 10 categories. In 5 categories, the differences are statistically significant, and in one additional category, the difference is marginally significant.

Thus, when we look at the category level, we find the same pattern as when we look at the store level. When we consider transaction prices, in 10 of 11 categories the Hi-Lo store has a higher frequency of price changes. When we look at the regular prices, in 10

of the 11 categories, the HYB store has a higher frequency of price changes. When we look at the filtered prices, the HYB store has a higher frequency of price changes in 9 categories. When we look at the reference prices, the HYB store has a higher frequency of price changes in 10 categories.

Table B1. Comparing the Frequency of Price Changes at the EDLP and the Hi-Lo Stores

Product Category	**Transaction Prices**	**Regular Prices**	**Filtered Prices**	**Reference Prices**
Baby Products & Foods	0.00	EDLP 12.64***	EDLP 2.70	EDLP 2.01
Beverage	Hi-Lo 19.60***	EDLP 76.07***	EDLP 0.58	EDLP 1.02
Breakfast/Cereals	Hi-Lo 20.62***	EDLP 56.35***	EDLP 0.10	EDLP 0.68
Condiments, Sauces & Spread	Hi-Lo 14.83***	EDLP 59.17***	EDLP 0.09	Hi-Lo 0.55
Dairy Products	Hi-Lo 0.12	EDLP 23.80***	EDLP 1.61*	EDLP 0.63
Frozen Food	Hi-Lo 4.48**	EDLP 26.66***	0.00	EDLP 0.54
Health & Beauty Aid	Hi-Lo 1.19	EDLP 1.75	Hi-Lo 0.07	Hi-Lo 0.02
Households	Hi-Lo 33.80***	EDLP 35.10***	EDLP 4.05**	EDLP 4.26**
Juices	Hi-Lo 39.88***	EDLP 25.29***	EDLP 0.55	Hi-Lo 0.25
Paper Towel, Tissue & Pet Supplies	Hi-Lo 40.14***	EDLP 0.37	EDLP 0.05	Hi-Lo 1.51
Soups/Canned Foods	Hi-Lo 31.20***	EDLP 4.38**	EDLP 2.66	EDLP 1.64
Total	Hi-Lo 151.26***	EDLP 284.01***	EDLP 3.50*	EDLP 1.94

Notes: The table gives the χ^2-test statistics for comparing the average frequencies of weekly price changes in the EDLP and Hi-Lo stores. The transaction price column gives the χ^2-test statistics for comparing the average frequency of weekly transaction price changes. The regular price column gives the χ^2-test statistics for comparing the average frequency of weekly regular price changes. The filtered price column gives the χ^2-test statistics for comparing the average frequency of weekly filtered price changes. The reference price column gives the χ^2-test statistics for comparing the average frequency of weekly reference price changes. The name of the store indicates that the average frequency of price changes at that store is higher than the average frequency at the other store. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B2. Comparing the Frequency of Price Changes at the EDLP and the HYB Stores

Product Category	**Transaction Prices**	**Regular Prices**	**Filtered Prices**	**Reference Prices**
Baby Products & Foods	HYB 0.13	EDLP 0.04	EDLP 0.34	HYB 3.67*
Beverage	EDLP 4.63**	EDLP 74.49***	HYB 6.57**	HYB 0.01
Breakfast/Cereals	HYB 2.14	EDLP 32.71***	HYB 2.08	HYB 5.41**
Condiments, Sauces & Spread	EDLP 3.81*	EDLP 47.30***	EDLP 0.06	HYB 3.99**
Dairy Products	HYB 0.07	EDLP 21.12***	EDLP 0.14	EDLP 0.24
Frozen Food	EDLP 0.02	EDLP 16.12***	HYB 1.31	HYB 1.05
Health & Beauty Aid	EDLP 0.46	EDLP 8.77***	EDLP 0.73	HYB 0.02
Households	HYB 2.83*	EDLP 10.82***	HYB 1.83	HYB 1.18
Juices	HYB 0.04	EDLP 16.47***	HYB 2.42	HYB 8.04***
Paper Towel, Tissue & Pet Supplies	HYB 5.36**	EDLP 0.25	HYB 0.31	HYB 0.81
Soups/Canned Foods	HYB 0.57	EDLP 7.60***	HYB 0.01	HYB 0.79
Total	EDLP 0.01	EDLP 216.06***	HYB 0.44	HYB 13.01***

Notes: The table gives the χ^2-test statistics for comparing the average frequencies of weekly price changes in the EDLP and HYB stores. The transaction price column gives the χ^2-test statistics for comparing the average frequency of weekly transaction price changes. The regular price column gives the χ^2-test statistics for comparing the average frequency of weekly regular price changes. The filtered price column gives the χ^2-test statistics for comparing the average frequency of weekly filtered price changes. The reference price column gives the χ^2-test statistics for comparing the average frequency of weekly reference price changes. The name of the store indicates that the average frequency of price changes at that store is higher than the average frequency at the other store. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B3. Comparing the Frequency of Price Changes at the Hi-Lo and the HYB Stores

Product Category	**Transaction Prices**	**Regular Prices**	**Filtered Prices**	**Reference Prices**
Baby Products & Foods	HYB 0.13	HYB 11.60***	HYB 4.57**	HYB 8.12***
Beverage	Hi-Lo 44.27***	HYB 0.28	Hi-Lo 3.22*	HYB 1.24
Breakfast/Cereals	Hi-Lo 9.02***	HYB 3.57*	HYB 3.08*	HYB 9.52***
Condiments, Sauces & Spread	Hi-Lo 30.30***	HYB 0.09	HYB 0.00	HYB 1.68
Dairy Products	Hi-Lo 0.01	HYB 0.39	HYB 0.90	HYB 0.12
Frozen Food	Hi-Lo 5.81**	HYB 2.94*	HYB 1.31	HYB 3.09*
Health & Beauty Aid	Hi-Lo 3.11*	Hi-Lo 2.77*	Hi-Lo 1.25	HYB 0.00
Households	Hi-Lo 19.42***	HYB 9.41***	HYB 11.12***	HYB 9.63***
Juices	Hi-Lo 37.89***	HYB 1.15	HYB 0.67	HYB 5.66**
Paper Towel, Tissue & Pet Supplies	Hi-Lo 22.61***	HYB 0.02	HYB 0.63	Hi-Lo 0.16
Soups/Canned Foods	Hi-Lo 34.39***	Hi-Lo 0.08	HYB 2.82*	HYB 4.59**
Total	Hi-Lo 161.69***	HYB 8.68***	HYB 6.59**	HYB 24.86***

Notes: The table gives the χ^2-test statistics for comparing the average frequencies of weekly price changes in the Hi-Lo and HYB stores. The transaction price column gives the χ^2-test statistics for comparing the average frequency of weekly transaction price changes. The regular price column gives the χ^2-test statistics for comparing the average frequency of weekly regular price changes. The filtered price column gives the χ^2-test statistics for comparing the average frequency of weekly filtered price changes. The reference price column gives the χ^2-test statistics for comparing the average frequency of weekly reference price changes. Positive values indicate that the average frequency of price changes at the HYB store is higher than the average frequency at the Hi-Lo store. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

APPENDIX C. DISTRIBUTION OF THE PRICE ENDINGS: LAST DIGIT AND LAST TWO DIGITS

In Figure C1, we present the distribution of the last digit of the prices in our data. According to the figure, digit 9 is the dominant price ending, which is in line with the common retail price-setting practice. See Levy et al. (2011), Anderson et al. (2015), and Snir and Levy (2021), and the studies cited therein.

In our data, 9-ending prices comprise more than 90% of the prices at the EDLP and Hi-Lo stores, similar to the price-ending distribution patterns Anderson et al. (2015) find in their data. At the HYB store, we find that prices ending with "7" are also common, which is in line with the practice of discount stores, often reported in trade publications. See, for example, Risley (2020).

In Figure C2, we present the distribution of the last two digits of the prices in our data. According to the figure, 99-ending prices are a dominant price feature in our data, also in line with the findings reported in the literature. See, for example, Levy et al. (2011).

