Price Saliency and Fairness:
Evidence from Regulatory Shaming*

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Abstract

How do firms and consumers respond when consumers realize they pay more than others? We study the effects of a regulation that required Israeli retailers to display on-the-shelf signs showing the (cheap) international price of products alongside the price of the very same products in the local store. We find that prices of products included in the regulation fell on average by 8%. The price decreases were larger the more expensive were the products compared to their international counterparts. Following the drop in prices, quantities sold increased. Yet, these increases were significantly smaller than those predicted based on pre-regulation demand elasticities and actual price drops. Moreover, products with larger differences between predicted and actual quantities were those that still remained much more expensive. Next, we develop a theoretical model that incorporates the role of salient unfair prices and explains our findings. We estimate the model, and find that from a consumer point-of-view, a 1% decrease in a product’s sale price is equivalent to a 20 percentage-point increase in the international price of that product. Finally, we calculate the impact of shaming on consumer welfare. We find that consumer utility decreased for some products included in the regulation, although the quantity consumed increased. This happens when the disutility from observing that other consumers pay less exceeds the added utility from increased consumption. We discuss the implications of our findings for optimal pricing strategies, nudges, and theoretical models of salient thinking.

JEL: D0, D4, D90, L81
Keywords: saliency, fairness, bottom-up attention, contrast, uniform pricing, retail, nudges

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1 Introduction

Researchers have long been interested in understanding how fairness affects decision-making and market outcomes (e.g., Kahneman, Knetsch and Thaler 1986, Rabin 1993, Fehr and Schmidt 1999). Although extensive lab and survey evidence show that fairness concerns are important it is still an open question as to whether fairness has a meaningful impact on consumers and firms in real-market settings. In their review of the literature, Fehr and Schmidt (2006) write: “the real question is ... under which conditions these preferences have important economic and social effects”.

Policymakers are increasingly using insights from behavioral economics to promote public goals. One highly popular type of intervention is nudges which aim to change “behavior in a predictable way without forbidding any options or significantly changing their economic incentives (Thaler and Sunstein 2008) p.6). This type of intervention often relies on the premise that consumer choices are context-dependent, and that changing the manner in which choices or prices are presented might significantly affect market outcomes. Proponents of using nudges stress that unlike traditional interventions such as taxes and price controls, nudges do not impose material costs but rather influence only the underlying “choice architecture”. Other researchers (e.g., Bernheim and Taubinsky 2018) point out that a full picture of the impact of nudges should acknowledge how nudges affect consumers, take into account firms’ responses, and evaluate the new equilibrium. Ignoring these equilibrium effects may lead to erroneous conclusions regarding the effectiveness of nudges and their impact on consumers.

This paper studies the effects of a nudge-type regulation that required Israeli retailers to place on-the-shelf signage that showed the (cheap) international price of a product alongside the price of the same product in the Israeli store. The objective of the regulation, often referred to as the shaming regulation, was to generate pressure on sellers to lower prices. Critiques of the shaming regulation claimed that it will not affect prices as long as consumers cannot purchase the products at international prices. Our paper examines the impact of the regulation on prices and sales volume of products included in the regulation compared to changes in control products. We also exploit variation across products included in the regulation, using the expensiveness of products relative to the international prices of those products. The analysis examines how the degree of expensiveness of a product, measured as the ratio between local and international prices, which became salient to consumers once the regulation came into affect, affected firms, consumers, and the equilibrium. Our findings show that the shaming regulation had an economically large impact on both pricing decisions and consumer demand. Retailers significantly decreased the prices of products included in the regulation and the demand for these products shifted inward. The magnitude of retailers’ pricing response and the shift in demand depended on how pricey were the local products. That is, the prices of relatively more expensive products decreased more, and the demand for relatively more expensive products fell more than the demand for products that became not that expensive after the regulation.

We begin the analysis by developing a theoretical model of a profit-maximizing firm that sells to utility-maximizing consumers subject to a budget constraint. We solve for the equilibrium before

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3p.618. See also Levitt and List 2007; Bartling, Weber and Yao 2013; Shleifer 2004; Falk and Szech 2013. Dewatripont and Tirole 2022. To be sure, the question of fairness in markets is also debated by philosophers, political scientists and sociologists (e.g., Anderson 1995, Fourcade and Heady 2007, and Sandel 2012).

2See also Spiegler 2013 for a theoretical discussion and Handel 2013 for an empirical application.

3The main criterion for choosing products included in the regulation was a large ratio between local and international prices. For instance, the mean price in Israel of Colgate 100ml Max Fresh cool mint toothpaste, one of the products chosen for the regulation was 16.04 NIS (about $4.6), whereas its average price outside of Israel was 8.25 NIS (about $2.4). Table 1 in Appendix 3 contains information on the 12 products included in the regulation.
and after the shaming signs are displayed, assuming that consumers’ attention is drawn to the price signs, and that their utility diminishes once they realize they pay more than others. Solving the model, we derive the following testable implications: First, the firm will reduce its prices after the regulation. Second, prices of products characterized by higher pre-shaming price ratios will drop more than prices with lower pre-shaming ratios. Third, following the price reductions, consumers will buy more of the products included in the regulation. Fourth, the quantity sold is lower than the quantity we would predict that consumers would buy were we to rely on the original demand curve at the new price. Finally, the difference between the predicted and the actual quantities increases with the post-shaming price ratio. That is, products that remain more expensive relative to the international price will experience a larger backlash in demand relative to products with prices that were set closer to the international price. An attractive feature of our model is that its components have clear empirical counterparts. First, both the model and the empirical setting distinguish between pre- and post-shaming periods. Second, the ratio between local and international prices of each product, which is an important ingredient of the model, is also observable in the data. The fact that we have several products allows us to compare the responses of consumers and firms at different levels of price ratios. Finally, the demand elasticities that we estimate can be directly linked to the demand elasticities in the theoretical model. In the second part of the empirical analysis, we estimate the model to measure structural parameters that capture consumers’ aversion to unfair prices, and then use these parameters to quantify the impact of the regulation on consumer surplus.

In the first part of the empirical analysis, we test the predictions from the model. Using comprehensive price data, we find that prices of shaming products fell shortly after the price signs were placed. On average, regular prices fall by 8.5% and promotional prices by 5.5%. Also, the more expensive were the products relative to the international price, the larger were the prices decreases. Auxiliary analysis shows that the change in prices is considerably larger for publicly-traded retailers compared to privately-owned retailers. Next, we use weekly store-level sales data to show that quantities sold increased after the price signs were placed. This increase is somewhat expected given the steep price drop. However, we want to examine whether the regulation affected quantities sold beyond the direct effect of lower prices. To do so, we compare the observed changes in quantities sold after the regulation with predicted changes in quantities. To obtain the predicted changes in quantities, we estimate the demand elasticities for each product using pre-regulation data. We then use these elasticities and the actual price drops to calculate the predicted change in quantity. The comparison between the predicted and the actual change shows that the actual increase in quantities sold (on average 10.5%) is significantly smaller than the predicted one (on average 18.5%). When we repeat this exercise for products not included in the regulation we do not find a significant difference between the actual and predicted quantities. Finally, and consistent with the predictions of the theoretical model, we show that the difference between the predicted and actual measures is larger for products that remain considerably more expensive also after the initial price drops. Thus, our findings suggest that consumer demand is sensitive to the level of expensiveness of a product which became salient to consumers after the regulation came into effect.

In the next step of the analysis, we use the theoretical model to evaluate the impact of shaming on consumer welfare. We proceed in two steps. We first estimate the parameter that captures the sensitivity of consumers to unfair prices. We exploit the variation in the price ratio of different products, and the quantities sold of each product before and after the regulation was implemented. We find that from a consumer’s perspective a 1% increase in the price of the product itself is equivalent to a reduction of 20 percentage-point in the international price. Given a mean price
ratio of 1.8 after the initial price drop, the in-store signs are comparable to an increase of nearly 4% in the average price of products. In the second step, we use the model and its estimates to quantify the impact of the regulation on consumer utility. Notably, although prices dropped and quantities increased, the impact on consumers is ex-ante ambiguous. This is because consumers also incur a disutility from observing that the price elsewhere is cheaper. Indeed, our calculations show that utility decreased for the majority of the products.

Our paper is related to three important strands of the behavioral economics literature: saliency, fairness and nudges. We contribute to the literature on salient thinking in several ways. First, to our knowledge, we are the first to provide field evidence on the contrast effect. That is, the change in saliency is due to a change in the way a product’s price is contrasted with the surrounding environment rather than by a change in the prominence of the price of the product itself. This contrast effect is related to the decoy effect (e.g., Huber, Payne and Puto 1982, Tversky and Simonson 1993), in which the demand for a given product increases when a third, arguably irrelevant option is added to the choice set. We are not aware of field evidence that supports the decoy effect or the contrast effect. In their review of the literature, Bordalo, Gennaioli and Shleifer 2022 identifies three sources for salient thinking: Prominence, surprise and contrast. By and large, existing studies on saliency have predominantly focused on the impact of prominence. For instance, Chetty, Looney and Kroft 2009 show that a commodity tax has a larger effect on demand if the sales tax is more prominent to consumers and included in the in-store posted price. Blake et al. 2021 show that consumers who observe the full price of a product (including shipping and handling) at the checkout page buy higher quality-products than consumers who observe the full price earlier. Dai and Luca 2020 show that making hygiene scores at Yelp more prominent to consumers affects the demand for restaurants. Second, we examine how both firms and consumers respond to an arguably exogenous change in saliency. Existing studies predominantly consider the impact of saliency only on individuals. For instance, Finkelstein (2009) shows that paying tolls electronically makes drivers less sensitive to the price they pay. A notable exception is Blake et al. 2021 which shows that firms offered better quality products to consumers who observe the full price at the check-out. Finally, our setting allows us to measure saliency not as a binary variable but rather as a continuous measure. Theoretical models of salient thinking emphasize this point, and our setting allows us to test how the degree of saliency affects pricing decisions and consumer demand. In Section 6.1 we discuss in more length how our findings add to this literature.

Our paper also contributes to the literature on fairness, providing novel field evidence on the impact of fairness on the behavior of firms and consumers. Identifying the role of fairness in the field has proven to be elusive. In a seminal paper, Kahneman, Knetsch and Thaler 1986 use surveys to demonstrate that fairness considerations in pricing decisions are important to consumers. A large body of experimental evidence, mostly in the context of bilateral negotiations (see Camerer 2011 for review) further shows that pro-social preferences are important for decision-makers. Theoretical contributions to this literature include Fehr and Schmidt 1999; Rabin 1993 which offer a unifying theory for many phenomena where individuals seem to care about the well-being of others. Two common relevant interpretations for unfair prices in our setting are: First, consumers consider prices as unfair if they realize that they pay more than others. Second, consumers do

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4 Also related are Frydman and Wang 2020 who show that making a stock’s purchase price more salient increases the disposition effect. Other studies rely on the structure of pricing plans to examine the role of salient prices on insurance (Sydnor 2010) or subscription plans (Ater and Landsman 2014). Papers outside economics mostly in marketing and revenue management also consider the role of fairness in pricing decisions (e.g., Xia, Monroe and Cox 2003; Li and Jain 2016; Cohen, Elmachtoub and Lei 2020). These papers often do not use field data to identify the impact of fairness. Richards, Liaukonyte and Streletskaia 2016 experimentally show that consumers care about the price that
not inherently care about the price that other consumers pay but use this price to learn about the margin obtained by their seller, where excessively high margins are considered unfair. In Section 6.2 we suggest that the latter explanation, which focuses on the sellers’ margin, is likely more relevant to our findings.

