Small Price Changes, Sales Volume, and Menu Cost*

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Revised: March 17, 2022

Keywords: Menu cost, (*S*, *s*) band, price rigidity, sticky prices, small price changes, small price adjustments, sales volume

JEL Codes: E31, E32, L16, L81, M31

* This is a substantially revised version of the manuscript that was presented at the October 2021 ECB-Federal Reserve Bank of Cleveland Conference on Inflation: Drivers and Dynamics, at the June 2021 ICEA's 3rd Warsaw Money-Macro-Finance Conference, and at Bank of Israel's Research Seminar. We thank the participants of these conferences, and especially Hervé Le Bihan, Luca Dedola, Anne Kathrin Funk, Emanuel Gasteiger, Tim Ginker, Peter Karadi, Ed Knotek, Jurek Konieczny, Francesco Lippi, Anton Nakov, Lukas Nord, Bentzi Schreiber, Georg Strasser, Emmanuel De Veirman, and David Wittekopf, for helpful and constructive comments and suggestions. Any remaining errors are ours.

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Abstract

We demonstrate that small price changes found in many retail price datasets can be consistent with menu costs by showing analytically that in a simple menu cost model there is an inverse relationship between sales volume and the width of the (*S*, *s*) band. That is, if sales-volume is high, small price changes will be more frequent. Analyzing a large retail dataset, we find overwhelming evidence consistent with this prediction: small price changes are more frequent when products' sales-volume is higher. This finding holds across and within product categories, and for individual products. It is also robust to various sensitivity analyses such as measurement errors, definition of "small" price changes, inclusion of measures of price synchronization, size of producer, the time horizon used to compute the average sales volume, etc.

1. Introduction

Extensive empirical analyses of price-setting behavior using various micro-level price datasets, show that individual prices tend to change at a significantly lower frequency than the corresponding market conditions.[1] A leading model offered to explain the sluggish response of prices to underlying shocks is the menu cost model, which posits that each time a firm changes a price, it incurs a lump sum cost that is independent of the size or the direction of the price change.[2]

A key prediction of the simple menu cost model is that firms will make infrequent but relatively large price changes because making frequent small price changes is assumed to be less economical (Caplin and Spulber 1987). However, empirical studies find that between 20%–44% of the observed price changes are small.[3]

To reconcile the existence of small price changes with menu costs, Dotsey et al. (1999) hypothesize stochastic menu costs which lead to small price changes when the realized menu cost is small. Lach and Tsiddon (2007), Klenow and Malin (2011), Midrigan (2011), and Alvarez and Lippi (2014) offer evidence that is consistent with economies of scope, allowing both small and large individual price changes, as long as the average price change is larger than the menu cost.[4] Rotemberg (1982b), Chen et al. (2008), and Chakraborty et al. (2015) suggest that consumer inattention can make small price changes profitable.

We argue that the likelihood of a small price change is a function of the sales volume and, thus, small price changes do not necessarily contradict the simple menu cost model. In other words, we argue that small price changes are possible even for a firm that sells a single product and faces a constant menu cost, if the sales volume is high enough.

The intuition of our argument is straightforward. In the menu cost model, a firm changes the price if the increase in profits expected from the price change exceeds the

[1] See, for example, Liebermann and Zilberfarb (1985), Carlton (1986), Cecchetti (1986), Lach and Tsiddon (1992, 1996), Blinder et al. (1998), Levy et al. (1998), Eden (2001, 2018), Dutta et al. (2002), Levy et al. (2002), Owen and Trzepacz (2002), Baharad and Eden (2004), Bils and Klenow (2004), Álvarez et al. (2006), Dhyne et al. (2006), Nakamura and Steinsson (2008), Kehoe and Midrigan (2015), Konieczny and Skrzypacz (2015), Gorodnichenko et al. (2017), Anderson et al. (2015, 2017), and studies cited therein. For older surveys, see Romer (1993), Weiss (1993), Taylor (1999), Willis (2003), and Wolman (2007). More recent surveys include Klenow and Malin (2011), Leahy (2011), and Nakamuara and Steinsson (2013).

[2] See, for example, Barro (1972), Sheshinski and Weiss (1977, 1979, and 1982), Rotemberg (1982a,b), Akerlof and Yellen (1985), and Mankiw (1985).

[3] See, for example, Bils and Klenow (2004), Nakamura and Steinsson (2008), Chen et al. (2008), Klenow and Kryvtsov (2008), Midrigan (2011), Bhattarai and Schoenle (2014), and Klenow and Malin (2011).

[4] Eichenbaum et al. (2014) and Cavallo and Rigobon (2012) suggest that many of the reported small price changes are due to measurment errors. Even these studies, however, find a non-negligible share of small price changes that cannot be explained by measurement errors.

menu cost. When a firm faces a small deviation from the optimal price, the expected change in profit from adjusting the price depends on the sales volume. Assuming that the cost of adjusting the price is fixed and is independent of the size of the price adjustment, the likelihood that the resulting change in profits will exceed the menu cost, even for a small price change, increases with the sales volume.

To demonstrate our argument analytically, we extend Barro's (1972) menu cost model to derive a relationship between the width of the (*S*, *s*) band and the sales volume. We show that the greater is the sales volume, the narrower is the optimal (*S*, *s*) band, which in turn implies that even small price changes might be profitable.

We explore this result empirically using Dominick's dataset, which is particularly useful for our purpose because it contains weekly information on both the prices and the sales volume. Another advantage of the dataset is its size: 18,035 different products in 29 product categories, with a total of over 98 million weekly observations.

Consistent with the predictions of the theoretical model, we find that there are more small price changes when the sales volume is higher. This finding is robust. It holds across product categories, within product categories, and for individual products. It is also robust to a various sensitivity analyses such as the definition of "small" price changes, measurement errors, inclusion of control variables, and the time horizon used to compute the average sales volume.

Particularly relevant for our work is Bhattarai and Schoenle (2014) and Kang and Usher (forthcoming). Bhattarai and Schoenle (2014) use a micro-level price dataset from the BLS underlaying the US producer price index to show that the average size of price changes is negatively correlated with the number of products offered by a producer. They also present evidence suggesting that producers that offer many products tend to have high sales volume. Their data does not allow direct analysis of the correlation between small price changes and sales volume, but their findings suggest that such correlation exists in their data. It therefore seems that our findings on the correlation between small price changes and sales volume in a retail market, holds for wholesale markets as well.

We check if our results may be driven by large firms having higher sales volume or more price changes. We find that controlling for (a) the number of products offered by each producer, (b) the percentage of prices that change, and (c) the average size of all price changes (excluding the current price change), has little effect on the estimated coefficients of the sales volume.

Kang and Usher (forthcoming) construct a model based on the assumption that the size of price changes is negatively correlated with the revenue and therefore, small price changes are possible if the revenue is sufficiently large. Because there is a strong correlation between sales volume and revenues (in our data the correlation is 0.87), our model and findings are consistent with their model and findings. Further, our empirical results suggest that the positive correlation between revenue and small price changes are driven by the sales volume component of the revenue, and not by the price component.

In light of the conclusions of Kang and Usher (forthcoming), our findings have important implications for the effectiveness of monetary policy. If prices of goods with high sales volume, i.e., the prices of more frequently bought goods, change in response to small deviations from the optimum, then they are likely to respond to monetary shocks, reducing the effect of monetary policy. This implies that the actual effect of a monetary policy may be smaller than predicted by models that do not account for the sales volume.

We proceed as follows. In section 2, we derive analytically the relationship between the sales volume and the (*S*, *s*) band. In section 3, we discuss the data. In section 4, we present the empirical results. In section 5, we address the robustness of our results. We conclude in section 6.

2. Sales volume and the width of the optimal (*S*, *s*) band

Following Barro (1972), consider a profit maximizing monopolist producing a homogenous good. The linear demand and the quadratic cost functions are given by $Y = \alpha - \beta P + u$ and $C(Y) = a + bY + cY^2$, respectively, where *u* is a symmetric demand disturbance/shifter, $C'(Y) > 0$, and $a, b, c, \alpha, \beta > 0$. The producer's maximization problem is thus given by:

$$\begin{cases} \max\left[PY - \left(a + bY + cY^2 \right) \right] \\ \text{s.t. } Y = \alpha - \beta P + u \end{cases} \tag{1}$$

Setting $MR = MC$, and solving for *P* and *Y*, we obtain

$$P^* = \left[\frac{\alpha + \beta\left(2c\alpha + b\right)}{2\beta\left(1 + c\beta\right)} \right] + \left[\frac{1 + 2c\beta}{2\beta\left(1 + c\beta\right)} \right] u \tag{2}$$

and

$$Y^* = \left[\frac{\alpha - \beta b}{2(1+c\beta)}\right] + \left[\frac{1}{2(1+c\beta)}\right] u \tag{3}$$

The second order condition for a maximum is given by $1+c\beta > 0$.

In the absence of a disturbance $u = 0$, the profit maximizing output is given by

$$Y^*\big|_{u=0} = \frac{\alpha - \beta b}{2(1+c\beta)} \tag{4}$$

where $\alpha - \beta b > 0$, which is required for the output to be positive in the disturbance-free equilibrium. We can think of $Y^*\big|_{u=0}$ as the expected output.

Following Barro (1972, p. 19), suppose that the value of the disturbance changes from 0 to *u*. Assuming that the firm continuously adjusts its price and output to the change in *u*, the resulting change in the firm's profit, as Barro shows, is given by

$$\begin{aligned} \Delta\pi_{(0,u)} &= \int_0^u \left(\frac{d\pi}{du}\right) du \\ &= \int_0^u \left[P - C'(Y)\right] du \\ &= \left[\frac{\alpha - \beta b}{2\beta(1+c\beta)}\right] u + \left[\frac{1}{4\beta(1+c\beta)}\right] u^2 \end{aligned} \tag{5}$$

Next, assume that the firm's price is sticky at $\hat{P}$, the optimal price in the disturbance-free equilibrium, with $\frac{d\hat{P}}{du} = 0$. According to (2),

$$\hat{P} = \frac{\alpha + \beta(2c\alpha + b)}{2\beta(1+c\beta)} \tag{6}$$

We follow Barro (1972, p. 20) to assume that the disturbance is not "too small" or "too large", i.e., $u_{\min} \le u \le u_{\max}$. This is necessary to avoid the situations of no production, which will be the case if $u < u_{\min}$, or a shortage, which will be the case if $u > u_{\max}$. Then,

$$\begin{aligned}\Delta\hat{\pi}_{(0,u)} &= \int_0^u \left(\frac{d\hat{\pi}}{du}\right)du \\ &= \int_0^u \left[\hat{P} - C'(\hat{Y})\right]du \\ &= \left[\frac{\alpha - \beta b}{2\beta\left(1+c\beta\right)}\right]u - cu^2\end{aligned} \tag{7}$$

The expression in (7) is the change in the profit when the disturbance value changes from 0 to *u*, but the firm does not adjust its price, i.e., when the price is stuck at $\hat{P}$.

The firm's profit gain, if it adjusts its price to the demand shock, is therefore given by

$$\Delta\pi_{(0,u)} - \Delta\hat{\pi}_{(0,u)} = \theta u^2 \tag{8}$$

where

$$\theta = \frac{\left(1+2c\beta\right)^2}{4\beta\left(1+c\beta\right)} > 0 \tag{9}$$

The expression in (9) can be interpreted as the loss the firm incurs for not adjusting its price in response to the demand shock. As Barro (1972, p. 20) notes, the symmetry of this loss means that what matters is the size of the demand shock, not its sign. It follows that the optimal price adjustment rule (*S*, *s*), is symmetric. Also, for a given disturbance *u*, the loss from not adjusting the price decreases with the price sensitivity of demand β, and increases with the slope of the marginal cost curve $C''(Y) = 2c$.

Barro's (1972) main conclusion is that if *u* follows a symmetric random walk, then the optimal (*S*, *s*) band is symmetric, given by $\left(\hat{h}, -\hat{h}\right)$, where

$$\hat{h} = \sqrt{\sigma}\left(\frac{6\gamma}{\theta}\right)^{\frac{1}{4}} \tag{10}$$

where γ is a fixed, lump-sum menu cost, σ^2 is the variance of the Bernoulli process driving the symmetric random walk, and θ is given by (9).

According to (10), the higher is the menu cost, the wider is the band of inaction. On the other hand, a high θ implies a narrow band of inaction. That is because a high θ, according to (8)–(9), means a greater profit loss from not adjusting the price.

We take advantage of the linear-quadratic structure of the optimization problem and extend the model to derive the relationship between the output and the optimal (*S*, *s*)

band. Rewrite (9) as

$$\begin{aligned}\theta &= \frac{\left(1+2c\beta\right)^2}{4\beta\left(1+c\beta\right)} \\ &= \left[\frac{\alpha-\beta b}{2\left(1+c\beta\right)}\right]\left[\frac{\left(1+2c\beta\right)^2}{2\beta\left(\alpha-\beta b\right)}\right]\end{aligned} \tag{11}$$

By (4), the term in the first brackets is the optimal level of output in the disturbance-free equilibrium $Y^*\big|_{u=0}$. Therefore, (11) can be written as a function of $Y^*\big|_{u=0}$,

$$\theta\left(Y^*\big|_{u=0}\right) = \left(Y^*\big|_{u=0}\right)\left[\frac{\left(1+2c\beta\right)^2}{2\beta\left(\alpha-\beta b\right)}\right] \tag{12}$$

with the derivative

$$\frac{d\theta\left(Y^*\big|_{u=0}\right)}{d\left(Y^*\big|_{u=0}\right)} = \left[\frac{\left(1+2c\beta\right)^2}{2\beta\left(\alpha-\beta b\right)}\right] > 0 \tag{13}$$

In other words, the greater is the monopolist's expected output level, the greater is θ, which means that the greater is the loss the firm incurs from not adjusting the price. Combining (10) and (12), we get:

$$\hat{h} = \sqrt{\sigma}\left\{6\gamma\left(Y^*\big|_{u=0}\right)^{-1}\left[\frac{\left(1+2c\beta\right)^2}{2\beta\left(\alpha-\beta b\right)}\right]^{-1}\right\}^{\frac{1}{4}} \tag{14}$$

with a partial derivative

$$\frac{\partial\hat{h}}{\partial\left(Y^*\big|_{u=0}\right)} < 0 \tag{15}$$

The expression in (15) is our main analytical result: the greater is the output level, the smaller is $\hat{h}$ and, therefore, the narrower is the optimal (*S*, *s*) band. In other words, there is an inverse relationship between the level of output and the width of the (*S*, *s*) band. If the output of the monopolist is high (low), then the (*S*, *s*) band will be narrower (wider), which means that we will see more (less) frequent smaller price changes.

This prediction can be tested with a dataset that contains both retail prices and sales volume. The model predicts that if the average sales volume is high, then we will see more frequent small price changes.

3. Data

We use the dataset of Dominick's, a large US retail food chain with 93 stores in the greater Chicago area with a market share of 25%. The dataset contains more than 98 million weekly observations over an 8-year period, from September 14, 1989 to May 8, 1997, for 18,035 products in 29 categories, including food, cleaning products, hygienic products, and pharmaceutical products. Each weekly observation includes the retail price, the number of units sold, the revenue, the retailer's markup and some product attributes. These features make the Dominick's dataset especially well-suited for our analysis.

An important attribute of the Dominick's data set is that its prices were set on a weekly basis. This implies that throughout the week, there was only a single price. If shoppers used manufacturer coupons, we cannot account for these. During the sample period, however, the use of such coupons was limited. See Barsky et al. (2003), Chen et al. (2008), and Levy et al. (2010, 2011), for more details about the data. In the robustness section, we describe various robustness tests we run to alleviate possible concerns that our results are driven by measurement errors.

4. Empirical findings

4a. Results of cross-category analysis

In the analyses that follow, we define a "small" price change as a price change of 10¢ or less. In the robustness section, we show that our findings are robust to alternative definitions of small price changes, including 5¢, 15¢, 2%, and 5%, as well as relative to the average price change in the corresponding category (Midrigan 2011, and Bhattarai and Schoenle 2014).

Table 1 shows the number of all price changes and the number of small price changes $(\Delta P \leq 10¢)$ by product category, both conditional on observing the prices in consecutive weeks (t and $t + 1$), the percentage of small price changes out of all price changes, and the average sales volume. The latter is calculated by first finding the average weekly sales volume for each product in each store (*product-store*) in the category, and then averaging

over all products.[5] There is a large cross-category variation in the share of small price changes, ranging from 5.4% in the beer category to 56.6% in the canned tuna category.

Figure 1 shows a scatterplot of the category-level average sales volume and the percentage of small price changes, along with a linear regression line (red solid line). We find a positive correlation between sales volume and the percentage of small price changes. The correlation is even stronger (green dashed line) if we exclude the categories of paper towels and bathroom tissues, which have particularly high values of both average sales volume and percentage of small price changes.

To test this more formally, we run cross-category OLS regressions which we report in Table 2. The dependent variable in all regressions is the category level percentage of small price changes. In column 1, the independent variable is the average weekly sales volume. We find that the coefficient is 0.89. Thus, at the category level, a 1-unit increase in the average weekly sales volume is associated with an increase of 0.89% in the percentage of small price changes.

A possible explanation for this correlation could be that categories with low average price levels have higher shares of small price changes and higher sales volume. The regression in column 2 shows that there is indeed a negative correlation between the average price in a category and the percentage of small price changes. However, in column 3, which reports the results of a regression that includes both the average prices and the average sales volume as independent variables, we find that the coefficient of the average sales volume is 0.69 and statistically significant. Thus, we find that sales volume is correlated with small price changes even after controlling for the price level.

A possible alternative explanation is competition. It could be that products in categories with high sales volume face stronger competition, and their producers may want to avoid large price changes that could alienate consumers. To tests this, in column 4 we look at the correlation between the percentage of small price changes and category level estimates of absolute own price elasticities, which are taken from Hoch et al. (1995). We find that the correlation is negative. I.e., small price changes are more common in product categories with low rather than high (in absolute values) price

[5] When calculating the average sales volume, we need to account for missing observations, because a missing observation in week *t* implies that the product had 0 sales on that week. Thus, averaging over the available observations can lead to an upward bias for products that are sold in small numbers. Therefore, for each product in each store, we find the average by first finding the total number of units sold over all available observations. We then find the first and last week for which we have observations, and calculate the average for each product-store as $\frac{total\ no.\ of\ units\ sold}{last\ week - first\ week}$.

elasticities, which is inconsistent with the hypothesis that small price changes are a response to competition.

It is consistent, however, with our model, because a low-price elasticity means a small response to price changes and, consequently, as an approximation, the retailer's benefit from a small price change can be assessed based on the sales volume prior to the price change. Furthermore, in column 5, where we report the results of a regression with both the sales volume and the price elasticity as independent variables, we find that adding the price elasticity as a control does not change the effect of the sales volume substantially. The coefficient of the sales volume is 0.73, and statistically significant.

As another test of the correlation between sales volume and the % of small price changes, we merged the observations in all 29 categories and then divided product-stores into deciles according to their sales volume. According to Figure 2, an increase in the sales volume is associated with a significant increase in the percentage of small price changes. The percentage of small price changes in the 10^{th} decile of sales volume is 31.7%, 3.2 times higher than the percentage of price changes in the 1^{st} decile of sales volume, 10.0%.

4b. Results of category-level analyses

To further study the correlation between small price changes and sales volume, we compare high sales volume products to low sales volume products in each category. For each product in each store, we compute the average sales volume over the entire sample period. By taking the average over a long period, we obtain an estimate of the expected sales volume that does not depend on transitory shocks or sales. We then group the products into high, medium and low sales volume products. Low sales volume products are products with average sales volume in the lower third of the distribution, high sales volume products have sales volume in the higher third of the distribution, and medium sales volume products have sales volume in between.

Figure 3 shows, for every category, the frequency of price changes for each size of price change from 1¢ to 50¢. The red dashed line depicts the frequency of price changes among high sales volume products, while the blue solid line depicts the frequency of price changes among low sales volume products. The green shaded area shows the range of small price changes, $\Delta P \leq 10¢$.

The figure shows that the most common price changes are multiples of 10¢. It can

also be observed that consistent with the prediction of Barro's (1972) model, in all categories except beers, which is highly regulated, small price changes are significantly more common among high sales volume products than among low sales volume products.

Focusing on the shaded area, we see that the frequency of small price changes is far greater among the high sales-volume products than among low sales volume products. Indeed, for high sales volume products, in most product categories, the frequency of small price changes exceeds the frequency of large price changes. This is far less common, and less dramatic, among low sales volume products.

As a formal test, we estimate a series of fixed effect regressions of the probability of small price changes:

$$\begin{aligned} small\ \ price\ change_{i,s,t} &= \alpha + \beta \log(average\ sales\ volume_{i,s}) + \gamma \mathbf{X}_{i,s,t} \\ &+ month_t + year_t + \delta_s + \mu_i + u_{i,s,t} \end{aligned} \tag{16}$$

where small price change is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The average sales volume is the average sales volume of product *i* in store *s* over the sample period. **X** is a matrix of other control variables. Month and year are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

Table 3 reports the coefficients of the key variable, the average sales volume, for each product category. Column 1 reports the results of baseline regressions that include only the average sales volume and the fixed effects for months, years, stores, and products.

We find that in all 29 product categories, the coefficients are positive and statistically significant. In other words, in all 29 product categories, there is a positive correlation between the likelihood that a price change is small and the average sales volume. The effect is economically significant. The average coefficient is 0.035, suggesting that an increase of 1% in the sales volume is associated with an increase of 3.5% in the likelihood that a price change will be small.

In column 2, we add the following controls: the log of the average price to control for the price level effect on the size of price changes, the percentage change in the wholesale price, and a control for sale- and bounce back prices. The latter is important as price

changes associated with sales tend to be large (Nakamura and Steinsson 2008).[6]

The results are similar to column 1. The coefficient of the average sales volume is positive and statistically significant in all categories, averaging 0.03. Thus, even after including the controls, we still find that increasing the average sales volume by 1% is associated with an increase of 3% in the likelihood of a small price change.

In column 3, we add a dummy for 9-ending prices as an additional control because when the pre-change price is 9-ending, price changes tend to be larger than when the pre-change price ends in other digits (Levy et al. 2020). Thus, if products with high sales volume tend to have non 9-ending prices, then it might lead to high sales volume product prices changing by small amounts.

However, adding this dummy does not change the main result appreciably. All 29 coefficients remain positive and statistically significant. On average, once we control for 9-ending prices, increasing the average sales volume by 1% is associated with an increase of 2.6% in the likelihood of a small price change.

In column 4, we focus on regular prices by excluding sale- and bounce back prices. We do this for two reasons. First, sale- and bounce back prices tend to be large and therefore, we need to account for them properly. Second, it is often argued that changes in sale prices have smaller effect on inflation than changes in regular prices (Nakamura and Steinsson 2008, Midrigan 2011, Anderson et al. 2017). It is therefore of interest to look at regular prices when studying the correlation between small price changes and sales volume.

We find that excluding sale prices strengthens the correlation between sales volume and small price changes. All coefficients are again positive and statistically significant, averaging 0.045, implying that for regular prices, an increase of 1% in the average sales volume is associated with an increase of 4.5% in the likelihood of a small price change.

4c. Results of product-level analyses

A possible explanation for the correlation between sales volume and small price changes is that products with high sales volume have some unobserved attributes that makes them prone to small price changes. We explore this possibility by estimating for

[6] To identify sale prices, we do not use the sales' flag included in the Dominick's data because it was not set on a consistent basis (Peltzman 2000). Instead, we use the sales filter algorithm of Fox and Syed (2016) to identify sales. This algorithm has the advantage that it was calibrated using the Dominick's data and, consequently, it is particularly useful for identifying sales in the Dominick's data.

each product a separate regression. If the correlation between sales volume and small price changes is found at the level of individual products, then it cannot be explained by unobserved attributes, since in each regression we have data on only one product.

Before presenting the full regression results, consider as an example the crackers category. In Figure 4, we show a scatter plot for each of the 22 cracker products that has data for all 93 stores of Dominick's. In each of the 22 figures, there are 93 dots, one for each store. In each figure, the x-axis in the figures gives the average weekly sales volume of the product in a store, and the y-axis gives the share of small price changes of the product in a store. The straight lines are regression lines.

According to the plots, the correlation between sales volume and the share of small price changes is positive for all 22 individual products. For 20 of them (marked with solid black regression lines), the correlations are statistically significant. The two regression lines that are not statistically significant are marked with red dotted lines.

For a more formal analyses, we calculate for each product in each of the 29 product categories the average weekly sales volume and the share of small price changes in each of the stores it was offered. Many products in the sample were offered for only short periods or only in a small number of stores. To avoid biases, we drop products for which we do not have information for at least 30 stores.

Using these data, we estimate for each product in each category an OLS regression with robust standard errors. The dependent variable is the share of small price changes for the product in each store. The independent variable is the average sales volume of the product in each store. The estimation results are summarized in Table 4.