Figure C1. The Distribution of the Right-Most Digits by Store Format

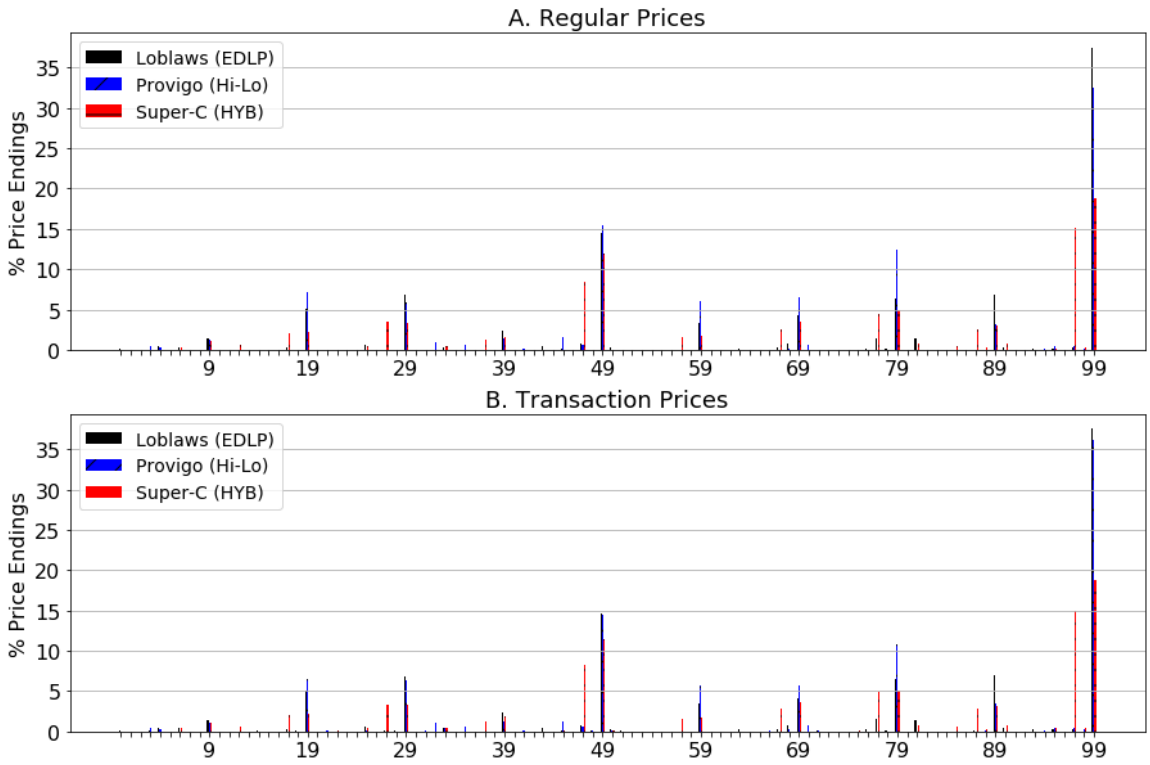


Figure C2. Distribution of the Two Right-Most Digits by Store Format

APPENDIX D. DETAILED LIST OF PRODUCTS SAMPLED AND THE CORRESPONDING REGULAR AND TRANSACTION PRICES

Table D1. Detailed List of the Products Sampled, by Product Category, by Brand (NB, PL), and by Store Pricing Format, and the Corresponding Average Regular and Transaction Prices

A. National Brand Products

		EDLP (Loblaw's)		Hi-Lo (Provigo)		HYB (Super-C)	
Product Category	**Product**	**Regular Price**	**Transaction price**	**Regular Price**	**Transaction price**	**Regular Price**	**Transaction price**
Baby Products and Foods	Dove Baby Soap	1.94 (0.164)	1.94 (0.164)	2.19 (0.000)	2.16 (0.136)	1.98 (0.009)	1.98 (0.009)
Baby Products and Foods	Farley's Biscuits 300g	3.75 (0.159)	3.75 (0.159)	3.99 (0.002)	3.99 (0.002)	3.68 (0.010)	3.68 (0.010)
Baby Products and Foods	Heinz Blueberry 213ml	0.81 (0.000)	0.81 (0.000)	0.99 (0.000)	0.97 (0.065)	0.87 (0.000)	0.87 (0.000)
Baby Products and Foods	Heinz Mixed Cereal 227g	2.52 (0.205)	2.52 (0.205)	2.99 (0.000)	2.99 (0.000)	2.83 (0.150)	2.80 (0.161)
Baby Products and Foods	Pablum Soya Cereal 454g	0.77 (0.000)	0.77 (0.000)	1.32 (0.000)	1.32 (0.000)	0.87 (0.005)	0.87 (0.005)
Beverage	Bleue Dry 12x341ml	15.36 (0.433)	15.36 (0.433)	15.80 (0.246)	15.17 (1.256)	15.34 (0.217)	15.34 (0.222)
Beverage	Coca-Cola Classic	1.28 (0.061)	1.28 (0.061)	1.77 (0.089)	1.42 (0.228)	1.29 (0.054)	1.28 (0.082)
Beverage	Molson Dry Beer 12x341ml	15.32 (0.541)	15.32 (0.541)	15.75 (0.252)	15.03 (1.260)	15.34 (0.217)	15.34 (0.222)
Beverage	Molson Dry Beer 24x341ml	24.33 (1.079)	24.33 (1.079)	26.33 (0.236)	26.26 (0.519)	24.14 (0.933)	23.89 (1.060)
Beverage	Montclair 1L	0.99 (0.052)	0.99 (0.052)	0.99 (0.000)	0.96 (0.057)	0.98 (0.010)	0.92 (0.091)
Beverage	Pepsi Diet 12x355ml	4.00 (0.321)	4.00 (0.321)	4.66 (0.105)	4.19 (0.336)	4.02 (0.093)	3.89 (0.333)
Beverage	Perrier Lemon 750ml	1.17 (0.056)	1.17 (0.060)	1.36 (0.045)	1.31 (0.138)	1.18 (0.010)	1.16 (0.058)
Beverage	Sprite 1L	1.26 (0.217)	1.26 (0.217)	1.54 (0.050)	1.52 (0.152)	0.69 (0.000)	0.69 (0.026)
Breakfast/Cereals	Alpha Bits 400g	3.58 (0.353)	3.58 (0.353)	4.01 (0.078)	3.83 (0.443)	3.49 (0.000)	3.45 (0.124)
Breakfast/Cereals	Cheerios Apple 575g	4.11 (0.290)	4.11 (0.290)	5.02 (0.092)	4.76 (0.551)	4.51 (0.105)	4.39 (0.380)
Breakfast/Cereals	Cheerios Multi-Grain 450g	4.13 (0.247)	4.13 (0.247)	4.77 (0.205)	4.58 (0.479)	4.52 (0.104)	4.41 (0.376)
Breakfast/Cereals	Chex Honey Nut 430g	3.85 (0.413)	3.85 (0.413)	4.03 (0.080)	3.95 (0.405)	4.01 (0.066)	3.99 (0.132)
Breakfast/Cereals	Corn Flakes 750g	3.79 (0.329)	3.79 (0.329)	4.17 (0.147)	4.00 (0.485)	3.61 (0.178)	3.55 (0.258)
Breakfast/Cereals	Life 730g	3.89 (0.241)	3.89 (0.241)	3.99 (0.000)	3.89 (0.251)	3.94 (0.045)	3.75 (0.384)
Breakfast/Cereals	Nesquick Cereal 775g	6.86 (0.633)	6.86 (0.633)	7.01 (0.094)	6.73 (0.819)	6.97 (0.091)	6.91 (0.184)

Breakfast/Cereals	Pops Corn 375g	3.96 (0.323)	3.94 (0.361)	4.99 (0.000)	4.71 (0.667)	3.73 (0.287)	3.68 (0.347)
Breakfast/Cereals	Shreddies Cereal 620g	3.90 (0.190)	3.90 (0.190)	4.19 (0.000)	4.07 (0.343)	3.75 (0.242)	3.73 (0.283)
Breakfast/Cereals	Special K Red berries 350g	4.42 (0.175)	4.42 (0.175)	4.49 (0.000)	4.41 (0.182)	4.49 (0.007)	4.37 (0.223)
Breakfast/Cereals	Sugar Crisp 400g	3.58 (0.353)	3.58 (0.353)	4.18 (0.073)	3.96 (0.504)	3.49 (0.000)	3.45 (0.124)
Condiments, Sauces and Spread	Canton Vegetable Delight 990ml	3.19 (0.261)	3.19 (0.261)	3.42 (0.193)	3.36 (0.234)	3.34 (0.091)	3.33 (0.118)
Condiments, Sauces and Spread	Classics Dressing 250ml	1.83 (0.177)	1.83 (0.177)	1.97 (0.040)	1.87 (0.259)	1.87 (0.059)	1.81 (0.179)
Condiments, Sauces and Spread	French's Yellow Mustard 400ml	2.04 (0.153)	2.04 (0.153)	1.99 (0.000)	1.95 (0.160)	2.16 (0.068)	2.15 (0.087)
Condiments, Sauces and Spread	HEINZ Tomato KETCHUP 1L	3.04 (0.250)	3.04 (0.250)	3.68 (0.175)	3.51 (0.360)	3.20 (0.236)	3.17 (0.250)
Condiments, Sauces and Spread	Hellmann's Mayonaise 1L	3.95 (0.243)	3.95 (0.243)	4.79 (0.000)	4.54 (0.589)	4.02 (0.116)	3.98 (0.231)
Condiments, Sauces and Spread	Miracle Whip Dressing Sauce 1L	3.90 (0.257)	3.90 (0.257)	4.79 (0.000)	4.47 (0.658)	3.98 (0.010)	3.94 (0.237)
Condiments, Sauces and Spread	Regular Sugar 2kg	2.57 (0.064)	2.57 (0.064)	2.61 (0.054)	2.53 (0.215)	2.58 (0.010)	2.58 (0.042)
Condiments, Sauces and Spread	Sifto Table Salt 1kg	1.10 (0.051)	1.10 (0.051)	1.40 (0.101)	1.40 (.101)	1.07 (0.036)	1.07 (0.038)
Condiments, Sauces and Spread	VH Soya Sauce 450ml	1.47 (0.047)	1.47 (0.047)	1.64 (0.067)	1.59 (0.125)	1.48 (0.024)	1.47 (0.040)
Dairy Products	Natrel 1% Partly Skimmed Milk 2L	2.85 (0.071)	2.85 (0.071)	2.84 (0.063)	2.84 (0.063)	2.84 (0.052)	2.84 (0.052)
Dairy Products	Extra Large Eggs 12un	2.46 (0.115)	2.46 (0.115)	2.52 (0.082)	2.52 (0.082)	2.48 (0.028)	2.47 (0.049)
Dairy Products	Lactantia 2% Skimmed Milk 2L	3.01 (0.030)	3.01 (0.030)	3.00 (0.056)	3.00 (0.056)	2.94 (0.041)	2.94 (0.041)
Dairy Products	Lactantia Butter 454g	3.89 (0.243)	3.89 (0.243)	4.15 (0.168)	4.07 (0.287)	3.95 (0.073)	3.85 (0.219)
Dairy Products	Large Eggs 12un	1.92 (0.302)	1.92 (0.302)	2.40 (0.100)	2.35 (0.236)	1.96 (0.181)	1.89 (0.298)
Dairy Products	Omega Eggs 12un	3.20 (0.063)	3.20 (0.063)	3.23 (0.081)	3.22 (0.100)	3.15 (0.050)	3.12 (0.071)
Dairy Products	P'tit Quebec Cheese 600g	6.32 (0.943)	6.27 (0.977)	7.04 (0.134)	6.74 (0.825)	6.59 (0.143)	6.37 (0.762)
Dairy Products	Quebon 3.25% Bottle Milk 2L	3.02 (0.033)	3.02 (0.033)	3.00 (0.030)	3.00 (0.030)	3.02 (0.034)	3.02 (0.034)
Dairy Products	Saputo Cheese 700g	7.28 (0.279)	7.28 (0.279)	7.51 (0.071)	7.46 (0.174)	7.12 (0.166)	6.97 (0.337)
Dairy Products	Soya 1.89L	3.93 (0.080)	3.93 (0.080)	3.95 (0.053)	3.87 (0.191)	3.98 (0.096)	3.96 (0.122)
Frozen Food	Arctic Garden California Style 2kg	6.13 (0.151)	6.13 (0.151)	6.91 (0.160)	6.91 (0.160)	6.26 (0.185)	6.26 (0.185)
Frozen Food	Arctic Garden Thai Style 1.75kg	6.77 (0.288)	6.77 (0.288)	7.23 (0.124)	7.23 (0.124)	6.76 (0.295)	6.76 (0.295)
Frozen Food	Delissio Pizza 840g	7.12 (0.813)	7.12 (0.813)	8.81 (0.060)	8.19 (1.270)	7.49 (0.008)	7.41 (0.518)
Frozen Food	6 Eggs 312g	2.21 (0.106)	2.20 (0.130)	2.50 (0.024)	2.37 (0.251)	2.24 (0.040)	2.21 (0.107)
Frozen Food	Minis Ice Cream 100ml	0.67 (0.044)	0.67 (0.044)	0.70 (0.008)	0.68 (0.052)	0.80 (0.037)	0.78 (0.070)