Finally, we contribute to the growing literature on nudges. Studies have demonstrated that nudges are effective in changing individuals’ behavior in various settings (e.g., Benartzi et al. 2017), such as exercising, eating healthy food, efficient energy consumption, and retirement savings. We add to this literature in two main ways. First, we show that nudges can be used to induce a behavioral response by firms. To our knowledge, previous studies examined the impact of nudges on individuals’ decision-making. In our setting, the nudge targets firms that respond because they expect to be punished by consumers if they decide otherwise. Still, firms’ choice set is not materially affected by the nudge itself. Second, we measure the impact of the shaming-nudge on consumer surplus, while taking into account not only its impact on prices and quantities but also the psychological burden or the disutility that consumers bear when they observe the price signs. Glaeser 2005 argues that many nudges are essentially emotional taxes that reduce utility without raising taxes. Allcott and Kessler 2019 is another study that measures the welfare effect of a particular nudge.

Our findings have implications for optimal-price setting, price discrimination, and price rigidity. In Section 6.2 we discuss these in more length, and here briefly mention that if consumer demand falls once consumers realize that they pay more than others, that could explain why firms engage in obfuscation strategies (e.g., Ellison and Ellison 2009, Allender et al. 2021). Moreover, if obfuscation is costly or ineffective, firms may limit the gap between high and low prices, by lowering the prices of high-priced products or by raising prices of low-priced products (Dubois, Gandhi and Vasserman 2019). At the extreme, firms may avoid price discrimination, setting similar prices in different markets (DellaVigna and Gentzkow 2019, Hitsch, Hortacsu and Lin 2021, Orbach and Einav 2007, Shiller and Waldfogel 2011, Ater and Right Forthcoming). Our findings also speak to the link between fairness and price rigidity (Rotemberg 2005, 2011; Eyster, Madarasz and Michaillat 2021). Anderson and Simester (2010) show that if customers buy a product and later observe that the same retailer sells it for less, they make fewer subsequent purchases.

The remainder of the paper is organized as follows. In Section 2 we develop the theoretical model and derive testable predictions. In Section 3 we provide the relevant background for the regulation and the industry and describe the data. In Section 4 we present the estimation and the results first for the impact of the shaming regulation on prices and then for quantities. In Section 5 we use the model to measure consumer sensitivity to unfair prices and to quantify the change in consumer surplus following the regulation. In Section 6 we discuss the implications of our findings. Section 7 concludes.
2 A Model of Price Saliency and Fairness

In this section, we develop a model of a profit-maximizing firm that sells to consumers before and after the price signs are displayed. In the pre-shaming period, consumer preferences are represented by a standard quasi-linear utility function. In the post-shaming period, the weight assigned to the utility from consuming the product depends on the ratio between local and international prices. We use the model to derive testable predictions regarding the impact of salient unfair prices on prices and on quantities sold. In Section 4 we test these predictions. Next, in Section 5 we use the model to measure consumer sensitivity to unfair prices and to quantify the change in consumer utility due to the regulation.

2.1 Setup

In the pre-shaming period, consumer preferences are represented by the following utility function:

\[ U(q, m) = q^{1-\beta}(1-\beta) + m, \] (1)

where \( q \) is the number of units consumed from the product sold by the firm, and \( m \) represents consumption of other products. The utility function is positive and is decreasing in \( q \) for positive, smaller than one, values of \( \beta \) (i.e., \( 0 < \beta < 1 \)).

In the post-shaming period, consumers observe the international price signs next to the local price, and we assume that the utility from a product whose local price is relatively expensive falls. We use the ratio between the local and the international price to capture the extent to which consumers dislike paying prices that are more expensive than other consumers.

In the post-shaming period we multiply the utility from \( q \) (i.e., \( q^{1-\beta}(1-\beta) \)) by \( \frac{1}{1+\gamma S} \). A possible interpretation for this latter component is a utility weight from \( q \). While in the pre-shaming period this weight equals 1 in the post-shaming period its value may change. In particular, for positive values of \( \gamma S \), the value of the decision weight is lower than one which means that the utility from consuming \( q \) in the post-shaming period falls compared to the pre-shaming period.

The degree to which consumers are sensitive to unfair prices is captured by \( \gamma \). If consumers do not experience disutility from unfair prices (i.e., prices that are higher than prices paid by other consumers) then \( \gamma \) equals zero. If consumers have fairness concerns then \( \gamma \) is positive. The extent to which a local price is considered unfair is captured by \( S \), where the expensiveness, or the degree of unfairness, is measured by the ratio between the local price \((P_{\text{local}})\) and the international price \((P_{\text{int}})\). This price ratio becomes salient to consumers only after the in-store price signs are placed (i.e. after the shaming regulation is implemented). At that time, consumers’ attention is drawn to the price ratio. In particular, \( S \) is defined as:

\[ S = \left( \frac{P_{\text{local}}}{P_{\text{int}}} - 1 \right) \times I, \] (2)

where \( I \) is an indicator for the presence of the in-store price signs, making the price ratio salient to the consumer. The consumer perceives the local price as unfair when she observes that the local price is more expensive than the international price. Intuitively, \( S \) increases with the ratio between local and international prices conditional on consumers observing the price signs. That is, consumers’ attention is drawn to products with higher price ratios, and the utility from these products is underweighted as this ratio increases. The utility function collapses to a standard

\footnote{This formulation captures the ordering property which the theoretical models of saliency emphasize. \cite{Lanzani2022} shows that the ordering property brings salience theory outside the prospect theory realm.}
utility function (i.e., with no fairness considerations) in three scenarios, namely when: 1) the ratio between the local and international prices is not salient (i.e., before the international price tags are displayed, \( I = 0 \)); 2) the local price and the international price equal, and 3) the consumer is insensitive to unfair prices (i.e., \( \gamma = 0 \)).

### 2.1.1 Consumer and firm maximization problems

A consumer maximizes her utility by buying \( q \) units at the price set by the firm. We denote by \( P_o \) the pre-shaming price and by \( P_a \) the post-shaming price. In the remaining budget, the consumer purchases other products, \( m \), whose price is normalized to 1. In the pre-shaming period, the consumer solves the following constrained-maximization problem:

\[
\max_{q,m} U(q,m) = q \frac{1-\beta}{1} + m \\
\text{s.t.} \quad q \times P_o + m \leq \text{Income}
\] (3)

Solving this maximization problem, we obtain the pre-shaming demand functions for \( q \) and \( m \):

\[
q^*_o = P_o \frac{1}{\beta} \\
m^*_o = \text{Income} - q^*_o P_o
\] (4)

After the implementation of the regulation, consumers’ attention is drawn to the ratio between the local and the international price, and the maximization problem is given by:

\[
\max_{q,m} U(q,m) = q \frac{1-\beta}{1 - \beta (1 + \gamma S)} + m \\
\text{s.t.} \quad q \times P_a + m \leq \text{Income},
\] (5)

and the respective demand functions for \( q \) and \( m \) are given by:

\[
q^*_a = P_a (1 + \gamma S)^{-\frac{1}{\beta}} \\
m^*_a = \text{Income} - q^*_a P_a
\] (6)

Figure 1 illustrates the transition from the pre-shaming/standard demand curve to the post-shaming/fairness demand curve. As shown in the figure, the demand curve shifts inward after the implementation of the regulation and for a given price a consumer buys fewer items. Notably, when local prices are more expensive demand becomes more elastic in the post-shaming regulation.
(a) Consumer demand before and after shaming

(b) The retailer’s optimal response to shaming

Figure 1: Change in consumer demand and retailer response

Notes: Panel (a) of Figure 1 shows how demand shifts inward once unfair prices become salient to the consumer. The black solid line represents the original demand curve and the blue solid line represents the new demand curve. The orange solid line denotes the international price of the product. As shown, for a given price ($P_0$) quantity falls from $q_o$ to $q_1$, and the two demand curves intersect when the local price equals the international price. Panel (b) of Figure 1 illustrates the impact of shaming on the optimal price and the quantity sold. $P_o$ represents the original pre-shaming optimal price, derived from setting the pre-shaming marginal revenue equal to the marginal cost. After shaming, the firm maximizes its profits using the new demand and the corresponding marginal revenue curve. Since the new marginal revenue curve lies above the initial MR curve (see text for details), the post-shaming price $P_A$ is lower than the original/pre-shaming price. Also, the actual quantity sold ($q_A$) is greater than the original quantity sold ($q_o$). Nonetheless, the post-shaming quantity sold is lower than what the consumer would have bought (denoted by $q_p$) at the new price had the demand curve remained unchanged.

Next, we consider the firm’s optimal price before and after the regulation is implemented. The firm maximizes its profits by setting the marginal revenue equal to the marginal cost. In the pre-shaming period, the solution to this maximization problem is given by $q_o$ shown in Panel (b) of Figure 1. After the regulation, the firm also sets the marginal cost equals to the marginal revenue which is derived from the new demand curve. Importantly, the new marginal revenue curve increases relative to the marginal revenue curve before shaming. This increase occurs for two reasons. The first reason is the standard law of demand, where a consumer buys more units as the price falls. The second reason is related to the disutility a consumer gets when he observes the price ratio. Accordingly, when the price falls, this disutility diminishes and the consumer demands buys more. Thus, following the shaming regulation the firm has the incentive to reduce its price below the pre-regulation price. Figure 1 illustrates this point graphically.

According to Equation (6), the inward shift of the demand curve depends on: 1) the degree to which consumers are sensitive to unfair prices, measured by $\gamma$; 2) the ratio between the international and the local price, and 3) the inverse of own-price elasticity of demand, captured by $\beta$. Thus, we expect the demand curve to shift more to the left when consumers are more sensitive to unfair prices, when the international price is lower, and when demand is more elastic.  

\[E_{\text{in}} \text{Appendix B we derive the conditions under which the optimal post-shaming prices are lower than pre-shaming optimal prices, and that quantity is higher than in the pre-shaming period.}\]
2.1.2 The change in profits and consumer surplus

The firm’s profit decreases after the international price tags are displayed. We use a revealed-preference argument to show this. In the pre-shaming period, the firm could have chosen the price $P_a$ and sold $q_p$ units. Had it done so, its profits would have been the same or lower than the profits it earned in the pre-shaming period. Due to shaming, the firm sets $P_a$ and sells $q_A$ which is less than $q_p$. This implies that profits are strictly lower in the post-shaming period.

Unlike profits, the impact on consumer surplus due to shaming is ex-ante ambiguous. On one hand, prices fall and the quantity sold increases, implying that consumer surplus is supposed to increase. However, in the post-shaming period, consumers also observe that they are paying more than other consumers, and incur costs from consuming these products, making the overall impact on consumer surplus ex-ante unclear.

2.2 Testable predictions

Below we outline testable predictions from the model. These predictions are based on the assumption that the international price is cheaper than the corresponding local price, and that the regulation made the price ratio salient to consumers. We provide below basic intuition for these hypotheses, and defer the formal derivations to Appendix B.

Hypothesis 1 (H1) Following the shaming regulation, prices of products included in the regulation drop.

Hypothesis 2 (H2) Following the price drop, the quantity sold increases.

This intuition for these hypotheses is shown in Figure 1b, where the firm’s optimal price falls as the demand curve shifts inward. If the price drop is sufficiently large (which is indeed the case) then consumers purchase a higher quantity of the product relative to its pre-shaming level.

Hypothesis 3 (H3) The quantity sold after the regulation is lower than the predicted quantity, which we derive based on the pre-shaming demand curve and the post-shaming price.

As shown in Figure 1b, the quantity sold at the post-shaming price ($P_a$) is less than the quantity sold at that price before the demand curve shifted, i.e. when we use the pre-shaming demand curve ($q_p > q_a$).

Hypothesis 4 (H4) The price drop is larger for products with a higher pre-shaming price ratio.