Column 1 gives, for each product category, the average of the estimated coefficients. Columns 2–5 give information on the sign of the estimated coefficients: the number of positive coefficients, the number of negative coefficients, the percentage of the positive coefficients, and the percentage of negative coefficients, respectively. Columns 6 and 7 report the number of coefficients that are both positive and statistically significant, and negative and statistically significant, respectively, at the 5% level.

According to the figures in the table, the average coefficients are positive in 28 of the 29 product categories. The only exception is the cigarettes category, which is highly regulated and, consequently, it is often excluded from the analyses (Chen et al. 2008, p. 729, footnote 2). In addition, the number of positive coefficients far exceeds the number of negative coefficients. On average, the former is 4.6 times larger than the latter.

Ignoring the cigarettes category, in all 28 categories more than 71% of the coefficients are positive.

Focusing on statistically significant coefficients, we find a far greater number of positive coefficients that are significant than negative coefficients that are significant. In fact, in 16 product categories we do not have a single case of statistically significant negative coefficient. In the remaining categories, there are only 1–4 products with statistically significant negative coefficient. In other words, for the overwhelming majority of the individual products in our sample, we find a positive relationship between their sales volume and the share of small price changes.

To summarize, we find that the correlation between sales volume and the share of small price changes is positive whether we look across categories, within categories, and for individual products across stores. It seems unlikely, therefore, that the correlation is due to unobserved characteristics of the products or the product categories.

4d. Sales volume versus revenue

Kang and Usher's (forthcoming) find that the size of price changes is negatively correlated with the revenue. In column 1 of Table 5, we report the Pearson correlation coefficient between the average sales volume and the average revenue for product-stores for each product category. The average correlation is 0.87, suggesting that at the category level, the correlation is very strong.

In column 2, we replicate one of Kang and Usher's (forthcoming) key findings by reporting for each product category, the coefficient estimates of regression (16) where we replace the log of the average sales volume with the log of the average revenue. The controls include fixed effects for months, years, stores, and products. The estimated coefficients are positive for 28 of the 29 product categories, all statistically significant (in 25 categories at the 1% level, in 2 categories at the 5% level, and in one category at the 10% level). We thus confirm that Kang and Usher's (forthcoming) findings hold in our data: there is a strong positive correlation between revenue and the likelihood of a small price change.

In columns 3 and 4, we show the results of regressions that include both the sales volume and the revenue as independent variables. Once we add the sales volume to the regression, the coefficients of the revenue become negative in 23 of the 29 categories. The coefficients of the sales volume, on the other hand, are positive in 24 of the 29

categories.

Since revenues equal price times quantity, these results suggest that holding the sales volume constant, the higher is the price level, the less frequent small price changes are. In other words, the positive correlation between revenues and the frequency of small price changes seems to materialize through the sales volume and not through the price.[7]

4e. Sales volume, producers' size and price synchronization

According to Lach and Tsiddon (2007), Midrigan (2011), and Alvarez et al. (2014), small price changes can be explained by economies of scale in price adjustment, which make small price changes profitable if the average price change exceeds the menu cost. Lach and Tsiddon (2007) and Bhattarai and Schoenle (2014) show that: (a) producers offering a large number of products are more likely to make small price changes than producers offering a small number of products, (b) small price changes are more likely when price changes are more synchronized, and (c) small price changes are more likely when the average size of all other contemporaneous price changes is high. In addition, Bhattarai and Schoenle (2014) provide evidence suggesting that producers offering more products are more likely to have large sales volume. It is therefore of interest to examine whether our results still hold when accounting for economies of scope by adding controls for price changes synchronization and the number of products per producer.

In column 1 of Table 6, we report the coefficients of the log of sales volume in regression (16), where in addition we also include the average number of products per category offered by the same producer.[8] The regression also includes fixed effects for months, years, stores, and products. We find that all the coefficients of the sales volume are positive, and 28 of the 29 coefficients are statistically significant at the 1% level. In addition, the coefficients of the sales volume are almost unaffected in comparison to the figures we report column 1 of Table 3. Thus, it appears that the effects of sales volume on the likelihood of small price changes are unrelated to the effects of the size of the producers.

In column 2, we add a control for the percentage of the products that changed the

[7]Another finding supporting the hypothesis that the revenue is correlated with small price changes through sales volume is that in 22 of the 29 categories, the coefficients of the sales volume are larger than the coefficients of the revenue. The average of the revenue coefficients is 0.31, compared to the average sales volume coefficient of 0.35 in column 1 of Table 3.

[8] To calculate the average number of products offered by a producer, we follow Bhattarai and Schoenle (2014), by first determining the nubmer of products offered by a producer each week, and then averaging over all weeks.

price on the same week, excluding the current observation. Again, the coefficients remain almost unchanged in comparison to the figures we report in column 1 of Table 3.

In column 3, we further add the average size of contemporaneous price changes, excluding the current observation. Lach and Tsiddon (2007) show that when price changes are synchronized, a small price change is correlated with a large average contemporaneous price change. However, we find that adding the average size of price changes has little effect on the size or the significance of the coefficients of the sales volume.

Finally, in column 4, we add the percentage of the products that are produced by the same producer and that changed price on the same week, excluding the current observation. This forces us to drop some observations because we can only use an observation if the producer offered at least two products on the relevant week. The upshot is that most of the observations that remain are of products produced by relatively large producers, which, according to Bhattarai and Schoenle (2014), are most likely to make small price changes.

Therefore, if our results are driven by the size of the producers rather than by the sales volume, then focusing on large producers should lead to a substantial drop in the coefficients of the sales volume. We find exactly the opposite: the size of the coefficients increases, and all 29 coefficients are statistically significant.

5. Robustness

To assess the robustness of our findings, we conducted 18 robustness checks as follows:

- *Measurement errors*: Eichenbaum et al. (2014) conclude that prices based on scanner data might include spurious small price changes. To mitigate this concern, we repeat the analyses, (1) by excluding all 1¢ price changes (Eichenbaum et al. 2014), (2) by excluding observations if the price, after it changes, does not last for at least two weeks (Strulov-Shlain 2019), and (3) by removing observations on price changes if the Dominick's sale flag indicates that there was a coupon use, because if some consumers used coupons, this could result in measurement errors (Eichenbaum et al. 2014).
- *Definition of small price changes*: We define a small price change as a price change of (4) 5¢ or less, and (5) 15¢ or less. Because the size of price changes may be larger

for more expensive products, we re-run the analyses by defining a small price change in percent as a price change of (6) 2% or less, and (7) 5% or less. We also followed Midrigan (2011) and Bhattarai and Schoenle (2014) to define small price changes relative to the average price change in the corresponding category. I.e., a price change is small if it is smaller or equal to $\kappa|\overline{\Delta p}|$, where $\overline{\Delta p}$ is the average price change in the category and κ attains the values (8) 0.5, (9) 0.33, (10) 0.25 and (11) 0.10.

- *Time horizon for computing the average sales volume*: Above, we use the average sales volume over the entire period, which can be thought of as a proxy for the expected sales volume that is based on 8 years of data. However, this implicitly assumes that in the first years the retailer can predict the future sales volume. An alternative is that the retailer makes decisions based on recent sales data. We therefore (12) repeat the analyses by calculating the average sales volume based on a rolling 52-weeks window.
- *Competition effect*: As another control for the effect of competition, we (13) add a control for Dominick's pricing zones. (14) We re-estimate the product-level regressions by augmenting the data with demographic information of the consumers that live in the neighborhood of each store, including their median income, the share of minorities, and the share of unemployed.
- *Controlling for revenue*: In section 4d, we estimate regressions with both the sales volume and the revenue at the category level. We (15) explore the effect of adding further controls. In addition, at the category level, the high correlation between the sales volume and the revenue may render the results suspect. We therefore (16) pool data from all categories together and re-estimate the regressions.
- *Controlling for the producers' size*: Finally, in section 5e, we calculate the number of products offered by each producer at the category level. To test that the results do not change for firms of different sizes, we follow Bhattarai and Schoenle (2014) (17) in dividing producers into bins according to the number of products they offer in each category and estimate the correlation between sales volume and small price changes for each bin separately. In addition, it is possible that producers that offer products in more than one category synchronize price changes across categories, or that retailers have more opportunities for price synchronization in categories with more products. We therefore (18) pool the data together and repeat the analysis.

Overall, our main results broadly remain unchanged and are robust across the different specifications. The Online Appendix contains the details of these analyses.

6. Conclusion and policy implications

The finding of frequent small price changes in many retail price datasets has been interpreted by many authors as a prima facie evidence against the simple menu cost model. We, however, argue that the finding of frequent small price changes is not necessarily inconsistent with a simple menu cost model. If the retailer expects to sell many units, then small price changes can be profitable also in a simple menu cost model.

To show this, we extend Barro's (1972) menu cost model, to demonstrate analytically that there is a negative relationship between the sales volume and the width of the (S, s) band. It follows that if the sales volume is high, then we are more likely to see more frequent small price changes.

To test this prediction, we use Dominick's scanner price dataset. Consistent with the predictions of the theoretical model, we find more frequent small price changes when products' sales volume is higher.

This finding is quite robust. It holds across product categories, within product categories, and for individual products. It is also robust to a variety of sensitivity analyses such as the definition of "small" price changes, measurement errors, inclusion of various control variables, price synchronization, producers' size, and the time horizon used to compute the average sales volume.

Our findings are consistent with the findings reported by Bhattarai and Schoenle (2014) and Kang and Usher (forthcoming), who employ more recent datasets. However, the advantage of Dominick's dataset, in comparison to more recent datasets is its richness. In addition to prices and sales volume—two critical variables for our analyses, it also contains information on wholesale prices, promotions and sales, pricing zones, shoppers' socio-demographics, etc. We employ these additional variables to check robustness.

We note two policy implications of our findings. First, following the model of Kang and Usher (forthcoming), our findings have important implications for the effectiveness of monetary policy. If prices of goods with high sales volume, i.e., the prices of more frequently bought goods, change in response to small deviations from the optimum, then they likely respond to monetary shocks, reducing the effect of monetary policy. This

suggests that the actual effect of monetary policy may be smaller than predicted by models that do not account for sales volume. Second, on the regulation side, our findings suggest that mergers that increase products' market shares may lead to reduced effectiveness of monetary policy.

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Table 1. Proportion of small price changes and the average sales volume by product categories

Product Category	All price changes (1)	Small price changes (2)	% of small price changes (3)	Average sales volume (4)
Analgesics	276,225	35,378	12.8	1.25
Bath soap	35,572	5,125	14.4	0.73
Bathroom tissues	325,837	136,493	41.9	39.21
Beer	45,9405	24,859	5.4	3.61
Bottled juices	962,368	358,443	37.3	8.12
Canned soups	950,357	488,159	51.4	12.4
Canned tuna	379,680	214,923	56.6	9.66
Cereals	724,013	226,449	31.3	14.98
Cheese	1,811,753	813,305	44.9	11.44
Cigarettes	56,000	16,327	29.2	2.37
Cookies	1,353,330	374,027	27.6	5.19
Crackers	476,008	164,529	34.6	4.81
Dish detergents	374,058	138,909	37.1	8.50
Fabric softeners	348,422	116,134	33.3	5.57
Front end candies	487,886	249,939	51.2	11.26
Frozen dinners	502,830	115,471	23.0	5.57
Frozen entrees	1,846,911	314,441	17.0	6.56
Frozen juices	658,225	235,246	35.7	16.32
Grooming products	659,842	82,759	12.5	1.21
Laundry detergents	559,576	107,931	19.3	7.29
Oatmeal	169,093	68,971	40.8	7.20
Paper towels	248,289	135,462	54.6	35.00
Refrigerated juices	800,280	259,263	32.4	19.82
Shampoos	701,813	54,068	7.7	0.87
Snack crackers	800,253	220,178	27.5	6.74
Soaps	324,724	145,984	45.0	4.69
Soft drinks	4,532,158	743,243	16.4	13.46
Toothbrushes	295,021	33,386	11.3	1.80
Toothpastes	588,261	100,141	17.0	3.07
Total	21,708,190	5,979,543	27.6	9.27

Notes: Column 1 presents the total number of price changes in each category. Column 2 presents the number of small price changes ($\Delta P \leq 10¢$). Column 3 presents the % of small price changes out of all price changes. Column 4 presents the average number of units sold per product, per week, per store.

Table 2. Cross-category regression of the % of small price changes and sales volume

	(1)	(2)	(3)	(4)	(5)
Average sales volume	0.89***		0.69**		0.73***
	(0.020)		(0.264)		(0.209)
Average price		–4.83***	–3.28*		
		(1.651)	(1.610)		
Absolute elasticity				–12.82**	–15.70**
				(5.282)	(4.139)
R^2	0.30	0.24	0.40	0.27	0.60
Number of categories	29	29	29	18	18

Notes: The table presents the results of OLS regressions. The dependent variable is the % of small price changes out of all price changes, in each of the 29 categories. Small price changes are defined as price changes of $\Delta P \leq 10¢$. The average price is the average price in the product category. The absolute elasticity is the absolute value of the demand price elasticity estimates as reported by Hoch et al. (1995). Columns (4) and (5) contain only 18 observations because Hoch et al. (1995) provide elasticity estimates only for 18 of the 29 product categories. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table 3. Category-level regressions of small price changes and sales volume

		(1)	(2)	(3)	(4)
Analgesics	Coefficient (Std.)	0.0381*** (0.0032)	0.031*** (0.0027)	0.0253*** (0.0025)	0.047*** (0.0052)
	Observations	276,225	276,225	276,225	77,653
Bath soap	Coefficient (Std.)	0.043*** (0.0087)	0.0471*** (0.0094)	0.0438*** (0.0091)	0.0885*** (0.0157)
	Observations	35,572	35,572	35,572	6,540
Bathroom tissues	Coefficient (Std.)	0.0321*** (0.0057)	0.0163*** (0.0046)	0.0136*** (0.0043)	0.0332*** (0.0067)
	Observations	32,5837	32,5837	32,5837	82,602
Beer	Coefficient (Std.)	0.0235*** (0.0015)	0.0252*** (0.0012)	0.0209*** (0.0012)	0.0679*** (0.005)
	Observations	459,405	459,405	459,405	56,829
Bottled juice	Coefficient (Std.)	0.0474*** (0.0037)	0.0377*** (0.0031)	0.0332*** (0.0031)	0.033*** (0.0044)
	Observations	962,368	962,368	962,368	243,787
Canned soup	Coefficient (Std.)	0.0239*** (0.004)	0.0161*** (0.0034)	0.0167*** (0.0033)	0.0182*** (0.0038)
	Observations	950,357	950,357	950,357	278,543
Canned tuna	Coefficient (Std.)	0.0367*** (0.0046)	0.0269*** (0.0039)	0.0228*** (0.0036)	0.0295*** (0.0043)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient (Std.)	0.0238*** (0.0026)	0.0184*** (0.0023)	0.0172*** (0.0024)	0.027*** (0.0034)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient (Std.)	0.0374*** (0.0027)	0.0219*** (0.0021)	0.018*** (0.0021)	0.0127*** (0.0032)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient (Std.)	0.0196*** (0.0031)	0.0191*** (0.0031)	0.0185*** (0.0031)	0.0186*** (0.0037)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient (Std.)	0.0436*** (0.0016)	0.0382*** (0.0016)	0.0323*** (0.0014)	0.0532*** (0.003)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient (Std.)	0.0548*** (0.0033)	0.0435*** (0.0031)	0.0392*** (0.0029)	0.0581*** (0.0063)
	Observations	476,008	476,008	476,008	88,768
Dish detergent	Coefficient (Std.)	0.0513*** (0.0034)	0.0388*** (0.0028)	0.0337*** (0.0028)	0.0419*** (0.004)
	Observations	374,058	374,058	374,058	93,657
Fabric softener	Coefficient (Std.)	0.0434*** (0.0038)	0.0316*** (0.0036)	0.028*** (0.0036)	0.0473*** (0.0047)
	Observations	348,422	348,422	348,422	100,472
Front-end-candies	Coefficient (Std.)	0.0043* (0.0035)	0.008*** (0.0027)	0.0069*** (0.0027)	0.0087*** (0.0029)
	Observations	487,886	487,886	487,886	157,539

Table 3. (Cont.)

		(1)	(2)	(3)	(4)
Frozen dinners	Coefficient	0.0513***	0.0406***	0.0392***	0.0874***
	(Std.)	(0.0025)	(0.0022)	(0.0022)	(0.0056)
	Observations	502,830	502,830	502,830	72,865
Frozen entrees	Coefficient	0.033***	0.0328***	0.0319***	0.0635***
	(Std.)	(0.0019)	(0.0016)	(0.0016)	(0.0034)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen juices	Coefficient	0.0326***	0.0261***	0.0235***	0.0295***
	(Std.)	(0.0037)	(0.0032)	(0.0031)	(0.0048)
	Observations	658,225	658,225	658,225	150,064
Grooming products	Coefficient	0.0398***	0.0448***	0.0388***	0.0624***
	(Std.)	(0.0022)	(0.002)	(0.0019)	(0.005)
	Observations	659,842	659,842	659,842	107,669
Laundry detergents	Coefficient	0.032***	0.0227***	0.0185***	0.0366***
	(Std.)	(0.0027)	(0.0024)	(0.0024)	(0.0041)
	Observations.	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0295***	0.0175***	0.0156***	0.0314***
	(Std.)	(0.0073)	(0.0052)	(0.0052)	(0.0093)
	Observations	169,093	169,093	169,093	63,705
Paper towels	Coefficient	0.0347***	0.0275***	0.0263***	0.0285***
	Std.	(0.0095)	(0.0102)	(0.0103)	(0.0085)
	Observations	248,289	248,289	248,289	53,732
Refrigerated juices	Coefficient	0.0307***	0.0208***	0.0181***	0.0302***
	(Std.)	(0.0032)	(0.0027)	(0.0026)	(0.0041)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0305***	0.0377***	0.0329***	0.0581***
	(Std.)	(0.0013)	(0.0013)	(0.0012)	(0.0035)
	Observations	701,813	701,813	701,813	96,389
Snack crackers	Coefficient	0.044***	0.0388****	0.0343***	0.0641***
	(Std.)	(0.0032)	(0.003)	(0.0026)	(0.004)
	Observations	800,253	800,253	800,253	143,143
Soaps	Coefficient	0.0567***	0.0404***	0.0333***	0.0515***
	(Std.)	(0.0043)	(0.0042)	(0.0041)	(0.0054)
	Observations	324,724	324,724	324,724	96,574
Soft drinks	Coefficient	0.0238***	0.0266***	0.0223***	0.0606***
	(Std.)	(0.0013)	(0.001)	(0.0009)	(0.0027)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Toothbrushes	Coefficient	0.0293***	0.0321***	0.0263***	0.0583***
	(Std.)	(0.0028)	(0.0028)	(0.0025)	(0.0063)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0293***	0.0292***	0.0255***	0.0593***
	(Std.)	(0.0027)	(0.0021)	(0.002)	(0.0053)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variable is the average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table 4. Product-level regressions of the % of small price changes and sales volume by categories

Product Category	Average coefficient (1)	No. of positive coefficients (2)	No. of negative coefficients (3)	% positive coefficients (4)	% Negative coefficients (5)	No. of positive and significant (6)	No. of negative and significant (7)
Analgesics	4.04	230	47	83.0	17.0	43	0
Bath Soaps	4.67	31	11	73.8	26.2	7	0
Bathroom tissues	4.75	83	20	80.6	19.4	16	0
Beers	2.35	253	23	91.7	8.3	84	0
Bottled juices	6.97	316	69	82.1	7.9	102	4
Canned soups	4.13	268	85	75.9	24.1	70	0
Canned tuna	4.94	137	47	74.5	25.5	30	1
Cereals	4.06	286	74	79.4	20.6	43	0
Cheese	4.50	399	95	80.8	19.2	133	1
Cigarettes	-0.06	84	45	65.1	34.9	1	1
Cookies	5.17	588	126	82.4	17.6	178	1
Crackers	5.96	193	25	88.5	11.5	71	0
Dish detergents	5.12	176	35	83.4	16.3	47	0
Fabric softeners	5.86	195	43	81.9	18.1	42	2
Front end candies	4.37	210	84	71.4	28.6	26	0
Frozen dinners	6.02	206	18	92.0	8.0	67	0
Frozen entrees	5.00	612	80	88.4	11.6	194	0
Frozen juices	3.87	108	35	75.5	24.5	31	0
Grooming products	2.89	565	145	79.6	20.4	119	3
Laundry detergents	3.50	334	100	77.0	23.0	48	2
Oatmeal	4.85	55	16	77.5	22.5	9	0
Paper towels	3.89	69	23	75.0	25.0	13	0
Refrigerated juices	3.54	133	49	73.1	26.9	33	3
Shampoos	3.05	757	177	81.0	19.0	116	0
Snack crackers	5.60	256	38	87.1	12.9	90	3
Soaps	5.89	185	46	80.1	19.9	29	0
Soft drinks	3.08	837	187	81.7	18.3	266	4
Toothbrushes	2.98	202	53	79.2	20.8	45	1
Toothpastes	2.32	275	103	72.8	27.2	46	1

Notes: For each product category, column 1 presents the average estimated coefficients. Column 2 presents the number of positive coefficients. Column 3 presents the number of negative coefficients. Column 4 presents the % of positive coefficients. Column 5 presents the % of negative coefficients. Last two columns present the number of coefficients that are both positive (negative) and statistically significant, at the 5% level.

Table 5. Category-level regressions of small price changes, sales volume and revenue

		Correlation	Revenue	Sales volume and Revenue	
		(1)	(2)	(3)	(4)
Analgesics	Coefficient (Std.)	0.8313	0.0371*** (0.0031)	0.1605*** (0.0411)	−0.1241*** (0.0409)
	Observations		276,255		
Bath Soap	Coefficient (Std.)	0.8048	0.0456*** (0.0089)	−0.3032*** (0.0924)	0.3484*** (0.0937)
	Observations		35,572		
Bathroom Tissues	Coefficient (Std.)	0.8861	0.0147** (0.0064)	0.3726*** (0.0397)	−0.3474*** (0.0374)
	Observations		325,837		
Beer	Coefficient (Std.)	0.9027	0.0235*** (0.0015)	−0.0435 (0.0342)	0.0669 (0.0342)
	Observations		459,405		
Bottled Juice	Coefficient (Std.)	0.9347	0.0318*** (0.005)	0.7843*** (0.0858)	−0.7436*** (0.0861)
	Observations		962,368		
Canned Soup	Coefficient (Std.)	0.9705	0.0092* (0.0048)	0.4559*** (0.04)	−0.4374*** (0.04)
	Observations		950,357		
Canned Tuna	Coefficient (Std.)	0.9016	0.0325*** (0.0046)	0.3748*** (0.0665)	−0.3421*** (0.0662)
	Observations		379,680		
Cereals	Coefficient (Std.)	0.9410	0.0239*** (0.0027)	0.022 (0.0366)	0.0017 (0.0375)
	Observations		724,013		
Cheese	Coefficient (Std.)	0.8715	0.0339*** (0.0029)	0.2955*** (0.0888)	−0.259*** (0.089)
	Observations		1,811,753		
Cigarettes	Coefficient (Std.)	0.9952	0.0209*** (0.0031)	−0.231*** (0.0452)	0.2515*** (0.0451)
	Observations		56,000		
Cookies	Coefficient (Std.)	0.9624	0.0427*** (0.0016)	0.0762*** (0.0271)	−0.0328 (0.0272)
	Observations		1,353,330		
Crackers	Coefficient (Std.)	0.9573	0.0547*** (0.0033)	0.134** (0.0531)	−0.0798 (0.0534)
	Observations		476,008		
Dish Detergent	Coefficient (Std.)	0.9573	0.0506*** (0.0033)	0.3337*** (0.1006)	−0.2851*** (0.1003)
	Observations		374,058		
Fabric Softener	Coefficient (Std.)	0.7917	0.0388*** (0.0039)	0.665*** (0.1424)	−0.6238*** (0.1438)
	Observations		348,422		
Front−End−Candies	Coefficient (Std.)	0.9552	−0.0217*** (0.0046)	0.5223*** (0.039)	−0.5184*** (0.0389)
	Observations		487,886		

Table 5 (Cont.)