Frozen Food	Nestle Parlour 2L	3.87 (0.482)	3.87 (0.482)	4.73 (0.060)	4.45 (.605)	4.43 (0.090)	4.33 (0.294)
Frozen Food	Quebon Classic 2L	4.56 (0.489)	4.56 (0.489)	4.92 (0.047)	4.87 (0.340)	3.96 (0.172)	3.68 (0.459)
Health & Beauty Aid	Alberto Hairspray 300ml	2.66 (0.240)	2.57 (0.310)	2.79 (0.368)	2.79 (0.370)	2.89 (0.008)	2.89 (0.008)
Health & Beauty Aid	Colgate Total 75ml	1.49 (0.002)	1.49 (0.002)	1.77 (0.058)	1.76 (0.077)	1.57 (0.034)	1.54 (0.084)
Health & Beauty Aid	Dove All Day 354ml	4.85 (0.124)	4.81 (0.285)	4.92 (0.304)	4.92 (0.304)	4.90 (0.186)	4.85 (0.200)
Health & Beauty Aid	Dove Soap 2x100g	1.98 (0.198)	1.98 (0.198)	2.37 (0.144)	2.29 (0.213)	1.97 (0.050)	1.96 (0.060)
Health & Beauty Aid	Finesse Extra Body Shampoo 300ml	1.89 (0.111)	1.89 (0.111)	2.90 (0.258)	2.90 (0.258)	2.86 (0.247)	2.79 (0.360)
Health & Beauty Aid	Fructis Style 300ml	3.06 (0.251)	2.95 (0.429)	3.16 (0.200)	3.11 (0.172)	3.35 (0.250)	3.31 (0.280)
Health & Beauty Aid	Gillette Shaving Cream 60g	3.20 (0.120)	3.20 (0.120)	3.91 (0.181)	3.87 (0.235)	3.29 (0.008)	3.25 (0.153)
Health & Beauty Aid	Head & Shoulder 400ml	5.30 (0.078)	5.06 (0.547)	5.48 (0.254)	5.45 (0.268)	5.42 (0.086)	5.38 (0.142)
Health & Beauty Aid	Pantene Shampoo 400ml	4.59 (0.265)	4.39 (0.489)	4.80 (0.408)	4.80 (0.412)	4.91 (0.054)	4.86 (0.150)
Health & Beauty Aid	Scope Mouthwash Original Mint 1L	3.73 (0.156)	3.73 (0.156)	4.00 (0.419)	3.99 (0.441)	3.86 (0.099)	3.86 (0.099)
Households	Arctic Power 3.3kg	6.66 (0.556)	6.66 (0.556)	8.49 (0.000)	8.34 (0.590)	6.85 (0.530)	6.80 (0.665)
Households	Canola Harvest Oil 1.89L	4.80 (0.523)	4.80 (0.523)	5.45 (0.250)	5.32 (0.491)	4.60 (0.498)	4.58 (0.502)
Households	Downy April Fresh 3L	5.58 (0.157)	5.58 (0.157)	6.74 (0.115)	6.64 (0.279)	5.68 (.010)	5.67 (0.038)
Households	Five Rose Flour 2.5kg	3.97 (0.139)	3.97 (0.139)	4.00 (0.058)	3.93 (0.188)	4.32 (0.056)	4.32 (0.057)
Households	Fleecy Fresh Air 5L	4.97 (0.539)	4.97 (0.539)	6.01 (0.065)	5.89 (0.479)	5.17 (0.138)	5.14 (0.161)
Households	Mazola Corn Cooking Oil 2L	5.01 (0.349)	5.01 (0.349)	6.08 (0.191)	5.91 (0.518)	5.71 (0.239)	5.38 (0.459)
Households	Palmolive Dishwashing Liquid 625L	2.00 (0.047)	2.00 (0.047)	2.62 (0.045)	2.54 (0.236)	1.98 (0.010)	1.98 (0.010)
Households	Purex 3.78L	5.83 (0.165)	5.83 (0.165)	8.02 (0.069)	7.98 (0.211)	5.78 (0.010)	5.78 (0.010)
Households	Robin Hood Flour 10kg	7.99 (0.000)	7.99 (0.000)	8.16 (0.484)	8.05 (0.784)	6.59 (0.689)	6.26 (0.827)
Households	Sunlight Detergent with bleach 3.3kg	7.79 (0.417)	7.79 (0.417)	8.99 (0.000)	8.78 (0.800)	6.91 (0.193)	6.90 (0.202)
Households	Sunlight Dishwashing Liquid 750ml	1.85 (0.054)	1.85 (0.054)	2.48 (0.039)	2.45 (0.100)	1.97 (0.047)	1.95 (0.080)
Households	Tide Detergent Power 3.4kg	8.41 (0.281)	8.41 (0.281)	9.99 (0.000)	9.72 (0.792)	8.53 (0.113)	8.46 (0.379)
Juices	Del Monte 1L	1.12 (0.119)	1.12 (0.119)	1.21 (0.086)	1.15 (0.161)	1.16 (0.062)	1.14 (0.078)
Juices	Oasis Classic 960ml	1.23 (0.168)	1.23 (0.168)	1.41 (0.141)	1.29 (0.241)	1.25 (0.083)	1.19 (0.137)
Juices	Ocean Spray Cocktail 1.89L	3.69 (0.028)	3.69 (0.028)	3.79 (0.028)	3.73 (0.158)	3.68 (0.010)	3.62 (0.193)
Juices	Rougemont 1.89L	2.57 (0.092)	2.57 (0.092)	2.59 (0.000)	2.57 (0.153)	2.39 (0.023)	2.39 (0.023)

Juices	Tropicana Orange Juice 1.89L	3.40 (0.283)	3.40 (0.283)	3.49 (0.028)	3.38 (0.256)	3.44 (0.107)	3.39 (0.165)
Juices	Welch's Fruit 1.82L	4.52 (0.076)	4.52 (0.076)	4.59 (0.059)	4.50 (0.210)	4.50 (0.068)	4.39 (0.219)
Paper Towel, Tissue & Pet Supplies	Cat Chow 4kg	10.09 (0.198)	10.09 (0.198)	10.95 (0.135)	10.95 (0.135)	9.98 (0.010)	9.96 (0.098)
Paper Towel, Tissue & Pet Supplies	Cottonolle Paper Towel 30RL	13.95 (0.277)	13.95 (0.277)	13.76 (0.645)	13.76 (0.645)	9.02 (0.118)	8.96 (0.339)
Paper Towel, Tissue & Pet Supplies	Dog Chow 2kg	4.99 (0.000)	4.99 (0.000)	5.38 (0.191)	5.28 (0.278)	4.98 (0.010)	4.98 (0.010)
Paper Towel, Tissue & Pet Supplies	Kleenex Tissue 230FE	2.45 (0.146)	2.45 (0.146)	2.79 (0.000)	2.77 (0.065)	2.58 (0.010)	2.57 (0.046)
Paper Towel, Tissue & Pet Supplies	Puffs Plus Lotion 144FE	2.55 (0.102)	2.55 (0.102)	2.89 (0.000)	2.86 (0.097)	2.48 (0.010)	2.45 (0.087)
Paper Towel, Tissue & Pet Supplies	Puppy Chow 8kg	11.06 (0.172)	11.06 (0.172)	14.26 (0.598)	14.10 (0.813)	11.47 (0.009)	11.45 (0.097)
Paper Towel, Tissue & Pet Supplies	Scotties Tissue 150 FE	0.99 (0.014)	0.99 (0.014)	1.24 (0.050)	1.20 (0.111)	0.99 (0.000)	0.99 (0.000)
Soup / Canned Foods	Aylmer Whole Tomato 796ml	1.29 (0.000)	1.29 (0.000)	1.42 (0.062)	1.31 (0.218)	1.28 (0.010)	1.26 (0.090)
Soup / Canned Foods	Del Monte Fruit Cocktail 796ml	2.72 (0.184)	2.72 (0.184)	2.93 (0.093)	2.86 (0.211)	2.75 (0.153)	2.73 (0.164)
Soup / Canned Foods	Green Giant Beans 398ml	1.03 (0.164)	1.03 (0.164)	1.17 (0.054)	1.13 (0.140)	1.15 (0.076)	1.09 (0.123)
Soup / Canned Foods	Pastene Diced Tomato 796ml	1.42 (0.054)	1.42 (0.054)	1.59 (0.000)	1.55 (0.119)	1.35 (0 .082)	1.31 (.110)

