Price Saliency and Fairness: Evidence from Regulatory Shaming*

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Abstract

When consumers realize that they pay more than other consumers for the same product, how do firms and consumers respond? 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 fell on average by 8%, and that the more expensive the local products were compared to their international counterparts, the more their prices fell. We further show that quantities increased after prices fell, although these increases were significantly smaller than increases predicted based on pre-regulation demand elasticities and price drops. Moreover, the products that remained more expensive exhibited larger differences between predicted and actual quantities. To explain these findings, we develop a model that incorporates the role of salient unfair prices. We also 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 points increase in the international price of that product. Also, consumer welfare decreased for some products, although consumption increased. This happens when the disutility from observing that other consumers paid less exceeded the added utility from increased consumption. We discuss implications of our findings for optimal pricing strategies and theoretical models of salient thinking.

JEL: D0, D4, D90, L81
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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 shows 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), p.618 write: "the real question is ... under which conditions these preferences have important economic and social effects.".[1]

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.[2] Critiques of the shaming regulation claimed that it would not affect prices as long as consumers could not 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 the expensiveness of a product, measured as the ratio between local and international prices, which became salient to consumers once the regulation went into effect, affected firms and consumers. 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 decreased. The magnitude of retailers' pricing response and the decrease in demand depended on how expensive the local products were. That is, the prices of products that were relatively more expensive decreased more, and the demand for products that remained relatively more expensive decreased more relative to products whose prices were set closer to the international price.

We begin the analysis by developing a simple theoretical model of a firm that sells products to consumers before and after the shaming regulation is introduced. We solve for the optimal price and quantity sold (henceforth "quantity" or "quantities") before 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 other consumers for the same product. 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 the prices of products that have lower pre-shaming ratios. Third, following the price reductions, quantities will increase, although these quantities will be lower than the quantities that consumers would have bought had prices declined to the same level but the international prices were not salient to consumers. Finally, the difference between the predicted and the actual quantities will increase with the post-shaming price ratio.[3] In the first part of the empirical analysis, we test

[1] See also Levitt and List 2007; Bartling, Weber and Yao 2015; Shleifer 2004; Falk and Szech 2013.

[2] The main criterion for choosing products included in the regulation was the large differential between local and international prices. For instance, the mean price of 100ml of Colgate Max Fresh cool mint toothpaste (one of the products chosen for the regulation) in Israel was NIS 16.04 (about $4.6), whereas its average price outside Israel was NIS 8.25 (about $2.4). Table 1 in Appendix A contains information on the products included in the regulation.

[3] An attractive feature of our model is that its components have clear empirical counterparts. First, both the theoretical model and the empirical setting distinguish between pre- and post-shaming. 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 there are several products included in the regulation allows us to compare the responses of

these predictions.

Using comprehensive price data, we find that the prices of "shamed" products fell shortly after the implementation of the regulation. On average, regular prices fell by 8.5% and promotional prices by 5.5%. Also, the more expensive products were relative to the international price, the larger the price decreases. Auxiliary analysis further shows that changes in prices were considerably larger in the stores run by publicly traded retail chains than in privately owned retail chains. Next, we use weekly store-level sales data to show that quantities increased after the regulation was implemented. This increase is somewhat expected given the steep price drop. However, we also examine whether shaming affected quantities beyond the direct effect of lower prices. To do so, we compare the actual changes in quantities after the regulation with predicted changes in quantities. To obtain a given product's change in predicted 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 quantities. A comparison of the predicted and the actual changes in quantities shows that the actual increase (on average 10.5%) is significantly smaller than the predicted increase (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. Consistent with the predictions of the theoretical model, we also show that the difference between predicted and actual quantities is larger for products that remained considerably more expensive also after the "shaming" price signs were placed. Thus, our findings suggest that consumer demand is sensitive to the relative level of the expensiveness of a product, which became salient to consumers after the regulation went 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 consumer sensitivity to unfair prices. We exploit the variation in price ratios of different products, and each product's corresponding sales volume before and after the regulation was implemented. We find that from the consumer's perspective a 1% increase in the local price of the product is equivalent to a reduction of 20 percentage points in the international price. Given a mean price ratio of 1.8 after the initial price drop, the impact of the in-store signs is 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 welfare. 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 they pay is more expensive. Indeed, our calculations show that consumer welfare decreased for most products.

This paper is related to three important strands in the literature of behavioral economics: 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) identify three sources of salient thinking: prominence, surprise, and contrast. Existing studies on saliency have almost exclusively focused on the impact of prominence. For instance,

consumers and firms to different price ratios. Finally, the estimated demand elasticities can be directly linked to demand elasticities in the model.

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. Finkelstein (2009), for instance, shows that paying tolls electronically makes drivers less sensitive to the price they pay. A notable exception is Blake et al. (2021), showing that firms offered better quality products to consumers who observe the full price at the checkout page. 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 at 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 a review) further shows that prosocial preferences are important for decision-makers. Theoretical contributions to this literature include Fehr and Schmidt (1999) and Rabin (1993), who offer a unifying theory for many phenomena where individuals seem to care about the well-being of others.[4] Two relevant interpretations of unfair prices in our setting are as follows: First, consumers consider prices as unfair if they realize that they pay more than other consumers for the same product.[5] Second, consumers do 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.[6] Our paper is also related to recent studies that examine the role of fairness in the context of pay transparency in labor markets. Card et al. (2012) conduct a field experiment that shows that wage comparisons among UC Berkeley employees may demotivate workers who earn below the median wage. Cullen and Perez-Truglia (2022) conduct a large field experiment in Southeast Asia and consider wage comparisons between peers and between employees and their bosses. They document the causal impact of these differences on employees' own behavior and emphasize fairness as a primary explanation for their findings.

Finally, we contribute to a growing literature on nudges. Nudges aim to change behavior in a predictable way without forbidding any options or significantly changing their economic incentives (Thaler and Sunstein 2008; Bernheim and Taubinsky 2018). Studies have demonstrated that nudges are effective in changing individuals' behavior in various settings (e.g., Benartzi et al. 2017),

[4]The marketing and revenue management literatures also consider the role of fairness in pricing decisions (e.g., Xia, Monroe and Cox (2004); Li and Jain (2016); Cohen, Elmachtoub and Lei (2022). These papers often do not use field data to identify the impact of fairness.

[5]Richards, Liaukonyte and Streletskaya (2016) experimentally show that consumers care about the price that other consumers pay; Leibbrandt (2020) show that pricing decisions take into account consumers' perceptions about the price that other consumers pay, 76% of respondents in a survey of American shoppers said they would be bothered to learn that other people pay less for the same products (Turow, Feldman and Meltzer 2005). Herz and Taubinsky (2018) provide evidence that previous transactions play an important role in shaping perceptions of fairness. They also stress the important role of price saliency in generating fairness perceptions.

[6]Kahneman, Knetsch and Thaler (1986) and Eyster, Madarász and Michaillat (2021) discuss this interpretation and provide supporting evidence.

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 to a shaming nudge because they expect to be punished by consumers if they decide otherwise. Still, a firm's choice set is not materially affected by the nudge itself. Second, we measure the impact of the shaming nudge on consumer welfare, while taking into account its impact not only on prices and quantities but also on 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 welfare without raising taxes. Allcott and Kessler (2019) is another study that measures the welfare effect of a particular nudge, beyond its direct intended impact.

Our findings have implications for optimal price setting, price discrimination, and price rigidity. In Section 6.2 we discuss these at 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 (Dubois, Gandhi and Vasserman 2019, and even avoid price discrimination by setting similar prices in different markets (DellaVigna and Gentzkow 2019; Hitsch, Hortaçsu and Lin 2021; Ater and Rigbi Forthcoming). Our findings also speak to the link between fairness and price rigidity (Rotemberg 2011; Eyster, Madarász 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 quantities. In Section 5 we use the model to measure consumer sensitivity to unfair prices and to quantify the change in consumer welfare. 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 utility function, whereas in the post-shaming period, utility also depends on the ratio between local and international prices. We use the model to derive testable predictions of the impact of salient unfair prices on the prices set by the firm and on the quantities purchased by consumers. In Section 4 we test these predictions, and in Section 5 we use the model to measure consumer sensitivity to unfair prices and to quantify the change in consumer utility due to shaming.

2.1 Setup

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

$$U(q, m) = \frac{q^{1-\beta}}{1-\beta} + m, \tag{1}$$

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

In the post-shaming period, consumers observe the international price displayed next to the local price, whereby the utility from consuming a product whose price turns out to be expensive, relative to the international price, falls. Specifically, in the post-shaming period, we multiply the utility from q (i.e., $\frac{q^{1-\beta}}{1-\beta}$) by the term $\frac{1}{1+\gamma S}$, which captures the 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 γS, the value of the weight is lower than one, which means that the utility from consuming q falls compared to the pre-shaming period. The degree to which consumers are sensitive to unfair prices is captured by γ. If consumers are indifferent to paying unfair prices (i.e., to paying prices that are higher than prices paid by other consumers) then γ is equal to zero, and positive otherwise. The extent to which a local price is considered unfair (i.e., too expensive) is captured by S, which is measured by the ratio between the local price (P^{local}) and the international price (P^{int}). This price ratio becomes salient to consumers only after the in-store price signs are displayed (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:

$$S = \left(\frac{P^{local}}{P^{int}} - 1\right) \times \mathrm{I}, \tag{2}$$

where I is an indicator of the presence of the in-store price signs when the price ratio becomes salient to consumers. Intuitively, S increases with the ratio between local and international prices and conditional on consumers observing the price signs. That is, consumers' attention is drawn to products with higher price ratios, and the utility derived from these products is underweighted as the price ratio increases.[7] The utility function collapses to the standard pre-shaming utility function in three scenarios, namely, when: (1) the ratio between the local price and the international price is not salient (i.e., before the international prices are displayed, $I = 0$), (2) the local price and the international price are 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. 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:

$$\begin{aligned} \max_{q,m} U(q,m) = & \frac{q^{1-\beta}}{1-\beta} + m \\ s.t. \quad & q \times P_o + m \leq \text{Income}. \end{aligned} \tag{3}$$

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

$$\begin{aligned} q_o^* &= P_o^{-\frac{1}{\beta}} \\ m_o^* &= \text{Income} - q_o^* P_o. \end{aligned} \tag{4}$$

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

[7] This formulation captures the ordering property, which the theoretical models of saliency emphasize. Lanzani (2022) shows that the ordering property distinguishes salience theory from prospect theory.