		Correlation	Revenue	Sales volume and Revenue	
		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.7248	0.0439***	0.256***	−0.2053***
	(Std.)		(0.0026)	(0.0246)	(0.024)
	Observations		502,830		
Frozen Entrees	Coefficient	0.8393	0.0242***	0.1775***	−0.1449***
	(Std.)		(0.002)	(0.0099)	(0.0098)
	Observations s		1,846,911		
Frozen Juices	Coefficient	0.9772	0.0261***	0.298***	−0.2667***
	(Std.)		(0.0038)	(0.0496)	(0.049)
	Observations s		658,225		
Grooming Products	Coefficient	0.8360	0.0397***	0.0453	−0.0055
	(Std.)		(0.0022)	(0.0295)	(0.0299)
	Observations s		659,842		
Laundry Detergents	Coefficient	0.9504	0.0299***	0.2676***	−0.2387***
	(Std.)		(0.0026)	(0.0445)	(0.0443)
	Observations s		559,576		
Oatmeal	Coefficient	0.8747	0.0307***	−0.0131	0.0438**
	(Std.)		(0.0075)	(0.0196)	(0.0205)
	Observations s		169,093		
Paper Towels	Coefficient	0.8033	0.0233**	0.5848***	−0.5525***
	(Std.)		(0.0093)	(0.1198)	(0.1178)
	Observations s		248,289		
Refrigerated Juices	Coefficient	0.9305	0.0299***	0.1183**	−0.0884*
	(Std.)		(0.0032)	(0.049)	(0.049)
	Observations s		800,280		
Shampoos	Coefficient	0.7840	0.0296***	0.115***	−0.0848***
	(Std.)		(0.0013)	(0.0149)	(0.0148)
	Observations s		701,813		
Snack Crackers	Coefficient	0.9101	0.0434***	0.1702**	−0.1271*
	(Std.)		(0.0033)	(0.0727)	(0.0737)
	Observations s		800,253		
Soaps	Coefficient	0.6668	0.0535***	0.5026***	−0.4472***
	(Std.)		(0.0045)	(0.1444)	(0.1449)
	Observations		324,724		
Soft Drinks	Coefficient	0.7855	0.0135***	0.2922***	−0.2679***
	(Std.)		(0.0029)	(0.0205)	(0.0202)
	Observations		4,532,158		
Toothbrushes	Coefficient	0.8353	0.0283***	0.1041***	−0.0757**
	(Std.)		(0.0028)	(0.0357)	(0.0359)
	Observations		295,021		
Toothpastes	Coefficient	0.9193	0.0308***	−0.0811**	0.1126***
	(Std.)		(0.0026)	(0.0397)	(0.0396)
	Observations		588,261		

Notes: Column 1 reports the Pearson correlation coefficient between the sales volume and the revenues for each category. Columns 2–4 report the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable in all columns is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. In column 2, the main independent variable is the log of average revenue for product *i* in store *s* over the sample period. In columns 3 and 4, we report the results of a regression that includes both the log of the sales volume and the log of the revenue as independent variables. Column 3 reports the coefficients of the sales volume. Column 4 reports the coefficients of the revenue. All regressions also include fixed effects for months, years, stores, and products. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table 6. Category-level regressions of small price changes and synchronization

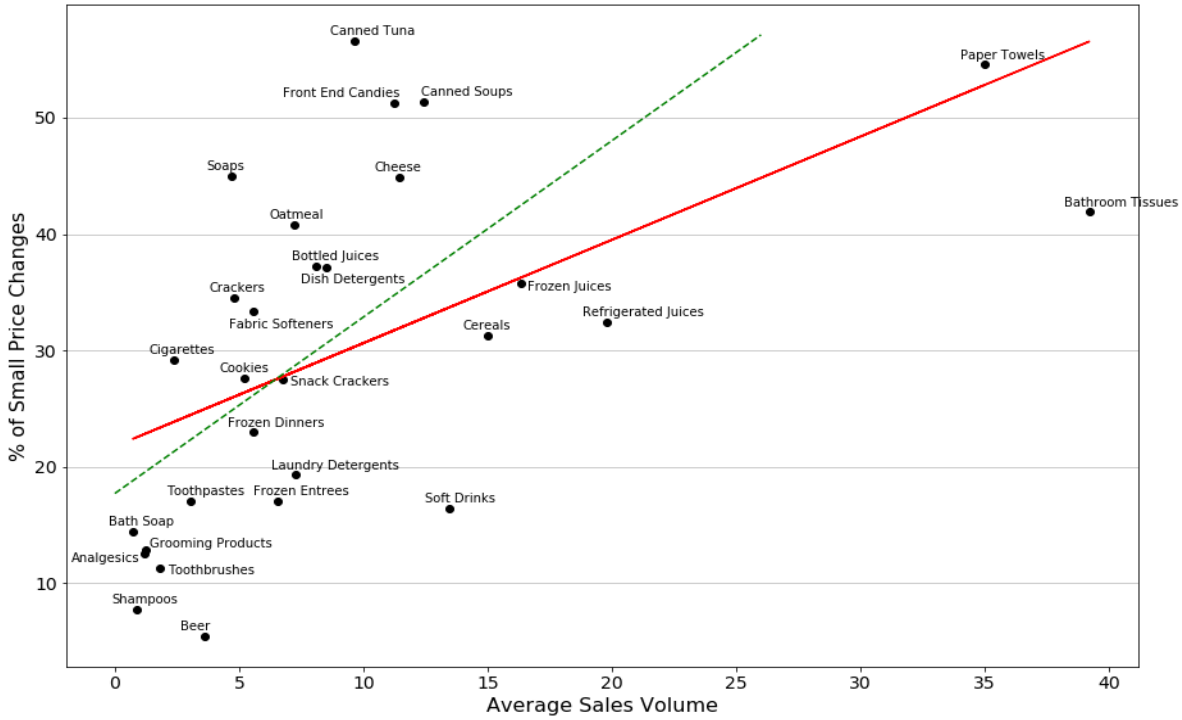
		(1)	(2)	(3)	(4)
Analgesics	Coefficient (Std.)	0.038*** (0.0031)	0.0378*** (0.0031)	0.0355*** (0.0031)	0.0566*** (0.0054)
	Observations	276,225	276,225	274,813	74,597
Bath Soap	Coefficient (Std.)	0.0447*** (0.008)	0.0448*** (0.0081)	0.0423*** (0.0078)	0.0887*** (0.0192)
	Observations	35,572	35,558	30,791	4,033
Bathroom Tissues	Coefficient (Std.)	0.0318*** (0.0057)	0.0314*** (0.0057)	0.0311*** (0.0057)	0.0542*** (0.0073)
	Observations	325,837	325,836	325,102	78,527
Beer	Coefficient (Std.)	0.0226*** (0.0015)	0.0221*** (0.0015)	0.0216*** (0.0015)	0.0801*** (0.0052)
	Observations	459,405	459,383	459,200	53,217
Bottled Juice	Coefficient (Std.)	0.0503*** (0.0037)	0.05*** (0.0037)	0.0479*** (0.0037)	0.0345*** (0.0049)
	Observations	962,368	962,366	962,255	237,566
Canned Soup	Coefficient (Std.)	0.0252*** (0.004)	0.0252*** (0.004)	0.0235*** (0.0039)	0.0209*** (0.0047)
	Observations	950,357	950,357	949,950	276,529
Canned Tuna	Coefficient (Std.)	0.036*** (0.0046)	0.0355*** (0.0046)	0.0349*** (0.0045)	0.033*** (0.0047)
	Observations	379,680	379,680	378,954	111,013
Cereals	Coefficient (Std.)	0.0237*** (0.0026)	0.0236*** (0.0026)	0.0223*** (0.0025)	0.0292*** (0.0035)
	Observations	724,013	724,013	723,945	257,833
Cheese	Coefficient (Std.)	0.0376*** (0.0027)	0.0371*** (0.0027)	0.0363*** (0.0027)	0.0294*** (0.0029)
	Observations	1,811,753	1,811,751	1,811,742	383,370
Cigarettes	Coefficient (Std.)	0.0176*** (0.004)	0.0177*** (0.0039)	0.0178*** (0.004)	0.0178*** (0.0038)
	Observations	56,000	55,995	55,341	43,308
Cookies	Coefficient (Std.)	0.044*** (0.0016)	0.0444*** (0.0016)	0.0433*** (0.0016)	0.0598*** (0.0034)
	Observations	1,353,330	1,353,324	1,353,288	225,751
Crackers	Coefficient (Std.)	0.0555*** (0.0035)	0.0559*** (0.0035)	0.0533*** (0.0035)	0.0631*** (0.0072)
	Observations	476,008	476,005	475,585	84,254
Dish Detergent	Coefficient (Std.)	0.0517*** (0.0035)	0.0509*** (0.0035)	0.0483*** (0.0034)	0.045*** (0.004)
	Observations	374,058	374,058	373,499	92,535
Fabric Softener	Coefficient (Std.)	0.0442*** (0.0039)	0.044*** (0.0039)	0.0405*** (0.0038)	0.0571*** (0.005)
	Observations	348,422	348,422	347,942	94,984
Front-End-Candies	Coefficient (Std.)	0.0036 (0.0035)	0.0027 (0.0035)	0.0051* (0.0028)	0.0112*** (0.003)
	Observations	487,886	487,886	486,721	149,425

Table 6. (Cont.) Category-level regressions of small price changes, synchronization

		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0451***	0.0456***	0.0426***	0.083***
	(Std.)	(0.0027)	(0.0028)	(0.0026)	(0.0059)
	Observations	502,830	502,830	502,579	72,725
Frozen Entrees	Coefficient	0.0366***	0.037***	0.0346***	0.0661***
	(Std.)	(0.002)	(0.002)	(0.002)	(0.0035)
	Observations	1,846,911	1,846,911	1,846,888	350,965
Frozen Juices	Coefficient	0.0329***	0.033***	0.0311***	0.0334***
	(Std.)	(0.0037)	(0.0037)	(0.0034)	(0.0052)
	Observations	658,225	658,225	658,184	145,104
Grooming Products	Coefficient	0.0391***	0.0396***	0.0391***	0.078***
	(Std.)	(0.0022)	(0.0022)	(0.0022)	(0.0052)
	Observations	659,842	659,841	659,625	106,407
Laundry Detergents	Coefficient	0.0327***	0.0324***	0.0301***	0.0438***
	(Std.)	(0.0027)	(0.0028)	(0.0027)	(0.0046)
	Observations	559,576	559,575	559,472	146,820
Oatmeal	Coefficient	0.0297***	0.0297***	0.0279***	0.0301**
	(Std.)	(0.0072)	(0.0072)	(0.0072)	(0.0107)
	Observations	169,093	169,093	166,304	56,104
Paper Towels	Coefficient	0.0354***	0.0354***	0.0348***	0.0393***
	(Std.)	(0.0095)	(0.0095)	(0.0094)	(0.0086)
	Observations	248,289	248,289	247,640	49,353
Refrigerated Juices	Coefficient	0.0308***	0.031***	0.0285***	0.0285***
	(Std.)	(0.0032)	(0.0032)	(0.003)	(0.0042)
	Observations	800,280	800,279	800,249	156,832
Shampoos	Coefficient	0.0298***	0.0297***	0.0283***	0.065***
	(Std.)	(0.0014)	(0.0014)	(0.0014)	(0.0037)
	Observations	701,813	701,813	701,663	94,030
Snack Crackers	Coefficient	0.0454***	0.0452***	0.0436***	0.0716***
	(Std.)	(0.0033)	(0.0033)	(0.0031)	(0.0045)
	Observations	800,253	800,252	800,151	138,599
Soap	Coefficient	0.056***	0.056***	0.0526***	0.0576***
	(Std.)	(0.0044)	(0.0044)	(0.0044)	(0.006)
	Observations	324,724	324,724	324,265	95,486
Soft Drinks	Coefficient	0.0237***	0.0237***	0.0236***	0.0629***
	(Std.)	(0.0014)	(0.0014)	(0.0014)	(0.0031)
	Observations	4,532,158	4,532,157	4,532,144	345,961
Toothbrushes	Coefficient	0.032***	0.0316***	0.0297***	0.0762***
	(Std.)	(0.0027)	(0.0028)	(0.0029)	(0.0072)
	Observations	295,021	295,021	293,628	43,636
Toothpastes	Coefficient	0.0284***	0.027***	0.0226***	0.0602***
	(Std.)	(0.0027)	(0.0026)	(0.0026)	(0.0058)
	Observations	588,261	588,261	587,831	94,582

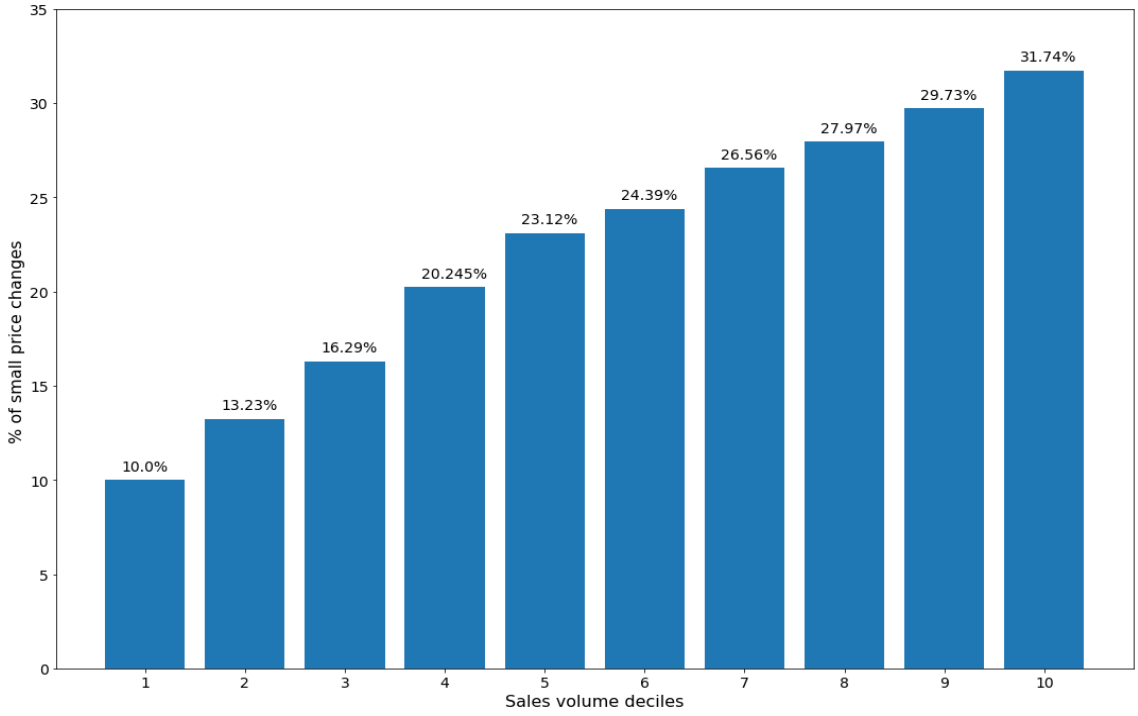
Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of a regression that includes the log of average sales volume and the average number of products offered in the category by the same producer. In column 2, we add the percentage of the products that changed the price on the same week, excluding the current observation. In column 3, we add the average size of contemporaneous price changes, excluding the current observation. In column 4, we add the percentage of the products that are produced by the same producer and that changed price on the same week, excluding the current observation. All regressions include fixed effects for months, years, stores, and product. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Figure 1. Cross-category correlation between small price changes and sales volume



Notes: The red solid line is a linear regression line when all 29 product categories are included. The dotted green line is the linear regression line if the two RHS categories (paper towels and bathroom tissues) are excluded.

Figure 2. Frequency of small price changes by sales volume deciles



Notes: The chart was obtained by merging all 29 product categories and dividing it into deciles according to the products' sales volume. The % of small price changes $(\Delta P \leq 10¢)$ was calculated for each decile as a ratio of the number of small price changes to the number of total price changes in each decile.

Figure 3. Frequency of price changes by size for high and low sales volume products

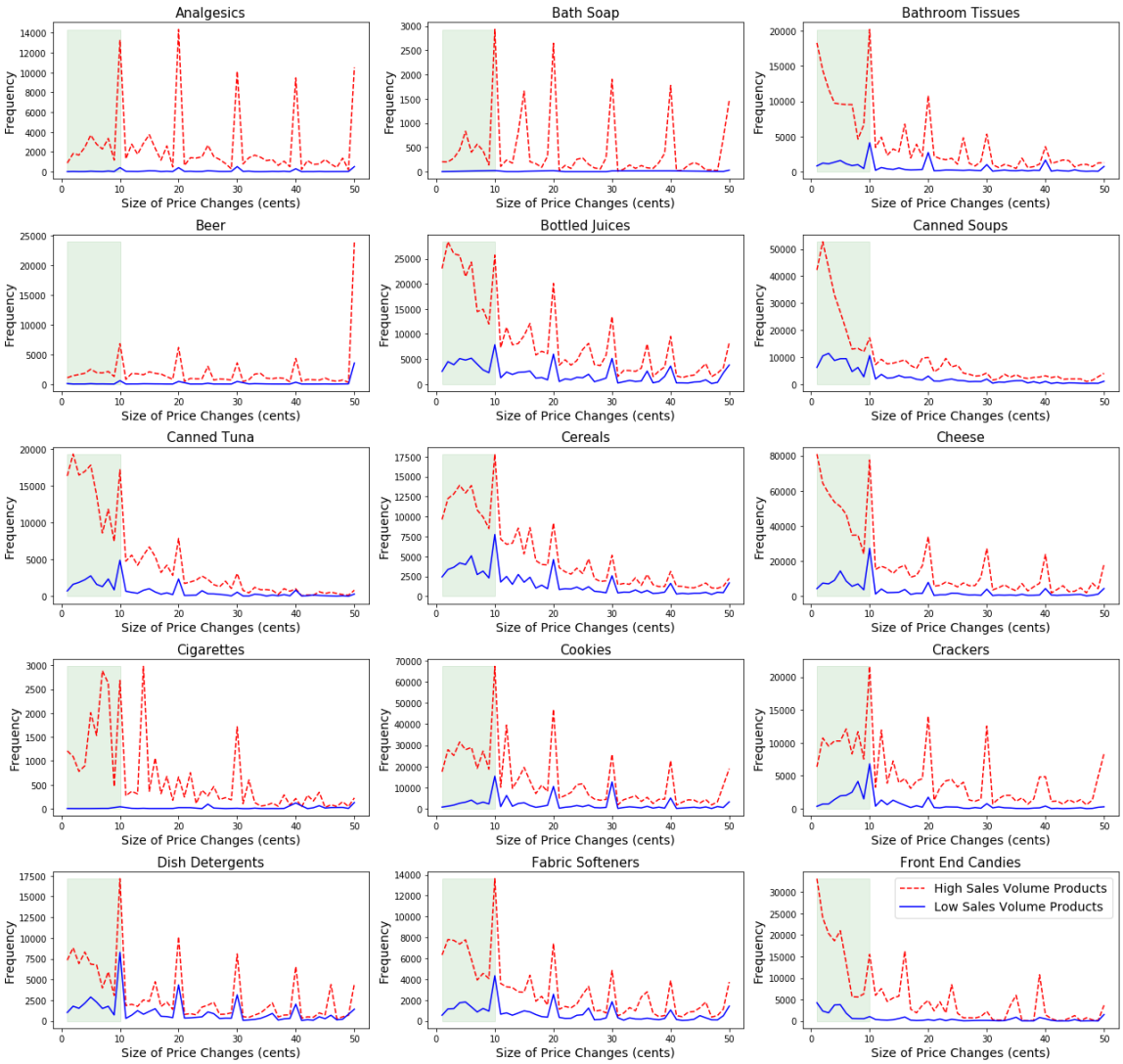
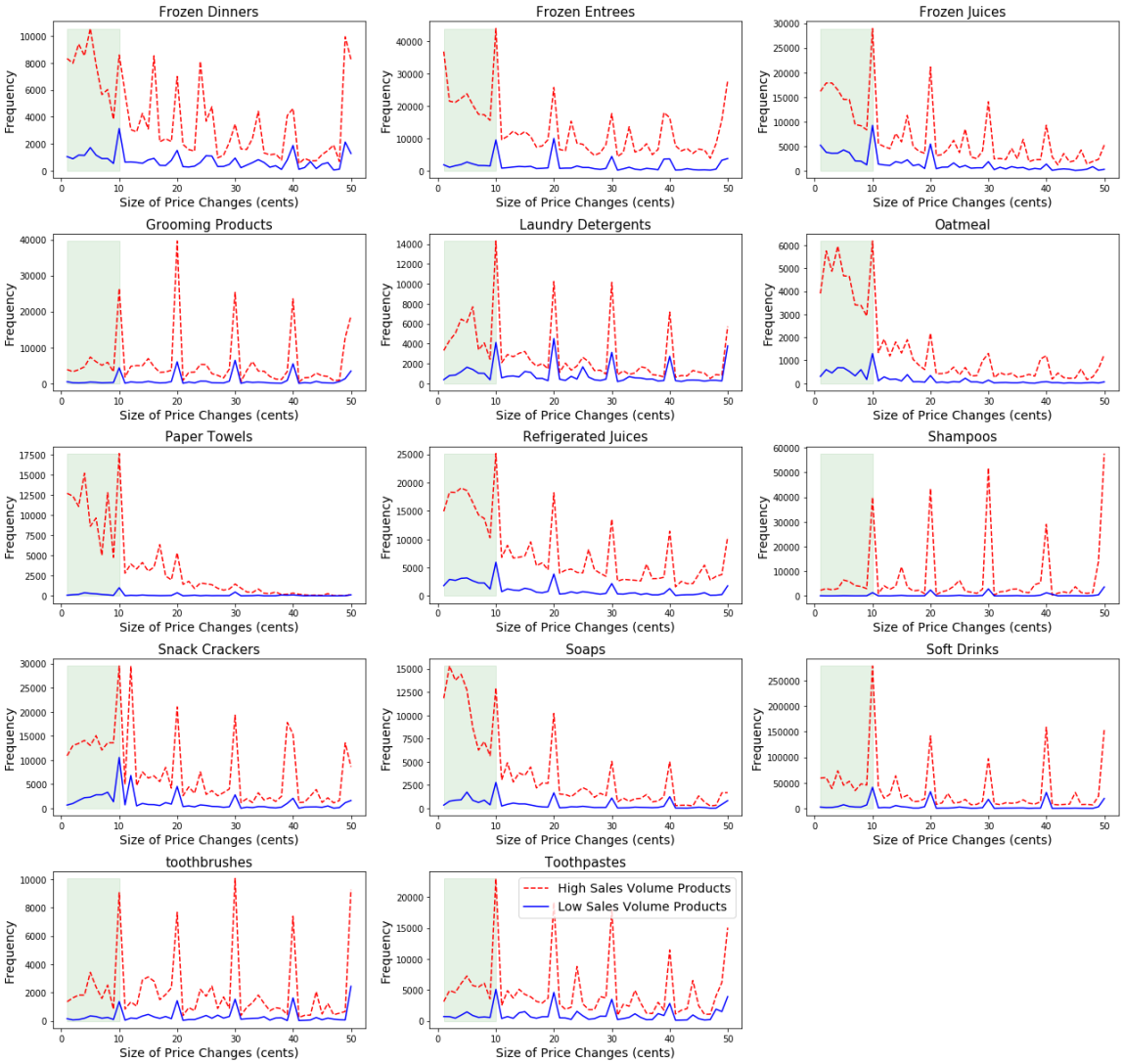
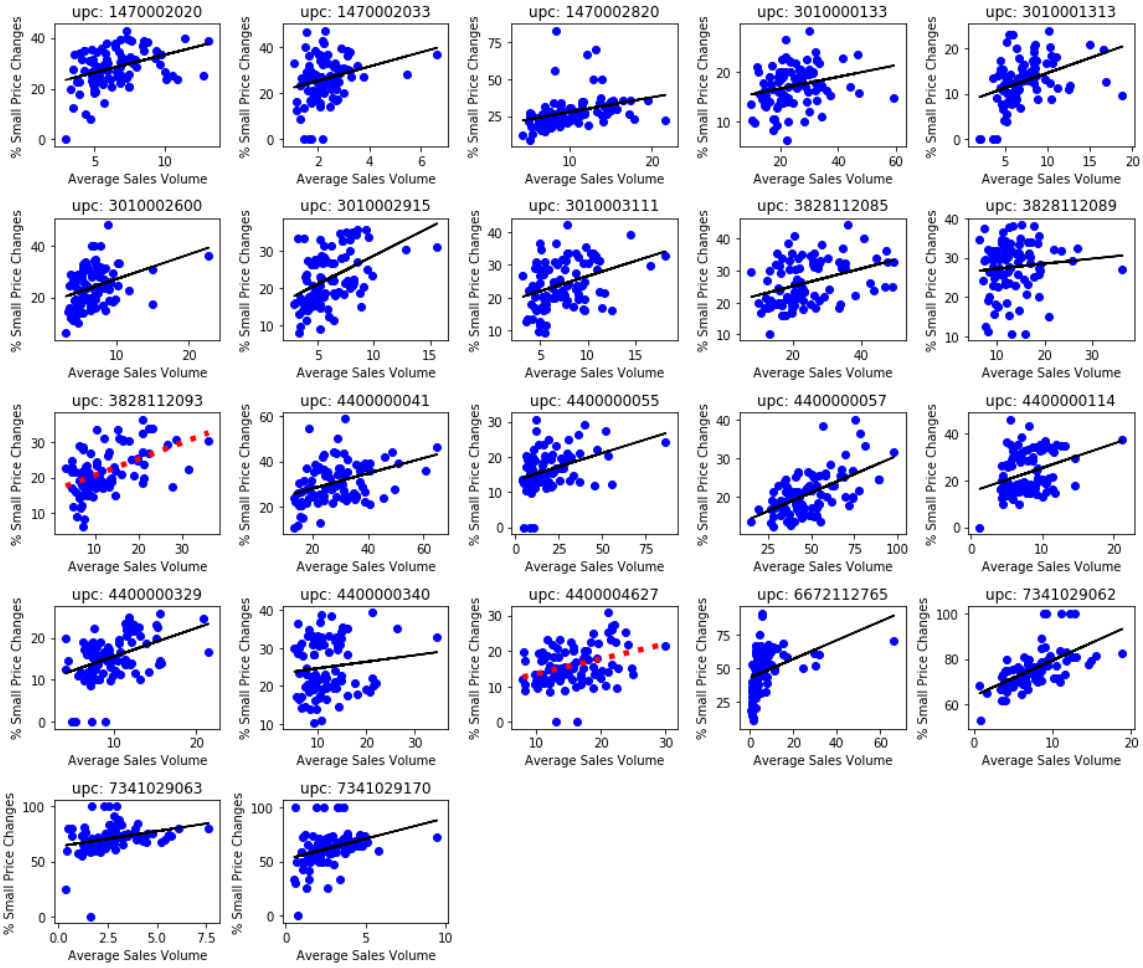


Figure 3. (Continues)



Notes: For each category, the figure shows the frequency of price changes for each size of price change from 1¢ to 50¢, comparing high sales volume products to low sales volume products. To obtain the figures, we compute the average sales volume over the entire sample period for each product, in each store. We then group the products into high, medium and low sales volume products. High (low) sales volume products are products in the high (low) third of the distribution. The y-axis shows the frequency of price changes. The red dashed line depicts the frequency of price changes for the high sales-volume products, and the blue solid line depicts the frequency of price changes for the low sales volume products. The green shaded area shows the range of small price changes, $\Delta P \leq 10¢$.