B. Private Label Products

		EDLP (Loblaw's)		**Hi-Lo (Provigo)**		**HYB (Super-C)**	
Product Category	**Product**	**Regular Price**	**Transaction price**	**Regular Price**	**Transaction price**	**Regular Price**	**Transaction price**
Beverage	PC Natural Spring Water 1.5L	0.76 (0.067)	0.76 (0.067)	0.77 (0.044)	0.75 (0.054)		
Beverage	PC Cola 2L	0.96 (0.082)	0.95 (0.105)	1.07 (0.036)	1.04 (0.070)		
Beverage	Super C Natural Spring Water 1.5L					0.68 (0.024)	0.68 (0.024)
Beverage	Super C Cola 2L					0.99 (0.017)	0.93 (0.100)
Beverage	Super C Mineral Water 1L					0.79 (0.007)	0.79 (0.007)
Breakfast/Cereals	PC Corn Flakes 750g	2.94 (0.179)	2.94 (0.179)	3.28 (0.249)	3.26 (0.269)		
Breakfast/Cereals	PC Crispy Rice 525g	2.20 (0.346)	2.20 (0.346)	2.74 (0.109)	2.69 (0.105)		
Breakfast/Cereals	Super C Corn Flakes 675g					2.75 (0.088)	2.74 (0.103)
Condiments, Sauces and Spread	PC Ketchup 1 L	2.09 (0.149)	2.09 (0.149)	2.30 (0.197)	2.20 (0.219)		

Condiments, Sauces and Spread	PC Original Whipped Salad 950ml	2.60 (0.212)	2.60 (0.212)	3.38 (0.650)	3.35 (0.661)		
Dairy Products	Super C Butter 454g					2.95 (0.080)	2.95 (.100)
Dairy Products	Super C Cheddar Cheese 600g					5.09 (0.220)	5.08 (0.215)
Frozen Food	Super C Buttermilk Pancake 310kg					1.73 (0.098)	1.73 (0.098)
Frozen Food	Super C Pizza Lunch 1.2kg					6.34 (0.230)	6.33 (0.234)
Households	PC Fabric Softener 3L	3.99 (0.000)	3.99 (0.000)	4.52 (0.118)	4.49 (0.171)		
Households	PC Laundry Detergent 3.4kg	6.82 (0.382)	6.82 (0.382)	6.99 (0.000)	6.85 (0.348)		
Households	Super C Dishwashing 850ml					1.77 (0.030)	1.76 (0.037)
Households	Super C Fabric Softener 3.6L					1.98 (0.010)	1.98 (0.010)
Households	Super C Laundry Detergent 3.6kg					5.94 (0.196)	5.80 (0.383)
Households	Super C Maize Oil 2L					3.98 (0.009)	3.97 (0.036)
Juices	PC Juice Cocktail 1.89L	2.91 (0.451)	2.91 (0.451)	3.22 (0.257)	2.99 (0.458)		
Juices	PC White Grape Juice 1.82 L	3.99 (0.000)	3.99 (0.000)	3.96 (0.073)	3.82 (0.283)		
Juices	Super C Fruit Punch Drink 2L					1.54 (.043)	1.54 (.043)
Juices	Super C Orange Juice 1.89L					2.85 (0.087)	2.85 (0.087)
Paper Towel, Tissue and Pet Supplies	Super C Bathroom Double Tissue 24un					9.82 (0.084)	9.80 (0.140)
Paper Towel, Tissue and Pet Supplies	Super C Facial Tissue 250un					1.46 (0.037)	1.44 (0.102)
Soup / Canned Foods	Super C Mais 398ml					0.85 (0.032)	0.85 (0.032)
Soup / Canned Foods	Super C Small Peas 398ml					0.95 (0.061)	0.95 (0.061)
Soup / Canned Foods	Super C Tomatoes 796ml					0.98 (0.010)	0.98 (0.027)

APPENDIX E. ALTERNATIVE CALCULATIONS OF THE AVERAGE PRICE DURATION

Carvalho (2006) shows that because of Jensen's inequality, calibrating sticky price models using the information on average frequencies, as we do in the paper, underestimates the stickiness of prices. In this appendix, therefore, we calculate an alternative measure of price durations:

(E1) $$-\frac{1}{N}\sum_{i\in C} [ln(1-f_i)]^{-1},$$

where f_i is the weekly price change frequency of product i in category C, and N is the number of products in category C.

However, the use of equation E1 with our data has a significant drawback. If for a given price measure and a given store, a product has no price changes, then we are forced to drop it from the calculation, biasing the estimates downwards. Our estimates are therefore a lower bound of the price durations. This downward bias is less severe for transaction prices, which are relatively volatile, but it is likely to be important for reference prices and perhaps also for the filtered and regular prices. The results are summarized in Table E1. Panel A presents the implied average durations based on the average frequencies, as we do in the paper.

Panel B presents the results based on Equation E1. The expected durations of transaction prices at the EDLP, Hi-Lo, and HYB stores are 10.70 weeks, 8.94 weeks, and 10.55 weeks, respectively. These durations are 59.2%, 137.1%, and 56.3% longer than the corresponding durations in Panel A.

For regular prices, the expected duration figures in panel B are 10.94 weeks, 27.66 weeks, and 21.96 weeks for the EDLP, Hi-Lo and HYB stores, respectively. These durations are 57.2%, 14.6%, and 20.5% longer than the corresponding durations in Panel A. For Nakamura and Steinsson's (2008) filtered prices, the expected durations in panel B are 26.01 weeks, 29.53 weeks, and 24.44 weeks for the EDLP, Hi-Lo and HYB stores, respectively. These durations are 13.1%, 6.9%, and 12.7% longer than the corresponding durations in Panel A. For Chahrour's (2011) reference price, the estimated durations in panel B are often shorter than in Panel A, indicating that for reference prices, our lower bound perhaps is not a good measure of price stickiness.

To obtain a better measure of the underestimation of price stickiness implied by using the average frequencies, we calculate the average price durations using only the

observations that we used to calculate Equation E1. I.e., we calculate $-\left[ln\,(1-\underline{f})\right]^{-1}$, where $\underline{f}$ is the ratio of the total number of price changes per week in the category to the number of products in the category, using information only on products that have at least one price change. In other words, the sample that we use is the same as the sample that we used to calculate Panel B of Table E1, making the results comparable. The results are reported in Table E2.

Focusing on the bottom rows, we find that for transaction prices, the durations reported in Panel B of Table E1 are 72.3% (EDLP), 142.9% (Hi-Lo), and 59.4% (HYB) greater than in Table E2. For regular prices, as defined by the store, the durations reported in Panel B of Table E1 are 70.1% (EDLP), 44.4% (Hi-Lo), and 26.6% (HYB) greater than in Table E2. For Nakamura and Steinsson (2008) filtered prices, the durations reported in Panel B of Table E1 are 38.9% (EDLP), 36.3% (Hi-Lo), and 19.5% (HYB) greater than in Table E2. For Chahrour's (2011) reference prices, the durations reported in Panel B of Table E1 are 32.4% (EDLP), 25.4% (Hi-Lo), and 22.2% (HYB) greater than in Table E2.

It therefore seems that in comparison to Equation (E1), the downward bias generated by using the average frequency to calculate price stickiness is most pronounced when prices are flexible. The bias is also affected by the variance in the frequency of price changes across products. Consequently, the greatest differences between Table E2 and Panel B of Table E1 are for the transaction prices of the Hi-Lo and EDLP stores. The differences are smallest for Nakamura and Steinsson (2008) filtered prices and Chahrour's (2011) reference prices of the HYB store.