Products with a higher pre-shaming price ratio experience a larger inward demand shift (Equation 6). Accordingly, the price response for these products due to shaming is expected to be larger than the price response for products with a smaller price ratio. In particular, products that are sold locally at the same price as the international prices we expect the demand and prices will not change following the regulation.

Hypothesis 5 (H5) The difference between actual and predicted quantities sold rises with the post-shaming ratio between local and international prices.

Hypothesis 5 focuses on the horizontal shift of the demand curve due to shaming. The larger the shift is, the larger the difference is between the predicted and the actual quantities sold. From Equation (6) it follows that this shift increases with the price ratio, implying that for products with high price ratios there is a larger difference between the actual and the predicted quantity.
3 Background, Data, and Descriptive Statistics

3.1 Industry background

Retail prices in Israel are expensive relative to OECD countries (OECD 2013; Hendel, Lach and Spiegel 2017). The high cost of living became a primary policy issue after the social protests in 2011. The Food Act, enacted in 2014, introduced a price transparency regulation where retailers require retailers to post daily prices online (Ater and Rigbi (Forthcoming)). In Israel, retail prices are determined solely by retailers and shelf prices are tax inclusive. Despite various regulatory attempts, retail prices in Israel, mainly for imported branded products such as toiletries and hygiene products, remain high in international comparisons. The regulation we study is another attempt to reduce prices.

The shaming regulation. In an attempt to reduce prices of imported brand products, the Ministry of Economy advanced a regulation in which retailers are required to display the international price of certain products near the price of the exact same product (at the barcode level) sold in the local store. The products chosen for the regulation were popular products whose prices were considerably more expensive than the mean price of the exact same product sold abroad. In late 2017, the Ministry identified relevant products and after hearing objections from importers and manufacturers the regulation was approved in February 2018. Starting in the following month (March 2018), retailers selling these products were required to display the international price of seven products along with the local price. In Israel, store tag prices are tax-inclusive and so the calculation of the international price also includes applicable taxes in the relevant countries. To reduce the burden on retailers, the signs were designed as simple as possible and were downloadable from the Ministry’s website. Exhibit 1 in Appendix A presents an example of these “on-the-shelf” shaming labels. The regulation also set financial sanctions for non-compliance, and in some cases retailers paid fines for non-compliance in specific stores. In December 2018, the composition of the products changed. Four products were excluded from the list after importers complained that these products are not exactly comparable to the international products. In addition, five other products were added. Below we refer to products included in March 2018 as first-wave products and to products added in December 2018 as second-wave products. Appendix A contains information on the 12 products included in the regulation. In April 2019, Nielsen, whose data was used for comparing local and international prices exited the Israeli market. Anecdotal evidence suggests that Nielsen’s exit from Israel was related to pressure exerted on Nielsen from the international manufacturers (e.g., Procter & Gamble, Colgate and Unilever) of the products included the regulation. Following the exit, the price comparison used in the regulation was no longer accurate and the regulation no longer effective.

3.2 Data and descriptive statistics

Our empirical analysis uses two main data sources. The first is comprehensive price data and the second is longitudinal sales data for 11 products, including the 7 products included in the first wave of the regulation and four control products. Below we describe these data and present relevant descriptive statistics.

11The decree can be found in (in Hebrew): https://www.gov.il/BlobFolder/generalpage/cpfta_price_comparison_to_abroad/he/docs_cpfta_ConsumerProtectionOrderCombinedVersion.pdf
12See (in Hebrew) and https://www.ynet.co.il/articles/0,7340,L-5427792,00.html and https://www.calcalist.co.il/marketing/articles/0,7340,L-3752402,00.html
3.2.1 Price data

The price data cover the time period between November 2016 and October 2019 and include comprehensive price information for 126 products sold in 1,250 stores affiliated with 28 retailers. We obtain the price data from Pricez.co.il, a price comparison platform that following the price transparency regulation collects prices of products sold by food retailers in Israel. In the analysis, we use the average monthly price at the chain level and present results using either the full price or the promotional price (price after promotions). We consider the 12 products included in the regulation as treatment products. Figure 2 presents the ratio between local and international prices \( \frac{p_{\text{local}}}{p_{\text{int}}'} \), separately for pre- and post- regulation time periods. The figure shows that local prices are considerably more expensive than the prices of the same products sold outside Israel. On average, local prices are twice as expensive as international prices. More importantly, the figure shows that after the regulation was implemented, the entire price distribution shifted to the left, implying that prices dropped. Nevertheless, local prices remain considerably higher than international prices even after the regulation.

![Figure 2: Price ratios, before and after the shaming regulation](image)

We construct three price comparison groups:

**Main control group.** We use price data for 23 products that were not included in the regulation ("non-shaming products") as our main control group. The products in this group serve similar needs as the treatment products but are arguably not strong substitutes. For example, we use mouthwash, toothpicks, and children’s toothpaste as controls for toothpaste products included in the shaming regulation. We use the fact that men’s deodorants in the shaming list are gel deodorants, and include spray deodorants in the main control group. On the other hand, the
women’s deodorant on the list is a spray deodorant, so we use a women’s gel deodorant in the control group. For the feminine hygiene items, we use menstrual pads as a control for daily liners, and tampons with an applicator as control for tampons without an applicator in the shaming list.

Panel (a) of Table 1 presents descriptive statistics for the 12 shaming products and the 23 non-shaming products in the main control group, before and after the regulation became effective. As seen in the table, the prices of shaming products fell by 9% after the regulation, while the prices of non-shaming products fell by 1%. Price dispersion among shaming products increased more than in the control group, suggesting that the effect of the regulation is not uniform across retailers.

Table 1: Descriptive statistics for the price (Panel a) and sales (Panel b) data

<table>
<thead>
<tr>
<th>Panel a: Price data</th>
<th>Pre-shaming</th>
<th>Post-shaming</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mean</td>
<td>s.e.</td>
<td>mean</td>
</tr>
<tr>
<td>Regular prices (NIS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaming products</td>
<td>22</td>
<td>6.6</td>
<td>20.4</td>
</tr>
<tr>
<td>Main control products</td>
<td>21.3</td>
<td>8.8</td>
<td>21.3</td>
</tr>
<tr>
<td>Same brand products</td>
<td>22</td>
<td>6.6</td>
<td>21.5</td>
</tr>
<tr>
<td>Shaming candidates products</td>
<td>19.5</td>
<td>3.9</td>
<td>19.7</td>
</tr>
<tr>
<td>Promotional prices (NIS)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaming products</td>
<td>20.1</td>
<td>6.3</td>
<td>18.6</td>
</tr>
<tr>
<td>Main control products</td>
<td>19.6</td>
<td>8.8</td>
<td>19.3</td>
</tr>
<tr>
<td>Same brand products</td>
<td>20</td>
<td>6.3</td>
<td>19.2</td>
</tr>
<tr>
<td>Shaming candidates products</td>
<td>17.6</td>
<td>3.4</td>
<td>17.3</td>
</tr>
</tbody>
</table>

Panel b: Sales data

<table>
<thead>
<tr>
<th>Weekly store volume per product (# of units)</th>
<th>Pre-shaming</th>
<th>Post-shaming</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaming products</td>
<td>11.9</td>
<td>18.7</td>
<td>13.8</td>
</tr>
<tr>
<td>Main control products</td>
<td>3.7</td>
<td>3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weekly store turnover per product (NIS)</th>
<th>Pre-shaming</th>
<th>Post-shaming</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaming products</td>
<td>149.1</td>
<td>179.1</td>
<td>155.1</td>
</tr>
<tr>
<td>Main control products</td>
<td>37.8</td>
<td>21.7</td>
<td>38.2</td>
</tr>
</tbody>
</table>

The table presents descriptive statistics on the two main data sources we use. For each variable of interest, we show its mean value and standard error in the pre-shaming period, post-shaming period, and a measure of the change between the two periods. Panel (a) shows descriptive statistics for the price data used in estimating Equation (7). The mean regular price of a shaming product sold at 28 retailers was 22 NIS before the regulation, and it dropped to 20.4 NIS after the regulation (-7.2%). The average price of a non-shaming product included in the main control group remain the same before and after the regulation and was 21.3 NIS. Panel (b) presents descriptive statistics for the sales data used in estimating Equation (8). The data include weekly information on the number of units sold and the respective turnover for 11 products (7 first-wave shaming products, and 4 non-shaming products). These data is based on 19 retailers and overall 250 stores. After the regulation, the number of units sold of shaming products increased from 11.9 to 13.8 (15.8%), whereas the number of units for non-shaming products dropped from 3.7 to 3.3 (-9.2%). At the same time, the turnover for shaming products increased by 4.1%, and by 1% for non-shaming products.

Shaming candidates group. We obtained from the Ministry of Economy a file with products that were considered to be included in the shaming list. The file includes the international price of these candidate products and we focus on 8 products that are as expensive as products that were included in the regulation. These products were not included in the regulation because their
market shares in the relevant category were not sufficiently large as those included in the regulation. By comparing changes in prices of products included in the regulation to the changes in prices of these products, we address concerns that the observed drop in prices is driven by retailers intent to prevent further regulatory interventions (rather than due to a drop in consumer demand for shaming products).

**Close substitutes group.** We also use price information for 17 products that we consider very close substitutes to products included in the regulation. These products include the same brand, and mostly same size products as those in the shaming list. For instance, this group contains other 100ml Colgate toothpastes, 150ml Dove deodorants, and other speed-stick deodorants. Due to the high substitution between these products and shaming products, we expect that the estimates from the regression analysis that uses this group will be downward bias relative to the main comparison group. We use this group to show that consumers’ response is driven by the saliency of price tags, and unlikely driven by consumers making inference on the expensiveness of all similar products. Table 2 in Appendix presents examples of products included in each of the three groups.

### 3.2.2 Sales data

The second data that we use is scanner weekly data on the turnover and the number of units sold in 250 stores affiliated with 19 retailers for the years 2013 and 2019. The scanner data, purchased from Storenext.co.il, contain information on 11 products: seven first-wave shaming products and four products that we use as control. Panel (b) of Table 1 presents descriptive statistics on the sales data. Unlike the price data, the scanner data do not include information on the identity of the chain or the location of the store. Comparing the change before and after the regulation, we observe that the average number of units sold of shaming products increased by 15.8%, whereas the turnover for these products increased only by 4.1%. These patterns are consistent with lower prices and a mild increase in quantity sold. For non-shaming products, we see that after the regulation, quantity decreased from an average of 3.7 units per week to 3.3 units. The drop in the volume for non-shaming products is also in the same range. Finally, shaming products, that were included in the regulation also based on their popularity, are sold in considerably higher quantities than non-shaming products.

### 4 Estimation and Results

#### 4.1 The effect on prices

To identify the effect of the regulation on prices and to test H, we compare changes in prices of treated products (shaming products) before and after the regulation against price changes in products that belong to the three comparison groups described above. In subsequent analyses we also test whether the price drop was larger for products with higher pre-shaming price ratios (H), and other heterogeneous effects. Formally, we estimate the following standard difference-indifferences specification:

\[
\log(\text{price}_{irt}) = \mu_{ir} + \gamma_{t} + \alpha \times \text{Post}_{it} \times \text{Shaming}_{i} + \epsilon_{irt},
\]  

(7)

where the dependent variable is the log of the average price of product \(i\) sold by retailer \(r\) in month \(t\). The parameter of interest is \(\alpha\), which captures the change in the prices of the 12 shaming products (the treatment group) relative to the corresponding change in the prices of the 23 non-shaming products (the control group). The dummy variable \(\text{Shaming}_{i}\) equals 1 for shaming
products and 0 otherwise, and $Post_{it}$ equals one for months in which the price tags are displayed, and 0 otherwise. We also add product-retailer ($\mu_{ir}$) and month ($\gamma_t$) fixed effects that capture time-invariant and brand-cost factors that affect pricing decisions. We weight each observation by the number of chain stores that sell product $i$ in month $t$, and cluster standard errors by product. The estimation results using regular prices are presented in Columns (1)-(3) in Table 2 and in Columns (4)-(6) we present results using promotional prices. The estimation results using the main control group indicate that regular prices of products included in the regulation fell by 8.5%, and promotional prices fell by 5.5% following the regulation.