Figure 4. Product-level correlations between sales volume and small price changes in the Crackers Category



Note: The figure depicts the correlation between average sales volume (x-axis) and the percentage of small price changes for various products in the crackers' category. Each dot in the figures represents the data for the product in a specific store. There are 93 dots in each figure, one for each store. Straight lines in the figures are the regression lines. Black solid regression lines indicate that the regression coefficient is significant at the 5% significance level, which is the case for 20 of the 22 products. The two regression lines that are not statistically significant are red dotted lines.

Online Supplementary Appendix

Not for Publication

Small Price Changes, Sales Volume, and Menu Cost

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Revised: March 17, 2022

Appendix A. Controlling for measurement errors

We use a scanner dataset. As Eichenbaum et al. (2014) note, the distribution of the size of price changes in scanner datasets is prone to measurement errors. The errors may arise because in scanner datasets, the price of a product on a given week is calculated as the ratio of the sales revenue to the quantity sold. Thus, if the price has changed during the week, or if some consumers used coupons, the price in the dataset might differ from the actual transaction price in that week.

This type of error is less of a concern in the Dominick's dataset, because prices at Dominick's are set on a weekly basis, and the use of coupons in the period we study was limited. See Barksy et al. (2003), Chen et al. (2008), and Levy et al. (2010, 2011).

Nevertheless, to mitigate possible concerns, we conduct three robustness checks. First, Table A1 presents the results of regressions equivalent to the regressions in Table 3 in the paper. This time however, we exclude price changes smaller or equal to 2¢. As Eichenbaum et al. (2014) note, such small price changes are likely to be the results of measurement errors. The regressions take the following form:

$$\begin{aligned} small\ \ price\ change_{i,s,t} = \alpha + \beta \log(average\ sales\ volume_{i,s}) + \gamma \mathbf{X}_{i,s,t} \\ + month_t + year_t + \delta_s + \mu_i + u_{i,s,t} \end{aligned} \quad \text{(A1)}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢ and larger than 2¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the sample period. **X** is a matrix of other control variables. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

The values in Table A1 are the coefficients of the log of the average sales volume. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. Consistent with the results we report in the paper, we find that all the coefficients of the log of the average sales volume are positive and statistically significant. The average coefficient is 0.030, suggesting that a 1% increase in the sales volume is associated with a 3% increase in the likelihood of a

small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). Again, all the coefficients are positive and statistically significant. The average coefficient is 0.026, suggesting that a 1% increase in the sales volume is associated with a 2.6% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All coefficients remain positive and statistically significant. The average coefficient is 0.024, suggesting that a 1% increase in the sales volume is associated with a 2.4% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.044, suggesting that a 1% increase in the sales volume is associated with a 4.4% increase in the likelihood of a small price change.

As a second robustness test, we re-run the above regressions, after dropping observations if the price that follows a price change does not last for at least two weeks. As Strulov-Shlain (2019) notes, if a price lasts for more than one week than it is unlikely to be the result of a measurement error.

Table A2 reports the estimation results. The coefficient estimates are similar in sign, in the magnitude, and in statistical significance, to the corresponding figures in Table A1. In all columns, the coefficient estimates are positive and significant, ranging between 0.019 and 0.038, on average.

As a third robustness test, we re-run the above regressions, after dropping observations if the Dominick's sales flag indicated that there was a coupon use in either the week the price changed or in the preceding week. As Eichenbaum et al. (2014) note, coupons are one reason that might lead to spurious small price changes.

Table A3 reports the estimation results. The coefficient estimates are similar in sign, in the magnitude, and in statistical significance, to the corresponding figures in Table A1. In all columns, the coefficient estimates are positive and significant, ranging

between 0.026 and 0.045, on average.

To summarize, the exclusion of (a) very small price changes, the exclusion of the (b) observations with prices that do not last for at least two weeks, or (c) the exclusion of observations with coupon use, do not change our main result. The likelihood of small price changes remains strongly correlated with the average sales volume. We therefore conclude that our results are not likely to be driven by measurement errors.

Table A1. Category-level regressions of small price changes and sales volume, excluding price changes less than or equal to 2¢

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0335***	0.0273***	0.0226***	0.0435***
	(Std.)	(0.003)	(0.0026)	(0.0024)	(0.0052)
	Observations	273,373	273,373	273,373	75,265
Bath Soap	Coefficient	0.0413***	0.0457***	0.043***	0.0907***
	(Std.)	(0.008)	(0.0087)	(0.0085)	(0.0161)
	Observations	35,154	35,154	35,154	6,348
Bathroom Tissues	Coefficient	0.0258***	0.0145***	0.012***	0.0393***
	(Std.)	(0.0055)	(0.0051)	(0.0048)	(0.0074)
	Observations	288,322	288,322	288,322	58,763
Beer	Coefficient	0.0217***	0.0231***	0.0198***	0.0661***
	(Std.)	(0.0013)	(0.0012)	(0.0011)	(0.0049)
	Observations	456,423	456,423	456,423	55,255
Bottled Juice	Coefficient	0.0395***	0.0328***	0.0293***	0.036***
	(Std.)	(0.0037)	(0.0031)	(0.0033)	(0.0047)
	Observations	883,440	883,440	883,440	187,518
Canned Soup	Coefficient	0.0167***	0.0116***	0.0126***	0.0229***
	(Std.)	(0.0041)	(0.0038)	(0.0036)	(0.0051)
	Observations	817,119	817,119	817,119	191,558
Canned Tuna	Coefficient	0.0327***	0.0252***	0.0222***	0.0324***
	(Std.)	(0.0046)	(0.004)	(0.0038)	(0.0052)
	Observations	334,293	334,293	334,293	89,780
Cereals	Coefficient	0.0201***	0.016***	0.0152***	0.0267***
	(Std.)	(0.0025)	(0.0023)	(0.0024)	(0.0037)
	Observations	684,764	684,764	684,764	227,620
Cheese	Coefficient	0.0303***	0.0201***	0.0171***	0.0133***
	(Std.)	(0.0027)	(0.0023)	(0.0023)	(0.0044)
	Observations	1,614,205	1,614,205	1,614,205	372,411
Cigarettes	Coefficient	0.0152***	0.0145***	0.0141***	0.0139***
	(Std.)	(0.003)	(0.003)	(0.003)	(0.0034)
	Observations	53,744	53,744	53,744	42,074
Cookies	Coefficient	0.0355***	0.0326***	0.028***	0.0488***
	(Std.)	(0.0015)	(0.0015)	(0.0014)	(0.003)
	Observations	1,301,274	1,301,274	1,301,274	205,055
Crackers	Coefficient	0.0443***	0.0368***	0.0336***	0.0537***
	(Std.)	(0.0029)	(0.0027)	(0.0025)	(0.0054)
	Observations	453,943	453,943	453,943	77,982
Dish Detergent	Coefficient	0.0417***	0.0336***	0.0302***	0.0438***
	(Std.)	(0.0033)	(0.0028)	(0.0028)	(0.0044)
	Observations	346,444	346,444	346,444	73,951
Fabric Softener	Coefficient	0.0336***	0.0254***	0.0231***	0.0433***
	(Std.)	(0.0037)	(0.0034)	(0.0035)	(0.005)
	Observations	326,485	326,485	326,485	84,159
Front-End-Candies	Coefficient	0.0128***	0.0136***	0.0129***	0.0101***
	(Std.)	(0.0032)	(0.0027)	(0.0026)	(0.003)
	Observations	412,365	412,365	412,365	123,255

Table A1. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0436***	0.038***	0.0371***	0.098***
	(Std.)	(0.0024)	(0.0022)	(0.0022)	(0.0064)
	Observations	478,053	478,053	478,053	57,892
Frozen Entrees	Coefficient	0.0302***	0.0307***	0.0302***	0.0601***
	(Std.)	(0.0015)	(0.0014)	(0.0014)	(0.0036)
	Observations	1,767,594	1,767,594	1,767,594	295,371
Frozen Juices	Coefficient	0.0252***	0.0227***	0.0207***	0.0312***
	(Std.)	(0.0036)	(0.0033)	(0.0033)	(0.0059)
	Observations	601,069	601,069	601,069	112,407
Grooming Products	Coefficient	0.0368***	0.0417***	0.0375***	0.06***
	(Std.)	(0.002)	(0.0019)	(0.0018)	(0.0051)
	Observations	649,634	649,634	649,634	103,843
Laundry Detergents	Coefficient	0.0282***	0.0201***	0.017***	0.0346***
	(Std.)	(0.0025)	(0.0023)	(0.0022)	(0.004)
	Observations	545,829	545,829	545,829	138,819
Oatmeal	Coefficient	0.0249***	0.0157***	0.0145***	0.0413***
	(Std.)	(0.0072)	(0.0059)	(0.0059)	(0.0074)
	Observations	154,887	154,887	154,887	51,607
Paper Towels	Coefficient	0.0278***	0.0237***	0.0226**	0.0259***
	(Std.)	(0.0099)	(0.0108)	(0.011)	(0.0102)
	Observations	218,936	218,936	218,936	37,328
Refrigerated Juices	Coefficient	0.0237***	0.0178***	0.0157***	0.0287***
	(Std.)	(0.0032)	(0.0028)	(0.0027)	(0.0047)
	Observations	749,239	749,239	749,239	127,091
Shampoos	Coefficient	0.0276***	0.0342***	0.03***	0.0561***
	(Std.)	(0.0012)	(0.0012)	(0.0011)	(0.0034)
	Observations	696,062	696,062	696,062	93,503
Snack Crackers	Coefficient	0.0372***	0.0345***	0.0311***	0.0605***
	(Std.)	(0.0029)	(0.0028)	(0.0026)	(0.0041)
	Observations	768,277	768,277	768,277	127,947
Soap	Coefficient	0.0452***	0.0348***	0.0295***	0.0536***
	(Std.)	(0.0042)	(0.0041)	(0.004)	(0.0065)
	Observations	291,596	291,596	291,596	73,039
Soft Drinks	Coefficient	0.0175***	0.0205***	0.0171***	0.0464***
	(Std.)	(0.001)	(0.0009)	(0.0008)	(0.0022)
	Observations	4,396,003	4,396,003	4,396,003	308,731
Toothbrushes	Coefficient	0.025***	0.0281***	0.0237***	0.0543***
	(Std.)	(0.0025)	(0.0025)	(0.0023)	(0.006)
	Observations	290,564	290,564	290,564	43,247
Toothpastes	Coefficient	0.0248***	0.026***	0.0232***	0.055***
	(Std.)	(0.0024)	(0.002)	(0.0019)	(0.005)
	Observations	575,547	575,547	575,547	89,416

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢ and larger than 2¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table A2. Category-level regressions of small price changes and sales volume, excluding price changes that do not last for at least two weeks

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0262***	0.019***	0.0188***	0.029***
	(Std.)	(0.0034)	(0.0032)	(0.0031)	(0.0068)
	Observations	144,461	144,461	144,461	44,950
Bath Soap	Coefficient	0.0293***	0.0277***	0.0285***	0.0972***
	(Std.)	(0.008)	(0.0082)	(0.0081)	(0.0192)
	Observations	15,295	15,295	15,295	3,208
Bathroom Tissues	Coefficient	0.0408***	0.0179***	0.0184***	0.0386***
	(Std.)	(0.007)	(0.0058)	(0.0057)	(0.0084)
	Observations	149,441	149,441	149,441	47,041
Beer	Coefficient	0.013***	0.0147***	0.0147***	0.0699***
	(Std.)	(0.0012)	(0.0012)	(0.0012)	(0.0063)
	Observations	290,620	290,620	290,620	27,348
Bottled Juice	Coefficient	0.0329***	0.0239***	0.0238***	0.0304***
	(Std.)	(0.0053)	(0.0044)	(0.0045)	(0.0063)
	Observations	496,557	496,557	496,557	133,714
Canned Soup	Coefficient	0.0158***	0.0108***	0.0134***	0.0144***
	(Std.)	(0.0056)	(0.005)	(0.0049)	(0.0049)
	Observations	495,543	495,543	495,543	176,235
Canned Tuna	Coefficient	0.0237***	0.0134***	0.0131***	0.0225***
	(Std.)	(0.0054)	(0.0046)	(0.0045)	(0.0058)
	Observations	213,043	213,043	213,043	64,161
Cereals	Coefficient	0.0204***	0.0149***	0.0148***	0.0188***
	(Std.)	(0.0037)	(0.0034)	(0.0034)	(0.0046)
	Observations	357,120	357,120	357,120	155,367
Cheese	Coefficient	0.0201***	0.0113***	0.0112***	0.0113***
	(Std.)	(0.0028)	(0.0025)	(0.0025)	(0.0033)
	Observations	796,150	796,150	796,150	224,889
Cigarettes	Coefficient	0.0084**	0.0073**	0.0074**	0.0069*
	(Std.)	(0.0046)	(0.0045)	(0.0044)	(0.0054)
	Observations	36,157	36,157	36,157	30,262
Cookies	Coefficient	0.0267***	0.022***	0.0223***	0.046***
	(Std.)	(0.0018)	(0.0017)	(0.0017)	(0.0035)
	Observations	688,761	688,761	688,761	132,488
Crackers	Coefficient	0.0379***	0.0302***	0.0306***	0.0467***
	(Std.)	(0.0031)	(0.0026)	(0.0026)	(0.0072)
	Observations	245,185	245,185	245,185	50,029
Dish Detergent	Coefficient	0.0393***	0.028***	0.0279***	0.0361***
	(Std.)	(0.0044)	(0.0036)	(0.0035)	(0.0041)
	Observations	189,633	189,633	189,633	53,289
Fabric Softener	Coefficient	0.0238***	0.0123***	0.0126***	0.0325***
	(Std.)	(0.0048)	(0.0043)	(0.0043)	(0.0057)
	Observations	181,056	181,056	181,056	56,234
Front-End-Candies	Coefficient	0.0047*	0.0057**	0.0059**	0.0053**
	(Std.)	(0.0041)	(0.0033)	(0.0032)	(0.0031)
	Observations	278,853	278,853	278,853	111,635

Table A2 (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0475***	0.036***	0.0389***	0.0795***
	(Std.)	(0.0034)	(0.0028)	(0.0027)	(0.0066)
	Observations	203,191	203,191	203,191	37,527
Frozen Entrees	Coefficient	0.028***	0.0259***	0.0266***	0.0443***
	(Std.)	(0.0021)	(0.0019)	(0.0019)	(0.0034)
	Observations	864,832	864,832	864,832	213,545
Frozen Juices	Coefficient	0.0273***	0.0198***	0.0206***	0.0293***
	(Std.)	(0.0048)	(0.0042)	(0.0041)	(0.0062)
	Observations	308,817	308,817	308,817	87,919
Grooming Products	Coefficient	0.0187***	0.0209***	0.021***	0.0417***
	(Std.)	(0.0023)	(0.0024)	(0.0024)	(0.0069)
	Observations	269,873	269,873	269,873	51,819
Laundry Detergents	Coefficient	0.0196***	0.0093***	0.0097***	0.02***
	(Std.)	(0.0032)	(0.0028)	(0.0028)	(0.0045)
	Observations	272,765	272,765	272,765	85,184
Oatmeal	Coefficient	0.028***	0.0152***	0.0154***	0.0338***
	(Std.)	(0.008)	(0.0067)	(0.0067)	(0.0098)
	Observations	79,983	79,983	79,983	36,043
Paper Towels	Coefficient	0.0454***	0.0316***	0.0321***	0.0378***
	(Std.)	(0.0105)	(0.0118)	(0.0119)	(0.0115)
	Observations	116,204	116,204	116,204	29,280
Refrigerated Juices	Coefficient	0.0357***	0.0209***	0.0209***	0.033***
	(Std.)	(0.0047)	(0.0039)	(0.0039)	(0.0056)
	Observations	306,865	306,865	306,865	72,031
Shampoos	Coefficient	0.0162***	0.02***	0.0201***	0.046***
	(Std.)	(0.0015)	(0.0016)	(0.0015)	(0.0052)
	Observations	261,778	261,778	261,778	40,996
Snack Crackers	Coefficient	0.0319***	0.0282***	0.0284***	0.0518***
	(Std.)	(0.0032)	(0.003)	(0.003)	(0.0052)
	Observations	398,665	398,665	398,665	78,581
Soap	Coefficient	0.0374***	0.0226***	0.0237***	0.049***
	(Std.)	(0.0055)	(0.005)	(0.005)	(0.0076)
	Observations	152,379	152,379	152,379	46,829
Soft Drinks	Coefficient	0.0211***	0.024***	0.023***	0.0517***
	(Std.)	(0.0017)	(0.0013)	(0.0012)	(0.0037)
	Observations	1,350,618	1,350,618	1,350,618	156,004
Toothbrushes	Coefficient	0.0204***	0.02***	0.0195***	0.0498***
	(Std.)	(0.0028)	(0.0028)	(0.0028)	(0.0076)
	Observations	125,380	125,380	125,380	24,955
Toothpastes	Coefficient	0.0123***	0.0111***	0.0111***	0.0393***
	(Std.)	(0.0026)	(0.0022)	(0.0022)	(0.0063)
	Observations	264,317	264,317	264,317	56,842

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. We exclude observation if the post change price does not last for at least two weeks. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table A3. Category-level regressions of small price changes and sales volume, excluding coupons sales

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0381***	0.031***	0.0252***	0.047***
	(Std.)	(0.0032)	(0.0027)	(0.0025)	(0.0052)
	Observations	276,216	276,216	276,216	77,653
Bath Soap	Coefficient	0.043***	0.0471***	0.0438***	0.0885***
	(Std.)	(0.0087)	(0.0094)	(0.0091)	(0.0157)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0321***	0.0163***	0.0136***	0.0332***
	(Std.)	(0.0057)	(0.0046)	(0.0043)	(0.0067)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0235***	0.0252***	0.0209***	0.0679***
	(Std.)	(0.0015)	(0.0012)	(0.0012)	(0.005)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0474***	0.0377***	0.0332***	0.033***
	(Std.)	(0.0037)	(0.0031)	(0.0031)	(0.0044)
	Observations	962,293	962,293	962,293	243,786
Canned Soup	Coefficient	0.0239***	0.0161***	0.0167***	0.0182***
	(Std.)	(0.004)	(0.0034)	(0.0033)	(0.0038)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.0367***	0.0269***	0.0228***	0.0295***
	(Std.)	(0.0046)	(0.0039)	(0.0036)	(0.0043)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0238***	0.0184***	0.0173***	0.027***
	(Std.)	(0.0026)	(0.0023)	(0.0024)	(0.0034)
	Observations	723,343	723,343	723,343	260,385
Cheese	Coefficient	0.0374***	0.0218***	0.0179***	0.0127***
	(Std.)	(0.0027)	(0.0021)	(0.0021)	(0.0032)
	Observations	1,811,660	1,811,660	1,811,660	521,158
Cigarettes	Coefficient	0.0196***	0.0191***	0.0185***	0.0186***
	(Std.)	(0.0031)	(0.0031)	(0.0031)	(0.0037)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0436***	0.0381***	0.0323***	0.0532***
	(Std.)	(0.0016)	(0.0016)	(0.0014)	(0.003)
	Observations	1,352,875	1,352,875	1,352,875	228,926
Crackers	Coefficient	0.0548***	0.0435***	0.0392***	0.0581***
	(Std.)	(0.0033)	(0.0031)	(0.0029)	(0.0063)
	Observations	475,879	475,879	475,879	88,766
Dish Detergent	Coefficient	0.0513***	0.0388***	0.0338***	0.0419***
	(Std.)	(0.0034)	(0.0028)	(0.0028)	(0.004)
	Observations	373,979	373,979	373,979	93,647
Fabric Softener	Coefficient	0.0434***	0.0316***	0.028***	0.0473***
	(Std.)	(0.0038)	(0.0036)	(0.0036)	(0.0047)
	Observations	348,359	348,359	348,359	100,472
Front-End-Candies	Coefficient	0.0042*	0.008***	0.0069***	0.0087***
	(Std.)	(0.0035)	(0.0027)	(0.0027)	(0.0029)
	Observations	487,512	487,512	487,512	157,514

Table A3 (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0513***	0.0406***	0.0392***	0.0874***
	(Std.)	(0.0025)	(0.0022)	(0.0022)	(0.0056)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.033***	0.0328***	0.0319***	0.0635***
	(Std.)	(0.0019)	(0.0016)	(0.0016)	(0.0034)
	Observations	1,846,890	1,846,890	1,846,890	352,701
Frozen Juices	Coefficient	0.0326***	0.0261***	0.0235***	0.0296***
	(Std.)	(0.0037)	(0.0032)	(0.0031)	(0.0048)
	Observations	658,215	658,215	658,215	150,055
Grooming Products	Coefficient	0.0398***	0.0448***	0.0388***	0.0624***
	(Std.)	(0.0022)	(0.002)	(0.0019)	(0.005)
	Observations	659,841	659,841	659,841	107,668
Laundry Detergents	Coefficient	0.032***	0.0227***	0.0185***	0.0366***
	(Std.)	(0.0027)	(0.0024)	(0.0024)	(0.0041)
	Observations	559,569	559,569	559,569	148,541
Oatmeal	Coefficient	0.0295***	0.0175***	0.0156***	0.0314***
	(Std.)	(0.0073)	(0.0052)	(0.0052)	(0.0093)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0347***	0.0275***	0.0263***	0.0285***
	(Std.)	(0.0095)	(0.0102)	(0.0103)	(0.0085)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0307***	0.0208***	0.0181***	0.0302***
	(Std.)	(0.0032)	(0.0027)	(0.0026)	(0.0041)
	Observations	800,176	800,176	800,176	161,074
Shampoos	Coefficient	0.0305***	0.0377***	0.0329***	0.0581***
	(Std.)	(0.0013)	(0.0013)	(0.0012)	(0.0035)
	Observations	701,740	701,740	701,740	96,382
Snack Crackers	Coefficient	0.044***	0.0388***	0.0343***	0.064***
	(Std.)	(0.0032)	(0.003)	(0.0026)	(0.004)
	Observations	799,390	799,390	799,390	143,133
Soaps	Coefficient	0.0567***	0.0404***	0.0333***	0.0515***
	(Std.)	(0.0043)	(0.0042)	(0.0041)	(0.0054)
	Observations	324,724	324,724	324,724	96,574
Soft Drinks	Coefficient	0.0238***	0.0267***	0.0223***	0.0607***
	(Std.)	(0.0013)	(0.001)	(0.0009)	(0.0027)
	Observations	4,525,931	4,525,931	4,525,931	349,663
Toothbrushes	Coefficient	0.0293***	0.0321***	0.0263***	0.0584***
	(Std.)	(0.0028)	(0.0028)	(0.0025)	(0.0063)
	Observations	294,891	294,891	294,891	45,369
Toothpastes	Coefficient	0.0293***	0.0292***	0.0255***	0.0593***
	(Std.)	(0.0027)	(0.0021)	(0.002)	(0.0053)
	Observations	588,258	588,258	588,258	96,727

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. We exclude observations on price changes, if the Dominick's sales flag indicates a coupon sale in either week t or $t-1$. The dependent variable is "small price change," which equals 1 if a price change of product i in store s at time t is less or equal to 10¢, and 0 otherwise. The main independent variable is the log of average sales volume of product i in store s over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Appendix B. Alternative definitions of small price changes

In the paper, we define a small price change as a price change smaller than or equal to 10¢. In this appendix, we repeat our main analyses using 8 alternative definitions of small price changes. First, we define small price changes as: (1) price changes up to, and including, 5¢, (2) price changes up to, and including, 15¢, (3) price changes up to, and including, 2% and (4) price changes up to, and including, 5%.