Table E1. Implied Price Duration

A. Implied Average Price Duration in Weeks based on average frequencies												
Product Category	**EDLP (Loblaw's)**				**Hi-Lo (Provigo)**				**HYB (Super-C)**			
	Transaction	Regular	Filtered	Reference	Transaction	Regular	Filtered	Reference	Transaction	Regular	Filtered	Reference
Baby Products & Foods	16.83	16.83	51.50	129.50	16.83	259.50	259.50	N/A	14.79	18.07	36.64	32.00
Beverages	3.81	3.89	13.94	34.16	2.27	22.10	16.83	51.50	5.09	17.37	28.10	33.14
Breakfast/Cereals	6.38	6.53	33.30	47.78	3.60	35.08	35.08	67.10	5.21	20.30	21.01	22.61
Condiments, Sauces & Spread	4.59	4.59	22.38	43.50	2.88	20.68	24.37	33.14	6.17	19.00	24.13	21.78
Dairy Products	6.24	6.42	16.83	22.10	5.91	18.07	24.26	28.39	5.99	15.49	19.62	25.50
Frozen Food	6.10	6.35	25.50	35.90	4.21	27.50	25.50	51.50	6.27	15.63	18.22	24.13
Health & Beauty Aid	7.61	9.69	17.43	23.13	6.15	12.83	16.83	22.10	8.61	18.75	22.10	22.10
Households	10.04	10.04	26.46	35.90	4.40	45.00	48.03	80.39	7.73	17.98	18.40	26.34
Juices	5.99	6.20	31.50	58.93	2.37	21.39	23.97	45.72	5.79	15.49	18.40	18.40
Paper Towel, Tissue & Pet Supplies	25.50	25.50	35.90	60.17	4.84	32.59	39.94	39.94	12.49	30.70	28.75	38.50
Soups/Canned Foods	8.16	8.16	20.30	29.21	2.35	15.49	51.50	68.83	6.77	18.65	20.91	19.72
Total	**6.72**	**6.96**	**23.00**	**36.53**	**3.77**	**24.13**	**27.63**	**44.26**	**6.75**	**18.22**	**21.69**	**24.79**
B. Expected Price Duration in Weeks												
Baby Products & Foods	15.67	15.67	34.16	25.50	26.94	51.50	51.50		32.99	33.29	36.33	35.25
Beverages	4.77	4.85	19.55	37.96	5.98	28.77	27.46	47.16	9.79	24.19	27.90	35.03
Breakfast/Cereals	7.93	7.99	30.70	42.83	4.66	32.24	30.31	48.61	6.12	20.73	23.07	22.03
Condiments, Sauces & Spread	6.01	6.01	24.47	30.55	7.78	21.44	25.39	27.35	7.98	24.40	28.87	28.39
Dairy Products	10.52	10.60	24.19	29.14	13.82	24.80	28.10	27.42	8.95	18.71	21.88	30.19
Frozen Food	8.32	8.38	31.07	40.66	15.40	31.69	30.45	47.16	9.08	17.79	20.20	27.88
Health & Beauty Aid	12.29	14.15	24.37	29.06	11.05	17.31	21.51	26.80	11.20	19.86	22.90	22.90
Households	12.07	12.07	24.63	26.04	5.48	39.80	42.04	41.39	11.15	20.73	21.38	31.73
Juices	15.16	15.25	29.83	36.33	5.08	27.35	27.97	28.75	7.94	16.29	22.25	19.54
Paper Towel, Tissue & Pet Supplies	26.22	26.22	28.96	38.50	13.65	27.23	27.66	27.66	15.63	30.91	29.83	35.40
Soups/Canned Foods	8.57	8.57	17.41	22.61	2.76	14.97	25.50	38.50	9.31	23.89	24.88	23.64
Total	**10.70**	**10.94**	**26.01**	**33.52**	**8.94**	**27.66**	**29.53**	**36.23**	**10.55**	**21.96**	**24.44**	**28.30**

Notes: In panel A of the table, we report the implied average duration of the prices in weeks. The average duration is calculated as $-\left[ln\,(1-\underline{f})\right]^{-1}$, for each one of the 11 product categories included in our data, for the three stores. For each category, we computed the $\underline{f}$ as the ratio of the total number of price changes per week in the category, to the number of products in the category (Levy et al., 1997, Table 1, p.

797, Gorodnichenko and Talavera 2017). The average weekly frequency of a price change at each store is calculated for the transaction price, the regular price (as classified and presented by the store), the filtered price (the prices after removing temporary price reductions as identified by Nakamura and Steinsson's (2008) sales filter A), and the reference prices. We use Chahrour's (2008) algorithm with a 13-week rolling window to derive the reference prices. The "total" row gives the average weekly frequency computed over all goods, in each store. In panel B, we calculate the expected durations as: $-\frac{1}{N}\sum_{i\in C} \quad [ln(1-f_i)]^{-1}$ where f_i is the frequency of price changes of product i in category C, and N is the total number of products in the category.

Table E2. Implied Price Duration Using Only Products with at least One Price Change.

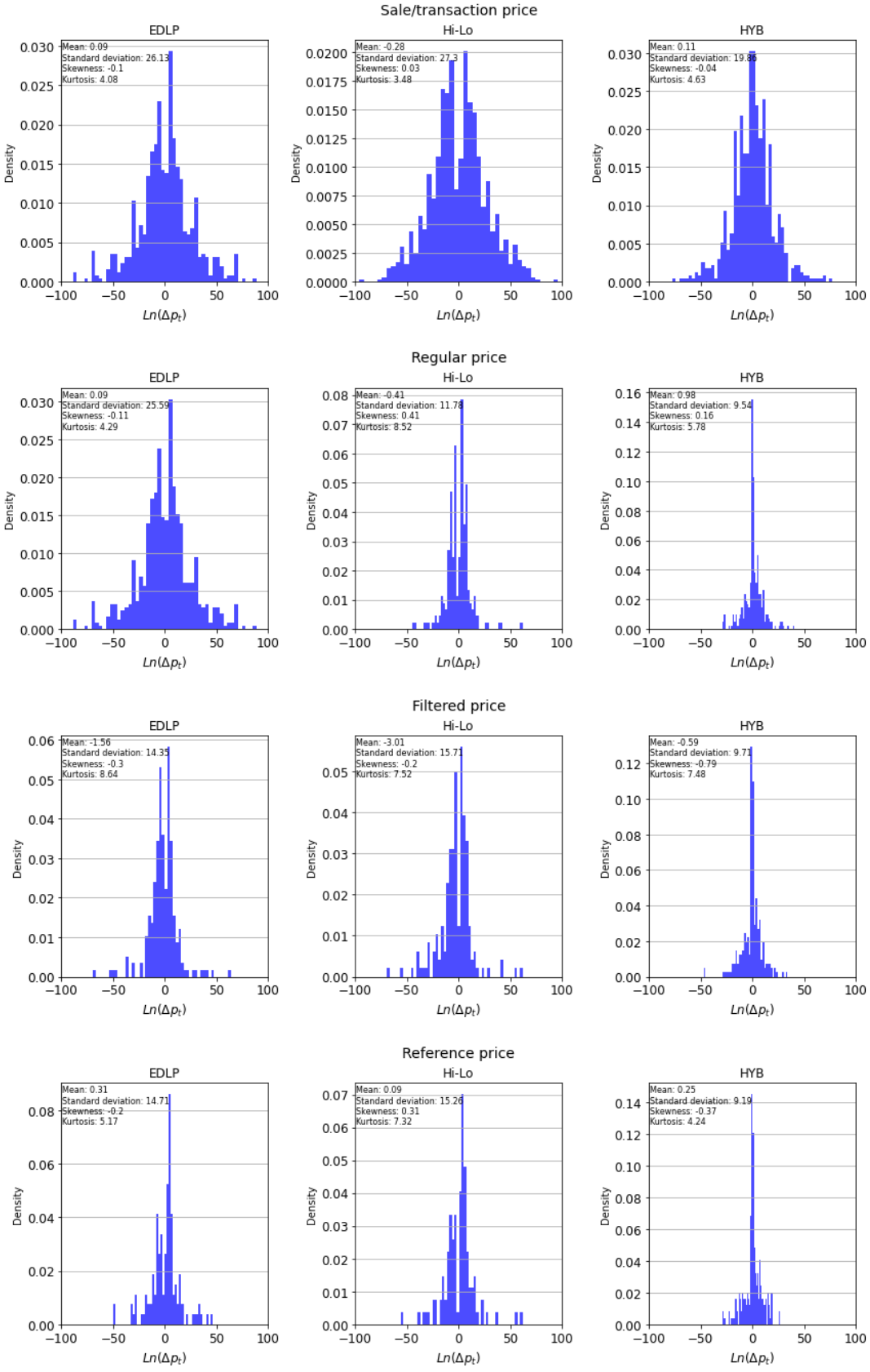
A. Implied Average Price Duration in Weeks based on average frequencies												
Product Category	**EDLP (Loblaw's)**				**Hi-Lo (Provigo)**				**HYB (Super-C)**			
	Transaction	Regular	Filtered	Reference	Transaction	Regular	Filtered	Reference	Transaction	Regular	Filtered	Reference
Baby Products & Foods	9.89	9.89	30.70	25.50	9.89	51.50	51.50	N/A	11.73	14.35	29.21	25.50
Beverages	3.81	3.89	12.49	27.23	2.27	19.84	15.09	41.10	5.09	15.74	22.90	30.09
Breakfast/Cereals	6.38	6.53	25.50	36.64	3.60	24.13	24.13	46.30	5.21	16.83	17.43	18.75
Condiments, Sauces & Spread	4.59	4.59	16.13	23.50	2.88	14.90	17.58	20.91	6.17	19.00	24.13	21.78
Dairy Products	6.24	6.42	16.83	22.10	5.91	18.07	24.26	25.50	5.99	15.49	19.62	25.50
Frozen Food	6.10	6.35	25.50	30.70	4.21	27.50	25.50	44.07	6.27	15.63	18.22	21.39
Health & Beauty Aid	7.61	9.69	17.43	20.77	6.15	12.83	16.83	22.10	8.61	18.75	22.10	22.10
Households	8.53	8.53	18.75	20.30	4.40	32.00	37.63	34.16	7.73	17.98	18.40	26.34
Juices	5.17	5.36	23.50	29.21	2.37	18.65	20.91	22.61	5.79	15.49	18.40	18.40
Paper Towel, Tissue & Pet Supplies	21.78	21.78	25.50	34.16	4.84	23.13	22.61	22.61	11.05	27.23	25.50	29.83
Soups/Canned Foods	5.99	5.99	15.09	21.78	2.35	11.49	25.50	34.16	6.77	18.65	20.91	19.72
Total	**6.21**	**6.43**	**18.73**	**25.31**	**3.68**	**19.15**	**21.66**	**28.89**	**6.62**	**17.35**	**20.46**	**23.15**

