Price Saliency and Fairness: Evidence from Regulatory Shaming*

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Abstract

What are the effects of attention to the price paid by other consumers on consumer demand and firms' pricing decisions? We study the effects of a regulation that required Israeli retailers to display on-the-shelf signs indicating the (cheap) international price of a product alongside the price of that product in the local store. We find that prices of products included in the regulation fell on average by 8%. The price drop was larger for products that were initially more expensive compared to their international price. Following the price drop, quantities sold increased. Yet, these increases were significantly smaller than increases in quantities that we predict based on pre-regulation demand elasticities and the actual price drops. Products that remained relatively expensive vis-á-vis their international price exhibited larger differences between predicted and actual quantities sold. We develop a theoretical model that explains these findings, and estimate it to quantify the importance of salient unfair prices. We find that a 20 percentage-point salient difference between local and international prices is equivalent to a 1% increase in the price of the local product itself. Next, we use the model and its estimated parameters to calculate the impact of the regulation on consumer utility. We find that utility declined for some products included in the regulation. This happens when the disutility from observing that other consumers pay less exceeds the added utility from reduced prices and increased consumption. We discuss potential implications of our findings for optimal pricing strategies, price rigidity, and theoretical models of salient thinking.

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1 Introduction

Economists have long been interested in understanding how fairness concerns affect decision-making (e.g., Kahneman, Knetsch and Thaler 1986; Rabin 1993; Fehr and Schmidt 1999), and extensive lab and survey evidence shows that such concerns are important, mostly in bilateral settings. Nevertheless, it remains an open question to what extent evidence found in the lab translates to real market settings, and has a meaningful impact on choices made by firms and consumers. In their review of the economics of fairness, Fehr and Schmidt (2006) write: "the real question is ... under which conditions these preferences have important economic and social effects"[1]

We use a regulation that required Israeli retailers to place on-the-shelf signs showing the (cheap) international price of a product alongside the price of the same product in the local store, to test how salient differences between international and local prices affect firms' pricing decisions and consumer demand. The motivation for the regulation, introduced in March 2018 and often referred to as the shaming regulation, was to generate pressure to reduce prices. The main criterion for choosing the 12 products included in it was a large difference between the local and the international price.[2] Critiques of the new regulation stressed that since Israeli consumers cannot buy these products at the international price, informing them about a cheap unattainable alternative might irritate them but will not affect prices in the local store.[3] Our findings nevertheless show that the regulation was effective in reducing prices. We demonstrate that differences between local and international prices, had an economically large impact on retailers' pricing decisions and consumer demand. Retailers significantly dropped prices of products included in the regulation, and consumers' demand for these products shifted inward. Moreover, the magnitude of retailers' pricing response on the one hand, and consumers' demand response on the other hand depended on how pricey is the product in the local store compared to the international price of that product. That is, prices of products that were initially more expensive dropped more, and consumers' demand fell more for products that remained more expensive. Thus, our paper provides novel field evidence on the impact of unfair prices, which are captured by the difference between local and international prices, on market outcomes. We also contribute to the growing literature on salient thinking (Bordalo, Gennaioli and Shleifer 2012, 2013, 2020, Kőszegi and Szeidl 2013, Bushong, Rabin and Schwartzstein 2021), showing how an exogenous change in the saliency of the environment has a large impact on consumers, firms and the equilibrium. To our knowledge, we are the first to provide field evidence on the impact of contrast, one of the three stimuli of salient thinking, on both consumers and firms.

We begin the analysis by developing a model of a profit-maximizing firm that sells to consumers who maximize a quasi-linear utility function subject to a budget constraint. Before the regulation is implemented, consumers' utility and induced demand are not affected by the international price of the product. Once the international price tags are displayed, consumers' attention is drawn to the international price and their preferences reflect antagonism toward the high prices they face. In particular, the ratio between the local and the international price enters their utility function,

[1] p.618. See also Levitt and List 2007; Bartling, Weber and Yao 2015; Shleifer 2004; Falk and Szech 2013; Dewatripont and Tirole 2022. To be sure, the question of morality and ethics in markets is also debated by philosophers, political scientists and sociologists (e.g., Anderson 1995, Fourcade and Healy 2007, and Sandel 2012).

[2] For instance, one of the products in the regulation was Colgate 100ml Max Fresh cool mint toothpaste. The mean price of this toothpaste in Israel was 16.04 NIS (about \$4.6), whereas its average price outside of Israel was 8.25 NIS (about \$2.4). Table 1 in Appendix A contains information on the 12 products included in the regulation.