Second, we follow Midrigan (2011) and Bhattarai and Schoenle (2014) to define small price changes relative to the average price change in the corresponding category. I.e., a price change is small if it is smaller than or equal to $\kappa|\overline{\Delta p}|$, where $\overline{\Delta p}$ is the average price change in the category and κ attains the values 0.5, 0.33, 0.25 and 0.10.

Table B1 presents the results of regressions equivalent to the regressions in Table 3 in the paper. The regressions take the following form:

$$\begin{aligned} small\ \ price\ change_{i,s,t} = \alpha + \beta \log(average\ sales\ volume_{i,s}) + \gamma \mathbf{X}_{i,s,t} \\ + month_t + year_t + \delta_s + \mu_i + u_{i,s,t} \end{aligned} \quad \text{(B1)}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 5¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the sample period. **X** is a matrix of other control variables. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

The values in the table are the coefficients of the log of the average sales volume. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that all the coefficients of the log of the average sales volume are positive and statistically significant. The average coefficient is 0.026, suggesting that a 1% increase in the sales volume is associated with a 2.6% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). Again, all the coefficients are positive and statistically significant. The average coefficient is 0.022,

suggesting that a 1% increase in the sales volume is associated with a 2.2% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All the coefficients are still positive and statistically significant. The average coefficient is 0.018, suggesting that a 1% increase in the sales volume is associated with a 1.8% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.037, suggesting that a 1% increase in the sales volume is associated with a 3.7% increase in the likelihood of a small price change.

Table B2 presents the results of similar regressions, where we define small price changes as price changes of up to, and including, 15¢. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that all the coefficients of the log of the average sales volume are positive and statistically significant. The average coefficient is 0.035, suggesting that a 1% increase in the sales volume is associated with a 3.5% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). Again, all the coefficients are positive and statistically significant. The average coefficient is 0.022, suggesting that a 1% increase in the sales volume is associated with a 3.0% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All the coefficients are still positive and statistically significant. The average coefficient is 0.026, suggesting that a 1% increase in the sales volume is associated with a 2.6% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically

significant. The average coefficient is 0.040, suggesting that a 1% increase in the sales volume is associated with a 4.0% increase in the likelihood of a small price change.

Table B3 presents the results where we define small price changes as price changes of up to 2%. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that 28 of the 29 coefficients of the log of the average sales volume are positive and statistically significant. One coefficient, for the front-end-candies category, is negative, but only marginally significant. The average coefficient is 0.025, suggesting that a 1% increase in the sales volume is associated with a 2.5% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). Again, 28 of the 29 coefficients are positive and statistically significant. One coefficient, for the front-end-candies category, is negative but not statistically significant. The average coefficient is 0.020, suggesting that a 1% increase in the sales volume is associated with a 2.0% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. 28 of the 29 coefficients are still positive and statistically significant. One coefficient, for the front-end-candies category, is negative but not statistically significant. The average coefficient is 0.018, suggesting that a 1% increase in the sales volume is associated with a 1.8% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.041, suggesting that a 1% increase in the sales volume is associated with a 4.1% increase in the likelihood of a small price change.

Table B4 presents the results where we define small price changes as price changes up to 5%. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that 28 of the 29 coefficients of the log of the average sales volume are positive and statistically

significant. One coefficient, for the front-end-candies category, is negative, but it is not statistically significant. The average coefficient is 0.037, suggesting that a 1% increase in the sales volume is associated with a 3.7% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). All the coefficients are positive and 28 of the 29 of them are statistically significant. The average coefficient is 0.032, suggesting that a 1% increase in the sales volume is associated with a 3.2% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All the coefficients are positive and 28 of the 29 of them are statistically significant. The average coefficient is 0.028, suggesting that a 1% increase in the sales volume is associated with a 2.8% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.048, suggesting that a 1% increase in the sales volume is associated with a 4.8% increase in the likelihood of a small price change.

Table B5 presents the results where we define small price changes as price changes of up to 50% of the average price in the category. In other words, a price change, $\Delta p_{i,s,t}$, of product i in store s in week t is small if $\left|\Delta p_{i,s,t}\right| \leq 0.50|\overline{\Delta p}|$, where $\overline{\Delta p}$ is the average size of a price change in the corresponding category. In column 1, the only control variables are the log of the average sales volume, and dummies for months, years, stores, and products. We find that all 29 coefficients of the log of the average sales volume are positive, and 27 of them are statistically significant. The average coefficient is 0.035, suggesting that a 1% increase in the sales volume is associated with a 3.5% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). 28 of the 29 of the

coefficients are positive and statistically significant. One coefficient, for the oatmeal category, is negative but not statistically significant. The average coefficient is 0.031, suggesting that a 1% increase in the sales volume is associated with a 3.1% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. 28 of the 29 coefficients are positive and statistically significant. One coefficient, for the oatmeal category, is negative but not statistically significant. The average coefficient is 0.027, suggesting that a 1% increase in the sales volume is associated with a 2.7% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and 28 of the 29 are statistically significant. The average coefficient is 0.040, suggesting that a 1% increase in the sales volume is associated with a 4.0% increase in the likelihood of a small price change.

Table B6 presents the results where we define small price changes as price changes up to 33% of the average price in the category. In other words, a price change, $\Delta p_{i,s,t}$, of product i in store s in week t is small if $\left|\Delta p_{i,s,t}\right| \leq 0.33|\overline{\Delta p}|$, where $\overline{\Delta p}$ is the average size of a price change in the corresponding category. In column 1, the only control variables are the log of the average sales volume, and dummies for months, years, stores, and products. We find that all 29 coefficients of the log of the average sales volume are positive. 28 of the coefficients are statistically significant. The average coefficient is 0.035, suggesting that a 1% increase in the sales volume is associated with a 3.5% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). All 29 coefficients are positive and statistically significant. 27 of the coefficients are significant at the 1% level. One more coefficient is significant at the 10% level. The average coefficient is 0.031, suggesting that a 1% increase in the sales volume is associated with a 3.1% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All 29 coefficients are positive and statistically significant. 26 of the coefficients are significant at the 1% level. One more coefficient is significant at the 10% level. The average coefficient is 0.027, suggesting that a 1% increase in the sales volume is associated with a 2.7% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.045, suggesting that a 1% increase in the sales volume is associated with a 4.5% increase in the likelihood of a small price change.

Table B7 presents the results where we define small price changes as price changes up to 25% of the average price in the category. In other words, a price change, $\Delta p_{i,s,t}$, of product i in store s in week t is small if $\left|\Delta p_{i,s,t}\right| \leq 0.25|\overline{\Delta p}|$, where $\overline{\Delta p}$ is the average size of a price change in the corresponding category. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that all 29 coefficients of the log of the average sales volume are positive and statistically significant. The average coefficient is 0.034, suggesting that a 1% increase in the sales volume is associated with a 3.4% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). All 29 coefficients are positive and statistically significant. 28 of the coefficients are significant at the 1% level. The average coefficient is 0.030, suggesting that a 1% increase in the sales volume is associated with a 3.0% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All 29 coefficients are positive and statistically significant. 27 of the coefficients are significant at the 1% level. One more coefficient is significant at the 5% level. The average coefficient is 0.026, suggesting that a 1% increase in the sales volume is associated with a 2.6% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on

regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.047, suggesting that a 1% increase in the sales volume is associated with a 4.7% increase in the likelihood of a small price change.

Table B8 presents the results where we define small price changes as price changes up to 10% of the average price in the category. In other words, a price change, $\Delta p_{i,s,t}$, of product i in store s in week t is small if $\left|\Delta p_{i,s,t}\right| \leq 0.10|\overline{\Delta p}|$, where $\overline{\Delta p}$ is the average size of a price change in the corresponding category. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that all 29 coefficients of the log of the average sales volume are positive. 28 of the coefficients are statistically significant. The average coefficient is 0.019, suggesting that a 1% increase in the sales volume is associated with a 1.9% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). 28 of the 29 coefficients are positive. Except for one coefficient, they are significant at the 1% level. One coefficient, of the front-end-candies category, is negative and statistically significant. The average coefficient is 0.017, suggesting that a 1% increase in the sales volume is associated with a 1.7% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. 28 of the 29 of the coefficients are positive. 24 of these coefficients are significant at the 1% level. 3 more coefficients are significant at the 5% level, and one coefficient at the 10% level. One coefficient, of the front-end-candies category, is negative and statistically significant. The average coefficient is 0.014, suggesting that a 1% increase in the sales volume is associated with a 1.4% increase in the likelihood of a small price change.

As a further control for the effects of sales, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and 28 are statistically significant. The average coefficient is 0.033, suggesting that a 1% increase in the sales volume is associated with a 3.3% increase in the likelihood of a small price change.

Table B1. Category-level regressions of small price changes ($\leq 5¢$) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0187***	0.0162***	0.0117***	0.0216***
	(Std.)	(0.0018)	(0.0016)	(0.0014)	(0.0035)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0221***	0.0239***	0.0214***	0.0499***
	(Std.)	(0.0047)	(0.0048)	(0.0045)	(0.012)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0336***	0.0207***	0.0186***	0.0335***
	(Std.)	(0.0042)	(0.0032)	(0.003)	(0.0063)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0109***	0.0123***	0.0088***	0.022***
	(Std.)	(0.0011)	(0.001)	(0.001)	(0.0046)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0313***	0.0222***	0.0183***	0.0333***
	(Std.)	(0.0032)	(0.0024)	(0.0024)	(0.0047)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0258***	0.0182***	0.0188***	0.0186***
	(Std.)	(0.0045)	(0.0041)	(0.0039)	(0.0046)
	Observations	950357	950357	950357	278543
Canned Tuna	Coefficient	0.0431***	0.0348***	0.0309***	0.0359***
	(Std.)	(0.0039)	(0.0035)	(0.0034)	(0.0046)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0161***	0.0129***	0.0118***	0.0275***
	(Std.)	(0.002)	(0.0017)	(0.0017)	(0.0034)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0328***	0.0173***	0.0127***	0.0145***
	(Std.)	(0.0022)	(0.0014)	(0.0014)	(0.0039)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0234***	0.0234***	0.0232***	0.0296***
	(Std.)	(0.0027)	(0.0027)	(0.0027)	(0.0035)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0335***	0.0293***	0.024***	0.0514***
	(Std.)	(0.0012)	(0.0012)	(0.0011)	(0.0028)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0495***	0.0395***	0.0358***	0.0703***
	(Std.)	(0.0027)	(0.0024)	(0.0024)	(0.0041)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0418***	0.0303***	0.0246***	0.0427***
	(Std.)	(0.0026)	(0.0017)	(0.0016)	(0.0034)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0317***	0.023***	0.0194***	0.0394***
	(Std.)	(0.0028)	(0.0025)	(0.0024)	(0.0046)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	0.01***	0.0138***	0.0123***	0.0158***
	(Std.)	(0.004)	(0.0036)	(0.0035)	(0.0035)
	Observations	487,886	487,886	487,886	157,539

Table B1. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0305***	0.0216***	0.0201***	0.0715***
	(Std.)	(0.0027)	(0.0023)	(0.0023)	(0.0057)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.0178***	0.0179***	0.0171***	0.0499***
	(Std.)	(0.0015)	(0.0012)	(0.0012)	(0.0028)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.03***	0.0245***	0.0221***	0.0373***
	(Std.)	(0.0028)	(0.0024)	(0.0024)	(0.0052)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0187***	0.0209***	0.0161***	0.0298***
	(Std.)	(0.0014)	(0.0014)	(0.0012)	(0.0031)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.0175***	0.0129***	0.0094***	0.0194***
	(Std.)	(0.0018)	(0.0017)	(0.0017)	(0.0035)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0339***	0.0237***	0.0212***	0.037***
	(Std.)	(0.0082)	(0.0051)	(0.0048)	(0.0078)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0237***	0.0208***	0.0191***	0.021***
	(Std.)	(0.0056)	(0.0053)	(0.005)	(0.0074)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0254***	0.0167***	0.0141***	0.034***
	(Std.)	(0.0026)	(0.0025)	(0.0024)	(0.0051)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0135***	0.0162***	0.0136***	0.026***
	(Std.)	(0.0007)	(0.0007)	(0.0007)	(0.0021)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0332***	0.0287***	0.0242***	0.0564***
	(Std.)	(0.0022)	(0.002)	(0.0017)	(0.0035)
	Observations	800,253	800,253	800,253	143,143
Soap	Coefficient	0.0481***	0.0327***	0.0259***	0.053***
	(Std.)	(0.0033)	(0.0029)	(0.0028)	(0.0051)
	Observations	324,724	324,724	324,724	96,574
Soft Drinks	Coefficient	0.0148***	0.017***	0.0135***	0.0537***
	(Std.)	(0.0009)	(0.0007)	(0.0007)	(0.0029)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Toothbrushes	Coefficient	0.0144***	0.0159***	0.0119***	0.0329***
	(Std.)	(0.0018)	(0.0018)	(0.0016)	(0.0046)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0166***	0.0168***	0.0134***	0.0445***
	(Std.)	(0.0017)	(0.0014)	(0.0013)	(0.0047)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 5¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B2. Category-level regressions of small price changes ($\leq 15¢$) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0458***	0.0374***	0.0286***	0.048***
	(Std.)	(0.004)	(0.0032)	(0.0028)	(0.0057)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0532***	0.0581***	0.055***	0.0948***
	(Std.)	(0.0083)	(0.0087)	(0.0087)	(0.0153)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0411***	0.0248***	0.0232***	0.0293***
	(Std.)	(0.0063)	(0.0054)	(0.0054)	(0.0061)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0305***	0.0325***	0.026***	0.0771***
	(Std.)	(0.0017)	(0.0013)	(0.0012)	(0.005)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0428***	0.0336***	0.0293***	0.0282***
	(Std.)	(0.0035)	(0.0029)	(0.003)	(0.0039)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0208***	0.0136***	0.0139***	0.0062***
	(Std.)	(0.003)	(0.0024)	(0.0024)	(0.0024)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.0261***	0.0168***	0.0141***	0.0197***
	(Std.)	(0.0044)	(0.0035)	(0.0033)	(0.0039)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0292***	0.0228***	0.0218***	0.0238***
	(Std.)	(0.0028)	(0.0024)	(0.0025)	(0.0034)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0333***	0.0193***	0.0164***	0.0101***
	(Std.)	(0.0029)	(0.0024)	(0.0023)	(0.0027)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0158***	0.0157***	0.0155***	0.0127***
	(Std.)	(0.0029)	(0.0031)	(0.0031)	(0.0035)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0384***	0.0326***	0.0268***	0.0371***
	(Std.)	(0.0016)	(0.0015)	(0.0014)	(0.0027)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0361***	0.0252***	0.0217***	0.0339***
	(Std.)	(0.0029)	(0.0027)	(0.0026)	(0.0044)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0459***	0.0333***	0.0295***	0.0354***
	(Std.)	(0.0029)	(0.0028)	(0.0028)	(0.0033)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0454***	0.033***	0.0296***	0.0449***
	(Std.)	(0.0046)	(0.0043)	(0.0044)	(0.0045)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	0.0054**	0.0081***	0.0076***	0.0048**
	(Std.)	(0.0036)	(0.0025)	(0.0025)	(0.0025)
	Observations	487,886	487,886	487,886	157,539

Table B2. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0488***	0.0375***	0.0367***	0.0767***
	(Std.)	(0.003)	(0.0029)	(0.0029)	(0.0054)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.0371***	0.0365***	0.0359***	0.0597***
	(Std.)	(0.0018)	(0.0016)	(0.0015)	(0.0034)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0317***	0.0249***	0.0234***	0.0155***
	(Std.)	(0.0039)	(0.0035)	(0.0034)	(0.0043)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0534***	0.0597***	0.0529***	0.0739***
	(Std.)	(0.0025)	(0.0023)	(0.0023)	(0.0054)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.0452***	0.034***	0.029***	0.0473***
	(Std.)	(0.0032)	(0.003)	(0.0029)	(0.0046)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0249***	0.0136***	0.0128***	0.0182**
	(Std.)	(0.0056)	(0.004)	(0.0041)	(0.0104)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0222***	0.0161**	0.0157**	0.0228***
	(Std.)	(0.0096)	(0.0098)	(0.0099)	(0.0075)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0316***	0.0202***	0.0179***	0.0237***
	(Std.)	(0.0034)	(0.0031)	(0.003)	(0.0037)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0404***	0.0511***	0.0452***	0.0742***
	(Std.)	(0.0017)	(0.0017)	(0.0016)	(0.0041)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0312***	0.0261***	0.02***	0.0346***
	(Std.)	(0.0018)	(0.0016)	(0.0016)	(0.0033)
	Observations	800,253	800,253	800,253	143,143
Soap	Coefficient	0.0534***	0.0383***	0.0327***	0.0416***
	(Std.)	(0.0045)	(0.0043)	(0.0042)	(0.0047)
	Observations	324,724	324,724	324,724	96,574
Soft Drinks	Coefficient	0.0174***	0.0189***	0.017***	0.0454***
	(Std.)	(0.0012)	(0.001)	(0.001)	(0.0025)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Toothbrushes	Coefficient	0.0343***	0.0379***	0.0311***	0.072***
	(Std.)	(0.0029)	(0.0029)	(0.0028)	(0.0068)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0363***	0.0353***	0.0307***	0.0611***
	(Std.)	(0.0039)	(0.0029)	(0.0028)	(0.0057)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 15¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B3. Category-level regressions of small price changes ($\leq 2\%$) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0367***	0.0301***	0.0234***	0.0432***
	(Std.)	(0.003)	(0.0022)	(0.002)	(0.0048)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0159***	0.0176***	0.0159***	0.0427***
	(Std.)	(0.0034)	(0.0035)	(0.0034)	(0.0107)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0286***	0.0191***	0.0177***	0.0336***
	(Std.)	(0.0042)	(0.0029)	(0.0028)	(0.0072)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0265***	0.0286***	0.0221***	0.0722***
	(Std.)	(0.0018)	(0.0014)	(0.0013)	(0.0058)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0271***	0.0193***	0.0162***	0.0285***
	(Std.)	(0.0025)	(0.0018)	(0.0017)	(0.0051)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0163***	0.0113***	0.0116***	0.0147***
	(Std.)	(0.0022)	(0.0018)	(0.0017)	(0.0046)
	Observations	950357	950357	950357	278543
Canned Tuna	Coefficient	0.0337***	0.027***	0.0242***	0.0353***
	(Std.)	(0.0035)	(0.0028)	(0.0026)	(0.0046)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0189***	0.0156***	0.0146***	0.029***
	(Std.)	(0.002)	(0.0015)	(0.0015)	(0.0035)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0366***	0.0206***	0.0171***	0.0181***
	(Std.)	(0.0022)	(0.0012)	(0.0011)	(0.0041)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0243***	0.0248***	0.0245***	0.0305***
	(Std.)	(0.0024)	(0.0024)	(0.0024)	(0.0029)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0269***	0.0227***	0.0191***	0.0489***
	(Std.)	(0.001)	(0.0009)	(0.0009)	(0.003)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0428***	0.0336***	0.0307***	0.0682***
	(Std.)	(0.0024)	(0.002)	(0.002)	(0.0048)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.041***	0.0292***	0.0251***	0.0462***
	(Std.)	(0.0022)	(0.0014)	(0.0014)	(0.0036)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0376***	0.0272***	0.0241***	0.043***
	(Std.)	(0.0027)	(0.0021)	(0.002)	(0.0052)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	-0.0028*	-0.0012	-0.0009	0.0076***
	(Std.)	(0.002)	(0.0017)	(0.0017)	(0.003)
	Observations	487,886	487,886	487,886	157,539

Table B3. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0305***	0.0219***	0.0206***	0.0718***
	(Std.)	(0.0023)	(0.0016)	(0.0015)	(0.0053)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.0127***	0.013***	0.0124***	0.0464***
	(Std.)	(0.0014)	(0.0011)	(0.0011)	(0.0028)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0196***	0.0152***	0.0141***	0.0335***
	(Std.)	(0.002)	(0.0016)	(0.0016)	(0.0049)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0203***	0.0233***	0.0186***	0.0392***
	(Std.)	(0.0022)	(0.0021)	(0.0017)	(0.0035)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.0381***	0.0282***	0.0234***	0.0457***
	(Std.)	(0.0026)	(0.0019)	(0.0019)	(0.0043)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0311***	0.0193***	0.0174***	0.0281***
	(Std.)	(0.0064)	(0.0032)	(0.0029)	(0.0061)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0192***	0.0202***	0.0194***	0.0424***
	(Std.)	(0.0039)	(0.0033)	(0.0031)	(0.0082)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0232***	0.0146***	0.0127***	0.035***
	(Std.)	(0.0022)	(0.0015)	(0.0015)	(0.0051)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0098***	0.0134***	0.0118***	0.0318***
	(Std.)	(0.0007)	(0.0007)	(0.0007)	(0.0027)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0273***	0.0232***	0.0195***	0.0536***
	(Std.)	(0.0017)	(0.0014)	(0.0012)	(0.0037)
	Observations	800,253	800,253	800,253	143,143
Soap	Coefficient	0.0528***	0.0354***	0.0301***	0.0551***
	(Std.)	(0.0035)	(0.0024)	(0.0024)	(0.0057)
	Observations	324,724	324,724	324,724	96,574
Soft Drinks	Coefficient	0.0126***	0.0124***	0.0109***	0.0588***
	(Std.)	(0.0006)	(0.0006)	(0.0005)	(0.0035)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Toothbrushes	Coefficient	0.01***	0.0116***	0.0089***	0.0314***
	(Std.)	(0.0012)	(0.0013)	(0.0012)	(0.0045)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0155***	0.0155***	0.0128***	0.0457***
	(Std.)	(0.0015)	(0.0012)	(0.0011)	(0.005)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 2%, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B4. Category-level regressions of small price changes ($\leq 5\%$) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0594***	0.0505***	0.0403***	0.0575***
	(Std.)	(0.0047)	(0.0039)	(0.0035)	(0.0067)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0448***	0.0497***	0.0469***	0.0999***
	(Std.)	(0.0087)	(0.0092)	(0.0091)	(0.0162)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0357***	0.0217***	0.0194***	0.0269***
	(Std.)	(0.0055)	(0.0042)	(0.004)	(0.0066)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0465***	0.0486***	0.0349***	0.0998***
	(Std.)	(0.002)	(0.0017)	(0.0017)	(0.0051)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0393***	0.0308***	0.0261***	0.0257***
	(Std.)	(0.0034)	(0.0028)	(0.0029)	(0.0041)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0186***	0.0116***	0.0123***	0.0196***
	(Std.)	(0.0052)	(0.0048)	(0.0046)	(0.005)
	Observations	950357	950357	950357	278543
Canned Tuna	Coefficient	0.0328***	0.0267***	0.0227***	0.034***
	(Std.)	(0.0039)	(0.0036)	(0.0034)	(0.0043)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0286***	0.0229***	0.022***	0.0266***
	(Std.)	(0.0031)	(0.0027)	(0.0028)	(0.0033)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0363***	0.0218***	0.0177***	0.0112***
	(Std.)	(0.0026)	(0.0022)	(0.0021)	(0.003)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0189***	0.0182***	0.0183***	0.0196***
	(Std.)	(0.0027)	(0.0028)	(0.0027)	(0.0031)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0439***	0.0382***	0.0318***	0.0548***
	(Std.)	(0.0017)	(0.0016)	(0.0015)	(0.003)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.055***	0.043***	0.0385***	0.0534***
	(Std.)	(0.0033)	(0.0033)	(0.0031)	(0.0058)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0494***	0.0368***	0.0318***	0.0408***
	(Std.)	(0.0029)	(0.0028)	(0.0028)	(0.0038)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0472***	0.0345***	0.0306***	0.0475***
	(Std.)	(0.0042)	(0.004)	(0.0042)	(0.0045)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	-0.0004	0.0029	0.0021	0.0127***
	(Std.)	(0.0043)	(0.004)	(0.004)	(0.0038)
	Observations	487,886	487,886	487,886	157,539