Notes: In panel A of the table, we report the implied average duration of the prices in weeks. The average duration is calculated as $-\left[ln\,(1-\underline{f})\right]^{-1}$, for each one of the 11 product categories included in our data, for the three stores. For each category, we computed the $\underline{f}$ as the ratio of the total number of price changes per week in the category, to the number of products in the category (Levy et al., 1997, Table 1, p. 797, Gorodnichenko and Talavera 2017). We use only observations on products that had at least 1 price change. The average weekly frequency of a price change at each store is calculated for the transaction price, the regular price (as classified and presented by the store), the filtered price (the prices after removing temporary price reductions as identified by Nakamura and Steinsson's (2008) sales filter A), and the reference prices. We use Chahrour's (2008) algorithm with a 13-week rolling window to derive the reference prices. The "total" row gives the average weekly frequency computed over all goods, in each store.

APPENDIX F. HISTOGRAMS OF PRICE CHANGES

Figure F1 depicts the histograms of the size of price changes. We find that there is a large variation in the kurtoses, both across stores and across price measures. If we look at the transaction price, we find that the kurtoses are between 3.48 at the Hi-Lo store and 4.63 at the HYB store. When we focus on regular prices, the kurtosis at the EDLP store remains almost unchanged (4.29), but the removal of sales, which are usually large in percentage terms, leads to an increase in the kurtoses at the Hi-Lo (8.52) and HYB (5.78) stores. For the filtered prices, the kurtoses are more similar across the three stores: 8.64 at the EDLP store, 7.52 at the Hi-Lo store, and 7.48 at the HYB store. There is also a large variation in the kurtoses of the reference prices: 5.17 at the EDLP store, 7.32 at the Hi-Lo store, and 4.24 at the HYB store.

Figure F1. Histograms of the Size of Price Changes



Notes: The figure shows the histograms of the size of price changes calculated as $100 \times \left[Ln\left(p_{s,i,t}\right) - Ln(p_{s,i,t-1})\right]$, where p is the relevant price measure of product i offered in store s on week t. The scale of the *y*-axis varies across the figures.

APPENDIX G. AVERAGE FREQUENCIES OF PRICE CHANGES AND IMPLIED DURATIONS: Nakamura and Steinsson's (2008) Sales Filter

One disadvantage of sales filters such as Nakamura and Steinsson's (2008) is that they can be less precise near the endpoints. For example, Figure 5 in the paper illustrates that if a price-cut takes place near the end of the sample period, the filter is unable to determine whether it is temporary or not.

This problem is likely to be more important in a short (time series) dataset, such as ours, than in longer datasets, where endpoints compose a smaller share of the observations. To estimate the effect of endpoints on the precision of our estimates for the frequency of price changes, we run the Nakamura and Steinsson's (2008) sales filter again, this time assuming that if the transaction price decreased less than 6 weeks away from the endpoint, without bouncing back up again, then we excluded these observations. We chose the value of 6 weeks because we calibrated the filter such that the maximum length of a sale is 6 weeks.

Panel A of Table G1 presents the average frequencies in each of the 11 product categories, in each of the 3 stores. We find that overall, excluding the price changes close to the end of the sample reduces the frequency of price changes relative to the values reported in Table 5 in the paper. In Table G1, the average frequencies of the EDLP, Hi-Lo, and HYB stores are 3.69%, 2.91%, and 4.20%, respectively. The corresponding values in Table 5 are 4.25%, 3.55%, and 4.50%. The average frequency decreases, therefore, by 13.2%, 18.0%, and 9.33%, respectively.

Panel B of Table G1 presents the average durations implied by the average frequencies of price changes. As in Panel B of Table 5, we calculate the average durations as $-\left[ln\,(1-\underline{f})\right]^{-1}$ where $\underline{f}$ is the average frequency of price changes. We find that the average durations are 28.20, 33.15 and 25.76 weeks at the EDLP, Hi-Lo and HYB stores, respectively. The corresponding values in Table 5 are 23.00, 27.63 and 21.69 weeks. Assuming no price changes close to the end points, therefore, increases the estimated durations by 18.8%–22.6%.

However, as we discuss in Appendix E, using the average frequencies might bias the average durations downwards. We therefore recalculate the expected durations following the same procedure as in Appendix E. The results are reported in Panel C.

We find that the expected durations are 28.20, 33.15 and 25.76 weeks for the EDLP, Hi-Lo, and HYB stores, respectively. This is compared to 26.01, 29.53, and 24.44 weeks, respectively, reported in Table E1. When we focus on the expected durations, therefore, the effects of assuming no price changes close to the end points are more modest: 8.4% for the EDLP store, 12.3% for the Hi-Lo store, and 5.4% for the HYB store.

Table G1. Average Frequencies of Price Changes and Implied Durations: Nakamura and Steinsson's (2008) Sales Filter

A. Average Weekly Frequency of Price Changes			
	Transaction	Regular	Filtered
Baby Products & Foods	1.54%	0.00%	2.31%
Beverages	6.35%	5.38%	3.15%
Breakfast/Cereals	2.37%	1.92%	4.17%
Condiments, Sauces & Spread	3.67%	3.32%	3.85%
Dairy Products	5.58%	3.85%	4.65%
Frozen Food	3.85%	3.02%	4.70%
Health & Beauty Aid	3.65%	4.23%	4.23%
Households	3.43%	1.79%	5.05%
Juices	2.64%	3.37%	5.05%
Paper Towel, Tissue & Pet Supplies	2.47%	1.92%	3.21%
Soups/Canned Foods	4.33%	1.44%	4.67%
Total	**3.69%**	**2.91%**	**4.20%**
B. Implied Average Price Duration in Weeks			
Baby Products & Foods	64.50	N/A	42.83
Beverages	15.25	18.07	31.28
Breakfast/Cereals	41.75	51.50	23.50
Condiments, Sauces & Spread	26.73	29.60	25.50
Dairy Products	17.43	25.50	21.01
Frozen Food	25.50	32.59	20.77
Health & Beauty Aid	26.87	23.13	23.13
Households	28.62	55.50	19.31
Juices	37.32	29.21	19.31
Paper Towel, Tissue & Pet Supplies	39.94	51.50	30.70
Soups/Canned Foods	22.61	68.83	20.91
Total	**26.59**	**33.82**	**23.29**
C. Expected Price Duration in Weeks			
Baby Products & Foods	25.50	N/A	38.50
Beverages	15.74	33.24	26.04
Breakfast/Cereals	39.36	39.94	26.97
Condiments, Sauces & Spread	22.84	30.37	31.76
Dairy Products	24.63	28.96	23.33
Frozen Food	31.07	36.64	20.08
Health & Beauty Aid	33.39	22.25	23.76
Households	25.50	39.94	23.55
Juices	32.72	36.64	22.79
Paper Towel, Tissue & Pet Supplies	34.16	22.61	30.91
Soups/Canned Foods	18.27	38.50	24.88
Total	**28.20**	**33.15**	**25.76**

APPENDIX H. COMPARISON WITH A RETAIL FOOD STORE IN ISRAEL

One weakness of our dataset is that it covers only 52 weeks. This has two effects on our estimates of price rigidity. First, when we look at the filtered and reference price series, we find many products with no price changes, biasing our estimates of the duration of prices downwards.

Second, Nakamura and Steinsson's (2008) sales filter, which we use to calculate the filtered price series, as well as Chahrour's (2011) algorithm which we use to calculate the reference price series, are less accurate near the endpoints. It is possible, therefore, that our estimates of the rigidity of the filtered and reference prices are affected by this inaccuracy. To address this concern, in Appendix G, we provided estimates for Nakamura and Steinsson's (2008) sales filter assuming that all price changes close to the end points are temporary.

In the current appendix, we try to gauge the significance of having a short price series, by using a longer dataset. We use data made available by the Israeli retail "price transparency" law. Since 2015, all major Israeli retailers are required to post their prices online. Prices are posted for both online and brick-and-mortar stores. Prices of all products in each store are posted online once every day. If prices are updated during the day, the internet site should be updated within one hour of the price change. See Bonomo et al. (2023) for more details about the price transparency law.

We have data for one store which belongs to the largest supermarket chain, "Shufersal Deal-Extra." The chain positions itself as a discount store, a form of HYB format, offering relatively low prices along with temporary price cuts. The particular store we sampled is located in the city of Nesher, in the north of Israel. By Israeli standards, it is a large store, carrying over 9,800 different products. We have weekly data on 2,256 products for the period January 7, 2018–April 11, 2021 (171 weeks). For each product, we have both the transaction and regular prices, as posted online by the chain.