Table 2: The effect of shaming on prices

<table>
<thead>
<tr>
<th></th>
<th>log(Price)</th>
<th>log(Promotional price)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Main control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaming candidates</td>
<td></td>
<td>-0.085***</td>
</tr>
<tr>
<td>Close substitutes</td>
<td></td>
<td>(0.013)</td>
</tr>
<tr>
<td>Observations</td>
<td>28,742</td>
<td>16,233</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.93</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Panel B: Publicly-traded

<table>
<thead>
<tr>
<th></th>
<th>log(Price)</th>
<th>log(Promotional price)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Main control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaming candidates</td>
<td></td>
<td>-0.173***</td>
</tr>
<tr>
<td>Close substitutes</td>
<td></td>
<td>(0.026)</td>
</tr>
<tr>
<td>Observations</td>
<td>12,788</td>
<td>7,294</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.91</td>
<td>0.87</td>
</tr>
</tbody>
</table>

Panel C: Privately-owned

<table>
<thead>
<tr>
<th></th>
<th>log(Price)</th>
<th>log(Promotional price)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Main control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaming candidates</td>
<td></td>
<td>-0.013</td>
</tr>
<tr>
<td>Close substitutes</td>
<td></td>
<td>(0.009)</td>
</tr>
<tr>
<td>Observations</td>
<td>15,954</td>
<td>8,939</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.94</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Notes: The table presents the estimation results for Equation 7 for the three comparison groups: the main control group, shaming candidates and close substitutes. In Columns (1)-(3) we use regular prices and in Columns (4)-(6) we use promotional prices as dependent variables. The results in panel A suggest that prices fell significantly after the implementation of the regulation. For the main control group, we find that regular prices dropped by 8.5% and by 5.5% when using promotional prices. We also observe a significant fall in prices (6.6% in regular prices, 3.6% in promotional prices) when we use the shaming candidates group. As expected, the results show a smaller drop in prices, though still large and significant, when we use the close substitutes group (4.7% in regular prices, 2.5% in promotional prices). In panel B we presents the results of the estimation using only publicly-traded retailers. The magnitude of the results in this sub population is higher, for example, Column 1 suggests that for publicly-traded retailer, after the regulation began the price of shaming products fell by 17% more than the prices of products in the main control group. In Panel C, we present the results for privately-owned retailers. The results in this panel are smaller and mostly insignificant both for regular and promotional prices. Observations are weighted by the number of stores operated by each chain. Standard errors are clustered at the product level. Additional covariates include product $\times$ retailer and month fixed effects. *$p<0.1$; **$p<0.05$; ***$p<0.01$
We also examine how the prices of shaming products evolved over time. To obtain the monthly effect of the regulation, we estimate a version of Equation (7), interacting the shaming variable with the month variable. The estimation captures the per-month change in the log(price) of products included in the regulation relative to the prices of products in the control group. Figure 3 presents the interaction monthly coefficients with the corresponding 95% confidence interval for regular prices. We present two time series, one for the products included in the first wave, and one for the products in the second wave. The two black vertical dashed lines indicate the first full month that the regulation was effective for each wave (March and December 2018, respectively). We also denote with a blue vertical dashed line the month in which Nielsen exited Israel, which is the date on which the regulation became ineffective. The figure shows that prices of products included in both waves fell abruptly soon after the regulation became effective, and that the effect on the first-wave products is twice as large as the effect on the second-wave products. The effect on the prices of products in the second wave dissipates over time and is statistically indistinguishable from zero after Nielsen exits the Israeli market. The coefficients on the last pre-implementation months are slightly negative because the effective date for the two waves was during the second half of these months. The figure is also useful for examining the common-trend assumption, showing that for both time series, the monthly effect is statistically equal to zero prior to the implementation of the regulation.

4.1.1 Heterogeneous price effects

Figure 4a plots the effect of the regulation on prices of shaming products at each retailer against the average price level at that retailer. Specifically, we estimate Equation (7) allowing the effect of the shaming to vary across retailers. The retailer’s average price level on the horizontal axis is the retailer’s fixed effect in the regression. The figure suggests that retailers’ response to the regulation was not uniform, where some retailers reduced prices by more than 30% whereas other retailers did not change prices and in a few cases raised them. We do not observe a clear pattern that high-priced retailers reduced prices more than low-priced retailers. However, the figure reveals that publicly-traded retailers (denoted by blue triangles) reduced prices more than privately-owned retailers (denoted by orange circles). Motivated by Figure 4a, when we separately estimate Equation (7) for publicly-traded and privately-owned retailers, we find that prices of shaming products sold by publicly-traded retailers fell by 18%, whereas the effect is small and statistically insignificant among privately-owned retailers. Using promotional prices, the effect is -10.4% for products sold by publicly-traded retailers, and is -1.7% for products sold by privately-owned retailers. Next, we turn to test H4 – that the price drop following the regulation is larger for products with a higher pre-shaming price ratio. To do so, we divide the products into quartiles based on their price ratio at each retailer. Thus, the three products with the highest pre-shaming ratio at a given retailer are included in this retailer’s top quartile. Overall, there are 348 product-retailer pairs, and each quartile contains 87 combinations. We then estimate a version of Equation (7) to examine the relationship between the pre-shaming price ratio and the price reduction following the regulation. The estimation results, presented in Figure 4b, indicate that prices of products with large price ratios fell more than price of products with smaller price ratios. Since the partition of products into quartiles implies that products sold by a given retailer are assigned to different quartiles, this analysis also controls for potential differences across retailers. As seen in the figure, and consistent with our previous results, the effects of shaming on products with a higher price ratio is considerably larger at publicly-traded retailers than in privately-owned retailers.
The figure shows the per-month change in the log(price) of products included in the shaming regulation relative to prices of products included in the control group for publicly traded retailers. The figure distinguishes between the two waves of the regulation, separately showing a time series for products included in the first and second waves. The two black vertical dashed lines indicate the first full month that the shaming signs were placed in stores. The blue vertical dashed line represents the month in which Nielsen exited Israel, effectively ending the regulation. For each month, we present the coefficient for the monthly effect and the corresponding 95% confidence interval. Prices of products included in both waves fell significantly after the regulation became effective, and the effect in the first-wave is twice as big as the effect in the second-wave. The effect on prices of products in the second wave is marginally significant. Before the implementation of the regulation we do not see a downward trend in prices, consistent with the common-trend assumption. Interestingly, the price of the products that were excluded from the regulation remained similar to the prices of product that remained in the shaming list.
Figure 4: Heterogeneous effects on price, by ownership type and pre-shaming price

Figure 4a shows how the effect of shaming varies with a retailer’s price level and ownership type. The Y-axis presents the estimated effects of shaming on prices at different retailers. On the X-axis we use a measure of a retailer’s price level. Specifically, we use the retailer fixed-effect from estimating Equation 1 using pre-shaming price data only. We denote by blue triangles publicly-traded retailers and in orange circles privately-owned retailers. The figure shows that publicly-traded retailers reduce prices significantly more than privately-owned retailers. We do not observe a clear pattern between the effect of shaming and a retailer’s price level. In Figure 4b we use the pre-shaming price data to divide shaming products into price-ratio quartiles. The grey line corresponds to the full sample, the blue to publicly-owned retailers and the orange to privately-owned retailers. We find that prices of products with high price-ratios fell more and that the effect is considerably larger for products sold by publicly-owned retailers.
Overall, the results support $H_1$ and $H_4$. Prices fell after the regulation and the price drop is considerably larger for products that are characterized with a larger price ratio. In the next section, we test the impact of the regulation on the quantities sold by retailers ($H_2$ and $H_3$).

4.2 The effect of shaming on quantities sold

In this section we examine how quantities sold of shaming products changed following the regulation. Since prices of shaming products dropped, we expect that sales will increase ($H_2$). However, our objective is to examine whether displaying the price tags had an effect on quantities sold above and beyond the effect driven by the price drop. Presumably, when consumers observe the price tags that will purchase fewer units relative to the number of units they would have purchased at the same price level but in the absence of the international price tags ($H_3$). To examine hypotheses ($H_3$ and $H_5$) we need a measure of predicted quantity sold of each product. That is, the quantity that consumers would have bought had prices dropped with no in-store price tags displayed. To obtain this measure, we estimate demand elasticities for each of the 7 shaming products in the first wave. These demand elasticities are computed using data only from the pre-regulation time period. We use these demand elasticities and the actual price reductions following the regulation to compute the measures of predicted quantities sold, which we later compare with the actual changes in quantities. We also test how the difference between the predicted and the actual quantities depends on the post-shaming expensiveness of the local price vis-à-vis the international price. we expect that products that remained pricier relative to the international price should exhibit a larger drop in sales relative to the predicted quantity sold in the absence of the international price tags ($H_5$).

4.2.1 Demand estimation

To estimate demand we use the sales data and focus on the pre-shaming period. The dependent variable is (log) quantity sold and the main independent variable is (log) price. An observation is product $i$ sold in store $s$ in week $t$. This specification is related to the theoretical model in Section 2, where $-1/\beta$ is the own-price elasticity of demand. We allow for store-product and month-product fixed effects, and estimate the following equation separately for each product $j$:

$$
\log (q_{jts}) = \alpha_{sj} + \zeta_{tj} + \sum_{k=1}^{J} \eta_{jk} \cdot \log (p_{kts}) + \epsilon_{jts}
$$

(8)

The coefficient of interest is $\eta_{jk}$ which is the own-price elasticity of demand of product $j$ in store $k$. To address the endogeneity of the price of product $j$ in store $k$, we use the log of the average price of product $j$ in other stores of the same retailer in the same month, as an instrument for $p_{jmt}$, controlling for product-month and product-store fixed effects (similar to Nevo 2001; DellaVigna and Gentzkow 2019; Goldin, Homonoff and Meckel 2022). The underlying assumption is that local demand shocks are unrelated to retailer-level pricing. This assumption seems reasonable given retailers’ use of uniform pricing. We present the matrix of demand elasticities in Figure 1 in Appendix C. The own-price elasticities in the main diagonal are all negative and less than -1,

13Appendix D describes additional exercises we conduct to demonstrate the robustness of our findings on prices. We first test whether our main results regarding the drop in prices are sensitive to the products included in the control groups. We also conduct falsification tests using data from prior periods and do not find an effect when running these tests. Finally, we estimate different specifications of Equation (7) without weighting, and using retailer and product linear time trends, and including product and retailer fixed effects separately. All the results are qualitatively similar to the results of the main specification.
implying elastic demand for these products. We use these elasticities to calculate the predicted changes in quantities sold following the price change triggered by the regulation and compare these predicted changes with the actual changes in quantities sold.

4.2.2 Comparing predicted and actual quantities sold

The comparison between predicted and actual changes in quantities sold is presented in Figure 5. On the vertical axis, we report the change in the prices of the 11 products and on the horizontal axis we present the predicted (orange) and the actual (blue) changes in quantities sold for each product. The seven shaming products are denoted by small circles and the four control products are denoted by small triangles.

In Figure 5, we use the estimated demand elasticities to calculate the predicted change in quantities sold. We compare the predicted changes for each product (orange) with the actual changes in quantities sold (blue). The figure shows that the prices of shaming products fell (-10.5%), and hence the predicted changes in quantities sold is positive (on average 18.5%). Yet, the actual changes in quantities sold are smaller than predicted (10.5% on average). For the control group, we do not observe a difference between the actual and predicted quantities sold.