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

and the respective demand functions for q and m are given by

$$q_a^* = P_a(1+\gamma S)^{-\frac{1}{\beta}},$$
$$m_a^* = \text{Income} - q_a^* P_a. \tag{6}$$

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 γ, (2) the ratio between the international price and the local price, and (3) the inverse of own-price elasticity of demand, captured by β. 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 than the local price, and when demand is more elastic. Figure 1a illustrates the transition from the pre-shaming/standard demand curve to the post-shaming/fairness demand curve.

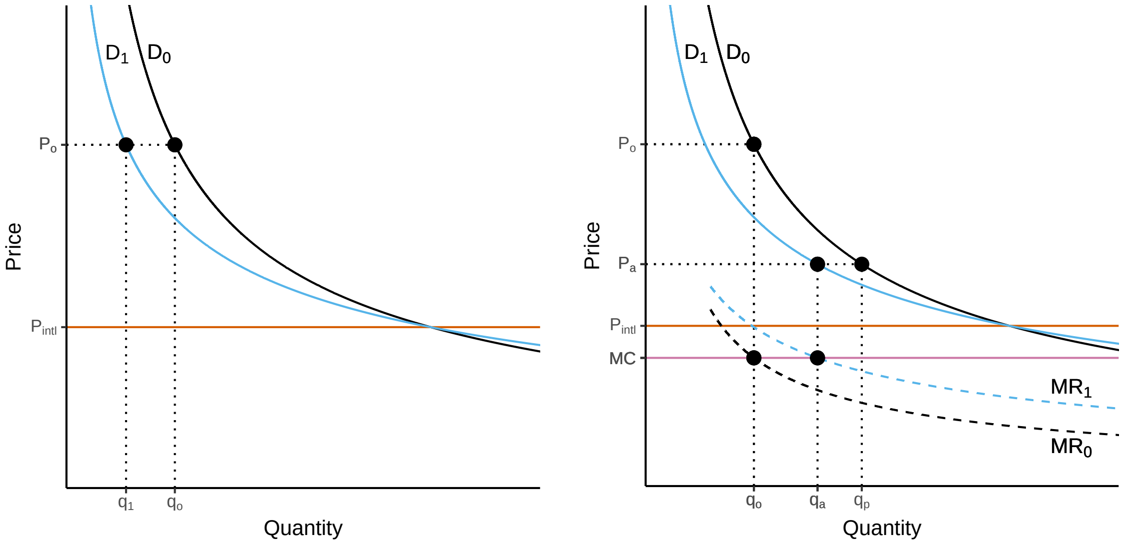
Next, we consider the firm's optimal price before and after the shaming regulation is implemented. The firm maximizes its profits by setting the marginal revenue equal to the marginal cost. In the pre-shaming period, the solution to this maximization problem is given by q_o as shown in Panel (b) of Figure 1. In the post-shaming period, the firm also sets the marginal cost equal to the marginal revenue that is derived from the new demand curve. Importantly, the post-shaming marginal revenue curve increases relative to the pre-shaming marginal revenue curve. 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 local price falls, this disutility diminishes and the consumer purchases more. Thus, following the shaming regulation the firm has the incentive to lower its price below the pre-regulation price.[8] Figure 1b illustrates this point graphically.

2.1.2 The change in profits and consumer welfare

The firm's profit decreases after the international prices 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 at that price. 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 the impact of the regulation on profits, its impact on consumer welfare is ex-ante ambiguous. On the one hand, prices decrease and the quantities increase, implying an increase in consumer welfare. On the other hand, in the post-shaming period, consumers also observe that they are paying more than other consumers, and incur nonmaterial costs, making the overall impact on consumer welfare ex-ante ambiguous.

[8] In Appendix B we derive the conditions under which the optimal post-shaming prices are lower than optimal pre-shaming prices, and that quantity increases in the post-shaming period.



(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 to the left and inward once unfair prices become salient to consumers. The black solid line represents the pre-shaming demand curve and the blue solid line represents the post-shaming demand curve. The orange solid line indicates the international price of the product. As shown, for a given price (P_0) quantity falls from q_0 to q_1, and the two demand curves intersect when the local price equals the international price. Panel (b) illustrates the impact of shaming on the optimal price and quantity purchased. P_o represents the optimal pre-shaming price, derived from setting the pre-shaming marginal revenue equal to the marginal cost. After shaming, the firm maximizes its profits using the post-shaming demand and marginal revenue. Since the post-shaming demand curve is more elastic (see text for details), the optimal post-shaming price P_a is lower than the optimal pre-shaming price. Also, quantity (q_a) is greater than the pre-shaming quantity (q_o). Nonetheless, the post-shaming quantity is lower than what the consumer would have purchased (denoted by q_p) at the new price had the demand curve remained unchanged.

2.2 Testable predictions

Below we outline testable predictions derived 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 makes the price ratio salient to consumers. We provide basic intuition for these hypotheses and defer the formal derivations to Appendix B.

Hypothesis 1 (H1) *Following the shaming regulation, the price of products decreases.*

Hypothesis 2 (H2) *Following the regulation and the price drop, quantity 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 decrease is sufficiently large (as is indeed the case) then consumers purchase larger quantities of the product relative to its pre-shaming level.

Hypothesis 3 (H3) *The actual quantities after the regulation are lower than the predicted quantities, which are derived based on the pre-shaming demand curve and the post-shaming price.*

As shown in Figure 1b, the quantities at the post-shaming price (P_a) are less than the quantities sold at the pre-shaming price ($q_p > q_a$).

Hypothesis 4 (H4) *The price decreases are larger for products that have higher pre-shaming price ratios.*

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

Hypothesis 5 (H5) *The differences between actual and predicted quantities increase with the post-shaming ratio between local and international prices.*

Hypothesis 5 focuses on the horizontal shift of the demand curve due to shaming. 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 predicted quantities.

3 Background, Data, and Descriptive Statistics

3.1 Industry background

Retail prices in Israel are expensive. According to a report prepared by the state comptroller in 2021, food and beverage prices in Israel are, on average, 51% more expensive than in EU countries.[9] The high cost of living became a primary policy issue in Israel after the social protests in 2011 (Hendel, Lach and Spiegel 2017). As a result of these protests, a price transparency regulation was introduced, and since May 2015 retailers are required to post online the prices of all products sold in their stores. Ater and Rigbi (Forthcoming) find that food prices fell by 4% following this regulation. The shaming regulation is another regulatory attempt to lower retail 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 alongside the price of the exact same product (at the upc 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 of Economy identified relevant products and after hearing objections from importers and manufacturers the regulation was approved in February 2018.[10] 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 in the simplest possible manner 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 noncompliance; in some cases, retailers paid fines for noncompliance 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 were not exactly comparable to international products. In addition, five other products were added. Below we refer to products included in

[9]https://www.mevaker.gov.il/sites/DigitalLibrary/Documents/2021/71C/2021-71c-101-Mazon.pdf (in Hebrew). See also OECD 2013.

[10]The decree can be found in (in Hebrew): `https://www.gov.il/BlobFolder/generalpage/cpfta_price_comparison_to_abroad/he/docs_cpfta_ConsumerProtectioOrderCombinedVersion.pdf`

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 to compare 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 in the regulation. Following Nielsen's exit, the price comparison used in the regulation was no longer accurate and the regulation was no longer effective.[11]

3.2 Data and descriptive statistics

Our empirical analysis uses two main data sources. The first is comprehensive price data for 126 products sold at stores operated by 28 retailers, and the second is longitudinal weekly sales store-level data for 11 products, including the seven products included in the first wave of the regulation and four control products. Below we describe this data and present relevant descriptive statistics.

3.2.1 Price data

The price data covers the time period between November 2016 and October 2019 and includes 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 in the wake of 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.[12] We consider the 12 products included in the regulation as treatment products. Figure 2 presents the ratios between local and international prices for these 12 products across all retailers ($\frac{p^{local}}{p^{int'l}}$), 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.

We evaluate price changes in the group of shaming products against price changes in three comparison groups of products:

Main control group. Our main control group includes 23 products that were not included in the regulation ("non-shaming products"). These products 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 as control products. By contrast, 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 a 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

[11] See (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`

[12] A promotional price is the unit sale's price after applying the specific promotion. For instance, for a buy one get one free, we use the price per unit.