To make our results comparable to the results we report in the paper, we use data only for products with no more than 3 missing observations. This leaves us with 447 products.

The average price is 13.44 NIS with a standard deviation of 9.89 NIS, and the average regular price is 14.56 NIS with a standard deviation of 10.59 NIS.[3]

In addition to the transaction and regular price series that we have, for each product we generate a series of filtered prices using Nakamura and Steinsson's (2008) sales filter, and a series of reference prices using Chahrour's (2011) algorithm. For each product, we therefore have four price measures: transaction, regular, filtered and reference.

For each price measure, we calculate the average frequency of price changes, the implied average durations based on the average frequencies, i.e., $-\left[ln\ (1-\underline{f})\right]^{-1}$, where $\underline{f}$ is the ratio of the total number of price changes per week in the category to the number of products in the category, and the expected implied durations, $-\frac{1}{N}\sum_{i=1}^{N}\ [ln(1-f_i)]^{-1}$, where f_i is the weekly price change frequency of product i, and N is the number of products.

In Panel A of Table H1, we present the results when we use all the observations. We find that for the transaction prices, regular prices, and the reference prices, the frequencies of price changes in the Israeli store are similar to the frequencies we find at the Canadian HYB store. The likelihood that the transaction price changes in each week is 13.62%, the likelihood that the regular price changes in each week is 4.68%, and the likelihood that the reference price changes is 4.47%. The finding that prices of a Hi-Lo store in Israel changes at a similar rate to a Canadian HYB store is consistent with Dhyne et al. (2006) that show that there are fewer temporary price cuts in Europe than in the US.

For the filtered prices, we find that the frequency of price changes is higher than for the regular prices as advertised by the store. It turns out that this happens because the store occasionally sets a high regular price, which is kept unchanged for a long period, and a lower transaction price. In other words, the store advertises certain products as being "on sale" for long periods. On such occasions, when the transaction price is changed (i.e., the size of the "discount" on the product is changed), the Nakamura and Steinsson (2008) sales filter identifies it as a filtered price change.

[3] The average US Dollar–NIS exchange rate during that period was 3.53 NIS for 1 US Dollar with standard deviation of 0.114 NIS.

Looking at the implied average durations, we find that the results for Israel are again quite similar to the results for the Canadian HYB store. The implied average duration for the transaction price in Israel (Canadian HYB) is 6.82 (6.75), for the regular price it is 20.85 (18.22), for the filtered prices it is 16.78 (21.69), and for the reference prices it is 21.87 (24.79).

It therefore seems that using a short series had only a modest effect on the implied average duration of prices. However, when we calculate the expected duration of prices, the effect of omitting products with no price changes seems to have had a significant effect on the results. The expected duration, in weeks, of the transaction prices in the Israeli (Canadian HYB) data is 18.34 (10.55), of the regular prices, 69.95 (21.96), of the filtered prices, 43.97 (24.44), and of the reference prices, 47.85 (28.30).

Thus, the short data series that we use in the paper likely leads to a significant underestimation of the expected duration of prices. There is a need in larger dataset to draw stronger conclusions.

The inclusion of endpoints, on the other hand, seems to have had only a modest effect on the estimates of duration and average/expected duration. This can be seen in Panel B, which shows the results when for each product we remove observations that are up to 6 weeks from the first or the last observations. We remove observations near the endpoints since Nakamura and Steinsson's (2008) and Chahrour's (2011) algorithms are likely to be less precise near the endpoints.

The results are almost unaffected compared to Panel A. Thus, imprecision around the endpoints does not seem to be a significant problem for price rigidity estimates, although the problem is likely to be more severe when the dataset is short.

Table H1. Frequency of Price Changes and Implied Durations, Israeli Dataset

A. All observations				
	Transaction price	Regular price	Filtered price	Reference price
Frequency of price changes	13.62%	4.68%	5.79%	4.47%
Implied average duration (weeks)	6.82	20.85	16.78	21.87
Expected duration (weeks)	18.34	69.95	43.97	47.85
B. Excluding end points				
Frequency of price changes	13.45%	4.57%	5.76%	4.56%
Implied average duration (weeks)	6.92	21.40	16.84	21.43
Expected duration (weeks)	17.16	66.60	42.33	46.43

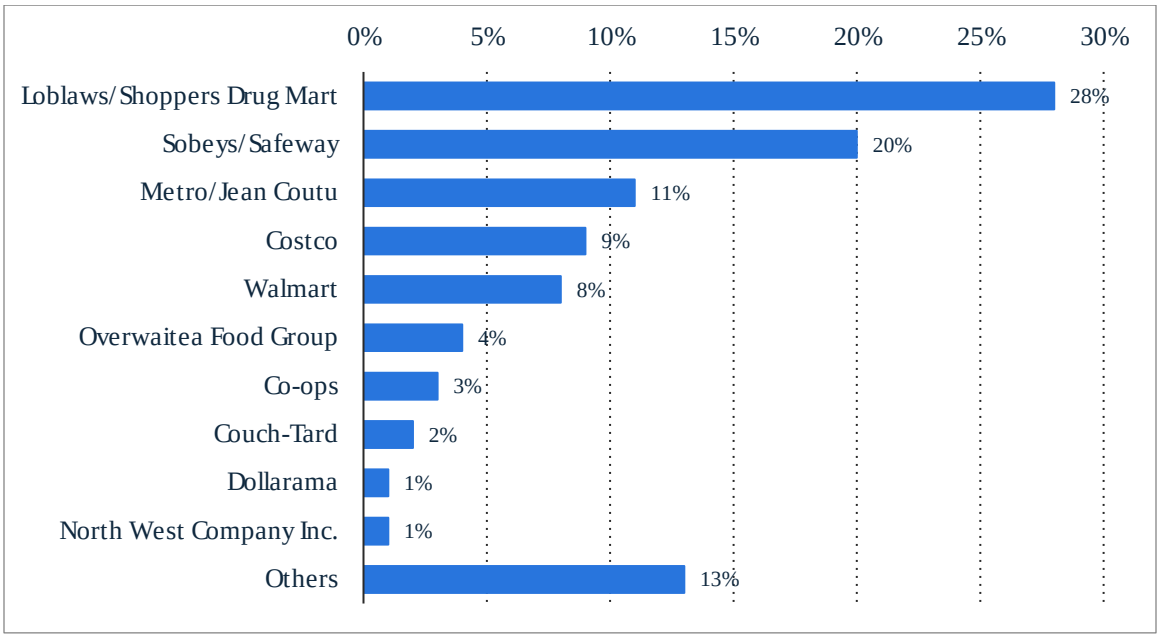
Notes: Results for Israeli store "Shufersal," store number 71, located in Nesher. Weekly data for 447 products, over the period January 7, 2018–April 11, 2021. The frequency of price changes is the average weekly frequency of price changes $\underline{f}$ (in %). We compute $\underline{f}$ as the ratio of the total number of price changes per week in the category, to the number of products in the category. The implied average duration is calculated as $-\left[ln\ (1-\underline{f})\right]^{-1}$. The expected duration is calculated as $-\frac{1}{N}\sum_{i=1}^{N}\ [ln(1-f_i)]^{-1}$, where f_i is the weekly price change frequency of product i, and N is the number of products. Panel A uses all observations. In Panel B, for each product we exclude observations that are less than 6 weeks from the first or last observation.

APPENDIX I. RETAIL SUPERMARKET LANDSCAPE IN CANADA

Retail sales of Canadian food stores amounted to about C$ 144 billion in 2021. The top Canadian food retailer is Loblaw Companies Ltd. With 28% market share, followed by Sobeys with 20%. Other leading food retailers include Metro Inc., Costco, and Walmart. Figure I1 shows the market share of top-10 retail food chain store operators in Canada.

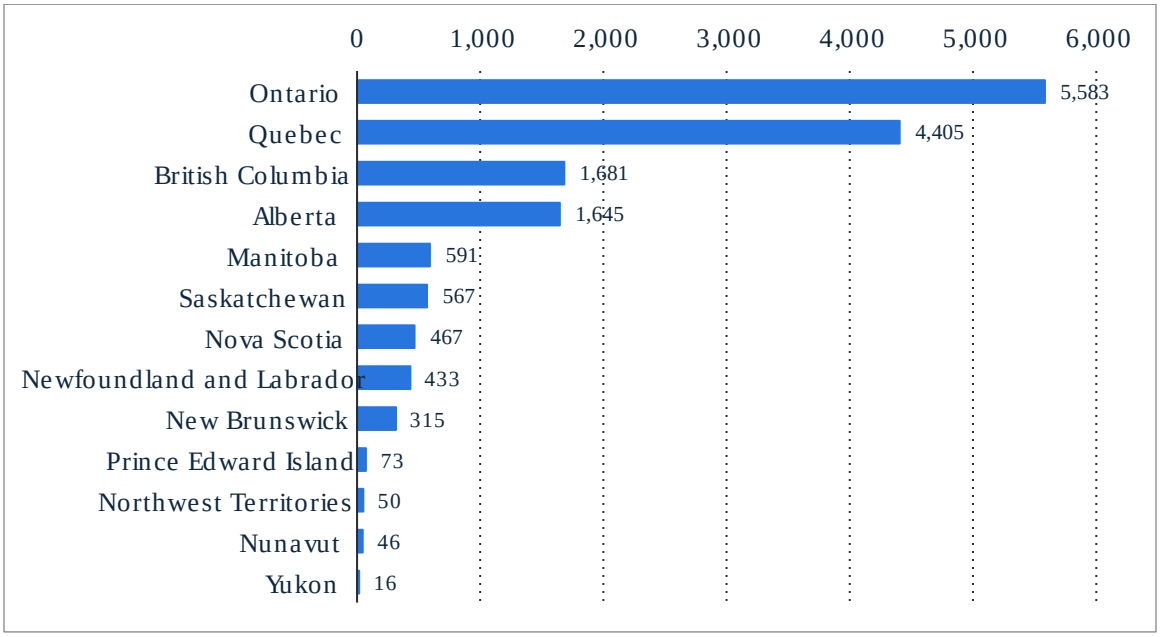
Of the nearly 27,000 food stores in Canada, over one third were Ontario. Loblaw Companies Ltd., with over 2,400 stores nationwide, had the largest number of stores among grocery retailers in Canada and generated about 37 billion Canadian dollars in food sales in 2021. Sobeys Inc. followed with more than 1,400 stores and sales reaching just over 28 billion dollars in the same year. Revenues of Costco, Walmart, and Metro, were not far behind with 27, 22, and 18 billion Canadian dollars, respectively. Figure I2 shows the number of grocery stores in Canada by regions.