As seen in the bottom-right square, prices of shaming products fell. On average, the price of shaming products included in the first wave fell by 10.5%. The predicted change in quantity

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14The set of retailers, products and the time frame in this analysis do not exactly overlap with those included in the price analysis. Therefore, we do not get the exact same results like in the price analysis.
sold for each product is denoted by an orange circle. We also denote by a larger circle the average impact on the shaming products and by a larger triangle the average impact on the control products. Given the actual price reductions, the average predicted increase in quantity is on average 18.5%. Yet, the actual average increase in quantities sold is much smaller, on average, 10.5%. For the non-shaming/control group of products, the actual quantities sold decreased by an average of 6% which is also the predicted decrease for these products.

![Figure 6: The difference between predicted and actual quantities](image)

The black dots in the figure capture the difference between the actual and predicted quantities sold following the regulation (vertical axis) against the post-shaming price ratio of these products (horizontal axis). The relationship is shown for each of the seven first-wave products, which are ranked by their post-shaming price ratio. For instance, for the product having a price ratio of nearly 2.2, the difference between the actual and predicted quantities is about minus 35%. The blue dot represents the average value of the difference across the seven products. The figure also shows the 90% confidence interval for these differences relative to a no-difference benchmark. The figure shows a clear negative relationship, where products with a larger price ratio show a larger difference between the predicted and the actual quantity sold. The differences are statistically different for 5 out of the 7 products.

The comparison between predicted and actual quantities sold against the actual change in price is useful to obtain a measure of the impact of the regulation. In particular, we calculate the price change that could have explained the actual change in quantity (i.e. an increase 10.5%), and compare it with the actual change in price. Based on the pre-shaming elasticities, a price reduction of about 6% could have explained the observed change in quantities sold. However, since prices actually declined by 10.5% we claim that the effect of shaming on demand is equal to an average increase of 4.5% in prices. In Section 5, we use the theoretical model to quantify the impact of international price tags, while taking into account also the price ratio of each product. The next step of the analysis focuses on explaining the variation across products in the difference between the actual and the predicted quantities sold. According to H5, we expect that a product with
Table 3: The difference between predicted and actual quantities and the post-shaming price ratio

<table>
<thead>
<tr>
<th>Dependent Variable: Predicted - Actual change in quantities (PP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>(2)</td>
</tr>
<tr>
<td>Price Ratio</td>
</tr>
<tr>
<td>0.468***</td>
</tr>
<tr>
<td>(0.104)</td>
</tr>
<tr>
<td>0.602***</td>
</tr>
<tr>
<td>(0.127)</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>10,187</td>
</tr>
<tr>
<td>10,187</td>
</tr>
<tr>
<td>R²</td>
</tr>
<tr>
<td>0.12</td>
</tr>
<tr>
<td>0.46</td>
</tr>
</tbody>
</table>

Notes: The table presents regression results of Equation (9) examining the relationship between the post-shaming price ratio of a product and the difference between predicted and actual changes in quantities. Consistent with H5, the results indicate that products characterized by a higher post-shaming price ratio exhibit a larger difference between the predicted and actual quantities sold. All regressions include month FE, column (1) includes retailer × item FE, and column (2) includes store × item FE. Standard errors are clustered at the Retailer level and reported in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

a high post-shaming price ratio will experience a larger drop in demand and therefore a larger difference between predicted and actual quantities sold. Figure 6 illustrates this relationship. The horizontal axis shows the difference between predicted and actual quantities sold for the seven first-wave products. The vertical axis shows the post-shaming price ratio difference.

As can be seen, for 6 out of 7 products included in the regulation, the actual quantity sold was lower than predicted. Strikingly, the relative drop in sales is negatively correlated with the post-shaming price ratio. Products that remain relatively more expensive compared to the international price suffered a greater drop in quantities sold after the shaming regulation. For the product that remained most expensive (2.2 times more expensive than the international price of the product), the difference between the predicted and actual quantities sold is the largest and is above 35%. Other products became less pricey and show a smaller difference between predicted and actual quantities sold. For 5 out of the 7 products, this difference is statistically different from zero. A similar exercise for non-shaming products shows that the difference between the actual predicted quantities sold is statistically different from zero only for one out of four products.

We can also estimate the relationship shown in Figure 6. In this analysis, the dependent variable is the percentage point difference between the predicted and the actual change in quantities sold. For example, if the predicted increase in quantity sold of a product is by 5%, and the actual increase is 3%, then the percentage point difference is 2%. Formally, we estimate the following equation:

$$100\left(\frac{\bar{Q}_{\text{ist}} - Q_{\text{ist}}}{\bar{Q}_{\text{ist}}^{\text{ns}}}\right) = \mu_{\text{is}} + \delta_t + \beta_{\text{local}}\frac{p_{\text{int}}}{p_{\text{net}}} + \epsilon_{\text{ist}},$$

(9)

where we derive \(\bar{Q}_{\text{ist}}\) using the elasticities matrix estimated in Equation 8 and prices and quantities sold in the two months that preceded the shaming regulation (\(Q^{\text{ns}}, P^{\text{ns}}\)). The results, presented in Table 3, show a strong positive relationship between the post-shaming price ratio and the difference between predicted and actual quantities sold, thus supporting hypotheses 5.

### 4.3 The impact of shaming on quantities – alternative approach

We also test the model’s hypotheses regarding quantities sold using a difference-in-differences research design. We consider the 7 first-wave shaming products as the treated group and the other products are in the control group. For completeness, we use the revenue data to construct not
Table 4: The impact of shaming on quantities - difference in differences specification

<table>
<thead>
<tr>
<th>Dependent Variables:</th>
<th>log(Price) (1)</th>
<th>log(Q) (2)</th>
<th>log(Price) (3)</th>
<th>log(Q) (4)</th>
<th>log(Q) (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post × Shaming</td>
<td>-0.127***</td>
<td>0.161***</td>
<td>-0.034**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>log(Price)</td>
<td>-1.556***</td>
<td></td>
<td>-1.531***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \left( \frac{\text{Price}<em>{\text{local}}}{\text{Price}</em>{\text{int'l}}} - 1 \right) ) × Post × Shaming</td>
<td>-0.113***</td>
<td></td>
<td>-0.077***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R²</td>
<td>0.86</td>
<td>0.82</td>
<td>0.83</td>
<td>0.86</td>
<td>0.83</td>
</tr>
<tr>
<td>Observations</td>
<td>73,333</td>
<td>73,333</td>
<td>72,953</td>
<td>73,333</td>
<td>72,953</td>
</tr>
</tbody>
</table>

Notes: Specifications (2), (3) and (5) are the second stage of TSLS regressions using prices in other store of the same retailer as instruments for the price. We drop observations of products sold only in one store of the same retailer (0.5% of the sample). All regressions include store × item, and month FE. Standard errors are clustered at the store level and reported in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

Only the quantity but also the price as the dependent variable in the regression results displayed below. This analysis allows us to present in one table and using the same data the results for the five hypotheses from the theoretical model. Thus, when we consider hypotheses 1 and 4 we use the price as the dependent variable. When we consider the hypotheses regarding the change in quantities (hypotheses 2, 3, 5) we use the quantity as the dependent variable. In particular, to test hypotheses 2, 3, 5 we estimate versions of the following difference–in-differences specification:

\[
\log(\text{quantity}_{ist}) = \mu_{is} + \gamma_{st} + \alpha \times Post_{it} \times Shaming_i + \epsilon_{ist},
\]

where the dependent variable is the log of the quantity of product \( i \) sold in store \( s \) in period \( t \). The parameter of interest is \( \alpha \) which captures the percentage change in the number of units sold for the shaming products (the treatment group) relative to the corresponding change in quantities of the non-shaming products (the control group). The dummy variable \( Shaming_i \) equals 1 for shaming products and 0 otherwise, and \( Post_{it} \) equals one for periods in which the price tags are displayed, and 0 otherwise. We also add product-store (\( \mu_{is} \)) and store-period (\( \gamma_{st} \)) fixed effects that capture local time-invariant and brand-cost factors that affect demand. The regression results are presented in Table 4. Following the order of the hypotheses in the theoretical model, columns 1 and 4 present results using the price as the dependent variable and columns 2, 4 and 5 present results using the quantity as the dependent variable. The results in columns 1 and 4 confirm the results obtained in Section 4.1. Following the regulation, prices dropped and this drop is larger for products with larger pre-shaming price ratio. The results in Column 2 suggest that quantity sold of shaming products increased by 15% following the shaming regulation. In Column 3, we add the log(price) of the product as an additional control variable. Like in the demand elasticity specification, we instrument for the price using prices at other stores of the same retailer. As expected, the coefficient for the log (price) is negative and significant. Moreover, the coefficient on the post-shaming interaction term (-0.061) is now negative and significant. Thus, once we control for the price of the product we find that quantity sold decreased by 6%. These results are consistent with our previous findings. To also examine H5, we add an interaction term of the price-ratio and

\(^{15}\)The analysis in Section 4.1 used price data which is more comprehensive that the revenue data.
the post-shaming indicator to the specification. Indeed, results shown in Column 5 indicate that products with larger price ratios experienced a larger drop in demand.

To sum, our empirical findings support the five predictions of the theoretical model developed in Section 2. In the next section, we use the theoretical model to perform two additional exercises. First, we measure the sensitivity to unfair pricing, $\gamma$. This parameter is useful to compare the relative importance of a change in the price of the product itself versus a change in the price ratio of that product. Second, we use the model to calculate the change in consumer surplus following the implementation of the shaming regulation. Notably, although prices dropped and quantities increased following the regulation, the overall impact on consumer surplus is ex-ante ambiguous because consumers incur disutility from observing that they pay more than other consumers.

5 Sensitivity to Unfair Prices and Consumer Surplus

In this section we estimate the sensitivity to unfair/salient prices (the parameter $(\gamma)$ in the theoretical model). This parameter would allow us to compare a change in the price of the product itself against a change in the international price of that product. Next we will use the model’s estimates to quantify the change in consumer utility due to the shaming regulation.

5.1 Quantifying the sensitivity to salient unfair prices

We use Equation 6 from the theoretical model in Section 2 to quantify the sensitivity to unfair salient prices. The equation describes the quantity sold in the post-shaming period as a function of the perceived price of a product. This perceived price incorporates the price paid and the ratio between that price and the international price of that product. Formally, applying a log transformation of Equation 6, we estimate:

$$\log(q_{ist}) = \eta \log(\hat{P}_{ist}) + \mu_{is} + \delta_t + \epsilon_{ist},$$

(11)

where

$$\hat{P} = \frac{\hat{P}_{local}}{1 + \gamma I \left( \frac{\hat{P}_{local}}{\hat{P}_{int}} - 1 \right)}$$

The parameters of interest in Equation 11 are $\eta$ and $\gamma$. We cannot estimate the parameters directly because $\hat{P}$ is a function of $\gamma$. We also need to address the concerns about the endogeneity of the local price. To deal with these concerns we use the General Methods of Moments (GMM). To estimate the equation using GMM we use the following assumptions on the error $\epsilon$:

$$\epsilon \sim N(0, \sigma^2)$$

(12a)

$$E[Z\epsilon] = 0.$$  

(12b)

We use Equation 12b to derive the moments for the mean and variance of the error. We use the average prices in other stores as an instrument for the price in the local store. Finally, as a second instrument, we interact the first instrument with the post-shaming indicator $I$. We denote these

---

$^{16}$Equation 11 includes several fixed effects, making the optimization harder. To reduce the number of dimensions involved in the optimization, we estimate the equation twice on two subsets of the data. First, we use only non-shaming products to recover the time fixed-effects. Second, we estimate the regression using only pre-shaming data, and keep the product $\times$ store fixed-effects. This approach reduces the number of dimensions of the problem to only three unknown parameters $\gamma$, $\eta$, and the variance of the error $\sigma^2$. We provide more details on the sample and the empirical strategy in Appendix 3.
variables as $Z$ and $ZI$, respectively. Formally, we construct the following population moments:

\[
\begin{align*}
&12a \implies E[\epsilon] = 0 \quad (13a) \\
&12b \implies V(\epsilon) = E[\epsilon^2] - E[\epsilon]^2 = \sigma^2 \implies E[\epsilon^2 - \sigma^2] = 0 \quad (13b) \\
&12c \implies E[Z\epsilon] = 0 \quad (13c) \\
&12d \implies E[ZI\epsilon] = 0. \quad (13d)
\end{align*}
\]

The estimation results imply that the value of $\gamma$ that brings the moment condition as close as possible to zero is 0.05. The interpretation of this value is that an increase of a 20-percentage point in the price ratio (from 2 times to 2.2 times more expensive) is similar to an increase of 1% in the price of a product itself. Taking into account that the average price ratio in the post shaming period is about 1.75 the shaming effect is similar to an increase of nearly 4% in the actual price of the products. We now use this parameter to quantify the impact of the regulation on consumer utility. The estimated parameter for $\eta$ is -1.44. This estimate captures an average demand elasticities across the seven shaming products in the first wave. This estimate lies within the range of demand elasticities that we derived for specific products, as shown in Figure 1 in Appendix C. We now turn to using the parameters $\beta$ and $\gamma$ to compute the change in consumer utility before and after the regulation.