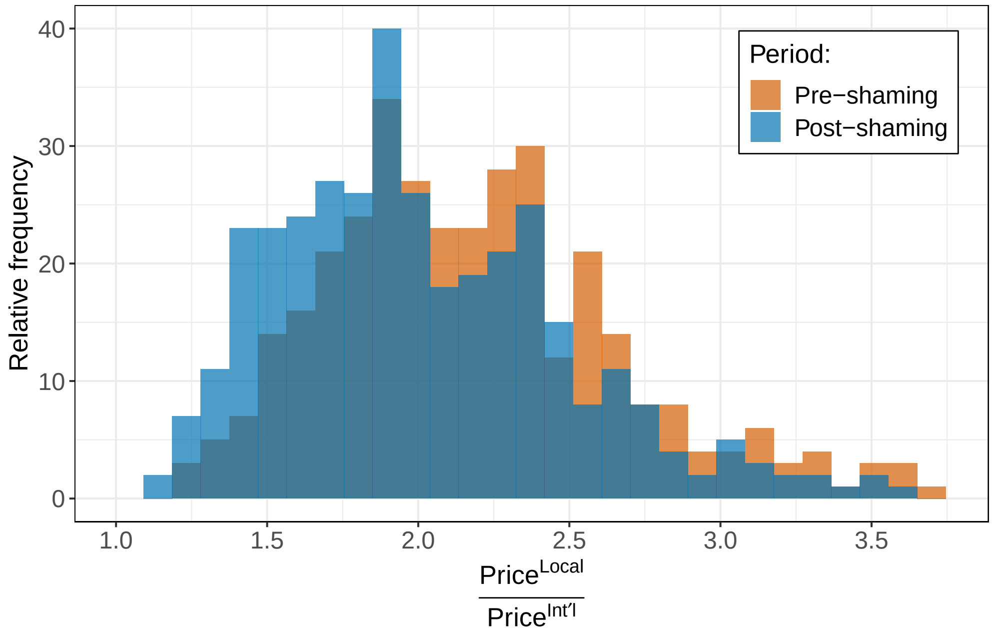


Figure 2: Price ratios, before and after the shaming regulation

Figure 2 presents the distribution of the ratio between local and international prices ($\frac{p^{local}}{p^{int'l}}$) before (in orange) and after (in light blue) the shaming regulation was implemented, where the dark blue area captures the overlap between the two distributions. The figure illustrates that following the regulation, the distribution of price ratios moved to the left. Yet, local prices remain higher than international prices also after the regulation.

dispersion among shaming products increased more than in the control group, suggesting that the effect of the regulation is not uniform across retailers.

Shaming candidates group. The second comparison group involves 8 products that would likely have been added to the shaming list had the regulation been extended. We obtained the list of these products from the Ministry of Economy, including the international price of these products. These products were not included in the first two waves of the regulation because their market shares in the relevant category were not as high as those of the products included in the regulation. By comparing the changes in prices of products included in the regulation to the changes in prices of the products not included in the first two waves of the regulation, 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 the products included in the regulation.

Close substitutes group. We also use price information for 17 products that are very close substitutes to products included in the regulation. We use this group to examine whether retailers' and consumers' responses are restricted to shaming products or also to other similar products. Finding that the price of shaming products fell significantly more than the prices of other similar products is consistent with a saliency argument. Due to the high substitution between these products and the shaming products, we expect that the estimates from the regression analysis that uses this group will be downward biased relative to the main comparison group. By contrast, findings that the prices of similar products fell to the same degree as the shaming products would suggest that the price tags were informative and that consumers were inferring about the expensiveness of

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

	Pre-shaming		Post-shaming		Change
	mean	s.e.	mean	s.e.	
Panel a: Price data					
Regular prices (NIS)					
Shaming products	22	6.6	20.4	6.3	-7.2%
Main control products	21.3	8.8	21.3	8.7	-0.1%
Same brand products	22	6.6	21.5	6.2	-2.6%
Shaming candidates products	19.5	3.9	19.7	4.1	1.3%
Promotional prices (NIS)					
Shaming products	20.1	6.3	18.6	5.8	-7.3%
Main control products	19.6	8.8	19.3	8.8	-1.6%
Same brand products	20	6.3	19.2	5.8	-4.1%
Shaming candidates products	17.6	3.4	17.3	3.6	-1.7%
Panel b: Sales data					
Weekly store volume per product (# of units)					
Shaming products	11.9	18.7	13.8	22.6	15.8%
Main control products	3.7	3	3.3	2.1	-9.2%
Weekly store turnover per product (NIS)					
Shaming products	149.1	179.1	155.1	190.8	4.1%
Main control products	37.8	21.7	38.2	20.5	1%

Notes: 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 remained 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 includes 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). This data is based on 19 retailers and 350 stores. After the regulation, the number of units sold increased from 11.9 to 13.8 (15.8%), whereas the number of units sold of 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.

similar products. We include in this group same-brand products as those in the shaming list and mostly same-size products. For instance, this group contains other kinds of 100ml Colgate kinds of toothpaste, 150ml Dove deodorants, and other speed-stick deodorants. Table 2 in Appendix A presents examples of products included in each of the three groups.

3.2.2 Sales data

The second data source 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 2016 and 2018. The scanner data, purchased from Storenext.co.il, contains information on 11 products: seven first-wave shaming products and four products that we use as controls. Panel (b) of Table 1 presents descriptive statistics on the sales data. Unlike the price data, the scanner data does 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 by only 4.1%. These patterns are consistent with lower prices and a mild increase in quantities. For non-shaming products, we see that after the regulation, quantity decreased from an average of 3.7 to 3.3 units per week. The decrease in quantities for non-shaming products is also in the same range. Finally, shaming products, which 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 H1, we compare changes in prices of treated products (shaming products) before and after the regulation against changes in prices of 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 (H4), and other heterogeneous effects. Formally, we estimate the following standard difference-–in–differences specification:

$$\log(price_{irt}) = \mu_{ir} + \gamma_t + \alpha \times Post_{it} \times Shaming_i + \epsilon_{irt}, \tag{7}$$

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 α, 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 $Shaming_i$ 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 (μ_{ir}) and month (γ_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.

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 indicate 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

Table 2: The effect of shaming on prices

	log(price)			log(promotional price)		
	(1)	(2)	(3)	(4)	(5)	(6)
	Main control	Shaming candidates	Close substitutes	Main control	Shaming candidates	Close substitutes
Panel a: Full sample						
post × shaming	-0.085***	-0.066***	-0.046***	-0.054***	-0.035***	-0.025*
	(0.013)	(0.016)	(0.012)	(0.012)	(0.011)	(0.013)
Observations	28,742	16,233	24,556	28,742	16,233	24,556
R^2	0.93	0.87	0.88	0.92	0.85	0.86
Panel b: Publicly traded						
post × shaming	-0.173***	-0.148***	-0.086***	-0.099***	-0.059***	-0.039*
	(0.026)	(0.029)	(0.024)	(0.021)	(0.020)	(0.022)
Observations	12,788	7,294	10,956	12,788	7,294	10,956
R^2	0.91	0.87	0.89	0.91	0.83	0.86
Panel c: Privately owned						
post × shaming	-0.013	0.001	-0.011	-0.018**	-0.015	-0.010
	(0.009)	(0.012)	(0.009)	(0.008)	(0.009)	(0.009)
Observations	15,954	8,939	13,600	15,954	8,939	13,600
R^2	0.94	0.88	0.89	0.93	0.87	0.88

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 promotional prices by 5.5%. 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 present the estimation results using only publicly traded retailers and find larger magnitudes of the estimates. For example, for publicly traded retailers, the prices of shaming products fell by 17% compared to 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 for both 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–retailer and month fixed-effects. $^{*}p<0.1$, $^{**}p<0.05$, $^{***}p<0.01$.

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.