[3] According to a survey of American shoppers online and off-line, 76% of respondents said they would be bothered to learn that other people pay less for the same products (Turow, Feldman and Meltzer 2005). Leibbrandt (2020) experimentally shows that sellers' pricing decisions take into account consumers' perceptions about the price that other consumers pay.

and inversely affects the utility derived from the product: the higher the price ratio, the lower the utility from consuming the product. The utility function collapses to the pre-shaming utility when the international and local prices are equal, when the consumers are insensitive to paying higher prices, and when attention is not drawn to the price ratio. We solve for the post-shaming equilibrium, showing that demand becomes more elastic.[4] Solving for the optimal price before and after the regulation takes place, we derive the following testable predictions. First, the firm will reduce its prices after the regulation. Second, prices of products characterized by higher pre-shaming price ratios will drop more. Third, following the price reductions consumers will buy more of the products included in the regulation. Fourth, the quantity sold is less than what we would expect were we to rely on the original demand curve to predict sales based on the new price. Finally, the difference between the actual and predicted quantities grows with the post-shaming price ratio. That is, products that remain more expensive relative to the international price will experience a larger backlash in demand relative to products with prices that are set closer to the international price.

In the empirical analysis we test the predictions from the model. We first examine how retailers changed prices after the regulation was introduced. Using comprehensive detailed price data on 126 products sold in 1,250 stores by 31 retailers over 36 months, we find that prices of products included in the regulation fell shortly after the international price signs were placed. When we use regular prices, we find that on average prices fell by 8.5% and 5.5 when we use promotional prices. We also show that the price drop was larger among products that exhibited a larger price difference vis-á-vis the international price. Next, we use weekly store-level sales data for 11 products sold in 250 stores investigate how quantities changed after the price signs were placed. We seek to examine whether the regulation affected quantities sold beyond the direct effect of lower prices. To do so, we compare the observed changes in quantities sold after the regulation with predicted changes in quantities. To obtain the predicted change in quantity sold of a given product, we first compute the demand elasticities for each product using pre-regulation data. We use these demand elasticities and multiply them by the actual drop in prices to derive a predicted change of each product. The comparison between the predicted change and the actual change observed in the data reveals that the actual increase in quantities sold, which is on average 10.5%, is significantly smaller than the predicted one, which is on average 18.5%. Also consistent with the predictions of the theoretical model, we show that the difference between the actual and predicted measures is larger for products that remain more expensive relative to the international price. Thus, our findings suggest that consumers' demand is sensitive to the ratio between the local and the international price. When we conduct these analyses for a control group of products, whose international prices were not displayed, we do not find considerable differences between the predicted and actual measures of quantities. Likewise, repeating the analysis for a placebo time period does not reveal similar patterns.

In the next step of the analysis, we use the model to perform two additional exercises. In the first exercise we estimate the parameter that captures the sensitivity of consumers to unfair prices. Our goal is to compare a change in the price of the product itself with a change in the ratio between the local and the international price. We exploit variation in the price ratio of different products, and the corresponding quantities sold of each product. Using the general methods of moments, we find that a 20 percentage-point salient difference between local and the international price is equivalent to a 1% increase in the price of the product itself. In the second exercise, we use

[4]Intuitively, demand is more elastic because a firm that lowers its price in the post-shaming period not only increases quantity due to the standard law of demand, but also earns additional sales because it decreases the ratio between the international and the local price, making the product more attractive to consumers.

the model to quantify the impact of the regulation on consumer utility. Although prices dropped and quantities increased after the regulation, the impact of shaming on consumer surplus is ex-ante ambiguous. This is because consumers who observe that other consumers pay less than they do, suffer and their utility falls. In fact, our back of the envelope calculations show that utility decreased for 4 out of seven products we have data for.

Our paper contributes to the literature on bottom-up attention and salient thinking in several ways. First, we examine how both firms and consumers respond to an exogenous change in saliency. Existing studies consider the impact of saliency on individuals, typically consumers. For instance, Chetty, Looney and Kroft (2009) show that a commodity tax has a larger effect on demand if the tax is included in the in-store posted price. Finkelstein (2009) shows that paying tolls electronically makes drivers less sensitive to the price they pay. Blake et al. (2021) show that drawing consumer attention to prices leads them to buy fewer items and reduce the quality of goods purchased.[5] Second, our findings demonstrate how a regulatory intervention that changes the saliency of the environment could result in lower prices, presumably to to the benefit of consumers. By contrast, existing studies predominantly show how firms manipulate the environment and push consumers toward higher-margin products. Third, we are able to quantify the impact of saliency, and use this measure to compare a change in an external price to a change in the price of the product itself. Finally, our setting does not concern a change in the prominence of the price of the product itself but rather by a change in the way the product's price is contrasted with the surrounding environment. To our knowledge, this is the first study that offers field evidence for contrast as a stimuli for salient thinking in the context of consumer choice (Bordalo, Gennaioli and Shleifer (2022)). In Section 6.1 we discuss in more length how our findings add to this literature. Our paper also contributes to the literature on fairness, providing novel field evidence of the impact of fairness on both firms' pricing decisions and on consumers' purchasing decisions. In a seminal paper, Kahneman, Knetsch and Thaler (1986) use surveys to demonstrate that fairness considerations in pricing decisions are important to consumers. Fehr and Schmidt (1999) offer a unifying theory for many observed phenomena where individuals seem to care about the well-being of others. Relatedly, a large body of experimental evidence, mostly in the context of bilateral negotiations (see Camerer (2011) for review), shows that pro-social preferences are important for decision-makers. Herz and Taubinsky (2018) stress the importance of price saliency to generate fairness perceptions.