5.2 The effect of shaming on consumer utility

To compute the change in consumer utility following the regulation, we use the average quantities sold before and after the regulation for the seven products. We plug these quantities together with the values of $\beta$ and $\gamma$ into the utility function in Equation $\frac{1}{\gamma S}$. That is, $U(q, m) = q^{1-\beta} \frac{1}{1-\gamma S} + m$.

Our back of the envelope calculations indicate that the consumer utility dropped for 4 products, and increased for 3 out of the 7 products. Products with high price ratios exhibited an increase in utility, whereas products with low price ratios show a decline in utility. A possible explanation for this pattern is that prices of products with high price ratios fell significantly more than products with a low price ratio ($H_4$). As a result, the consumption of these products increased considerably leading to increased utility derived from these products. For products whose prices changed little, the change in quantities sold is small and the adverse effect on utility from observing that other consumers pay less is relatively important, making the overall change in utility negative. Figure 8 illustrates this relationship for an internal solution, in which we set the level of income at 1000.

6 Discussion

6.1 Implications for salient thinking

In a series of important theoretical papers, Bordalo, Gennaioli and Shleifer (2012, 2013, 2020) show how bottom-up attention can distort economic choice by distracting decision makers from certain choice attributes. In standard economics, attention is either unlimited or, if costly, optimally deployed “top down” given current goals and expectations. Our paper adds to the growing literature on salient thinking in several ways.

First, our paper considers a situation where a regulator intervenes in the market and changes the level of saliency. This intervention allows us to examine how both firms and consumers respond to the change in saliency. Previous studies typically focused on situations in which a firm or researchers manipulated the level of saliency, and the analysis explored how consumers responded. In addition, we can examine how the scope of competition changes when consumers’ attention
The figure shows the change in utility for the seven first-wave products following the introduction of the international price tags. For this exercise, we calculate the utility before and after the regulation using the observed prices and quantities of each product, and the estimates of $\gamma$ and $\beta$. We fix the income to 1000 NIS, though results remain qualitatively similar for other income levels as long as the consumer chooses positive quantities of $q$ and $M$. The figure shows a positive relationship between the pre-shaming price ratio and the change in utility from a given product.

shifts from quality to price. In their model, Bordalo, Gennaioli and Shleifer (2016) show how such a change leads to price cuts. Second, the shaming regulation included several products and we can therefore construct a measure of saliency – the ratio between local and international price – for each product before and after the regulation is implemented. Importantly, we can use this measure to rank products by their level of saliency and examine its impact on consumers’ and on firms’ responses. This feature allows us to connect the empirical analysis with theoretical models that emphasize that a heightened saliency should trigger a greater behavioral response, what Bordalo, Gennaioli and Shleifer (2012, 2013, 2020) consider as the ordering property.

Third, Bordalo, Gennaioli and Shleifer (2022) discuss three sources of stimuli that affect saliency: contrast, surprise, and prominence. Existing studies predominantly focus on changes in saliency due to surprise and prominence. For instance, Chetty, Looney and Kroft (2009) examine if a commodity tax has a larger effect on sales of non-food products if the tax is included in the posted price that customers see when shopping, and hence is more salient. Finkelstein (2009) examine how the introduction of electronic tolls affect drivers sensitivity to the price they pay. These and other studies concern situations where the price of a product itself becomes less or more salient, and therefore its prominence changes. In our setting, saliency changes due to the introduction of the international price, via its contrast with the price of the product in the local store. According to Bordalo, Gennaioli and Shleifer (2022), contrast captures the idea that a specific attribute of a good may stand out when the good is compared to alternatives. We are not aware of papers.

\footnote{The distinction between the three sources of stimuli is not always trivial. For instance, Hartzmark and Shue (2018) show that investors mistakenly perceive earnings news today as more impressive if yesterday’s earnings surprise was bad and less impressive if yesterday’s surprise was good. They attribute this behavior to contrast effects while their description is likely relevant mostly to the effect of surprise.}
that use field data to examine the role of contrast/saliency on consumer choice. Fourth, we examine the welfare implications of a change in saliency. According to our results, consumers might be worse off although the change in saliency led to lower prices and increased consumption. This interpretation is relevant to the debate regarding the effectiveness of policies that manipulate the choice architecture through nudges and reminders (e.g., Thaler (2018), Thaler, Sunstein and Balz (2013)), and to the distinction between FAST (Forgetful And Salient Thinkers) and FBOR (Forgetful But Otherwise Rational) consumers (Bordalo, Gennaioli and Shleifer 2022).

Our modelling approach also offers a contribution to the literature. In models of salient thinking product attributes are overweighted when they are more salient to consumers. Bordalo, Gennaioli and Shleifer 2022 propose the concept of decision weights although it is unclear how these weights are determined in a particular empirical application. In our setting this implies that local prices are overweighted in the decision process once the international price signs are displayed. We follow Bordalo, Gennaioli and Shleifer 2022 and use the attractiveness of a deal, measured as the ratio between local and international prices, to reflect these decision weights. Our modeling assumptions are also related to the concept of ‘transaction utility’ introduced by Thaler 1999. Thaler proposed that overall utility is the sum of the standard utility from consuming a product (known as acquisition utility) and the utility derived from the terms of the deal offered for the product (transaction utility). When a deal is bad the consumer derives less utility from consuming the product. We follow Thaler and include the attractiveness of a deal when considering the utility the consumer derives and hence the number of units she buys. We further show that the terms of the deal enters the utility only when the terms are salient.

6.2 Implications for optimal pricing strategy and price rigidity

Classic textbook pricing models show how price discrimination schemes increase firms’ profits and affect consumers surplus. In general, these models do not consider the observability of the price paid by other consumers as an important or a relevant factor. If, however, consumers have fairness concerns then such pricing schemes are less effective then we usually think (Li and Jain 2016; Cohen, Elmachtoub and Lei Forthcoming). Below, we discuss potential implications of our findings for firms’ pricing strategies, obfuscation strategies and for price rigidity.

The importance of what other consumers pay might depend on the identity of the other seller, the type of consumers, and the accessibility of information. Thus, consumers’ antagonism towards unfair pricing is potentially larger it is the same retailer who sets different prices for the same product in different stores or in the same store for different consumers, compared to a situation involving different retailers setting prices in different countries. Our analysis focuses on the prices of identical products which are sold in different countries, likely facing different costs, demand and socio-demographic characteristics. Despite these differences, we find that consumers are antagonized by the price differential, and according to our calculations are willing to pay 1% more for a lower 20% decrease in the price ratio. In that sense, our measure of $\gamma$, or the 1-20 ratio is a lower bound.

Our findings shed light on the question why multi-store retailers set similar prices in environ-
ments characterized by very different demographic and competition conditions (e.g., DellaVigna and Gentzkow 2019, Hitsch, Hortaçsu and Lin 2021, Ater and Rigbi Forthcoming). In particular, our findings suggest that retailers adopt uniform pricing to limit consumer antagonism in case prices by the same retailer differ across stores. Indeed, Ater and Rigbi (Forthcoming) show that Israeli retailers adopted uniform pricing shortly after prices became transparent in the Israeli retail food market. Consumer antagonism toward unfair prices could also explain why firms in online markets often engage in price obfuscation practices, making it difficult for consumers to realize what the final price is. A common explanation for these practices is that they are used to confuse customers about the final price of the product they are considering to buy. We propose that obfuscation is actually meant to make it difficult for consumers to observe the price that other consumers paid for the same product. Our findings could have implications for price rigidity and inflation. If consumers’ antagonism towards prices that other consumers previously paid for the same product, then changing prices today entails costs that sellers may want to avoid in the future. In some circumstances, consumers may therefore decide not to change prices. Thus, fairness concerns constitute a form of menu costs that needs to be taken into account. Rotemberg (2005, 2011), and Eyster, Madarász and Michaillat (2021) offer related theoretical models.

6.3 Alternative explanations

A common challenge in empirical papers that focus on saliency-based explanations is ruling out alternative information-related explanations. Handel and Schwartzstein (2018) show that information-related explanations such as search or switching costs can often also explain observed choices. For instance, consumers may fail to calculate the full price since they are unaware of the certain fees or taxes, rather than due to limited attention. Unlike papers that focus on prominence of a product’s price or fees that consumers become aware of, we study a regulatory intervention that does not involve a change in the product’s price or in its fees. What changes in our setting is external to the product’s price, making concerns that the intervention changes the information that consumers have about the price less relevant. What about other explanations for the patterns we uncover?

First, the international price tags might reveal information about the quality of the products included in the regulation. Arguably, if consumers learn that the same product is sold for a much lower price abroad, they may lower the intrinsic value they attach for the product, and reduce their willingness-to-pay for that product. According to this argument, the drop in prices and in quantities we observe is not driven by saliency and fairness concerns. We think that this concern is less relevant for two main reasons. First, the products included in the regulation are highly popular and are considered well-established brands. Accordingly, it is unlikely that the regulation will have a substantial adverse impact on the quality that consumers attach to the shaming products. Our analysis that uses very close substitutes, finds that the prices of these products fell but not as much as shaming products, further indicates that consumers do not infer that the quality of very similar products fell.

Second, another concern is that informing consumers about the price of the same products abroad might sway consumers from buying in local stores. This force might also result in lower in-store demand. We believe this explanations is also unlikely for two main reasons. First, customs and shipping costs in Israel are significant, making buying the shaming products abroad for an individual not cost-ineffective. Second, the overall quantity of shaming products increased, whereas if buying internationally would have become the norm, we would expect overall quantities to fall. Finally, if these channel is important we would expect the prices in high-priced retailers would be more sensitive to the regulation, whereas we do not find such relationship.
Third, our results might be driven by retailers and importers concerns that the government is planning additional interventions in the market. Accordingly, the drop in prices we observe is a way to appease the regulator. While we cannot completely rule out that such concerns exist, we can test whether prices of products that were almost included in the regulation also changed. Presumably, concerns from future interventions should also be reflected in the prices of these products. The regression results using the shaming candidates products suggest that the prices of these products did not significantly change following the regulation. Thus, we can argue that such concerns are unlikely to drive the results we document for the shaming products.