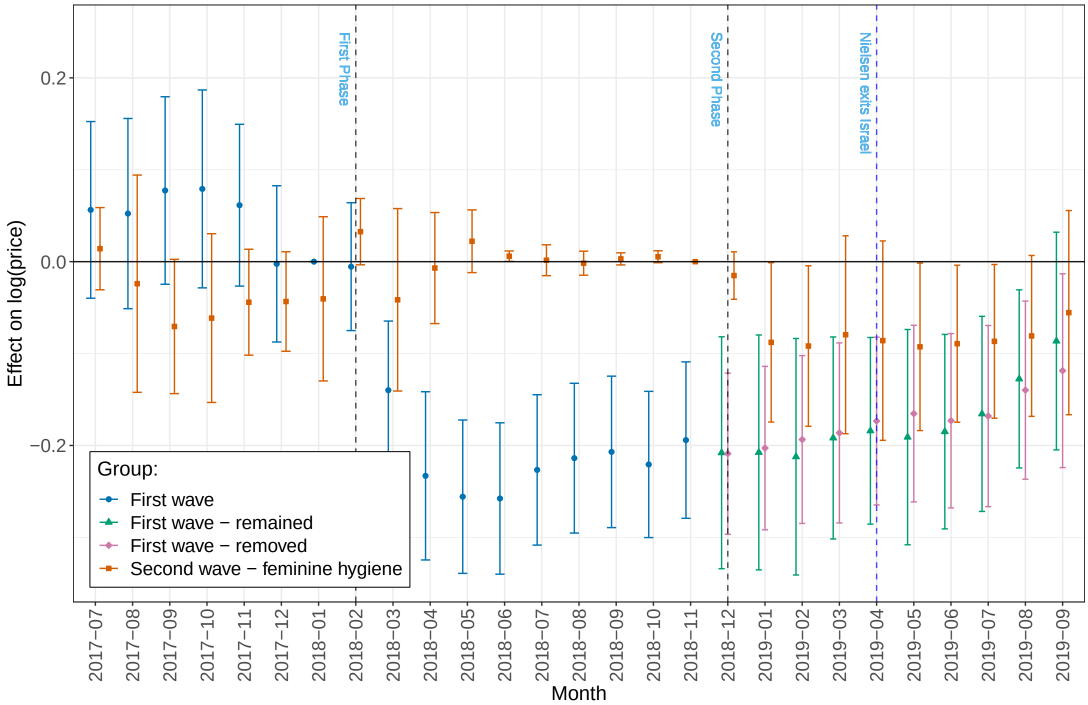


Figure 3: The monthly effect of the shaming regulation on prices

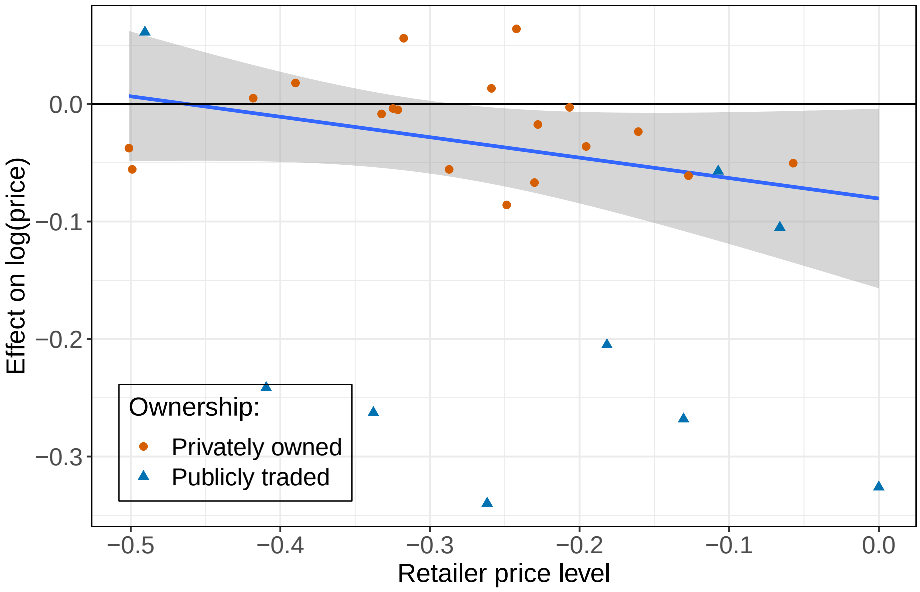
Notes: The figure shows the per-month change in the price of shaming products relative to prices of products included in the control group for publicly traded retailers. The figure distinguishes between the two waves of the shaming regulation, separately showing a time series for products included in 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 on prices in the first-wave is twice as big as the effect on prices in the second-wave. We do not see a downward trend in prices before the implementation of the regulation, consistent with the common-trend assumption. Interestingly, the prices of the products that were excluded from the regulation in December 2018, remained similar to the prices of products that remained in the shaming list.

4.1.1 Heterogeneous price effects

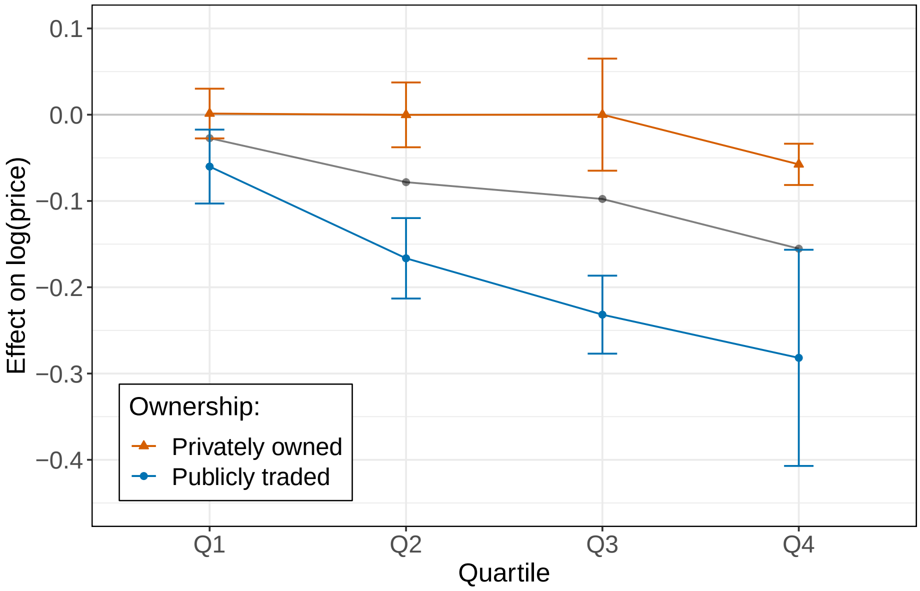
Figure 4a plots the effect of the regulation on the prices of shaming products at each retailer against the average price level at that retailer. Specifically, we estimate Equation (7) allowing the effect of the shaming to vary across retailers. The retailer's average price level on the horizontal axis is the retailer's fixed effect in that regression. The figure suggests that retailers' response to the regulation was not uniform, with some retailers reducing prices by more than 30% and other retailers not changing prices and in a few cases raising 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 (indicated with blue triangles) reduced prices more than privately-owned retailers (denoted by orange circles). Motivated by Figure 4a, we separately estimate Equation (7) for publicly traded and privately owned retailers, and 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 -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 higher pre-shaming price ratios. 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 high price ratios fell more than prices of products with low 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 effect of shaming on products with higher price ratios is considerably larger for publicly traded retailers than for privately owned retailers.

Overall, the results support H1 and H4. Prices fell after the regulation and the price drop is considerably larger for products that are characterized by higher price ratios.[13] In the next section, we test the impact of the regulation on the quantities sold by retailers (2,3, and 5).

[13] Appendix D describes additional exercises we conduct to demonstrate the robustness of our findings on prices. We test whether our main results for the drop in prices are sensitive to the products included in the control groups. We also estimate different specifications of Equation (7), including one 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.



(a) The effect of shaming on prices, by retailer's price level and ownership type



(b) The effect of shaming on prices, by ownership and pre-shaming price-ratios

Figure 4: Heterogeneous effects on price, by ownership type and pre-shaming price

Notes: Figure 4a shows how the effect of shaming varies with a retailer's price level and ownership type. The vertical axis presents the estimated effects of shaming on prices at different retailers. On the horizontal 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 indicate with blue triangles publicly traded retailers and with orange circles privately-owned retailers. The figure shows that publicly traded retailers reduced 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 the prices of products with high price ratios fell more, and that the effect is considerably larger for products sold by publicly owned retailers.

4.2 The effect of shaming on quantities

In this section, we examine how quantities sold of shaming products changed following the regulation. Our objective is to examine whether displaying the price tags had an effect on quantities above and beyond the effect driven by the price drop. To examine H2) and (H3), we need to predict the quantities that consumers would have purchased had prices dropped with no in-store price tags displayed. To obtain this measure, we estimate the demand elasticities for each of the shaming products. These demand elasticities are computed using only pre-regulation time period data. Next, we use these demand elasticities and the actual price reductions following the regulation to compute the predicted quantities, which we then compare with the actual changes in quantities. Finally, we test how the difference between the predicted and the actual quantities depends on the post-shaming expensiveness of the local price vis-â-vis the international price. We expect that products that remained more expensive relative to the international price should exhibit a larger drop in actual quantities relative to the predicted quantities (H5).

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 of product i sold in store s in week t and the main independent variable is (log) price. We allow for store–product and month–product fixed effects, and estimate the following equation separately for each product j:

$$\log\left(q_{jts}\right) = \alpha_{sj} + \zeta_{tj} + \sum_{k=1}^{J} \eta_{jk} \cdot \log\left(p_{kts}\right) + \epsilon_{jts} \tag{8}$$

The coefficient of interest is η_{jk}, which is the own-price elasticity of demand of product j in-store k. This specification is related to the theoretical model in Section 2, where $-1/\beta$ is the own-price elasticity of demand. 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 DellaVigna and Gentzkow 2019; Goldin, Homonoff and Meckel 2022). The underlying assumption is that local demand shocks are unrelated to a retailer's average level of 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, 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 indicated with small circles and the four control products with small triangles.