Table B4. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0452***	0.0343***	0.0332***	0.0789***
	(Std.)	(0.0026)	(0.0024)	(0.0024)	(0.0058)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.03***	0.0301***	0.0293***	0.061***
	(Std.)	(0.0017)	(0.0013)	(0.0013)	(0.0033)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0333***	0.0271***	0.0246***	0.0377***
	(Std.)	(0.0032)	(0.0028)	(0.0027)	(0.005)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0475***	0.0529***	0.0464***	0.0701***
	(Std.)	(0.0024)	(0.0024)	(0.0023)	(0.0049)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.0555***	0.0425***	0.0364***	0.0526***
	(Std.)	(0.0038)	(0.0036)	(0.0035)	(0.0047)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0343***	0.0224***	0.0214***	0.0293***
	(Std.)	(0.0071)	(0.0056)	(0.0055)	(0.006)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0294***	0.027***	0.0256***	0.0286***
	(Std.)	(0.007)	(0.0062)	(0.0062)	(0.009)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0286***	0.0194***	0.0168***	0.0274***
	(Std.)	(0.0034)	(0.0029)	(0.0027)	(0.0042)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0307***	0.0388***	0.0347***	0.063***
	(Std.)	(0.0015)	(0.0015)	(0.0014)	(0.0037)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0428***	0.037***	0.0323***	0.059***
	(Std.)	(0.0032)	(0.0029)	(0.0027)	(0.0036)
	Observations	800,253	800,253	800,253	143,143
Soap	Coefficient	0.0608***	0.0446***	0.0378***	0.0515***
	(Std.)	(0.0041)	(0.004)	(0.0038)	(0.0051)
	Observations	324,724	324,724	324,724	96,574
Soft Drinks	Coefficient	0.0237***	0.0239***	0.0201***	0.0653***
	(Std.)	(0.0009)	(0.0008)	(0.0007)	(0.0032)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Toothbrushes	Coefficient	0.0282***	0.0318***	0.0267***	0.0743***
	(Std.)	(0.0024)	(0.0024)	(0.0024)	(0.0069)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0348***	0.035***	0.0307***	0.0718***
	(Std.)	(0.0029)	(0.0022)	(0.002)	(0.0062)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 5%, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B5. Category-level regressions of small price changes (less or equal 50% of the average price change) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0535***	0.0438***	0.0337***	0.0479***
	(Std.)	(0.0051)	(0.0043)	(0.0039)	(0.0061)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0478***	0.0512***	0.0479***	0.0946***
	(Std.)	(0.0074)	(0.0076)	(0.0077)	(0.0175)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0367***	0.0293***	0.0278***	0.0326***
	(Std.)	(0.0067)	(0.0053)	(0.0053)	(0.0064)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0507***	0.0521***	0.0362***	0.1009***
	(Std.)	(0.0022)	(0.0021)	(0.002)	(0.0055)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0391***	0.0338***	0.0297***	0.0271***
	(Std.)	(0.0031)	(0.003)	(0.003)	(0.0039)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0163***	0.0136***	0.0139***	0.0113***
	(Std.)	(0.0033)	(0.0031)	(0.0031)	(0.0032)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.0426***	0.037***	0.0325***	0.035***
	(Std.)	(0.0043)	(0.0039)	(0.0036)	(0.0046)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0285***	0.0231***	0.0224***	0.0181***
	(Std.)	(0.003)	(0.0027)	(0.0028)	(0.0024)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0325***	0.0192***	0.0167***	0.0095***
	(Std.)	(0.0027)	(0.0023)	(0.0023)	(0.0028)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0043**	0.0045**	0.0046***	0.0059***
	(Std.)	(0.0022)	(0.0022)	(0.0022)	(0.0021)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0391***	0.0332***	0.0271***	0.0361***
	(Std.)	(0.0017)	(0.0017)	(0.0015)	(0.0027)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0385***	0.0274***	0.024***	0.038***
	(Std.)	(0.003)	(0.0028)	(0.0026)	(0.0049)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0429***	0.0314***	0.0281***	0.0367***
	(Std.)	(0.003)	(0.0029)	(0.003)	(0.0034)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0401***	0.0326***	0.029***	0.0403***
	(Std.)	(0.0043)	(0.0042)	(0.0043)	(0.0045)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	0.0038*	0.0082***	0.007***	0.0086***
	(Std.)	(0.0032)	(0.0027)	(0.0027)	(0.003)
	Observations	487,886	487,886	487,886	157,539

Table B5. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0339***	0.0246***	0.0238***	0.0508***
	(Std.)	(0.0046)	(0.0045)	(0.0046)	(0.0054)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.0307***	0.0315***	0.0311***	0.0387***
	(Std.)	(0.0028)	(0.0025)	(0.0024)	(0.0047)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0326***	0.0258***	0.0245***	0.0189***
	(Std.)	(0.0038)	(0.0037)	(0.0036)	(0.0042)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0558***	0.062***	0.0591***	0.0709***
	(Std.)	(0.0028)	(0.0029)	(0.0029)	(0.0049)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.0508***	0.044***	0.0384***	0.0484***
	(Std.)	(0.0037)	(0.0035)	(0.0033)	(0.0042)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0079**	-0.0029	-0.0028	0.0067*
	(Std.)	(0.0056)	(0.0044)	(0.0044)	(0.0054)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0242***	0.0265***	0.0247***	0.0291***
	(Std.)	(0.0072)	(0.0077)	(0.0076)	(0.0078)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0244***	0.017***	0.0145***	0.0216***
	(Std.)	(0.0032)	(0.0027)	(0.0026)	(0.0036)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0557***	0.0655***	0.0602***	0.074***
	(Std.)	(0.0022)	(0.0021)	(0.002)	(0.0043)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0158***	0.015***	0.0136***	0.033***
	(Std.)	(0.0011)	(0.0011)	(0.0011)	(0.0024)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Soap	Coefficient	0.0311***	0.0258***	0.0197***	0.0331***
	(Std.)	(0.0017)	(0.0016)	(0.0017)	(0.0033)
	Observations	800,253	800,253	800,253	143,143
Soft Drinks	Coefficient	0.0499***	0.0367***	0.0316***	0.0439***
	(Std.)	(0.0043)	(0.0043)	(0.0043)	(0.005)
	Observations	324,724	324,724	324,724	96,574
Toothbrushes	Coefficient	0.0391***	0.0438***	0.0364***	0.0669***
	(Std.)	(0.0044)	(0.0042)	(0.0039)	(0.0068)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0435***	0.0434***	0.0372***	0.0691***
	(Std.)	(0.004)	(0.0032)	(0.0031)	(0.0055)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to $0.5|\overline{\Delta p}|$ where $\overline{\Delta p}$ is the average price change in the category, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B6. Category-level regressions of small price changes (less or equal 33% of the average price change) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0495***	0.0407***	0.0326***	0.0503***
	(Std.)	(0.0045)	(0.0037)	(0.0034)	(0.0059)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0552***	0.0579***	0.0544***	0.0962***
	(Std.)	(0.0073)	(0.0076)	(0.0079)	(0.015)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0237***	0.0153***	0.0124***	0.0355***
	(Std.)	(0.0062)	(0.0047)	(0.0042)	(0.0069)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0439***	0.0452***	0.0325***	0.0974***
	(Std.)	(0.0019)	(0.0015)	(0.0013)	(0.005)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0436***	0.0377***	0.0322***	0.0375***
	(Std.)	(0.0034)	(0.0031)	(0.0032)	(0.0044)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0184***	0.0151***	0.0157***	0.0205***
	(Std.)	(0.0045)	(0.0044)	(0.0041)	(0.0046)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.0387***	0.033***	0.0288***	0.0351***
	(Std.)	(0.0036)	(0.0033)	(0.0032)	(0.0048)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0274***	0.0224***	0.0214***	0.0236***
	(Std.)	(0.0029)	(0.0025)	(0.0025)	(0.0034)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0427***	0.0274***	0.0219***	0.021***
	(Std.)	(0.0026)	(0.0021)	(0.002)	(0.0041)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0111***	0.0116***	0.0114***	0.0085***
	(Std.)	(0.0023)	(0.0026)	(0.0026)	(0.0027)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0365***	0.0305***	0.0274***	0.0395***
	(Std.)	(0.0016)	(0.0015)	(0.0014)	(0.0028)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0583***	0.0476***	0.0422***	0.072***
	(Std.)	(0.0034)	(0.0032)	(0.0029)	(0.0069)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0518***	0.04***	0.0332***	0.0482***
	(Std.)	(0.0034)	(0.0028)	(0.0026)	(0.0042)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.034***	0.0264***	0.0242***	0.0411***
	(Std.)	(0.0042)	(0.0039)	(0.004)	(0.0047)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	0.0016	0.006***	0.0049**	0.007**
	(Std.)	(0.0036)	(0.003)	(0.003)	(0.0033)
	Observations	487,886	487,886	487,886	157,539

Table B6. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0405***	0.0306***	0.0297***	0.0745***
	(Std.)	(0.004)	(0.004)	(0.004)	(0.0053)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.0343***	0.0353***	0.0349***	0.0517***
	(Std.)	(0.0021)	(0.0017)	(0.0017)	(0.0038)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0326***	0.0261***	0.0232***	0.0341***
	(Std.)	(0.0033)	(0.003)	(0.0028)	(0.0045)
	Observations	658,225	658,225	658,225	150,64
Grooming Products	Coefficient	0.0486***	0.0545***	0.0487***	0.0709***
	(Std.)	(0.0025)	(0.0023)	(0.0022)	(0.0053)
	Observations	659,842	659,842	659,842	10,669
Laundry Detergents	Coefficient	0.0458***	0.0389***	0.0333***	0.0445***
	(Std.)	(0.0034)	(0.0033)	(0.0032)	(0.0044)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0199***	0.0085***	0.0075**	0.0143**
	(Std.)	(0.006)	(0.0042)	(0.0043)	(0.0112)
	Observations	169,093	169,093	169,093	6,705
Paper Towels	Coefficient	0.0166***	0.0186***	0.0168***	0.0174***
	(Std.)	(0.0061)	(0.0061)	(0.0057)	(0.0083)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0293***	0.0217***	0.0197***	0.0267***
	(Std.)	(0.0034)	(0.003)	(0.0029)	(0.0043)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0465***	0.0554***	0.0482***	0.0766***
	(Std.)	(0.0018)	(0.0017)	(0.0017)	(0.0042)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0163***	0.0156***	0.0146***	0.0355***
	(Std.)	(0.0011)	(0.0011)	(0.0011)	(0.0024)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Soap	Coefficient	0.0313***	0.0257***	0.0232***	0.0418***
	(Std.)	(0.002)	(0.0018)	(0.0018)	(0.0038)
	Observations	800,253	800,253	800,253	143,143
Soft Drinks	Coefficient	0.0524***	0.0376***	0.0298***	0.0525***
	(Std.)	(0.0033)	(0.0034)	(0.0032)	(0.0049)
	Observations	324,724	324,724	324,724	96,574
Toothbrushes	Coefficient	0.0341***	0.0386***	0.0313***	0.0722***
	(Std.)	(0.003)	(0.0029)	(0.0027)	(0.0068)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0333***	0.0333***	0.0302***	0.0683***
	(Std.)	(0.003)	(0.0024)	(0.0024)	(0.0058)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or to $0.33|\overline{\Delta p}|$ where $\overline{\Delta p}$ is the average price change in the category, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B7. Category-level regressions of small price changes (less or equal 25% of the average price change) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0495***	0.0421***	0.0313***	0.0516***
	(Std.)	(0.0043)	(0.0034)	(0.003)	(0.0057)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0464***	0.0498***	0.0481***	0.082***
	(Std.)	(0.0088)	(0.0091)	(0.0091)	(0.0163)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.029***	0.0209***	0.0182***	0.0363***
	(Std.)	(0.0052)	(0.0039)	(0.0036)	(0.0068)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0379***	0.0392***	0.0311***	0.0896***
	(Std.)	(0.0019)	(0.0014)	(0.0012)	(0.0051)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.037***	0.0309***	0.0259***	0.0317***
	(Std.)	(0.0033)	(0.0029)	(0.003)	(0.0042)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0204***	0.0169***	0.0175***	0.0183***
	(Std.)	(0.0042)	(0.004)	(0.0038)	(0.0047)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.035***	0.0297***	0.0263***	0.0345***
	(Std.)	(0.0031)	(0.0027)	(0.0025)	(0.0041)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0218***	0.0173***	0.0165***	0.0273***
	(Std.)	(0.0029)	(0.0026)	(0.0027)	(0.0034)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0363***	0.0207***	0.0156***	0.0162***
	(Std.)	(0.0025)	(0.0018)	(0.0017)	(0.0041)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0122***	0.0127***	0.0125***	0.0115***
	(Std.)	(0.003)	(0.0033)	(0.0032)	(0.0033)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0462***	0.0408***	0.0339***	0.0666***
	(Std.)	(0.0016)	(0.0015)	(0.0013)	(0.0031)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0554***	0.0442***	0.0399***	0.0689***
	(Std.)	(0.0029)	(0.0027)	(0.0026)	(0.0047)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0422***	0.0307***	0.0245***	0.0404***
	(Std.)	(0.0032)	(0.0025)	(0.0023)	(0.0037)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.039***	0.0312***	0.0267***	0.0479***
	(Std.)	(0.0038)	(0.0034)	(0.0033)	(0.0051)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	0.0093***	0.0133***	0.012***	0.0157***
	(Std.)	(0.0041)	(0.0038)	(0.0037)	(0.0037)
	Observations	487,886	487,886	487,886	157,539

Table B7. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0471***	0.0371***	0.0364***	0.0791***
	(Std.)	(0.0027)	(0.0024)	(0.0025)	(0.005)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.0369***	0.0378***	0.0371***	0.0601***
	(Std.)	(0.0018)	(0.0016)	(0.0016)	(0.0036)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0286***	0.0226***	0.0199***	0.0311***
	(Std.)	(0.003)	(0.0026)	(0.0025)	(0.0045)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0391***	0.045***	0.041***	0.0628***
	(Std.)	(0.0023)	(0.0022)	(0.0022)	(0.0055)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.0459***	0.0394***	0.0331***	0.0533***
	(Std.)	(0.0034)	(0.0033)	(0.0032)	(0.0049)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0199***	0.0084**	0.0075**	0.0206***
	(Std.)	(0.0073)	(0.005)	(0.0051)	(0.0094)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0181***	0.0199***	0.0184***	0.0213***
	(Std.)	(0.0052)	(0.0051)	(0.0049)	(0.0072)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0286***	0.0208***	0.0175***	0.0349***
	(Std.)	(0.0034)	(0.0028)	(0.0026)	(0.0043)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0361***	0.0448***	0.041***	0.0699***
	(Std.)	(0.0016)	(0.0015)	(0.0015)	(0.0042)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.0197***	0.0191***	0.017***	0.0454***
	(Std.)	(0.0011)	(0.001)	(0.001)	(0.0025)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Soap	Coefficient	0.044***	0.0387***	0.0334***	0.0688***
	(Std.)	(0.003)	(0.0028)	(0.0024)	(0.0037)
	Observations	800,253	800,253	800,253	143,143
Soft Drinks	Coefficient	0.045***	0.0305***	0.0232***	0.0494***
	(Std.)	(0.0031)	(0.0028)	(0.0027)	(0.0048)
	Observations	324,724	324,724	324,724	96,574
Toothbrushes	Coefficient	0.0269***	0.0309***	0.0266***	0.0639***
	(Std.)	(0.0031)	(0.003)	(0.0029)	(0.0068)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0323***	0.0323***	0.0268***	0.0659***
	(Std.)	(0.0026)	(0.0021)	(0.0019)	(0.0056)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or to $0.25|\overline{\Delta p}|$ where $\overline{\Delta p}$ is the average price change in the category, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table B8. Category-level regressions of small price changes (less or equal 10% of the average price change) and sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0253***	0.0222***	0.0157***	0.0291***
	(Std.)	(0.0022)	(0.0019)	(0.0017)	(0.0042)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.0152***	0.0163***	0.0145***	0.0286***
	(Std.)	(0.0032)	(0.0031)	(0.0029)	(0.0078)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0159***	0.0103***	0.0092***	0.0192***
	(Std.)	(0.0039)	(0.003)	(0.0029)	(0.0063)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0212***	0.0217***	0.016***	0.0448***
	(Std.)	(0.0015)	(0.0013)	(0.0013)	(0.0055)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0146***	0.0116***	0.0095***	0.0216***
	(Std.)	(0.002)	(0.0018)	(0.0018)	(0.0046)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0148***	0.0114***	0.0118***	0.0113***
	(Std.)	(0.0031)	(0.0029)	(0.0029)	(0.005)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.0149***	0.0129***	0.0116***	0.0206***
	(Std.)	(0.0016)	(0.0014)	(0.0014)	(0.0032)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0146***	0.0123***	0.0113***	0.0273***
	(Std.)	(0.0019)	(0.0016)	(0.0016)	(0.0033)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0226***	0.0147***	0.0124***	0.0228***
	(Std.)	(0.0022)	(0.0016)	(0.0016)	(0.0039)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0224***	0.0224***	0.0218***	0.0234***
	(Std.)	(0.0032)	(0.0032)	(0.0032)	(0.004)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0248***	0.0223***	0.0188***	0.044***
	(Std.)	(0.0011)	(0.001)	(0.001)	(0.0026)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0277***	0.0242***	0.0225***	0.0493***
	(Std.)	(0.002)	(0.0018)	(0.0018)	(0.0032)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0236***	0.0178***	0.0147***	0.03***
	(Std.)	(0.0017)	(0.0013)	(0.0013)	(0.0032)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0243***	0.0195***	0.0168***	0.0379***
	(Std.)	(0.0026)	(0.0024)	(0.0023)	(0.0057)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	-0.0144***	-0.0118***	-0.012***	0.0031
	(Std.)	(0.0035)	(0.0031)	(0.0032)	(0.0039)
	Observations	487,886	487,886	487,886	157,539

Table B8. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient (Std.)	0.0314*** (0.0026)	0.0228*** (0.0021)	0.0213*** (0.002)	0.0729*** (0.0056)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient (Std.)	0.0257*** (0.0016)	0.0265*** (0.0014)	0.0254*** (0.0013)	0.0612*** (0.0031)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient (Std.)	0.0183*** (0.0022)	0.0146*** (0.0019)	0.0135*** (0.0019)	0.032*** (0.0058)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient (Std.)	0.015*** (0.0013)	0.0165*** (0.0013)	0.0125*** (0.0011)	0.0261*** (0.0028)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient (Std.)	0.0243*** (0.0023)	0.0197*** (0.0022)	0.0147*** (0.0021)	0.0294*** (0.0039)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient (Std.)	0.0325*** (0.0075)	0.0235*** (0.005)	0.0213*** (0.0045)	0.0418*** (0.0084)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient (Std.)	0.0111*** (0.0033)	0.012*** (0.0028)	0.0114*** (0.0027)	0.0329*** (0.0079)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient (Std.)	0.0194*** (0.0018)	0.0146*** (0.0016)	0.0128*** (0.0016)	0.0376*** (0.0052)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient (Std.)	0.0102*** (0.0006)	0.0116*** (0.0006)	0.0097*** (0.0006)	0.018*** (0.0018)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient (Std.)	0.0199*** (0.0008)	0.0196*** (0.0008)	0.0152*** (0.0007)	0.0547*** (0.0028)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Soap	Coefficient (Std.)	0.024*** (0.0019)	0.0212*** (0.0018)	0.0182*** (0.0016)	0.0533*** (0.0036)
	Observations	800,253	800,253	800,253	143,143
Soft Drinks	Coefficient (Std.)	0.0317*** (0.0022)	0.0244*** (0.0019)	0.0207*** (0.0019)	0.0423*** (0.0051)
	Observations	324,724	324,724	324,724	96,574
Toothbrushes	Coefficient (Std.)	0.0123*** (0.0017)	0.0134*** (0.0017)	0.0104*** (0.0015)	0.0287*** (0.0042)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient (Std.)	0.0104*** (0.0012)	0.0104*** (0.0011)	0.0084*** (0.001)	0.0236*** (0.0035)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or to $0.10|\overline{\Delta p}|$ where $\overline{\Delta p}$ is the average price change in the category, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Appendix C. Using all price changes

In the paper, we use observations on price changes only if we observe the price in both week *t* and *t*+1. In this appendix, we re-run the regressions we report in Table 3 in the paper, but this time using observations on all price changes. As in the paper, we define small price changes as price changes smaller than, or equal to, 10¢.

Table C1 presents the results of regressions equivalent to the regressions in Table 3 in the paper. The regressions take the following form:

$$\begin{aligned} small\ \ price\ change_{i,s,t} = \alpha + \beta \log(average\ sales\ volume_{i,s}) + \gamma \mathbf{X}_{i,s,t} \\ + month_t + year_t + \delta_s + \mu_i + u_{i,s,t} \end{aligned} \quad \text{(C1)}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the sample period. **X** is a matrix of other control variables. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

The values in the table are the coefficients of the log of the average sales volume. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that all the coefficients of the log of the average sales volume are positive and statistically significant. The average coefficient is 0.034, suggesting that a 1% increase in the sales volume is associated with a 3.4% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). Again, all the coefficients are positive and statistically significant. The average coefficient is 0.036, suggesting that a 1% increase in the sales volume is associated with a 3.6% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. All the coefficients are still positive and statistically significant. The average coefficient is 0.032, suggesting that a 1% increase in the sales volume is associated with a 3.2% increase in the likelihood of a

small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. All the coefficients are positive and statistically significant. The average coefficient is 0.055, suggesting that a 1% increase in the sales volume is associated with a 5.5% increase in the likelihood of a small price change.

Table C1. Category-level regressions of small price changes ($\leq 10¢$) and sales volume, using all observations

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0263***	0.0394***	0.0352***	0.0542***
	(Std.)	(0.0027)	(0.0027)	(0.0024)	(0.0041)
	Observations	465,197	465,197	465,197	163,028
Bath Soap	Coefficient	0.0229***	0.0512***	0.0489***	0.0752***
	(Std.)	(0.0065)	(0.0059)	(0.0057)	(0.0089)
	Observations	76,076	76,076	76,076	22,502
Bathroom Tissues	Coefficient	0.0338***	0.0205***	0.0173***	0.0388***
	(Std.)	(0.0057)	(0.0048)	(0.0044)	(0.0074)
	Observations	342,750	342,750	342,750	88,926
Beer	Coefficient	0.0188***	0.029***	0.0245***	0.0559***
	(Std.)	(0.0013)	(0.0014)	(0.0013)	(0.0038)
	Observations	615,345	615,345	615,345	95,951
Bottled Juice	Coefficient	0.052***	0.0456***	0.0404***	0.0515***
	(Std.)	(0.0036)	(0.0031)	(0.0032)	(0.0048)
	Observations	1,043,357	1,043,357	1,043,357	267,459
Canned Soup	Coefficient	0.0264***	0.0205***	0.0207***	0.0306***
	(Std.)	(0.0037)	(0.0033)	(0.0031)	(0.004)
	Observations	1042534	1042534	1042534	308101
Canned Tuna	Coefficient	0.0431***	0.0367***	0.0317***	0.0469***
	(Std.)	(0.0044)	(0.0039)	(0.0036)	(0.005)
	Observations	453,103	453,103	453,103	145,437
Cereals	Coefficient	0.0271***	0.0262***	0.0249***	0.0422***
	(Std.)	(0.0026)	(0.0025)	(0.0025)	(0.0034)
	Observations	768,909	768,909	768,909	282,251
Cheese	Coefficient	0.0406***	0.0285***	0.0238***	0.0291***
	(Std.)	(0.0026)	(0.0022)	(0.0022)	(0.0038)
	Observations	1,926,985	1,926,985	1,926,985	558,238
Cigarettes	Coefficient	0.0129***	0.0143***	0.0135***	0.01***
	(Std.)	(0.0016)	(0.0015)	(0.0015)	(0.0014)
	Observations	154,594	154,594	154,594	135,123
Cookies	Coefficient	0.0478***	0.0476***	0.0413***	0.0682***
	(Std.)	(0.0015)	(0.0015)	(0.0014)	(0.0028)
	Observations	1,555,856	1,555,856	1,555,856	293,228
Crackers	Coefficient	0.0601***	0.0547***	0.0496***	0.0727***
	(Std.)	(0.0035)	(0.0033)	(0.0031)	(0.0058)
	Observations	564,765	564,765	564,765	113,178
Dish Detergent	Coefficient	0.0529***	0.0477***	0.0419***	0.0657***
	(Std.)	(0.0033)	(0.0029)	(0.003)	(0.0044)
	Observations	425,369	425,369	425,369	112,771
Fabric Softener	Coefficient	0.0476***	0.0438***	0.0387***	0.0663***
	(Std.)	(0.0038)	(0.0035)	(0.0036)	(0.0048)
	Observations	405,069	405,069	405,069	123,371
Front-End-Candies	Coefficient	0.0097***	0.0137***	0.0126***	0.0136***
	(Std.)	(0.0032)	(0.0026)	(0.0026)	(0.0032)
	Observations	523,910	523,910	523,910	176,070

Table C1. (Cont.).