7 Concluding Remarks

How consumers make choices is at the core of economics. Growing evidence shows that the context in which decisions are made greatly affects consumer choices. Yet, these studies typically focus on the consumer side and ignore firms’ responses to changes in the context in which the choices are presented or in the saliency of alternatives. This paper addresses this gap in the literature and examines the effectiveness of a unique and unconventional regulation that changed the saliency of price information presented in Israeli retail stores. The regulation required Israeli retailers to post on-shelf signs indicating the average international price of 12 items alongside the price of the same item sold in the Israeli store. Notably, the regulation did not change the amount of information on the price of a given product but rather changed the context in which the product’s price was presented to consumers. Arguably, this setting is more suited to test theoretical models that emphasize the role of saliency of information. Our analysis shows that prices fell by 8% and that this effect is driven by prices that were exceptionally expensive vis-à-vis international prices, and by publicly traded retailers. Moreover, we also find that following the regulation consumers bought more of the products included in the regulation but to a smaller extent than what had expected based on demand elasticities that we compute using pre-regulation data.

From a policy perspective, the regulation was highly effective in reducing prices. Nevertheless, we show that its implications on consumers are ambiguous since following the regulation consumers become aware to the fact they pay more than others. Moreover, since the regulation was short-lived it is difficult to determine what would have been the long-term consequences of the shaming signs. Also, the regulation covered only 12 products. Presumably, covering a larger number of products could have a different effect, if consumers’ attention to these price tags is limited. We leave these issues to future research.

References


Appendix A  On-the-shelf shaming signs - an example

Exhibit 1: Retail and international price labels

The figure shows the local and the international price of a 150ml Dove Spray Deodorant Original (UPC code 729003806577). The local retailer’s promotional price is 14.90 NIS (22.90 NIS full price) and the average international price is 8.60 NIS.
Table 1: Products included in the shaming regulation

<table>
<thead>
<tr>
<th>Price (Local ; Intl)</th>
<th>Diff</th>
<th>Shaming period</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.2 ; 8.25</td>
<td>133% ↑</td>
<td>1st wave</td>
</tr>
<tr>
<td>11.3 ; 5.92</td>
<td>91% ↑</td>
<td>1st − 2nd wave</td>
</tr>
<tr>
<td>15.8 ; 8.9</td>
<td>79% ↑</td>
<td>1st wave</td>
</tr>
<tr>
<td>19 ; 8</td>
<td>139% ↑</td>
<td>2nd wave</td>
</tr>
</tbody>
</table>

Price (Local ; Intl) 23.7 ; 8.6 24.4 ; 10.3 24.5 ; 10.9 23.7 ; 9.8
Diff 176% ↑ 136% ↑ 125% ↑ 143% ↑
Shaming period 1st wave 1st wave 1st wave 2nd wave

Price (Local ; Intl) 19.2 ; 8.6 22.2 ; 12.9 30.1 ; 15.6 30.4 ; 16.8
Diff 124% ↑ 72% ↑ 93% ↑ 82% ↑
Shaming period 1st − 2nd wave 2nd wave 2nd wave 2nd wave

Table 2: Examples of products in each group

<table>
<thead>
<tr>
<th>Shaming products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non shaming products:</td>
</tr>
<tr>
<td>(1) Same brand and category group</td>
</tr>
<tr>
<td>(2) Main group</td>
</tr>
<tr>
<td>(3) Shaming candidates group</td>
</tr>
</tbody>
</table>
Table 3: List of products in the main control group

<table>
<thead>
<tr>
<th>Name</th>
<th>Shaming period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbitol Mouthwash Triple Pink 500ml</td>
<td></td>
</tr>
<tr>
<td>Meridol Mouthwash for fresh breath 400ml</td>
<td></td>
</tr>
<tr>
<td>Meridol dental mouthwash 400ml</td>
<td></td>
</tr>
<tr>
<td>Tayadent Mouthwash with fluoride 150ml</td>
<td></td>
</tr>
<tr>
<td>Orbitol Gum Toothpaste for Children 70ml</td>
<td></td>
</tr>
<tr>
<td>Elmex Toothpaste for Children 75ml</td>
<td></td>
</tr>
<tr>
<td>Toothpicks with dental floss 35 units</td>
<td></td>
</tr>
<tr>
<td>Adidas Spray Deodorant for men - Pro Level A3 200ml</td>
<td></td>
</tr>
<tr>
<td>Adidas Spray Deodorant for men - Fresh 200ml</td>
<td></td>
</tr>
<tr>
<td>Roxena Spray Deodorant for men - Invisible 150 ml</td>
<td></td>
</tr>
<tr>
<td>Lady Speed Stick Deodorant for Women - Pink 65g</td>
<td></td>
</tr>
<tr>
<td>Nivea Roll-on Deodorant for Women 50ml</td>
<td></td>
</tr>
<tr>
<td>Careline Roll-on Deodorant for Women - Exotic scent 50ml</td>
<td></td>
</tr>
<tr>
<td>Fe Roll-on Deodorant for Women - cotton scent 50ml</td>
<td></td>
</tr>
<tr>
<td>Crema Deodorant for Women 75ml</td>
<td></td>
</tr>
<tr>
<td>Tempax- Tampons with applicator - Super Plus 30 units</td>
<td></td>
</tr>
<tr>
<td>Kotex- Tampons with applicator - Mini 16 units</td>
<td></td>
</tr>
<tr>
<td>Always Overnight Menstrual Pads Size 4 - Safe Night - 18 units</td>
<td></td>
</tr>
<tr>
<td>Always Overnight Menstrual Pads Size 3 - Quatro Ultra- 40 units</td>
<td></td>
</tr>
<tr>
<td>Always Menstrual Pads Quatro Long Size 4 - 12 × 4 units</td>
<td></td>
</tr>
<tr>
<td>Always Menstrual Pads Ultra Long - 12 × 2 units</td>
<td></td>
</tr>
<tr>
<td>Kotex- Menstrual Pads with wings- Normal Plus 30 units</td>
<td></td>
</tr>
<tr>
<td>Lyly- Natural Menstrual Pads with wings - 24 units</td>
<td></td>
</tr>
</tbody>
</table>
Appendix B  
Model Solution

B.1  
Price elasticity of demand

The price elasticity of demand is given by
\[ \eta_{X,P} = \frac{\partial X}{\partial P} \frac{P}{X} = \frac{1}{-\beta} \left[ \frac{1 + \gamma I \left( \frac{2P}{P_{\text{Int}}} - 1 \right)}{1 + \gamma I \left( \frac{P}{P_{\text{Int}}} - 1 \right)} \right] \]  

(14)

The elasticity of demand has several properties. First, when the utility function collapses to the standard utility function (i.e., consumers are insensitive to unfair prices; local price equals to the international price; international prices are not salient), the elasticity is equal to \( \frac{1}{-\beta} \). Second, \( \frac{1}{-\beta} \) is an upper bound for the value of the own price elasticity. When consumers become aware to unfair prices, and are sensitive to these prices, their demand becomes more elastic.

Third, an increase in \( \gamma \) does not change the elasticity of demand if the international prices are not displayed. However, when they are displayed, an increase in consumer sensitivity to unfair prices makes demand more elastic and consumers more price sensitive, regardless of the price ratio. Similarly, the display of international prices leads to similar results. Elasticity decreases for any positive value of \( \gamma \) and unchanged when consumers are insensitive to salient prices.

Next, we examine the impact of an increase in the price ratio on price elasticity.

\[ \frac{\partial}{\partial \gamma} \left( \frac{1}{-\beta} \left[ \frac{1 + \gamma I \left( \frac{2P}{P_{\text{Int}}} - 1 \right)}{1 + \gamma I \left( \frac{P}{P_{\text{Int}}} - 1 \right)} \right] \right) = \frac{1}{-\beta} \left[ \frac{\gamma I - (\gamma I)^2}{1 + \gamma I \left( \frac{P}{P_{\text{Int}}} - 1 \right)} \right]^2 \leq 0 \]  

(15)

when \( \gamma I = 0 \) (i.e., the international price tags are not displayed; or consumers are insensitive to salient prices) an increase in the price ratio does not affect the demand elasticity. However, if \( 0 < \gamma I < 1 \) the numerator is positive, and demand becomes more elastic when the price ratio rises.

B.2  
The firm problem

Profits are given by:

\[ V = q(P)(P - c), \]

with \( q(P) = \left( P + P^2 \frac{\gamma I}{P_{\text{Int}}} \right)^{-\frac{1}{2}} \)

We write the maximization problem as

\[ \max_P V = \max_P [q(P)(P - c)] \]

The first order condition is:

\[ \frac{\partial V}{\partial P} = \left( P + P^2 \frac{\gamma I}{P_{\text{Int}}} \right)^{-\frac{1}{2}} - \]

\[ (P - C) \frac{1}{\beta} \left( 1 + 2P \frac{\gamma I}{P_{\text{Int}}} \right) \left( P + P^2 \frac{\gamma I}{P_{\text{Int}}} \right)^{-\frac{1}{2} - 1} = 0 \]

define:

\[ \bar{q} = P + P^2 \frac{\gamma I}{P_{\text{Int}}} \]

arrange:
\[
\frac{\partial V}{\partial P} = \tilde{q}^{\beta - 1} \left( \tilde{q} - \tilde{q}' \left( P - C \right) \frac{1}{\beta} \right) = 0
\]

Only the right term could be zero-
\[
\tilde{q} - \tilde{q}' \left( P - C \right) \frac{1}{\beta} = 0
\]

Thus we get,
\[
P + P^2 \frac{\gamma I}{P_{\text{int}}} - (1 + 2P \frac{\gamma I}{P_{\text{int}}}) \left( P - C \right) \frac{1}{\beta} = 0
\]

After arranging we get the standard quadratic equation
\[
P^2 \left( \beta - 2 \right) \frac{\gamma I}{P_{\text{int}}} + P \left( \beta - 1 + 2C \frac{\gamma I}{P_{\text{int}}} \right) + C = 0
\]

We assume that the marginal costs, local and international prices are strictly positive. and \(0 < \beta < 1\) which implies that the demand is elastic. under these constraints, we can derive the optimal price by a monopoly:
\[
P^* = \begin{cases} 
\left( \frac{\beta - 1 + 2C \frac{\gamma I}{P_{\text{int}}}}{1 - \beta} \right) & , \frac{\gamma I}{\gamma I_{\text{int}}} \neq 0 \\
\left( \frac{\beta - 1 + 2C \frac{\gamma I}{P_{\text{int}}}}{1 - \beta} \right) & , \frac{\gamma I}{\gamma I_{\text{int}}} = 0
\end{cases}
\]

The optimal price when \(\gamma I = 0\) collapses to the standard monopoly price, which depends only on the marginal cost and demand elasticity. When \(\gamma I > 0\), the optimal price is lower, and at the limit, as \(\gamma I\) approaches 0, it is the standard monopoly price:
\[
\lim_{\gamma I \to 0} P^* = \frac{c}{1 - \beta}
\]

Using the optimal price, we can conduct comparative static analysis with regard to price and quantity following a change in \(\gamma I\) for the first solution of \(P^*\). The derivative of \(P^*\) with respect to \(\gamma I\) is given by:
\[
\frac{\partial P^*}{\partial \gamma} = \frac{P_{\text{int}} \left( 2\gamma c - P_{\text{int}}(-1 + \beta)^2(-1 + \gamma I) + (-1 + \beta) \frac{\sqrt{4\gamma^2 c^2 I^2 - 4P_{\text{int}} c \gamma I(-1 + \gamma I) + P_{\text{int}}^2 (-1 + \beta)^2(-1 + \gamma I)^2}}{2(-2 + \beta)\gamma^2 I \sqrt{4P_{\text{int}}(-2 + \beta)(-1 + \gamma I)c \gamma I + (P_{\text{int}}(-1 + \beta)(-1 + \gamma I) - 2\gamma I)c^2}} \right)}{(2(-2 + \beta)\gamma^2 I \sqrt{4P_{\text{int}}(-2 + \beta)(-1 + \gamma I)c \gamma I + (P_{\text{int}}(-1 + \beta)(-1 + \gamma I) - 2\gamma I)c^2})}
\]

This equation is always negative under the constraints on the parameters. Thus, we can conclude that when the consumer becomes more sensitive to unfair prices, the monopoly has incentive to decrease prices.