As seen in the bottom-right square, the prices of shaming products fell. On average, the prices of shaming products included in the first wave fell by 10.5%.[14] The predicted change in quantities

[14]The set of retailers, the products and the time frame in the analysis that uses the scanner data do not exactly

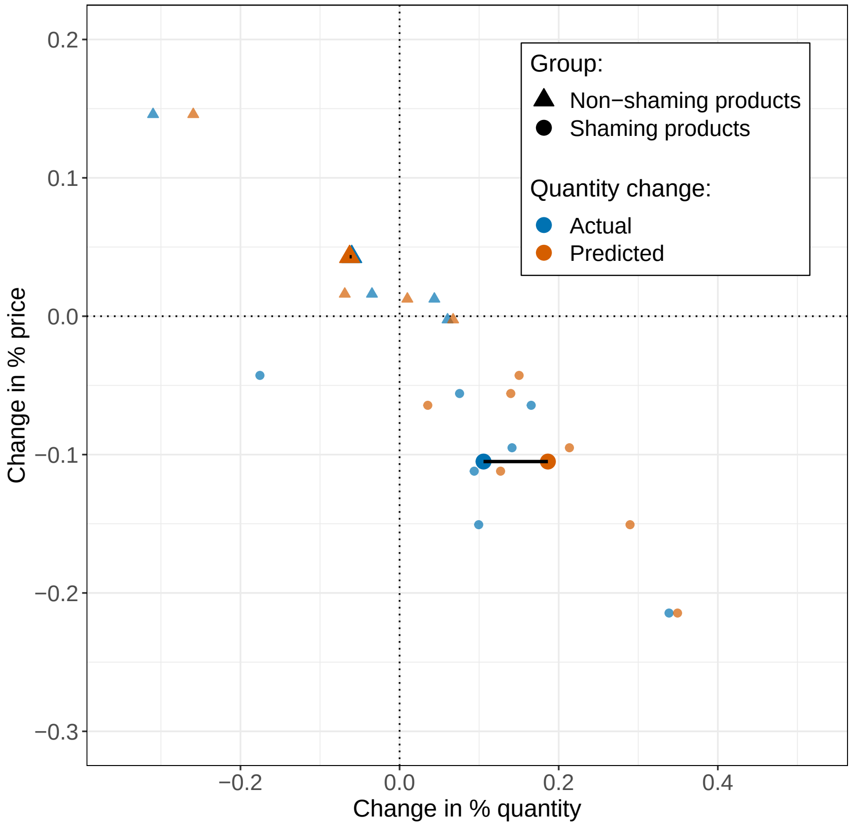


Figure 5: Predicted and actual changes in quantities sold by price drop

Notes: In Figure 5 we use the estimated demand elasticities to calculate the predicted change in quantities. We compare the predicted change in quantities of each product (orange) with the actual change (blue). The figure shows that the prices of shaming products fell (-10.5%), and hence the predicted change in quantities is positive (and on average 18.5%). Yet, for the shaming products, we find that the actual quantity is on average only 10.5%. Moreover, for 6 out of the 7 products the predicted change is larger than the actual one. For the control group, there is no consistent pattern between the predicted and actual quantities, and on average we do not observe a difference between them.

for each product is denoted by an orange circle. We also denote by a larger circle the average impact of the regulation 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, for 6 out of the 7 shaming products, the actual quantities were less than predicted (and 10.5% on average). For the control group, there is no consistent pattern between the predicted and average quantities, and, on average, there is no significant difference between predicted and actual quantities. The comparison between the predicted and actual quantities against the actual change in price is also useful for obtaining a first measure of the impact of the regulation. In particular, we can calculate the price change that could have explained the actual change in quantities (i.e. an increase of 10.5%). 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

overlap with those included in the price analysis. Therefore, we do not get the exact same results as in the price analysis presented in Section 4.1.

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 the price ratio of each product.

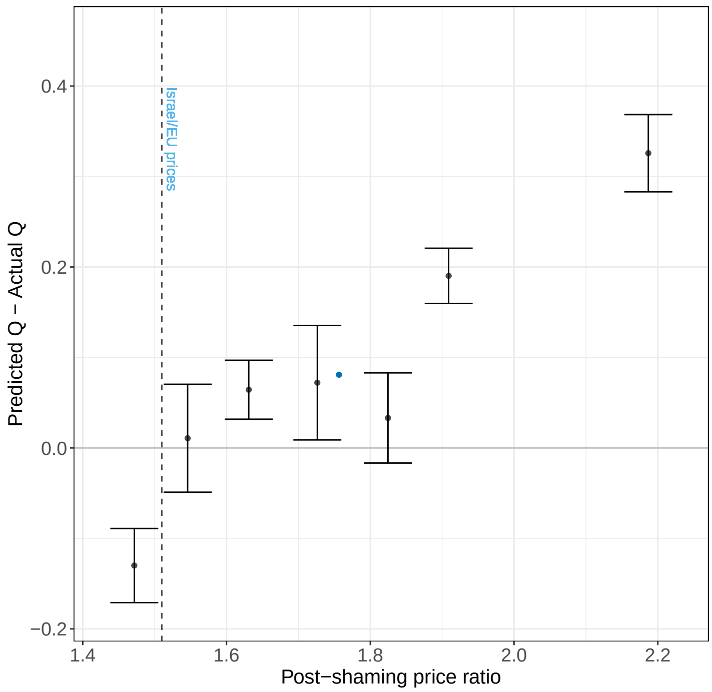


Figure 6: The difference between predicted and actual quantities

Notes: The black dots in the figure capture the difference between the actual and predicted quantities following the regulation (vertical axis) against the post-shaming price ratio of these products (horizontal axis). The relationship is shown for each of the 7 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 dashed vertical black line shows a measure of the average price of Israeli food products relative to the average price in EU countries (Israel's state comptroller, 2021). The figure shows a clear negative relationship, with products with higher price ratios showing a larger difference between the predicted and actual quantities. For products that have the lowest price ratio, below the "EU threshold", we find that predicted quantities are lower than the actual quantities.

The next step of the analysis focuses on explaining the difference between the actual and the predicted quantities across products. According to H5, a product with a high post-shaming price ratio will experience a larger drop in demand and therefore a larger difference between the predicted and the actual quantities. Figure 6 illustrates this relationship. The horizontal axis indicates the post-shaming price ratio for different products and the vertical axis indicates the difference between the predicted and actual quantities for each product. As can be seen, for 6 out of 7 products included in the regulation, the actual quantities were lower than predicted.

Strikingly, there is a strong positive relationship between the post-shaming price ratio and the relative drop in demand. Local products that remained more expensive compared to their international counterparts experienced a greater drop in quantities than predicted. For the local products that remained most expensive (2.2 times more expensive than the international price of the product), we find that the difference between the predicted and actual quantities is the largest

Table 3: The difference between predicted and actual quantities and the post-shaming price ratio

Dependent Variable:	Predicted - Actual change in quantities (PP)	
	(1)	(2)
Price Ratio	0.468***	0.602***
	(0.104)	(0.127)
Observations	10,187	10,187
R^2	0.12	0.46

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

and is above 35%. Other products became less expensive and show a smaller difference between predicted and actual quantities. For the products with the lowest price-ratio (1.47), we find that the predicted quantities are less than the actual quantities. Since food prices in Israel are 51% more expensive than prices in EU countries (Section 3), it might be that consumers perceived the 1.47 price ratio as not expensive, and hence did not reduce their demand for the products whose price ratios fell below 1.5. 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 5%, and the actual increase is 3%, then the percentage point difference is 2%. Formally, we estimate the following equation:

$$100\left(\frac{\hat{Q}_{ist} - Q_{ist}}{\bar{Q}^{ns}_{is}}\right) = \mu_{is} + \delta_t + \beta\frac{p^{local}}{p^{int'l}} + \epsilon_{ist}, \tag{9}$$

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

4.3 Testing the model's hypotheses: An alternative approach

We can also test the model's five hypotheses using a difference-in-differences research design. To this end, we consider the 7 first-wave shaming products in the treatment group and the other 4 non-shaming products in the control group. We use the sales data to construct the dependent variables: the prices (to test H1 and H4) and quantities (to test H2, H3, and H5). In particular, to test hypotheses 1 and 4 we estimate versions of the following difference-in-differences specification:

$$\log(price_{ist}) = \mu_{is} + \gamma_{st} + \alpha \times Post_{it} \times Shaming_i + \epsilon_{ist}, \tag{10}$$

and to test H2, H3, and H5 we estimate versions of the following difference-in-differences specification:

$$\log(quantity_{ist}) = \mu_{is} + \gamma_{st} + \alpha \times Post_{it} \times Shaming_i + \epsilon_{ist}, \tag{11}$$

Table 4: The impact of shaming on quantities and prices - difference in differences specifications

Dependent Variables:	log(Price)	log(Q)		log(Price)	log(Q)
	(1)	(2)	(3)	(4)	(5)
Post × Shaming	-0.127***	0.161***	-0.034**		
	(0.007)	(0.017)	(0.016)		
log(Price)			-1.556***		-1.531***
			(0.037)		(0.036)
$\left(\frac{\text{Price}^{\text{local}}}{\text{Price}^{\text{int'l}}} - 1\right)$ × Post × Shaming				-0.113***	-0.077***
				(0.006)	(0.016)
R^2	0.86	0.82	0.83	0.86	0.83
Observations	73,333	73,333	72,953	73,333	72,953

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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

where the dependent variable is either the log(price) or log(quantity) (Equations (10) and (11), respectively) of product i sold in store s in period t. The parameter of interest is α, which captures the percentage change in the prices (quantities) of shaming products relative to the corresponding change in the price (quantities) of the non-shaming products. 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 (μ_{is}) and store–period (γ_{st}) fixed effects that capture local time-invariant and brand-cost factors that affect demand.

The regression results are presented in Table 4, and the columns are ordered by the hypotheses numbers as described in the theoretical model. 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 higher pre-shaming price ratios. The results in Column (2) suggest that quantities of shaming products increased by 15% following the shaming regulation. In Column (3), we add log(price) as an additional control variable. As in the demand elasticity specification, we instrument for the potential endogeneity of the price in a given store using prices at other stores operated by the same retailer. As expected, the coefficient on log(price) is negative and significant. Moreover, the coefficient on the post-shaming interaction term (-0.061) flips signs and is now negative and significant. Thus, once we control for the price, we find that after the regulation was implemented the quantity decreased by 6%. These results are consistent with our previous findings. To examine H5, we add to the specification an interaction term of the price-ratio and the post-shaming indicator. Confirming our previous results, the results in Column (5) indicate that products with higher price ratios experienced a larger drop in demand.