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0536***	0.0511***	0.0491***	0.1144***
	(Std.)	(0.0024)	(0.0022)	(0.0022)	(0.0059)
	Observations	566,628	566,628	566,628	86,041
Frozen Entrees	Coefficient	0.0341***	0.0423***	0.0413***	0.0896***
	(Std.)	(0.0018)	(0.0017)	(0.0017)	(0.0039)
	Observations	2,073,655	2,073,655	2,073,655	416,118
Frozen Juices	Coefficient	0.0377***	0.0341***	0.0305***	0.0502***
	(Std.)	(0.0038)	(0.0035)	(0.0033)	(0.0054)
	Observations	699,817	699,817	699,817	162,207
Grooming Products	Coefficient	0.027***	0.0446***	0.0406***	0.0555***
	(Std.)	(0.0017)	(0.0017)	(0.0016)	(0.0036)
	Observations	1,107,987	1,107,987	1,107,987	241,668
Laundry Detergents	Coefficient	0.0335***	0.0307***	0.0257***	0.0479***
	(Std.)	(0.0025)	(0.0023)	(0.0022)	(0.004)
	Observations	659,354	659,354	659,354	184,821
Oatmeal	Coefficient	0.0349***	0.0241***	0.0219***	0.0457***
	(Std.)	(0.0074)	(0.0059)	(0.0059)	(0.0116)
	Observations	180,748	180,748	180,748	69,521
Paper Towels	Coefficient	0.0359***	0.0333***	0.0315***	0.0408***
	(Std.)	(0.009)	(0.0102)	(0.0102)	(0.0082)
	Observations	263,777	263,777	263,777	59,406
Refrigerated Juices	Coefficient	0.0346***	0.0283***	0.025***	0.0472***
	(Std.)	(0.0032)	(0.0029)	(0.0027)	(0.0048)
	Observations	827,359	827,359	827,359	169,826
Shampoos	Coefficient	0.017***	0.0353***	0.0319***	0.044***
	(Std.)	(0.0011)	(0.0012)	(0.0011)	(0.0023)
	Observations	1,330,193	1,330,193	1,330,193	310,372
Snack Crackers	Coefficient	0.0505***	0.0491***	0.0438***	0.0823***
	(Std.)	(0.0035)	(0.0033)	(0.0029)	(0.0045)
	Observations	895,630	895,630	895,630	171,556
Soap	Coefficient	0.0588***	0.0515***	0.0425***	0.0671***
	(Std.)	(0.0044)	(0.004)	(0.0039)	(0.0055)
	Observations	371,571	371,571	371,571	113,918
Soft Drinks	Coefficient	0.0231***	0.0292***	0.0248***	0.0611***
	(Std.)	(0.0012)	(0.001)	(0.0009)	(0.0025)
	Observations	5,145,960	5,145,960	5,145,960	462,850
Toothbrushes	Coefficient	0.0199***	0.037***	0.0311***	0.0536***
	(Std.)	(0.0027)	(0.0027)	(0.0024)	(0.0055)
	Observations	476537	476537	47,6537	96,920
Toothpastes	Coefficient	0.0244***	0.0365***	0.0329***	0.0696***
	(Std.)	(0.0024)	(0.0019)	(0.0019)	(0.0047)
	Observations	762,759	762,759	762,759	153,129

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Appendix D. Using a rolling 52 weeks window to calculate the average sales volumes

In the paper, we calculate the average sales volume for each product in each store over the entire period. This has the advantage of using a long-term "expected" sales volume for each product in each store. However, it implicitly assumes that the retailer can forecast future sales.

An alternative is to assume that the retailer makes decisions based on a recent past. To control for this possibility, we calculate the average sales volume for each product in each store based on data from the previous 52 weeks.

We then use the results to re-estimate regressions similar to the ones that we report in Table 3 in the paper. The regressions take the following form:

$$\begin{aligned} small\ \ price\ change_{i,s,t} = \alpha + \beta \log(average\ sales\ volume_{i,s}) + \gamma \mathbf{X}_{i,s,t} \\ + month_t + year_t + \delta_s + \mu_i + u_{i,s,t} \end{aligned} \quad \text{(D1)}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the 52 weeks preceding week *t*. **X** is a matrix of other control variables. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

The results are summarized in Table D1. The values in the table are the coefficients of the log of the average sales volume. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that 24 of the 29 coefficients of the log of the average sales volume are positive and that 19 of them are statistically significant. Two more coefficients are marginally significant. None of the 5 negative coefficients are statistically significant. The average coefficient is 0.019, suggesting that a 1% increase in the sales volume is associated with a 1.9% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016). We find that 26 of the 29

coefficients are positive and that 20 of them are statistically significant. None of the negative coefficients is statistically significant. The average coefficient is 0.017, suggesting that a 1% increase in the sales volume is associated with a 1.7% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. Again, we find that 26 of the 29 coefficients are positive and that 20 of them are statistically significant. None of the negative coefficients is statistically significant. The average coefficient is 0.015, suggesting that a 1% increase in the sales volume is associated with a 1.5% increase in the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. We find that 27 of the 29 coefficients are positive and 22 of them are statistically significant. One more coefficient (laundry detergents) is marginally significant. Out of the two negative coefficients, one (cheese) is marginally significant. The average coefficient is 0.028, suggesting that a 1% increase in the sales volume is associated with a 2.8% increase in the likelihood of a small price change.

Thus, basing the estimation on the sales volume of the more recent period does not change our main results. The correlation between small price changes and sales volume holds in a large majority of the product categories.

Table D1. Category-level regressions of small price changes ($\leq 10¢$), using a rolling 52 weeks sales volume

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.026***	0.022***	0.017***	0.034***
	(Std.)	(0.008)	(0.007)	(0.007)	(0.012)
	Observations	255,724	255,724	255,724	72,840
Bath Soap	Coefficient	0.031***	0.027***	0.028***	0.038***
	(Std.)	(0.008)	(0.008)	(0.007)	(0.015)
	Observations	31,390	31,390	31,390	5,113
Bathroom Tissues	Coefficient	0.013	0.007	0.003	0.018**
	(Std.)	(0.013)	(0.011)	(0.010)	(0.010)
	Observations	310,257	310,257	310,257	76,420
Beer	Coefficient	0.018***	0.014***	0.011***	0.031***
	(Std.)	(0.002)	(0.002)	(0.002)	(0.006)
	Observations	410,095	410,095	410,095	50,178
Bottled Juice	Coefficient	0.024***	0.013**	0.011**	-0.001
	(Std.)	(0.007)	(0.006)	(0.006)	(0.007)
	Observations	919,362	919,362	919,362	228,259
Canned Soup	Coefficient	-0.007	0.000	0.003	0.007
	(Std.)	(0.007)	(0.006)	(0.006)	(0.007)
	Observations	892,567	892,567	892,567	256,685
Canned Tuna	Coefficient	0.005	0.003	0.001	0.027***
	(Std.)	(0.009)	(0.007)	(0.007)	(0.008)
	Observations	357,329	357,329	357,329	110,671
Cereals	Coefficient	0.015***	0.012***	0.010***	0.010
	(Std.)	(0.006)	(0.004)	(0.004)	(0.009)
	Observations	690,766	690,766	690,766	241,608
Cheese	Coefficient	0.007*	-0.001	-0.003	-0.008*
	(Std.)	(0.006)	(0.005)	(0.005)	(0.006)
	Observations	1,723,472	1,723,472	1,723,472	490,683
Cigarettes	Coefficient	0.013***	0.013***	0.012***	0.010***
	(Std.)	(0.003)	(0.003)	(0.003)	(0.003)
	Observations	46,465	46,465	46,465	39,541
Cookies	Coefficient	0.035***	0.024***	0.022***	0.031***
	(Std.)	(0.004)	(0.004)	(0.004)	(0.007)
	Observations	1,282,112	1,282,112	1,282,112	208,655
Crackers	Coefficient	0.051***	0.037***	0.034***	0.042***
	(Std.)	(0.008)	(0.007)	(0.007)	(0.009)
	Observations	448,672	448,672	448,672	81,054
Dish Detergent	Coefficient	0.034***	0.022***	0.017***	0.023***
	(Std.)	(0.007)	(0.006)	(0.005)	(0.009)
	Observations	353,674	353,674	353,674	87,187
Fabric Softener	Coefficient	0.010*	0.015***	0.012**	0.034***
	(Std.)	(0.008)	(0.006)	(0.006)	(0.011)
	Observations	332,275	332,275	332,275	93,830
Front-End-Candies	Coefficient	-0.006	0.006	0.006	0.008*
	(Std.)	(0.009)	(0.008)	(0.008)	(0.005)
	Observations	467,298	467,298	467,298	141,542

Table D1. (Cont.).

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.057***	0.052***	0.053***	0.071***
	(Std.)	(0.006)	(0.005)	(0.006)	(0.010)
	Observations	443,348	443,348	443,348	58,232
Frozen Entrees	Coefficient	0.019***	0.028***	0.029***	0.053***
	(Std.)	(0.002)	(0.003)	(0.002)	(0.006)
	Observations	1,770,508	1,770,508	1,770,508	318,010
Frozen Juices	Coefficient	0.019***	0.016***	0.012**	0.057***
	(Std.)	(0.007)	(0.007)	(0.007)	(0.009)
	Observations	626,648	626,648	626,648	140,778
Grooming Products	Coefficient	0.028***	0.025***	0.025***	0.029***
	(Std.)	(0.003)	(0.003)	(0.003)	(0.006)
	Observations	594,592	594,592	594,592	88,340
Laundry Detergents	Coefficient	-0.001	0.005	0.001	0.013*
	(Std.)	(0.005)	(0.004)	(0.004)	(0.009)
	Observations	529,882	529,882	529,882	134,426
Oatmeal	Coefficient	-0.002	-0.007	-0.008	0.011
	(Std.)	(0.011)	(0.009)	(0.009)	(0.009)
	Observations	153,894	153,894	153,894	56,320
Paper Towels	Coefficient	0.039***	0.034***	0.030***	0.037***
	(Std.)	(0.014)	(0.014)	(0.013)	(0.015)
	Observations	233,222	233,222	233,222	49,595
Refrigerated Juices	Coefficient	-0.003	-0.001	-0.005	0.022***
	(Std.)	(0.008)	(0.007)	(0.007)	(0.008)
	Observations	763,905	763,905	763,905	150.388
Shampoos	Coefficient	0.023***	0.022***	0.019***	0.019***
	(Std.)	(0.002)	(0.002)	(0.002)	(0.005)
	Observations	589,607	589,607	589,607	65,313
Snack Crackers	Coefficient	0.037***	0.031***	0.027***	0.056***
	(Std.)	(0.005)	(0.005)	(0.005)	(0.008)
	Observations	756,943	756,943	756,943	128,180
Soap	Coefficient	0.011	0.005	0.003	0.024**
	(Std.)	(0.013)	(0.010)	(0.010)	(0.013)
	Observations	291,497	291,49	291,49	83,391
Soft Drinks	Coefficient	0.014***	0.016***	0.014***	0.045***
	(Std.)	(0.003)	(0.003)	(0.003)	(0.004)
	Observations	4,294,961	4,294,961	4,294,961	304,159
Toothbrushes	Coefficient	0.029***	0.026***	0.022***	0.027***
	(Std.)	(0.005)	(0.005)	(0.005)	(0.009)
	Observations	272,745	272,745	272,745	38,637
Toothpastes	Coefficient	0.022***	0.020***	0.017***	0.054***
	(Std.)	(0.005)	(0.004)	(0.005)	(0.009)
	Observations	554,338	554,338	554,338	87,123

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the 52 weeks preceding time *t*. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, and a control for sale- and bounce back prices, which we identify using a sales filter algorithm. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Appendix E: Adding Dominick's pricing zones

According to the Dominick's data manual, Dominick's employed 16 price zones, but in practice priced according to four price tiers: Cub-Fighter, low, medium, and high. Thus, we can use the zones as a proxy for the competition level.

We therefore incorporate the data on pricing zones and re-estimate regressions similar to the ones that we report in Table 3 in the paper. The regressions take the form,

$$\begin{aligned} small\ \ price\ change_{i,s,t} = \alpha + \beta \log(average\ sales\ volume_{i,s}) + \gamma \mathbf{X}_{i,s,t} \\ + month_t + year_t + \delta_s + \mu_i + u_{i,s,t} \end{aligned} \quad \text{(E1)}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the 52 weeks preceding week *t*. **X** is a matrix of other control variables. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

The figures in Table E1 are the coefficients of the log of the average sales volume. In column 1, the only control variables are the log of the average sales volume, and the dummies for months, years, stores, and products. We find that all 29 coefficients of the log of the average sales volume are positive and statistically significant. The average coefficient is 0.035, suggesting that a 1% increase in the sales volume is associated with a 3.5% increase in the likelihood of a small price change.

In column 2, we add controls for the log of the average price, the log of the absolute change in the wholesale price, a control for sale- and bounce back prices, which we identify using the sales filter algorithm of Fox and Syed (2016), and the Dominick's pricing zone. We find that all 29 coefficients are positive and statistically significant. The average coefficient is 0.030, suggesting that a 1% increase in the sales volume is associated with a 3.0% increase in the likelihood of a small price change.

In column 3, we also add a control for 9-ending prices. Again, we find that all 29 coefficients are positive and statistically significant. The average coefficient is 0.026, suggesting that a 1% increase in the sales volume is associated with a 2.6% increase in

the likelihood of a small price change.

As a further control for the effects of sales on the results, in column 4 we focus on regular prices by excluding all sale and bounce back prices. When we focus on regular prices, the results are even stronger. We find that all 29 coefficients are positive and statistically significant. The average coefficient is 0.045, suggesting that a 1% increase in the sales volume is associated with a 4.5% increase in the likelihood of a small price change.

Thus, adding a control for pricing zones does not change our main results. The correlation between small price changes and sales volume holds in all 29 product categories.

Table E1. Category-level regressions of small price changes and sales volume, controlling for Dominick's pricing zones

Category		(1)	(2)	(3)	(4)
Analgesics	Coefficient	0.0381***	0.031***	0.0253***	0.047***
	(Std.)	(0.0032)	(0.0027)	(0.0025)	(0.0052)
	Observations	276,225	276,225	276,225	77,653
Bath Soap	Coefficient	0.043***	0.0471***	0.0438***	0.0885***
	(Std.)	(0.0087)	(0.0094)	(0.0091)	(0.0157)
	Observations	35,572	35,572	35,572	6,540
Bathroom Tissues	Coefficient	0.0321***	0.0163***	0.0136***	0.0332***
	(Std.)	(0.0057)	(0.0046)	(0.0043)	(0.0067)
	Observations	325,837	325,837	325,837	82,602
Beer	Coefficient	0.0235***	0.0252***	0.0209***	0.0679***
	(Std.)	(0.0015)	(0.0012)	(0.0012)	(0.005)
	Observations	459,405	459,405	459,405	56,829
Bottled Juice	Coefficient	0.0474***	0.0377***	0.0332***	0.033***
	(Std.)	(0.0037)	(0.0031)	(0.0031)	(0.0044)
	Observations	962,368	962,368	962,368	243,787
Canned Soup	Coefficient	0.0239***	0.0161***	0.0167***	0.0182***
	(Std.)	(0.004)	(0.0034)	(0.0033)	(0.0038)
	Observations	950,357	950,357	950,357	278,543
Canned Tuna	Coefficient	0.0367***	0.0269***	0.0228***	0.0295***
	(Std.)	(0.0046)	(0.0039)	(0.0036)	(0.0043)
	Observations	379,680	379,680	379,680	116,890
Cereals	Coefficient	0.0238***	0.0184***	0.0172***	0.027***
	(Std.)	(0.0026)	(0.0023)	(0.0024)	(0.0034)
	Observations	724,013	724,013	724,013	260,460
Cheese	Coefficient	0.0374***	0.0219***	0.018***	0.0127***
	(Std.)	(0.0027)	(0.0021)	(0.0021)	(0.0032)
	Observations	1,811,753	1,811,753	1,811,753	521,244
Cigarettes	Coefficient	0.0196***	0.0191***	0.0185***	0.0186***
	(Std.)	(0.0031)	(0.0031)	(0.0031)	(0.0037)
	Observations	56,000	56,000	56,000	44,322
Cookies	Coefficient	0.0436***	0.0382***	0.0323***	0.0532***
	(Std.)	(0.0016)	(0.0016)	(0.0014)	(0.003)
	Observations	1,353,330	1,353,330	1,353,330	228,976
Crackers	Coefficient	0.0548***	0.0435***	0.0392***	0.0581***
	(Std.)	(0.0033)	(0.0031)	(0.0029)	(0.0063)
	Observations	476,008	476,008	476,008	88,768
Dish Detergent	Coefficient	0.0513***	0.0388***	0.0337***	0.0419***
	(Std.)	(0.0034)	(0.0028)	(0.0028)	(0.004)
	Observations	374,058	374,058	374,058	93,657
Fabric Softener	Coefficient	0.0434***	0.0316***	0.028***	0.0473***
	(Std.)	(0.0038)	(0.0036)	(0.0036)	(0.0047)
	Observations	348,422	348,422	348,422	100,472
Front-End-Candies	Coefficient	0.0043*	0.008***	0.0069***	0.0087***
	(Std.)	(0.0035)	(0.0027)	(0.0027)	(0.0029)
	Observations	487,886	487,886	487,886	157,539

Table E1. (Cont.)

Category		(1)	(2)	(3)	(4)
Frozen Dinners	Coefficient	0.0513***	0.0406***	0.0392***	0.0874***
	(Std.)	(0.0025)	(0.0022)	(0.0022)	(0.0056)
	Observations	502,830	502,830	502,830	72,865
Frozen Entrees	Coefficient	0.033***	0.0328***	0.0319***	0.0635***
	(Std.)	(0.0019)	(0.0016)	(0.0016)	(0.0034)
	Observations	1,846,911	1,846,911	1,846,911	352,717
Frozen Juices	Coefficient	0.0326***	0.0261***	0.0235***	0.0295***
	(Std.)	(0.0037)	(0.0032)	(0.0031)	(0.0048)
	Observations	658,225	658,225	658,225	150,064
Grooming Products	Coefficient	0.0398***	0.0448***	0.0388***	0.0624***
	(Std.)	(0.0022)	(0.002)	(0.0019)	(0.005)
	Observations	659,842	659,842	659,842	107,669
Laundry Detergents	Coefficient	0.032***	0.0227***	0.0185***	0.0366***
	(Std.)	(0.0027)	(0.0024)	(0.0024)	(0.0041)
	Observations	559,576	559,576	559,576	148,548
Oatmeal	Coefficient	0.0295***	0.0175***	0.0156***	0.0314***
	(Std.)	(0.0073)	(0.0052)	(0.0052)	(0.0093)
	Observations	169,093	169,093	169,093	63,705
Paper Towels	Coefficient	0.0347***	0.0275***	0.0263***	0.0285***
	(Std.)	(0.0095)	(0.0102)	(0.0103)	(0.0085)
	Observations	248,289	248,289	248,289	53,732
Refrigerated Juices	Coefficient	0.0307***	0.0208***	0.0181***	0.0302***
	(Std.)	(0.0032)	(0.0027)	(0.0026)	(0.0041)
	Observations	800,280	800,280	800,280	161,098
Shampoos	Coefficient	0.0305***	0.0377***	0.0329***	0.0581***
	(Std.)	(0.0013)	(0.0013)	(0.0012)	(0.0035)
	Observations	701,813	701,813	701,813	96,389
Snack Crackers	Coefficient	0.044***	0.0388***	0.0343***	0.0641***
	(Std.)	(0.0032)	(0.003)	(0.0026)	(0.004)
	Observations	800,253	800,253	800,253	143,143
Soaps	Coefficient	0.0567***	0.0404***	0.0333***	0.0515***
	(Std.)	(0.0043)	(0.0042)	(0.0041)	(0.0054)
	Observations	324,724	324,724	324,724	96,574
Soft Drinks	Coefficient	0.0238***	0.0266***	0.0223***	0.0606***
	(Std.)	(0.0013)	(0.001)	(0.0009)	(0.0027)
	Observations	4,532,158	4,532,158	4,532,158	350,167
Toothbrushes	Coefficient	0.0293***	0.0321***	0.0263***	0.0583***
	(Std.)	(0.0028)	(0.0028)	(0.0025)	(0.0063)
	Observations	295,021	295,021	295,021	45,457
Toothpastes	Coefficient	0.0293***	0.0292***	0.0255***	0.0593***
	(Std.)	(0.0027)	(0.0021)	(0.002)	(0.0053)
	Observations	588,261	588,261	588,261	96,728

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of average sales volume and the fixed effects for months, years, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, a control for sale- and bounce back prices, which we identify using a sales filter algorithm and the competition zone of the store. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Appendix F. Product-level regressions of the % of small price changes and sales volume by categories with added controls

In the paper, we study the correlation between small price changes and sales volume at the product level using regressions that have only the sales volume as the independent variable. This can raise a concern that the results may be driven by differences between the stores rather than by differences in the sales volume.

To mitigate this concern, we augment the data with demographic information about consumers living in the neighborhood of each store, including their median income, the share of minorities, and the share of unemployed. To control for local competition, we also add a control for the pricing zone of each store, using pricing zone indicators included in the Dominick's data.

We estimate for each product in each category an OLS regression with robust standard errors. The dependent variable is the share of small price changes for the product in each store. The independent variable is the average sales volume of the product in each store, the median income, the share of minorities, the share of unemployed and the stores' pricing zone.

The estimation results are summarized in Table F1. Column 1 presents, for each product category, the average of the estimated coefficients. Columns 2–5 present information on the sign of the estimated coefficients: the number of positive coefficients, the number of negative coefficients, the percentage of the positive coefficients, and the percentage of negative coefficients, respectively. Columns 6 and 7 report the number of coefficients that are both positive and statistically significant, and negative and statistically significant, respectively, at the 5% level.

According to the figures in the table, the average coefficients are positive in 29 of the 29 product categories. The number of positive coefficients far exceeds the number of negative coefficients. On average, the former is 4.1 times larger than the latter.

Focusing on statistically significant coefficients, we find a far greater number of positive coefficients that are significant than negative coefficients that are significant. In fact, in 17 product categories we do not have a single case of statistically significant negative coefficient. In the remaining categories the average ratio of positive and significant coefficients to negative and significant coefficients is 40.5. In other words, for

the overwhelming majority of the individual products in our sample, we find a positive relationship between sales volume and the share of small price changes.

Table F1. Product-level regressions of the % of small price changes and sales volume by categories, including controls

Category	Average coefficient	No. of positive coefficients	No. of negative coefficients	% positive coefficients	% Negative coefficients	No. of positive & significant	No. of negative & significant
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Analgesics	3.43	212	62	77.4%	22.6%	34	0
Bath Soaps	3.40	32	8	80.0%	20.0%	5	0
Bathroom Tissues	3.98	78	24	76.5%	23.5%	14	0
Beers	2.17	242	25	90.6%	9.4%	54	0
Bottled Juices	5.98	327	57	85.2%	14.8%	79	3
Canned Soups	2.98	260	93	73.7%	26.3%	45	0
Canned Tuna	3.89	122	62	66.3%	33.7%	28	1
Cereals	3.39	265	93	74.0%	26.0%	29	0
Cheese	4.38	399	95	80.8%	19.2%	97	1
Cigarettes	0.41	84	43	66.1%	33.9%	0	0
Cookies	5.19	599	111	84.4%	15.6%	158	2
Crackers	5.56	183	34	84.3%	15.7%	52	1
Dish Detergents	4.27	159	52	75.4%	24.6%	25	0
Fabric Softener	4.38	188	50	79.0%	21.0%	30	0
Front-End-Candies	2.56	188	106	63.9%	36.1%	15	0
Frozen Dinners	5.41	202	22	90.2%	9.8%	50	0
Frozen Entrees	4.45	603	88	87.3%	12.7%	139	2
Frozen Juices	4.68	119	24	83.2%	16.8%	27	0
Grooming Products	2.87	521	163	76.2%	23.8%	95	0
Laundry Detergents	2.65	315	118	72.7%	27.3%	27	0
Oatmeal	4.20	51	19	72.9%	27.1%	6	0
Paper Towels	3.07	65	27	70.7%	29.3%	9	1
Refrigerated Juices	3.45	135	46	74.6%	25.4%	27	4
Shampoos	2.87	709	174	80.3%	19.7%	92	0
Snack Crackers	5.47	252	42	85.7%	14.3%	79	3
Soaps	5.01	174	54	76.3%	23.7%	14	0
Soft Drinks	2.92	821	195	80.8%	19.2%	240	6
Toothbrushes	2.63	196	51	79.4%	20.6%	31	1
Toothpastes	2.47	262	99	72.6%	27.4%	41	2

Notes: For each product category, column 1 presents the average estimated coefficients of the average sales volumes. The regressions also include controls for the median income, the share of ethnic minorities, the unemployment rate, and the competition zone of the store. Column 2 presents the number of positive coefficients. Column 3 presents the number of negative coefficients. Column 4 presents the % of positive coefficients. Column 5 presents the % of negative coefficients. Last two columns present the number of coefficients that are both positive (negative) and statistically significant, at the 5% level.