To find the impact on quantity we use a similar exercise and find that the derivative of \(Q(P^*)\) with respect to \(\gamma\):
\[
\frac{\partial (Q(P^*))}{\partial \gamma} = \frac{\partial \left( (P \cdot (1 + \gamma S(P, P_{\text{int}})I)) \right)}{\partial \gamma} = 2^{-1 + \frac{1}{\beta}} \left( 2c \gamma I + P_{\text{int}} \omega - \delta \right) \frac{\left( \frac{2c \gamma I - P_{\text{int}} \omega + \delta}{(-2 + \beta)\gamma I} \right)^{\frac{1}{\beta}}}{(\gamma I - 1 + \gamma I)}
\]

where we define:
\[
\delta = \sqrt{4P_{\text{int}}(-2 + \beta)c \gamma I(-1 + \gamma I) + (-2 c \gamma I + P_{\text{int}} \omega)}
\]
\[
\omega = (-1 + \beta)(-1 + \gamma I)
\]
\[
\frac{\partial Q(P^*)}{\partial \gamma} = \text{is positive, which suggests that quantity increases with } \gamma.
\]
Appendix C  Demand Elasticities

We estimate Equation (8) and present the price elasticity matrix. Insignificant elasticities (at 5%) are not shown. The figure shows that all own-price elasticities are negative and less than -1. Cross-price elasticities are mostly insignificant. The color denotes the magnitude of the elasticities, ranging from orange for negative elasticities to blue for positive elasticities.

![Elasticity of demand for product: W.R.T the price of:](image)

**Figure 1:** Price elasticities before shaming
Appendix D  Robustness

We describe several exercises we conduct to examine the robustness of our findings.

D.1 Different specifications

We check that the estimation results of Equation 7 are insensitive to the chosen specifications. Table 4 presents the results of the ordinary least squares estimation in Columns 1-3. In column 4-9 we include and exclude different variables to test whether our results depends on the inclusion of a specific fixed-effect, or driven by some linear time trend. In panel A we present the results using the regular prices as our dependent variable, and in Panel B we use promotional prices. The results remain significant and qualitatively similar to our main specification.

D.2 Placebo tests

Falsification test using alternative placebo outcomes. We estimate equation 7 using the monthly number of stores that sell a product by each retailer. We present the regression results in table 5. The table shows that the initiative has no effect on the availability of the products. Had we obtained a significant result in this exercise that would have raised concerns that estimation results are biased, and that the effect of the regulation is confounded due to unobserved sources.

---

20 As shaming products are highly popular, retailers are unlikely to discontinue selling them after the regulation.
<table>
<thead>
<tr>
<th>Panel A: Dependent variable: log(price)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>post × shaming</td>
<td>-0.083***</td>
<td>-0.206***</td>
<td>-0.011</td>
<td>-0.080***</td>
<td>-0.178***</td>
<td>-0.014</td>
<td>-0.042**</td>
<td>-0.120***</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
<td>(0.034)</td>
<td>(0.009)</td>
<td>(0.014)</td>
<td>(0.027)</td>
<td>(0.009)</td>
<td>(0.017)</td>
<td>(0.039)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>R²</td>
<td>0.93</td>
<td>0.92</td>
<td>0.94</td>
<td>0.88</td>
<td>0.87</td>
<td>0.91</td>
<td>0.93</td>
<td>0.93</td>
<td>0.95</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Dependent variable: log(promotional price)</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>post × shaming</td>
<td>-0.058***</td>
<td>-0.143***</td>
<td>-0.008</td>
<td>-0.050***</td>
<td>-0.098***</td>
<td>-0.018*</td>
<td>-0.018*</td>
<td>-0.056**</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.032)</td>
<td>(0.011)</td>
<td>(0.013)</td>
<td>(0.022)</td>
<td>(0.010)</td>
<td>(0.009)</td>
<td>(0.025)</td>
<td>(0.008)</td>
</tr>
<tr>
<td>R²</td>
<td>0.91</td>
<td>0.90</td>
<td>0.92</td>
<td>0.88</td>
<td>0.88</td>
<td>0.90</td>
<td>0.92</td>
<td>0.92</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Fixed-effects

- product-retailer
- month
- product
- retailer
- product specific lin. time trend
- retailer specific lin. time trend

Weights by stores

- Retailers: All, Public, Private
- Observations: 29,046, 10,849, 18,197, 29,046, 10,849, 18,197, 29,046, 10,849, 18,197

Notes: TBD
Table 5: Average effect on the number of stores selling shaming products

<table>
<thead>
<tr>
<th></th>
<th>log(branches)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>post × shaming</td>
<td>0.018</td>
<td>0.013</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(0.063)</td>
<td>(0.068)</td>
<td>(0.067)</td>
</tr>
</tbody>
</table>

Fixed-effects

Month ✓ ✓ ✓
Product × Retailer ✓ ✓ ✓
Retailers
All ✓
Public ✓
Private ✓
Observations 29,046 10,849 18,197
R² 0.93 0.95 0.91

Notes: The table presents a placebo test where we estimate the effect of the regulation on the number of stores that offer each item in a given month. The table shows that retailers did not significantly change the availability of items after the regulation began. While removing items from the shelves can be a strategic response to the regulation, we do not find evidence for such a response. Standard errors are clustered by item. Observations are not weighed. *p<0.1; **p<0.05; ***p<0.01

Appendix E  Details on the structural approach for quantifying consumer sensitivity to unfair prices

In this appendix we elaborate on the two empirical methods that we used to quantify the sensitivity of consumer to salient unfair prices.

E.1 GMM

The GMM estimator find the parameter that brings the moments condition as close as possible to zero. We use averages to construct the sample counterpart of the population moments. Formally, the sample moments are:

\[ m_1(\theta, Y, X) = \epsilon_i \]  \hspace{1cm} (18a)
\[ m_2(\theta, Y, X) = \epsilon_i^2 - \sigma^2 \]  \hspace{1cm} (18b)
\[ m_3(\theta, Y, X) = Z_i \]  \hspace{1cm} (18c)
\[ m_4(\theta, Y, X) = Z_i I_i \epsilon_i \]  \hspace{1cm} (18d)

We further define \( m_i \) as vector of moment conditions for obs \( i \).

The sample counterpart of moment condition \( k \) is:

\[ \bar{m}_k(\hat{\theta}) = \frac{1}{N} \sum_{i=1}^{N} (m_k(\hat{\theta}, Y, X)) \]  \hspace{1cm} (19)

The GMM estimator is defined as:

\[ \hat{\theta} = \arg \min_{\theta} \bar{m}(\theta)' W \bar{m}(\theta) \]

We follow Hansen (1982) and use the following weighting matrix:

\[ W = \frac{1}{N} \sum_{i=1}^{N} (m_i(\hat{\theta}, Y, X) m_i(\hat{\theta}, Y, X)')^{-1} \]

We use cluster-bootstrap on the retailer-item level to produce confidence interval.
<table>
<thead>
<tr>
<th>Coef</th>
<th>conf.low</th>
<th>conf.upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>γ</td>
<td>0.049</td>
<td>0.031</td>
</tr>
<tr>
<td>η</td>
<td>-1.437</td>
<td>-1.439</td>
</tr>
<tr>
<td>σ²</td>
<td>0.442</td>
<td>0.428</td>
</tr>
</tbody>
</table>

*Notes:* The table presents the results of estimating Equation 11 using GMM. To estimate the confidence interval we use cluster-bootstrap on the retailer × item level, with 1000 replications. Column (1) shows the coefficients using the full sample, and columns (2) and (3) presents the 99% confidence interval from the bootstrap exercise.

Table 6: GMM Estimation results

### E.2 MSM

The MSM estimator minimizes the weighted distance between empirical moments and simulated moments. The moments are constructed using quantity averages of different subsets of the population. We match the empirical moments with moments derived from simulations, where we simulate data according to Equation 11. The moments are insensitive to changes in γ before the shaming regulation was introduced and for non-shaming products. Therefore, for this procedure we only use data from the post-shaming period.

**The moments.** An informative moment should be sensitive to changes of at least one element in θ. Thus, we choose the moments using a one-dimension sensitivity analysis that tests how each moment changes following changes in one of the unknown parameters. We construct three groups of moments, and Figure 2a shows the sensitivity of each of the moment to different values of γ. All of the moments are based on the (log) quantity sold of product i in store s during month t:

- Monthly averages from the post-shaming period only. $M_T = \frac{\sum_i \sum_s \log(q_{i,s,t})}{\sum_i \sum_s 1}$ (12 moments).
- Average quantity by retailer (19 moments).
- Average quantity by product (per store s in time t), for treated products (7 moments).

**Empirical strategy**

After finding informative moment conditions, we match the vector of empirical moments with a vector of an average of k draws of the simulated moments. The objective function of the MSM is to minimize the weighted differences between the two vectors, by changing the values of the unknown parameters. Formally, we are looking for an estimated set of parameters $\hat{\theta}$ that satisfies:

$$\hat{\theta} = \text{argmin}(\tilde{M}_S - M_D) W (\tilde{M}_S - M_D),$$ (20)

where $\tilde{M}_S$ are the average of k draws of simulated moments $M_S$, $M_D$ are the empirical moments, and $W$ is the weighting matrix. To estimate the optimal weighting matrix we follow the two-steps procedure described in Jalali, Rahmandad and Ghoddusi (2015). As the MSM involves an optimization process, we need to check that the optimization converges to a global minimum. To address this concern, we repeat the optimization process using different initial values, seeds, and number of draws k we use to evaluate each average of simulated moment, and the number of draws L for the number of draws used for estimating the optimal weighting matrix. We reject any statistical association between those values and the estimated parameters. Figure 2a presents the empirical and simulated moments, and Table 7 shows the estimation for the unknown parameters.

The results of the estimation imply that the value of γ that minimizes the differences between the empirical and simulated moments is 0.1. The interpretation of this value is that an increase of a 10-percentage point in the price ratio (from 2 times more expensive to 2.1 times more expensive) is similar 21 Similarly to the GMM estimation, we use fixed-effect from other regressions to reduce the number of dimensions of the optimization problem.
Panel (a) of Figure 2a presents the relationship between values of $\gamma$ (the parameter that captures the sensitivity to unfair prices) and the different moments. We calculate the average simulated moments in this figure using 100 draws simulation errors, with different errors in each draw. Each line in the figure represents a moment, and the figure illustrates how quantities decrease with the increase of $\gamma$ regardless of the product, retailer and month identity. We fix the elasticity of demand to -1.5. The negative association between the values of $\gamma$ and the moments remain for negative elasticities. We repeat this one-dimension analysis holding $\gamma$ fixed, and changing the demand elasticity $\eta$ and find similar patterns. In Figure 2b, the X-axis denote the different moments and for each moment we present both the empirical and simulated moment. The simulated moments are generated based on the estimated unknown parameters, i.e., the parameters that minimizes the weighted differences between the empirical and simulated moments.
to an increase of 1% in the price of a product itself. We now use this parameter to quantify the impact of the regulation on consumer utility.

<table>
<thead>
<tr>
<th>Parameters Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma$</td>
</tr>
<tr>
<td>0.095</td>
</tr>
<tr>
<td>(0.0001)</td>
</tr>
</tbody>
</table>

Table 7: MSM Estimation results