To summarize, our empirical findings support the five hypotheses 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 consumer sensitivity to unfair pricing, γ. This sensitivity parameter is useful for comparing the relative importance of a change in the price of the product itself compared to a change in the price ratio of that product, or to a change in the international price of the product. Second, we use the model to calculate the change in consumer welfare following the implementation of the shaming regulation. Notably, although prices decreased and quantities increased following the regulation, the overall impact on consumer welfare is ex-ante ambiguous because consumers incur disutility from observing that they pay more than other consumers.

5 Sensitivity to Unfair Prices and Consumer Welfare

In this section, we estimate the consumer sensitivity to salient unfair prices. Estimating this sensitivity parameter, denoted by γ in the theoretical model, would allow us to compare how a consumer values 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 how the shaming regulation affected consumer welfare.

5.1 Quantifying the sensitivity to salient unfair prices

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

$$\log(q_{ist}) = \eta \log(\tilde{P}_{ist})) + \mu_{is} + \delta_t + \epsilon_{ist}, \text{where} \tag{12}$$

$$\tilde{P} = P^{local}(1 + \gamma I\left(\frac{P^{local}}{P^{int}} - 1\right)).$$

The parameters of interest are η and γ. We cannot estimate the parameters directly because $\tilde{P}$ is a function of γ. 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), [15] and make the following assumptions regarding the error term ϵ:

$$\epsilon \sim \mathcal{N}(0, \sigma^2) \tag{13a}$$

$$E[Z\epsilon] = 0. \tag{13b}$$

We then use Equation 13a to derive the moments for the mean and variance of the error, and the average price in other stores as an instrument for the price in the local store. As a second instrument, we interact the first instrument with the post-shaming indicator I. We denote these variables as Z and ZI, respectively. Formally, we construct the following population moments:

$$13a \implies E[\epsilon] = 0 \tag{14a}$$

$$13a \implies V(\epsilon) = E[\epsilon^2] - E[\epsilon]^2 = \sigma^2 \implies E[\epsilon^2 - \sigma^2] = 0 \tag{14b}$$

$$13b \implies E[Z\epsilon] = 0 \tag{14c}$$

$$13b \implies E[ZI\epsilon] = 0. \tag{14d}$$

The estimation results imply that the value of γ that brings the moment condition as close as possible to zero is 0.05. The interpretation of this value is that an increase of 20 percentage points in the price ratio (e.g., from 2 times to 2.2 times more expensive) is similar to an increase of 1%

[15] Equation (12) 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 $product - -store$ fixed effects. This approach reduces the number of dimensions of the problem to only three unknown parameters: γ, η, and the variance of the error σ^2. We provide more details on the sample and the empirical strategy in Appendix E.

in the price that the consumer pays for the product. Alternatively, taking into account that the post-shaming mean price ratio is about 1.75, we can calculate that the shaming effect is similar to an increase of nearly 4% in the prices of the shaming products. The estimated parameter for η is -1.44. This estimate captures the average demand elasticity across the seven shaming products in the first wave. This estimate lies within the range of demand elasticities that we derived for the products shown in Figure 1 in Appendix C. We now turn to use the parameters β and γ to compute the change in consumer welfare before and after the regulation.

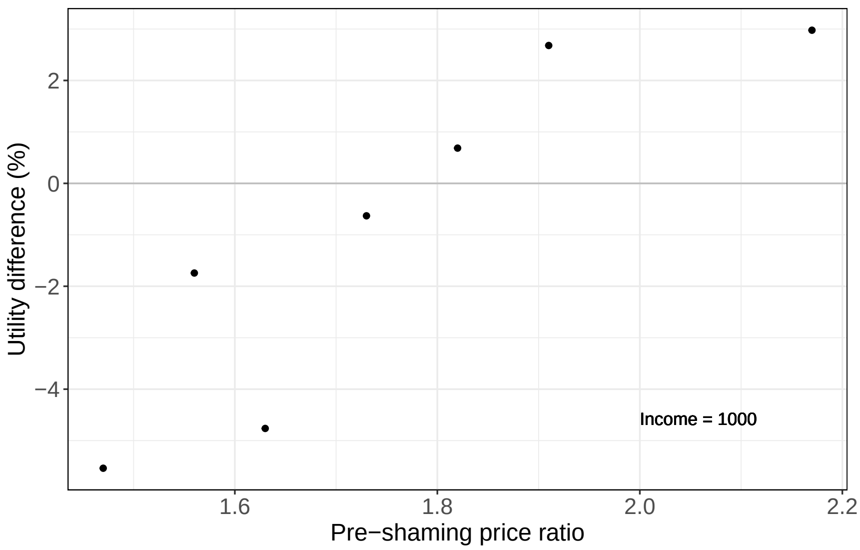


Figure 7: The change in utility following the regulation

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 γ and β. 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.

5.2 The effect of shaming on consumer welfare

To compute the change in consumer welfare following the regulation, we use the average quantities before and after the regulation. We plug these quantities together with the values of β and γ into the utility function in Equation (1). That is, $U(q,m) = \frac{q^{1-\beta}}{1-\beta}\frac{1}{(1+\gamma S)} + m$. Our back-of-the-envelope calculations indicate that the consumer utility decreased for 4 out of the 7 products, and increased for the other three. Interestingly, the utility increased for products with high price ratios, whereas it decreased for products with low price ratios.

A likely explanation for this pattern is that the prices of products with high price ratios fell significantly more than products with low price ratios (H4). As a result, consumption of these products increased considerably leading to higher utility from these products. For products whose prices changed little, the change in quantities is small and the adverse effect on consumer utility from observing that other consumers pay less is greater, making the overall change in welfare negative. Figure 7 illustrates this relationship when we set the level of income to 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, 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 whether 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) examines how the introduction of electronic tolls affects drivers' sensitivity to the price they pay.[16] These and other studies concern situations where the price paid by the consumer became less or more salient. In our setting, saliency changes due to the introduction of the international price paid by other consumers, which contrasts with the price of the same 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 that use field data to examine the role of contrast/saliency on consumer choice.[17] Second, 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 focused on situations in which a firm or researchers manipulated the level of saliency, and the analysis explored how consumers responded. In addition, we examine how the scope of competition changes when consumers' attention 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 the local and the international price – for each product before and after the regulation is implemented. Importantly, can use this measure to rank products by their level of saliency and examine its impact on consumers and on firms. This feature allows us to connect the empirical analysis with theoretical models that emphasize that a heightened saliency should trigger a greater behavioral response. Fourth, we examine the welfare implications of a change in saliency. According to our results, consumers might be worse off even though the change in saliency led to lower prices and increased consumption. This interpretation is relevant to the debate over the distinction between FAST (forgetful and salient thinkers) and FBOR (forgetful but otherwise rational) consumers (Bordalo, Gennaioli and Shleifer 2022).[18]

[16] 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 earnings surprise was good. They attribute this behavior to contrast effects while their description is likely relevant mostly to the effect of surprise.

[17] Our setting thus combines the background contrast effect and the decoy effect. "Background contrast" experiments (Simonson and Tversky (1992) confront subjects with prices in two stages. Subjects are less likely to choose a good in the second stage if they saw lower prices in the first stage. The decoy effect (e.g., Huber, Payne and Puto 1982, Tversky and Simonson 1993) describes a phenomenon in which consumers have a specific change in preference between two options, when they are also presented with a third, less attractive option, the decoy. See also Landry and Webb 2021 for an alternative metric of contrast that builds on insights from the neuroscience of perception.

[18] Our modeling approach also offers a contribution to the literature. In models of salient thinking, product attributes are overweighted when they are more salient to decision-makers. Bordalo, Gennaioli and Shleifer 2012

6.2 Implications for optimal pricing strategy and price rigidity

Classic textbook pricing models show how price discrimination schemes increase firms' profits and affect consumer welfare. These models do not consider how the observability of the price paid by other consumers affects firms' profits and consumers' willingness-to-pay. If, however, consumers' willingness-to-pay declines when they realize that they pay unfair prices, then such pricing schemes might be less effective than we usually think (Li and Jain 2016; Cohen, Elmachtoub and Lei 2022). Below, we discuss further potential implications of our findings for firms' pricing strategies, obfuscation strategies, and 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 tow unfair pricing is potentially stronger if it is the same retailer who sets different prices for the same product in different stores compared to a situation involving retailers that set prices in different countries. Our analysis focuses on identical products that are sold in different countries, likely having different costs, demand, and socio-demographic characteristics. Despite these differences, we find that consumers are antagonized by the price differential, and per our calculations are willing to pay 1% more for a 20% decrease in the price ratio. In that sense, our measure of γ, or the 1-20 ratio, is a lower bound. Our findings shed light on the question of why multi-store retailers set similar prices in environments 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 cases where prices by the same retailer differ across stores. Consumer antagonism to 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 buying. We propose that obfuscation is actually meant to make it difficult for consumers to observe the price that other consumers pay for the same product. Our findings could have implications for price rigidity and inflation. If consumers dislike paying more than what other consumers previously paid for the same product, then changing prices today may entail costs that sellers may want to avoid. In some circumstances, sellers may therefore decide not to change prices. Thus, fairness concerns constitute a form of menu costs that need to be taken into account. Rotemberg (2011) and Eyster, Madarász and Michaillat (2021) offer related theoretical models.