Appendix G. Robustness: sales volume, revenue, and small price changes

In the paper, we estimate category level regressions of small price changes where the main independent variables are sales volume and revenue. In this appendix, we conduct two sets of robustness tests. First, we add further controls and estimate the category level regressions again. Second, because the correlation between sales volume and revenue at the category level is high, the results of category level regressions could be suspect. We therefore pool the data from all categories together, and re-estimate the regressions using the pooled data.

In Tables G1 and G2, we present the results of the category level regression estimations. The regressions we estimate are of the following form:

$$small\ price\ change_{i,s,t} = \alpha + \beta_1 log\left(average\ sales\ volume_{i,s}\right) + \qquad \text{(G1)}$$

$$\beta_2 log\left(average\ revenue_{i,s}\right) + \gamma \boldsymbol{X}_{i,s,t} + month_t + year_t + \delta_s + \mu_i + u_{i,s,t}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the sample period. The *average revenue* is the average revenue of product *i* in store *s* over the sample period. **X** is a matrix of other control variables. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term. We estimate separate regressions for each product category, clustering the errors by product.

Columns 1 and 2 give the coefficients of sales volume and revenue, respectively in a regression that also include percentage changes in the wholesale price and a dummy for sale and bounce back prices as control variables.[1] This does not change the results we report in the paper. 24 of the sales volume coefficients are positive. 21 of the coefficients are statistically significant, and one more is statistically significant at the 10% level. Only one of the negative coefficients is significant at the 10% level. Of the revenue coefficients, 23 are negative. 18 of the 23 negative coefficients are statistically significant

[1] We do not add the log of the average price because the log of the price plus the log of the sales volume equals the log of the revenue, leading to a perfect multicollinearity.

and one more is significant at the 10% level.

Columns 1 and 2 of Table G2 present the coefficients of sales volume and revenue, respectively in a regression to which we also add a dummy for 9-ending prices. We still find that 24 of the sales volume coefficients are statistically significant. Of the 24 positive coefficients, 18 are statistically significant, and one more is statistically significant at the 10% level. Of the revenue coefficients, 22 of the coefficients are negative, 15 of which are statistically significant and one more is significant at the 10% level.

Thus, including more controls does not change the conclusions we derive in the paper. The revenue seems to be correlated to small price changes mostly through the sales volume. The effect of the price, holding sales volume constant seems to be mostly negative.

However, the results at the category level are suspect because of the strong correlation between sales volume and revenue. In the paper, we show that the average correlation at the category level is 0.87. The high correlation at the category level is due to the relatively low within category variation in prices. To attenuate this concern, we pool the data from all categories together. Since the between categories variation in prices is higher than the within category variation, in the pooled data the correlation between sale volume and revenue is 0.51.

Table G3 presents the results of regressions similar to G1, to which we also add fixed effects for the categories. Column 1 gives the results of a regression that includes only the sale volume and the revenue as independent variables. The coefficient of the sale volume, 0.29, is positive and statistically significant, whereas the coefficient of the revenue, −0.26, is negative and statistically significant.

In column 2, we add controls for percentage changes in the wholesale price and for sale and bounce back prices. The coefficient of the sale volume, 0.27, is positive and statistically significant, whereas the coefficient of the revenue, −0.24, is negative and statistically significant.

In column 3, we also add a dummy for 9-ending prices. The coefficient of the sale volume, 0.25, remains positive and statistically significant, whereas the coefficient of the revenue, −0.23, remains negative and statistically significant.

Finally, in column 4, we remove sale prices and focus on regular prices. The

coefficient of sale prices price, 0.31, is positive and significant. The coefficient of revenue, −0.27, is negative and statistically significant.

Thus, also when we estimate the regressions using the pooled data, we find a positive correlation between sales volume and small price changes. We also find that when we hold the sales volume constant, the correlation between revenue and small price changes is negative.

Table G1. Regressions with sales volume and revenue, with extra controls

Category	Sales Volume		Revenue		No. of Observations
	Coefficient	Std.	Coefficient	Std.	
Analgesics	0.1671***	0.0389	-0.1312***	0.0388	276,225
Bath Soap	-0.2943***	0.0850	0.3615***	0.0859	35,572
Bathroom Tissues	0.129***	0.0502	-0.1099**	0.0485	325,837
Beer	-0.0648***	0.0277	0.0941***	0.0277	459,405
Bottled Juice	0.63***	0.0826	-0.5512***	0.0828	962,368
Canned Soup	0.1124***	0.0380	-0.0853**	0.0381	950,357
Canned Tuna	0.3388***	0.0579	-0.3015***	0.0575	379,680
Cereals	0.0767***	0.0328	-0.0543	0.0335	724,013
Cheese	0.2743***	0.0852	-0.2441**	0.0853	1,811,753
Cigarettes	-0.3227***	0.0390	0.3286***	0.0391	56,000
Cookies	0.0298**	0.0165	0.0168	0.0166	1,353,330
Crackers	0.0891*	0.0796	-0.0197	0.0804	476,008
Dish Detergent	0.2953***	0.0932	-0.2647***	0.0932	374,058
Fabric Softener	0.5052***	0.1238	-0.4517***	0.1246	348,422
Front-End-Candies	0.14***	0.0201	-0.1271***	0.0203	487,886
Frozen Dinners	0.0996***	0.0262	-0.0480*	0.0255	502,830
Frozen Entrees	0.0559***	0.0099	-0.0140	0.0096	1,846,911
Frozen Juices	0.1319***	0.0369	-0.0819**	0.0368	658,225
Grooming Products	0.0469**	0.0261	0.0285	0.0265	659,842
Laundry Detergents	0.2263***	0.0384	-0.1853***	0.0383	559,576
Oatmeal	-0.0106	0.0172	0.0307	0.0189	169,093
Paper Towels	0.3879***	0.1142	-0.3438***	0.1144	248,289
Refrigerated Juices	0.0537**	0.0388	-0.0133	0.0391	800,280
Shampoos	0.1031***	0.0142	-0.0488***	0.0142	701,813
Snack Crackers	0.0798**	0.0666	-0.0090	0.0676	800,253
Soap	0.2962***	0.0212	-0.2601***	0.0209	4,532,158
Soft Drinks	0.407***	0.1169	-0.3230***	0.1175	324,724
Toothbrushes	0.1009***	0.0339	-0.0328	0.0341	295,021
Toothpastes	0.1671***	0.0357	0.0686*	0.0357	588,261

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variables are the log of average sales volume of product *i* in store *s* over the sample period and the log of the average revenue of product *i* in store *s* over the sample period. The regressions also include the following independent variables: percentage changes in the wholesale price and a dummy for sale and bounce back prices, as well as fixed effects for years, months, stores and products. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table G2. Regressions with sales volume and revenue, with extra controls (2)

Category	Sales Volume		Revenue		No. of Observations
	Coefficient	Std.	Coefficient	Std.	
Analgesics	0.1558***	0.0378	-0.1367***	0.0378	276,225
Bath Soap	-0.3167***	0.0870	0.3423***	0.0874	35,572
Bathroom Tissues	0.1247***	0.0498	-0.1115**	0.0485	325,837
Beer	-0.073***	0.0273	0.0900***	0.0273	459,405
Bottled Juice	0.5823***	0.0800	-0.5945***	0.0801	962,368
Canned Soup	0.1023***	0.0390	-0.0959***	0.0391	950,357
Canned Tuna	0.3252***	0.0569	-0.3110***	0.0565	379,680
Cereals	0.072***	0.0326	-0.0578*	0.0332	724,013
Cheese	0.2621***	0.0842	-0.2524***	0.0843	1,811,753
Cigarettes	-0.308***	0.0386	0.3438***	0.0388	56,000
Cookies	0.0156*	0.0166	0.0084	0.0167	1,353,330
Crackers	0.0587	0.0804	-0.0460	0.0811	476,008
Dish Detergent	0.2969***	0.0928	-0.2581***	0.0929	374,058
Fabric Softener	0.4813***	0.1206	-0.4720***	0.1212	348,422
Front-End-Candies	0.1341***	0.0199	-0.1318***	0.0201	487,886
Frozen Dinners	0.0873***	0.0252	-0.0589***	0.0245	502,830
Frozen Entrees	0.0461***	0.0097	-0.0229***	0.0094	1,846,911
Frozen Juices	0.1049***	0.0361	-0.1064***	0.0360	658,225
Grooming Products	0.0106	0.0254	-0.0023	0.0258	659,842
Laundry Detergents	0.2041***	0.0369	-0.2034***	0.0367	559,576
Oatmeal	-0.0142*	0.0159	0.0289	0.0181	169,093
Paper Towels	0.3763***	0.1112	-0.3543***	0.1115	248,289
Refrigerated Juices	0.0323*	0.0371	-0.0320	0.0373	800,280
Shampoos	0.0804***	0.0136	-0.0668***	0.0136	701,813
Snack Crackers	0.0432	0.0661	-0.0414	0.0671	800,253
Soap	0.2797***	0.0198	-0.2723***	0.0196	4,532,158
Soft Drinks	0.3567***	0.1117	-0.3662***	0.1124	324,724
Toothbrushes	0.0589**	0.0322	-0.0693**	0.0324	295,021
Toothpastes	-0.0416*	0.0354	0.0735**	0.0353	588,261

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variables are the log of average sales volume of product *i* in store *s* over the sample period and the log of the average revenue of product *i* in store *s* over the sample period. The regressions also include the following independent variables: percentage changes in the wholesale price, a dummy for sale and bounce back prices, and a dummy for 9-ending prices, as well as fixed effects for years, months, stores and products. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table G3. Regressions with sales volume and revenue, using a pooled dataset

	(1)	(2)	(3)	(4)
Log of sales volume	0.29***	0.27***	0.25***	0.31***
	(0.001)	(0.001)	(0.001)	(0.004)
Log of revenue	−0.26***	−0.24***	−0.23***	−0.27***
	(0.001)	(0.001)	(0.001)	(0.004)
Observations	21,708,190	21,708,190	21,708,190	4,297,138

Notes: The table reports the results of pooled fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variables are the log of average sales volume and the log the revenue of product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of the average sales volume, the log of the average revenue, and the fixed effects for months, years, categories, stores, and products. In column 2, we add the following controls: the log of the average price, the log of the absolute change in the wholesale price, a control for sale- and bounce back prices, which we identify using a sales filter algorithm and the competition zone of the store. In column 3, we add a dummy for 9-ending prices as an additional control. In column 4, we focus on regular prices by excluding the sale- and bounce back prices. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Appendix H. Producers' size and the robustness of the correlation between small price changes and sales volumes

Bhattarai and Shoenle (2014) report that large producers, i.e., producers that sell a large number of products, are more likely to have small price changes. Table H1 shows for each of the categories, the % of small price changes by quartiles of producers' size. To find the producers' size, in each category, we find the weekly average number of products per producer. We then average over all weeks to get the average number of products sold by each producer (Bhattarai and Shoenle, 2014).

We find that in our data, there is no clear pattern. Taking the average over all categories, we find that there are 33.24%, 29.48%, 28.64% and 28.54% small price changes in the first, second, third and fourth quartiles, respectively. Therefore, in our data, we do not find a correlation between small price changes and producers' size, perhaps because in our data decisions on the timing of price changes are made by the retailer rather than by the producers.

Nevertheless, we divide each category to quartiles by producers' size and estimate:

$$small\ price\ change_{i,s,t} = \alpha + \beta_1 log\left(average\ sales\ volume_{i,s}\right) + \qquad \text{(H1)}$$

$$month_t + year_t + \delta_s + \mu_i + u_{i,s,t}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the sample period. The *average revenue* is the average revenue of product *i* in store *s* over the sample period. *Month* and *year* are fixed effects for the month and the year of the price change. δ and μ are fixed effects for stores and for products. *u* is an iid error term.

In Table H2 we report the estimation results. We find that for the first three quartiles, all 29 coefficients are positive. Except for the front-end-candies category, all the other 28 coefficients are statistically significant in all the cases. The coefficient of the front-end-candies category is not statistically significant in any of the quartiles.

When we use data of the fourth quartile of producers' size, we find that the coefficients are positive in 28 of the 29 categories. Only the coefficient in the front-end-candies category is negative and statistically significant.

We also find that in the first three quartiles of producers' size, the sizes of the coefficients are similar. The average coefficients are 0.38, 0.36 and 0.37 in the first, second and third quartile, respectively. The sizes of the coefficients are a little smaller in the fourth quartile of producers' size, but they are still quite high: the average coefficient in the fourth quartile is 0.32.

As a final test, we consider the possibility that by calculating the producers' size at the category level, we might be underestimating the size of producers' that offer products in two or more categories. We therefore pool the data from all the product categories together.

Table H3 reports the results of regressions similar to the regressions that their results are reported in Table 6 in the paper. I.e.:

$$small\ price\ change_{i,s,t} = \alpha + \beta_1 log\left(average\ sales\ volume_{i,s}\right) + \gamma \boldsymbol{X}_{i,s,t} + month_t + year_t + category_i + \delta_s + \mu_i + u_{i,s,t} \quad \text{(H2)}$$

where *small price change* is a dummy that equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The *average sales volume* is the average sales volume of product *i* in store *s* over the sample period. **X** is a matrix of other control variables. *Month*, *year* and *category* are fixed effects for the month of the price change, the year of the price change, and the product category. δ and μ are fixed effects for stores and for products. *u* is an iid error term.

In column 1, the other extra control variables include the average weekly number of products per producer. . The coefficient of the average sales volume is positive and statistically significant ($\beta = 0.022, p < 0.01$). It therefore seems that controlling for the size of the producers does not change our main finding: there is a positive correlation between the sales volume and the likelihood of a small price change. In column 2, we also add a control for the percentage of the products that changed the price on the same

week, excluding the current observation. This does not affect the coefficient of the average sales volume. In column 3, we further add the average size of contemporaneous price changes, excluding the current observation. The coefficient of the average sales volume remains unaffected. In column 4, we add the percentage of the products that are produced by the same producer and that changed price on the same week, excluding the current observation. The coefficient of the average sales volume is only slightly affected ($\beta = 0.019, p < 0.01$) but remains positive and statistically significant.

Table H1. % of small price changes by quartile

	1st Quartile	2nd Quartile	3rd Quartile	4th Quartile
Analgesics	15.04%	12.31%	12.19%	11.69%
Bath Soaps	18.46%	9.98%	12.38%	16.81%
Bathroom Tissues	46.13%	33.03%	38.34%	50.17%
Beers	2.47%	3.95%	6.76%	8.48%
Bottled Juices	45.52%	36.06%	38.22%	29.14%
Canned Soups	58.63%	49.65%	48.05%	49.13%
Canned Tuna	61.09%	54.31%	55.64%	55.38%
Cereals	34.68%	28.89%	28.57%	32.99%
Cheese	64.29%	43.16%	33.49%	38.81%
Cigarettes	34.13%	29.13%	28.24%	25.09%
Cookies	27.28%	29.72%	23.85%	29.66%
Crackers	38.88%	48.10%	27.38%	23.88%
Dish Detergents	44.63%	41.61%	31.13%	31.20%
Fabric Softener	48.32%	28.68%	27.49%	28.86%
Front-End-Candies	59.34%	47.39%	43.92%	54.14%
Frozen Dinners	13.01%	23.86%	34.66%	20.28%
Frozen Entrees	20.46%	15.53%	15.19%	16.91%
Frozen Juices	30.44%	38.18%	42.51%	31.82%
Grooming Products	11.00%	10.97%	13.81%	14.41%
Laundry Detergents	27.60%	16.21%	16.62%	16.72%
Oatmeal	37.71%	46.51%	38.05%	40.84%
Paper Towels	55.84%	52.25%	52.61%	57.54%
Refrigerated Juices	32.12%	35.66%	32.95%	28.85%
Shampoos	7.41%	6.26%	7.82%	9.34%
Snack Cracker	38.75%	27.07%	20.87%	23.34%
Soaps	46.30%	49.18%	46.42%	38.02%
Soft Drinks	16.23%	13.71%	26.57%	9.06%
Toothbrushes	13.32%	8.16%	11.10%	12.68%
Toothpastes	14.64%	15.28%	15.86%	22.33%

Notes: The table presents the % of small price changes in each quartile of producers' size by category. To calculate the quartiles of producers' size, we first calculate the size of each producer in each category by finding the number of products sold by each producer in each week and then averaging over all weeks. We then divide producers into quartiles using the average number of products they sell each week.

Table H2. Category-level regressions of small price changes, by quartiles of manufacturers' size

		(1)	(2)	(3)	(4)
Analgesics	Coefficient (Std.)	0.0396*** (0.0069)	0.0268*** (0.0044)	0.0386*** (0.0053)	0.0402*** (0.0071)
	Observations	69,126	68,817	68,448	69,834
Bath Soap	Coefficient (Std.)	0.0685*** (0.0157)	0.0206** (0.0145)	0.045*** (0.0126)	0.052*** (0.0187)
	Observations	8,898	8,924	8,863	8,887
Bathroom Tissues	Coefficient (Std.)	0.0412*** (0.0074)	0.0633*** (0.0102)	0.0583*** (0.0119)	0.0205*** (0.0081)
	Observations	81,567	82,001	81,374	80,895
Beer	Coefficient (Std.)	0.015*** (0.002)	0.0223*** (0.0029)	0.0282*** (0.0027)	0.0301*** (0.0031)
	Observations	115,076	114,708	115,158	114,463
Bottled Juice	Coefficient (Std.)	0.0307*** (0.0064)	0.0512*** (0.0072)	0.076*** (0.0058)	0.0343*** (0.0054)
	Observations	240,760	240,475	241,500	239,633
Canned Soup	Coefficient (Std.)	0.0452*** (0.0063)	0.0102** (0.005)	0.0443*** (0.006)	0.0197*** (0.0048)
	Observations	236,867	240,019	231,123	242,348
Canned Tuna	Coefficient (Std.)	0.0442*** (0.0074)	0.0204*** (0.0083)	0.0377*** (0.0069)	0.0457*** (0.0078)
	Observations	94,956	94,632	95,750	94,342
Cereals	Coefficient (Std.)	0.0258*** (0.0047)	0.0291*** (0.0049)	0.0241*** (0.005)	0.0239*** (0.0045)
	Observations	181,740	179,231	183,988	179,054
Cheese	Coefficient (Std.)	0.0502*** (0.0048)	0.022*** (0.0046)	0.0334*** (0.0037)	0.032*** (0.0038)
	Observations	452,000	449,475	460,206	450,072
Cigarettes	Coefficient (Std.)	0.0134** (0.0066)	0.0195*** (0.005)	0.0281*** (0.005)	0.0089*** (0.0056)
	Observations	13,914	14,379	13,886	13,821
Cookies	Coefficient (Std.)	0.0408*** (0.0027)	0.0569*** (0.003)	0.0441*** (0.0033)	0.0358*** (0.0031)
	Observations	338,484	340,011	336,506	338,329
Crackers	Coefficient (Std.)	0.0655*** (0.0043)	0.0553*** (0.0058)	0.0499*** (0.0036)	0.0445*** (0.005)
	Observations	119,334	118,712	120,227	117,735

Table H2. (Cont.) Category-level regressions of small price changes, by quartiles of manufacturers' size

		(1)	(2)	(3)	(4)
Dish Detergent	Coefficient	0.0521***	0.0571***	0.0416***	0.048***
	(Std.)	(0.006)	(0.0051)	(0.0057)	(0.0051)
	Observations	93,887	92,819	94,010	93,342
Fabric Softener	Coefficient	0.0418***	0.0652***	0.0471***	0.0424***
	(Std.)	(0.01)	(0.0061)	(0.0059)	(0.0065)
	Observations	87,134	86,559	88,479	86,250
Front-End-Candies	Coefficient	0.0068*	0.0083*	0.0057	-0.009***
	(Std.)	(0.0056)	(0.0066)	(0.0076)	(0.0043)
	Observations	122,112	122,820	119,907	123,047
Frozen Dinners	Coefficient	0.0448***	0.0616***	0.0444***	0.0406***
	(Std.)	(0.0038)	(0.0055)	(0.0057)	(0.006)
	Observations	125,819	125,972	126,140	124,899
Frozen Entrees	Coefficient	0.0383***	0.0349***	0.0223***	0.0178***
	(Std.)	(0.0032)	(0.0033)	(0.0032)	(0.004)
	Observations	462,547	459,939	464,265	460,160
Frozen Juices	Coefficient	0.0284***	0.0353***	0.0345***	0.0389***
	(Std.)	(0.0077)	(0.0047)	(0.0055)	(0.0063)
	Observations	164,965	164,468	164,797	163,995
Grooming Products	Coefficient	0.0303***	0.0395***	0.0401***	0.0431***
	(Std.)	(0.0034)	(0.0035)	(0.0039)	(0.0043)
	Observations	164,784	166,176	165,977	162,905
Laundry Detergents	Coefficient	0.0365***	0.0363***	0.0374***	0.0207***
	(Std.)	(0.0056)	(0.0053)	(0.0048)	(0.0049)
	Observations	139,935	139,833	141,450	138,358
Oatmeal	Coefficient	0.0413***	0.0187**	0.0415***	0.015***
	(Std.)	(0.0184)	(0.0098)	(0.0129)	(0.0104)
	Observations	42,459	42,772	42,228	41,634
Paper Towels	Coefficient	0.0214**	0.0237**	0.0558***	0.0597***
	(Std.)	(0.0126)	(0.0117)	(0.0158)	(0.0123)
	Observations	62,200	62,044	62,047	61,998
Refrigerated Juices	Coefficient	0.0325***	0.0275***	0.0239***	0.0303***
	(Std.)	(0.0065)	(0.0058)	(0.0059)	(0.005)
	Observations	200,303	200,844	199,233	199,900
Shampoos	Coefficient	0.0318***	0.0274***	0.021***	0.0395***
	(Std.)	(0.0024)	(0.0021)	(0.0025)	(0.003)
	Observations	175,538	174,697	176,919	174,659
Snack Crackers	Coefficient	0.0478***	0.0596***	0.0365***	0.0276***
	(Std.)	(0.0068)	(0.0068)	(0.0038)	(0.004)
	Observations	199,960	202,315	200,525	197,453

Table H2. (Cont.) Category-level regressions of small price changes, by quartiles of manufacturers' size

		(1)	(2)	(3)	(4)
Soap	Coefficient	0.0631***	0.0618***	0.0533***	0.0453***
	(Std.)	(0.0066)	(0.008)	(0.0085)	(0.0093)
	Observations	81,223	80,440	81,242	81,819
Soft Drinks	Coefficient	0.0282***	0.0314***	0.023***	0.0254***
	(Std.)	(0.0021)	(0.0022)	(0.002)	(0.0025)
	Observations	1,133,096	1,133,299	1,134,675	1,131,088
Toothbrushes	Coefficient	0.0302***	0.0207***	0.028***	0.0303***
	(Std.)	(0.0041)	(0.004)	(0.0046)	(0.0053)
	Observations	73,866	73,260	74,817	73,078
Toothpastes	Coefficient	0.0385***	0.038***	0.0218***	0.0223***
	(Std.)	(0.0054)	(0.0035)	(0.004)	(0.0051)
	Observations	147,818	146,730	147,078	146,635

Notes: The table reports the results of category-level fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢ and larger than 2¢, and 0 otherwise. The main independent variable is the log of average sales volume of product *i* in store *s* over the sample period. The regressions also include fixed effects for months, years, stores, and products. Columns 1, 2, 3, and 4 are for the 1st, 2nd, 3rd and 4th quartiles of the manufacturers' size, measured as the average number of products they sell each week. We estimate separate regressions for each product category, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

Table H3. Pooled data regressions of small price changes and synchronization

	(1)	(2)	(3)	(4)
Log of sales volume	0.022***	0.022***	0.022***	0.019***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	21,701,315	21,701,315	21,701,315	21,701,315

Notes: The table reports the results of pooled fixed effect regressions of the probability of a small price change. The dependent variable is "small price change," which equals 1 if a price change of product *i* in store *s* at time *t* is less or equal to 10¢, and 0 otherwise. The main independent variable is the log of average sales volume product *i* in store *s* over the sample period. Column 1 reports the results of baseline regression that includes only the log of the average sales volume and the fixed effects for months, years, categories, stores, and products. In column 2, we add the average number of products each producer offers on every week. In column 3, we add the percentage of the products that changed the price on the same week, excluding the current observation as an additional control. In column 4, we control synchronization by adding the percentage of the products that been produced by the same producer and that changed price on the same week, excluding the current observation. We estimate a pooled regression, clustering the errors by product. * $p < 10\%$, ** $p < 5\%$, *** $p < 1\%$

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