Figure I1. Top Grocery Retailers in Canada by Market Share, 2021



Source: Statista, https://www.statista.com/

Figure I2. Number of Grocery Stores in Canada by Regions, 2022



Source: Statista, https://www.statista.com/

APPENDIX J. RETAIL SUPERMARKET LANDSCAPE IN THE US

In Table J1, we list the 15 largest retail food chains in the US, and their store pricing format distribution. According to the table, some chains have a dominant pricing format. For example, H.E. Butt employs the EDLP format at 96% of its stores, Food-Lion at 86% of its stores, and Walmart at 73% of its stores. Thus, at these chains, EDLP is the most common format. Most chains, however, use all three formats. For example, Kroger employs Hi-Lo at 47% of the stores, HYB at 40% of its stores, and EDLP at 13% of the stores. Stop & Shop, employs EDLP, Hi-Lo and HYB pricing formats, at 7%, 50% and 43% of its stores, respectively.

The chains with a high proportion (say, 30% or more) of Hi-Lo stores include A&P, Safeway, Stop & Shop, Kroger, Pathmark, and Lucky, each employing the Hi-Lo format at 35%–55% of their stores. The chains with a high proportion of EDLP stores include H.E. Butt, Food-Lion, Walmart, Winn-Dixie, Albertson's, Cub-Food, and Pathmark, each employing the EDLP format at 33%–96% of their stores. The chains operating a high proportion of HYB stores include Publix, Fred-Meyer, Giant, Stop & Shop, Safeway, Albertson's, Kroger, Lucky, Cub-Food, A&P, and Winn-Dixie, each employing a HYB format at 30%–71% of their stores. In sum, in the US retail food market, all three pricing formats are common and widespread.

The above figures suggest that the pricing format is not a chain-level variable. It turns out, however, there may be substantial variability in the pricing formats used by a retail chain even at the level of local markets. Consider, for example, Pathmark stores located in New Jersey, in the "small" area around the Raritan River, between Madison and Raritan Bay, as shown in Figure J1. In the magnified area of the figure, there are 37 Pathmark stores and as the Figure shows, they follow very different pricing formats, despite their close proximity to each other.

The variability in the pricing format is not limited to a particular chain. According to Ellickson and Misra (2008), this is characteristic of the entire retail food industry, irrespective of chain/store size, and irrespective of whether or not the stores are vertically integrated or not.

In Figure 1 in the paper, we show the spatial distribution of the pricing format across the

US. As the figure shows, there are no clear differences between the spatial distributions of the three pricing formats.

However, if we look at the actual shares of each pricing format across the US regions, then we find some differences. In Table J2, we present the pricing format distribution across 8 regions of the US. According to the table, EDLP format stores are particularly popular in the South, South-East, Southern Central, and the South-West regions of the US. Hi-Lo format stores are particularly popular in the Great Lakes, Southern Central, North-East, and West Coast regions. HYB format stores are particularly popular in the North-West, South-West, West Cost, North-East, and South-East regions of the US. Thus, there is a regional variation in the prevalence of the different pricing formats, although all three formats are present in all parts of the US.

Table J1. Store Pricing Format Distribution for the 15 Largest Supermarket Retail Chains in the US

Supermarket Chain	Number of Stores	Percentage of		
		EDLP Stores	Hi-Lo Stores	HYB Stores
Kroger	1,399	13	47	40
Food-Lion	1,186	86	2	12
Winn-Dixie	1,174	67	3	30
Safeway	1,165	5	52	43
Albertson	922	48	11	41
Fred-Meyer	821	18	22	60
Lucky	813	27	35	38
Giant	711	11	29	60
A&P	698	15	55	30
Publix	581	16	13	71
Walmart	487	73	1	26
Cub-Foods	375	40	26	34
H.E. Butt	250	96	1	3
Stop & Shop	189	7	50	43
Pathmark	135	33	42	25

Source: Ellickson and Misra (2008)

Table J2. Distribution of Store Pricing Formats by Regions

US Region	Percentage of		
	EDLP Stores	Hi-Lo Stores	HYB Stores
West Coast	22	39	39
North-West	17	32	51
South-West	32	20	48
South	43	32	25
Southern Central	28	45	27
Great Lakes	17	54	29
North-East	23	40	37
South-East	40	23	37

Notes: The figures in the table are the averages for 17,388 stores in the US, with annual revenues of at least $2 million.

Source: Ellickson and Misra (2008).

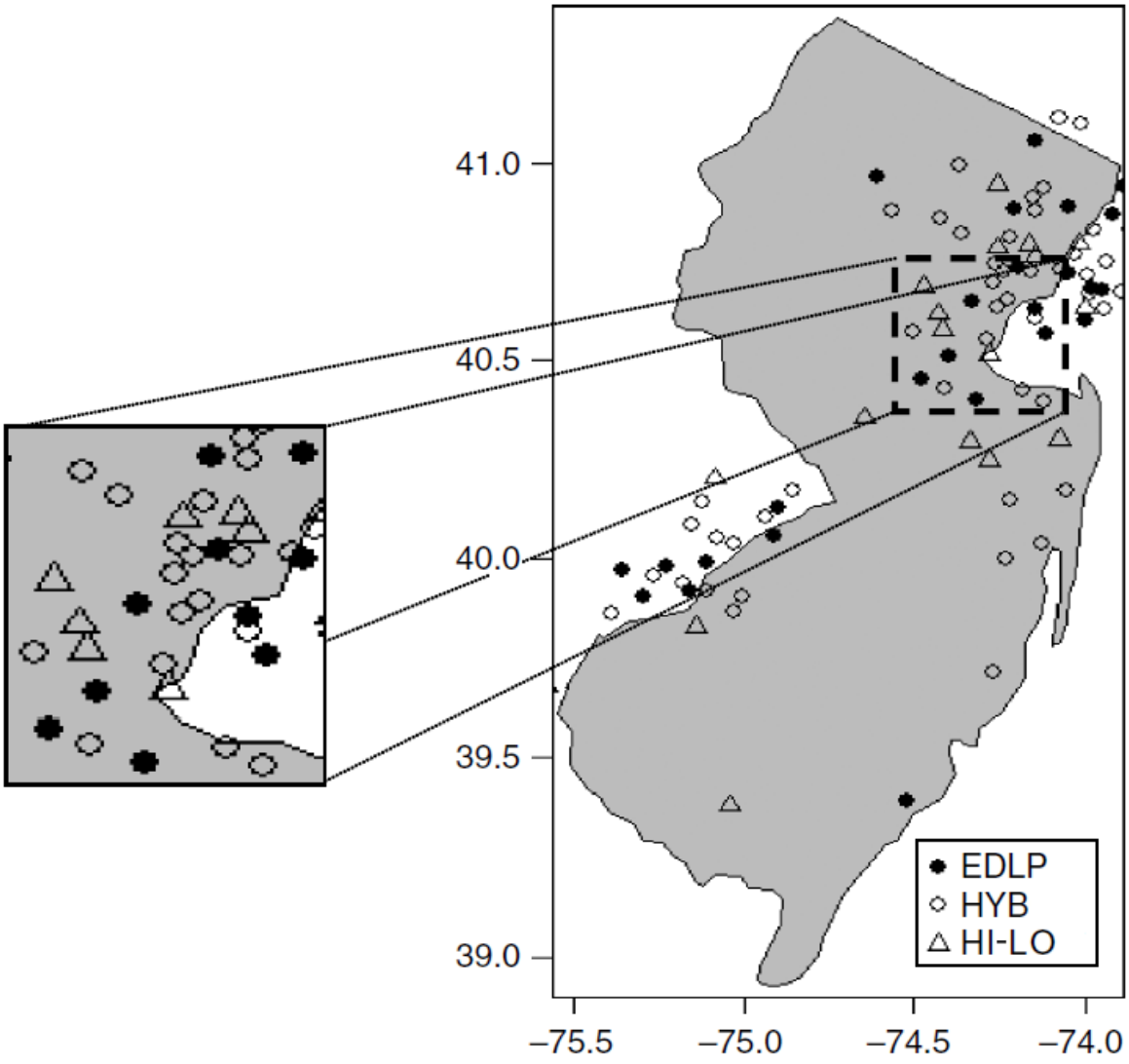


Figure J1.Local Variability in the Pricing Format of Pathmark Stores in New Jersey, Zooming-In the Area Around the Raritan River, between Madison and Raritan Bay (Source: Ellickson and Misra 2008)

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