6.3 Nudges

Policymakers are increasingly using the concept of nudges to promote public goals (Bernheim and Taubinsky (2018)). Nudges often rely on the premise that consumer choices are context-dependent, and that changing the manner in which choices or prices are presented can debias

propose the concept of decision weights although it is unclear how these weights are determined in a particular empirical application. In our setting, 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 by the ratio between the 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 the 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.

behavioral consumers and improve decision-making. Proponents of 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." We add to the nascent literature on nudges in two ways. First, we illustrate that nudges can also target firms, not only individuals or consumers. In particular, these nudges arouse behavioral concerns among consumers and induce firms to respond in a way that mitigates these concerns and promotes policy. Second, we measure the impact of these nudges, taking into account both firms' and consumers' responses to these nudges. Notably, ignoring these equilibrium effects may lead to erroneous conclusions about the effectiveness of nudges and their impact on consumers.

6.4 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 costs or switching costs can often explain observed choices. For instance, consumers may fail to calculate the full price since they are unaware of certain fees or taxes, rather than due to limited attention. Unlike papers that focus on the 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, 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 assign to 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 not 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 shaming products. Our analysis of very close substitutes finds that the prices of these products fell but not as much as the shaming products, which further indicates that consumers do not infer that the quality of very similar products diminished.

Second, another concern is that informing consumers about the price of the same products abroad might result in consumers not buying in local stores. It might also result in lower in-store demand. We believe that this explanation 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-efficeint. Second, the overall quantity of shaming products increased, whereas if buying internationally were the norm we would expect overall quantities to fall. Finally, if this channel were important we would expect high-priced retailers to be more sensitive to the regulation, whereas we do not find such a 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 a possibility, we can test whether the prices of products that were almost included in the regulation also changed. Presumably, concerns about future interventions should also be reflected in the prices of these products. The regression results using the candidates' products for shaming 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 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 better suited to test theoretical models that emphasize the role of the saliency of information. Our analysis shows that prices fell by 8% and that this effect was driven both 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 been expected based on demand elasticities that we compute using pre-regulation data.

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

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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 7290003806577). 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

				
Price (Local ; Intl)	19.2 ; 8.25	11.3 ; 5.92	15.8 ; 8.9	19 ; 8
Diff	**133%** ↑	**91%** ↑	**79%** ↑	**139%** ↑
Shaming period	1^{st} wave	$1^{st} - 2^{nd}$ wave	1^{st} wave	2^{nd} wave
				
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	1^{st} wave	1^{st} wave	1^{st} wave	2^{nd} 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	$1^{st} - 2^{nd}$ wave	2^{nd} wave	2^{nd} wave	2^{nd} wave

Table 2: Examples of products in each group

Shaming products						
Non shaming products:	(1) Same brand and category group					
	(2) Main group					
	(3) Shaming candidates group	 				

Table 3: List of products in the main control group

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

Appendix B Model Solution

B.1 Price elasticity of demand

The price elasticity of demand is given by

$$\eta_{X,P_x} = \frac{\partial X}{\partial P_x}\frac{P_x}{X} = \frac{1}{-\beta}\frac{\left[1+\gamma I\left(2\frac{P}{P_{int}}-1\right)\right]}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]} \tag{15}$$

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 of unfair prices and are sensitive to these prices, their demand becomes more elastic.

$$\frac{\partial}{\partial \gamma}\left(\frac{1}{-\beta}\frac{\left[1+\gamma I\left(2\frac{P}{P_{int}}-1\right)\right]}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]}\right) = \frac{1}{-\beta}\frac{I\frac{P}{P_{int}}}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]^2} \leq 0. \tag{16}$$

Third, an increase in γ 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 γ and is unchanged when consumers are insensitive to salient prices.

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

$$\frac{\partial}{\partial \frac{P}{P_{int}}}\left(\frac{1}{-\beta}\frac{\left[1+\gamma I\left(2\frac{P}{P_{int}}-1\right)\right]}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]}\right) = \frac{1}{-\beta}\frac{\gamma I-(\gamma I)^2}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]^2} \leq 0 \tag{17}$$

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 $q(P) = \left(P + P^2\frac{\gamma I}{P_{int}}\right)^{-\frac{1}{\beta}}$

We write the maximization problem as

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

The first order condition is:

$$\frac{\partial V}{\partial P} = \left(P + P^2\frac{\gamma I}{P_{int}}\right)^{-\frac{1}{\beta}} - (P-C)\frac{1}{\beta}\left(1+2P\frac{\gamma I}{P_{int}}\right)\left(P+P^2\frac{\gamma I}{P_{int}}\right)^{-\frac{1}{\beta}-1} = 0$$

define:

$$\tilde{q} = P + P^2\frac{\gamma I}{P_{int}}$$

arrange:

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

Only the right term could be zero-

$$\tilde{q} - \tilde{q}'\left(P-C\right)\frac{1}{\beta} = 0$$

Thus we get,

$$P + P^2\frac{\gamma I}{P_{int}} - (1 + 2P\frac{\gamma I}{P_{int}})\left(P-C\right)\frac{1}{\beta} = 0$$

After arranging we get the standard quadratic equation

$$P^2\left((\beta-2)\frac{\gamma I}{P_{int}}\right) + P\left(\beta - 1 + 2C\frac{\gamma I}{P_{int}}\right) + C = 0$$

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:

$$P^* = \begin{cases} \frac{(\beta-1+2C\frac{\gamma I}{P_{int}})+\sqrt{4C\frac{\gamma I}{P_{int}}+4\left(C\frac{\gamma I}{P_{int}}\right)^2+(\beta-1)^2}}{2(2-\beta)\frac{\gamma I}{P_{int}}} & ,\gamma I \neq 0 \\ \frac{c}{1-\beta} & ,\gamma I = 0 \end{cases} \tag{18}$$

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 γI 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 a comparative static analysis with regard to price and quantity following a change in γI for the first solution of P^*. The derivative of P^* with respect to γI is given by:

$$\frac{\partial P^*}{\partial \gamma} = \frac{\left(P_{int}\left(2\gamma c I - P_{int}(-1+\beta)^2(-1+\gamma I) + (-1+\beta)\sqrt{4\gamma^2c^2I^2 - 4P_{int}c\gamma I(-1+\gamma I) + {P_{int}}^2(-1+\beta)^2(-1+\gamma I)^2}\right)\right)}{(2(-2+\beta))\gamma^2 I\sqrt{4P_{int}(-2+\beta)(-1+\gamma I)c\gamma I + (P_{int}(-1+\beta)(-1+\gamma I) - 2\gamma I c)^2}}$$

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 γ:

$$\frac{\partial\left(Q(P^*)\right)}{\partial \gamma} = \frac{\partial\left(\left(P\cdot(1+\gamma S(P,P_{int})I)\right)^{\frac{1}{-\beta}}\right)}{\partial \gamma} = \frac{2^{-1+\frac{1}{\beta}}\left(2c\gamma I + P_{int}\omega - \delta\right)\left(-\frac{2c\gamma I - P_{int}\omega+\delta}{(-2+\beta)\gamma I}\right)^{\frac{1}{-\beta}}}{\beta\gamma(-1+\gamma I)\delta}$$

where we define:

$$\delta = \sqrt{4P_{int}(-2+\beta)c\gamma I(-1+\gamma I) + (-2c\gamma I + P_{int}\omega)}$$

$$\omega = (-1+\beta)(-1+\gamma I)$$

$\frac{\partial Q(P^*)}{\partial \gamma}$ = is positive, which suggests that quantity increases with γ.

Appendix C Demand Elasticities

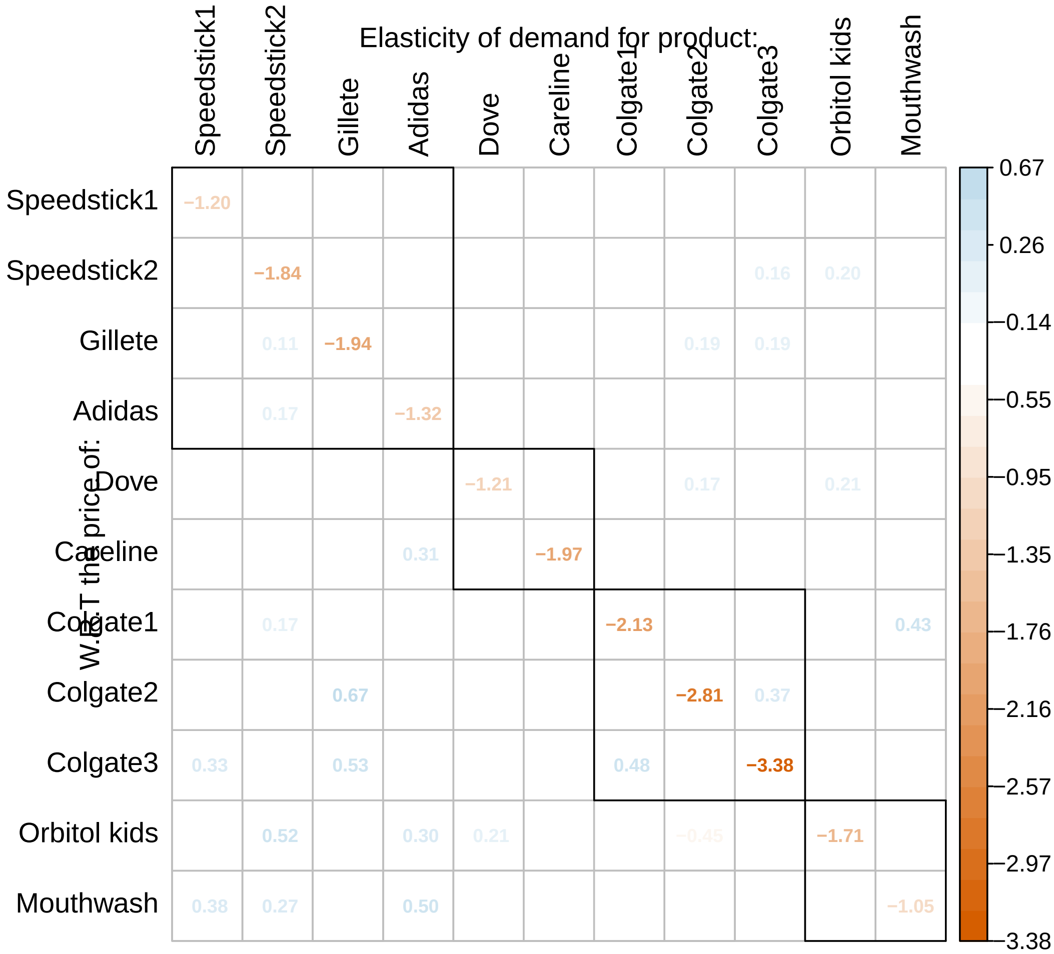


Figure 1: Price elasticities before shaming

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.

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 columns 4-9 we include and exclude different variables to test whether our results depend on the inclusion of a specific fixed effect, or are 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.[19] 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.

[19] As shaming products are highly popular, retailers are unlikely to discontinue selling them after the regulation.

Table 4: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: *Dependent variable:* log(*price*)									
post × *shaming*	-0.083***	-0.206***	-0.011	-0.080***	-0.178***	-0.014	-0.042**	-0.120***	0.005
	(0.014)	(0.034)	(0.009)	(0.014)	(0.027)	(0.009)	(0.017)	(0.039)	(0.013)
R^2	0.93	0.92	0.94	0.88	0.87	0.91	0.93	0.93	0.95
Panel B: *Dependent variable:* log(promotional price)									
post × *shaming*	-0.058***	-0.143***	-0.008	-0.050***	-0.098***	-0.018*	-0.018*	-0.056**	0.004
	(0.016)	(0.032)	(0.011)	(0.013)	(0.022)	(0.010)	(0.009)	(0.025)	(0.008)
R^2	0.91	0.90	0.92	0.88	0.88	0.90	0.92	0.92	0.93
Fixed-effects									
product-retailer	✓	✓	✓				✓	✓	✓
month	✓	✓	✓	✓	✓	✓	✓	✓	✓
product				✓	✓	✓	✓	✓	✓
retailer				✓	✓	✓	✓	✓	✓
product specific lin. time trend							✓	✓	✓
retailer specific lin. time trend							✓	✓	✓
Weights by stores				✓	✓	✓	✓	✓	✓
Retailers	All	Public	Private	All	Public	Private	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

	log(branches)		
	(1)	(2)	(3)
post × *shaming*	0.018	0.013	0.021
	(0.063)	(0.068)	(0.067)
Fixed-effects			
Month	✓	✓	✓
Product × Retailer	✓	✓	✓
Retailers	All	Public	Private
Observations	29,046	10,849	18,197
R^2	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 consumers to salient unfair prices.

E.1 GMM

The GMM estimator finds 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:

$$m_{1i}(\theta, Y, X) = \epsilon_i \tag{19a}$$
$$m_{2i}(\theta, Y, X) = \epsilon_i^2 - \sigma^2 \tag{19b}$$
$$m_{3i}(\theta, Y, X) = Z_i \tag{19c}$$
$$m_{4i}(\theta, Y, X) = Z_i I_i \epsilon_i \tag{19d}$$

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

The sample counterpart of moment condition k is:

$$\bar{m}_k(\tilde{\theta}) = \frac{1}{N}\sum_{1}^{N}(m_k(\tilde{\theta}, Y, X)) \tag{20}$$

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:

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

We use cluster-bootstrap on the retailer-item level to produce a confidence interval.

	Coef	conf.low	conf.upper
γ	0.049	0.031	0.067
η	-1.437	-1.439	-1.435
σ^2	0.442	0.428	0.457

Notes: The table presents the results of estimating Equation 12 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) present 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 12.[20] 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 moments 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. $M_T = \frac{\sum_i \sum_s \log(q_{i,s,t \in T})}{\sum_i \sum_s 1}$ (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

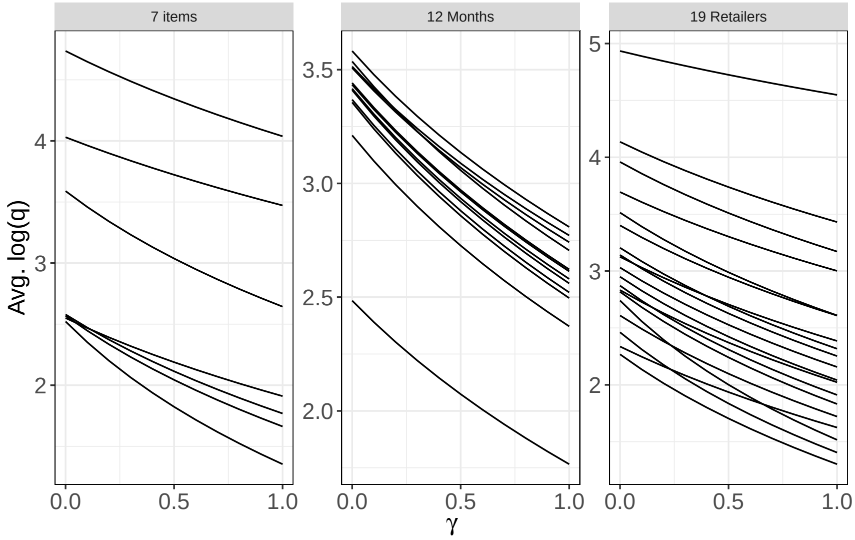
After finding informative moment conditions, we match the vector of empirical moments with a vector of an average of k draws of the simulated moments. The objective function of the MSM is to minimize the weighted differences between the two vectors, by changing the values of the unknown parameters. Formally,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

$$\hat{\theta} = \text{argmin}(\tilde{M}_S - M_D)' W (\tilde{M}_S - M_D), \tag{21}$$

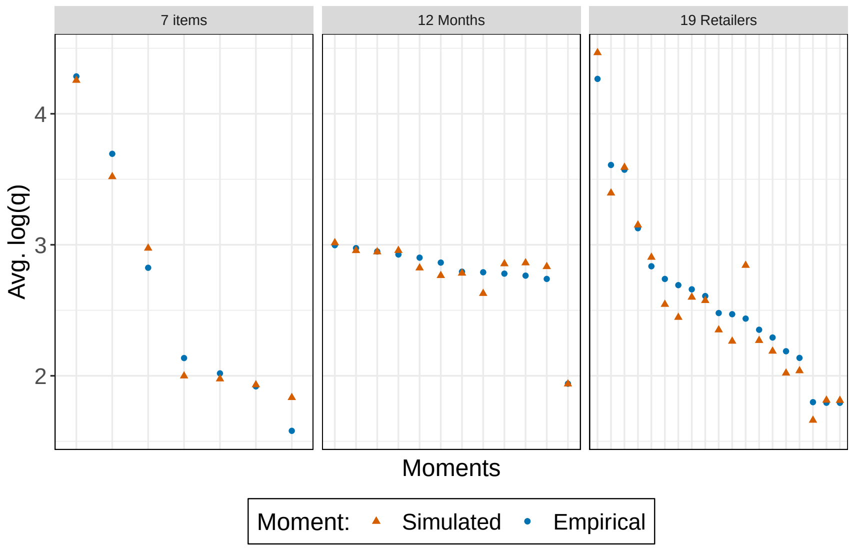
where $\tilde{M}_S$ are the average of k draws of simulated moments M_S, M_D are the empirical moments, and W is the weighting matrix. To estimate the optimal weighting matrix we follow a two-step procedure. As the MSM involves an optimization process, we need to check that the optimization converges to a global minimum. To address this concern, we repeat the optimization process using different initial values, seeds, the number of draws k we use to evaluate each average of the 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 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.

[20] Similarly to the GMM estimation, we use fixed-effect from other regressions to reduce the number of dimensions of the optimization problem.



(a) Changes in moments with respect to changes in values of γ



(b) Comparisons between empirical and simulated moments

Figure 2: Simulated moments

Panel (a) of Figure 2a presents the relationship between values of γ (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 γ regardless of the product, retailer, and month identity. We fix the elasticity of demand to -1.5. The negative association between the values of γ and the moments remains for negative elasticities. We repeat this one-dimension analysis holding γ fixed, and changing the demand elasticity η and find similar patterns. In Figure 2b, the X-axis denotes 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 minimize the weighted differences between the empirical and simulated moments.

Parameters Estimate	
γ	η
0.095	-1.673
(0.0001)	(0.0001)

Table 7: MSM Estimation results