Our findings have implications for optimal-price setting, price discrimination, and price rigidity. In Section 6.2 we discuss these in more length, and here briefly mention that if firms take into account that consumer demand falls if consumers realize they pay more than other consumers, that could explain why firms engage in obfuscation strategies (e.g., Xia, Monroe and Cox 2004, Ellison and Ellison 2009, Allender et al. 2021). If obfuscation is costly or ineffective, firms may limit the gap between high and low prices, either by lowering prices of high-priced products or by raising prices of low-priced products (Dubois, Gandhi and Vasserman 2019. At the extreme, firms may avoid price discrimination, setting similar prices in different markets (DellaVigna and Gentzkow 2019, Hitsch, Hortaçsu and Lin 2021, Orbach and Einav 2007 Shiller and Waldfogel 2011, Ater and Rigbi 2022). Our findings also speak to the link between fairness and price rigidity (Rotemberg 2005, 2011; Eyster, Madarász and Michaillat 2020). Anderson and Simester (2010) show that if customers buy a product and later observe the same retailer sells it for less, they make fewer subsequent purchases.

[5] Also related are Frydman and Wang (2020) who show that making a stock's purchase price more salient increases the disposition effect, and Dai and Luca (2020) who show that the saliency of hygiene scores affects the demand for restaurants. Other studies rely on the structure of pricing plans to examine the role of salient prices on insurance (Sydnor 2010) or subscription plans (Ater and Landsman 2013).

The remainder of the paper is organized as follows. Section 2 contains the model and derives testable predictions. In Section 3 we describe the relevant background and the data. In Section 4 we present the estimation and results for the impact of shaming on prices and for quantities. In Section 5, we use the model to measure consumer sensitivity to unfair prices, and to quantify the change in consumer surplus following the regulation. In Section 6 we discuss the implications of our findings. Section 7 concludes.

2 A Model of Price Saliency and Fairness

In this section we develop a model of a profit-maximizing firm that sells to consumers before and after the price signs are displayed. For the pre-shaming period, consumer preferences are represented by a standard utility function, and for the post-shaming period, utility also depends on the ratio between the local and the international price. We use the model to derive testable predictions regarding the impact of salient unfair prices on prices and quantities sold. 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 utility generated by the regulation.

2.1 Setup

Consumer preferences are represented by the following quasi-linear utility function:

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

where q is the number of units consumed from the product sold by the firm, and m represents consumption of other products. The first component of the utility from q – $\frac{q^{1-\beta}}{(1-\beta)}$ – is positive and is decreasing in q for positive, smaller than one, values of β (i.e., $0 < \beta < 1$). This first component can be viewed as a standard no-fairness considerations benchmark, which captures the pre-shaming utility. The second component – $\frac{1}{1+\gamma S}$ – is relevant only when fairness matters, and is the weight attached to the utility from consuming q. For positive values of γS, consumer utility is lower compared to the utility derived from consuming the same number of units when fairness considerations are irrelevant. In particular, if consumers are not sensitive to unfair prices then γ, which captures the sensitivity to unfair pricing is equal to zero. The extent to which a local price is both salient and expensive is captured by S. The expensiveness, or the degree of unfairness, is reflected by the ratio between the local price (P^{local}) and the international price (P^{int}). This price ratio becomes salient to consumers after the in-store price signs are placed (i.e. after the shaming regulation is implemented). At that time, consumers' attention is drawn to the price ratio they observe. In particular, we define S as:

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

where I is an indicator for the presence of the in-store price signs, and hence for the observability of the price ratio. The consumer perceives the local price as unfair once the signs are placed, and when the local price is higher than the international price (i.e. price ratio is larger than 1). Intuitively, S increases with the ratio between local and international prices conditional on consumers observing the price signs. That is, consumers' attention is drawn to products with higher price ratios and the utility from these products is underweighted as this ratio increases.[6]

[6]This formulation captures the ordering property which the theoretical models of saliency emphasize. Lanzani (2022) shows that the ordering property brings salience theory outside the prospect theory realm.

The utility function collapses to a standard utility function (i.e., with no fairness considerations) in three scenarios, namely when: 1) the ratio between the local and international prices is not salient (i.e., before the international price tags are displayed, $I = 0$); 2) the local price and the international price equal, and 3) the consumer is insensitive to unfair prices (i.e., $\gamma = 0$).

The consumer and firm maximization problems.

The consumer buys q units at the price P_o before the regulation, and at P_a after the regulation. The remaining budget is used to purchase other products, m, whose price is normalized to 1. In the pre-shaming period, fairness considerations are irrelevant and the consumer solves the following constrained-maximization problem:

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

Solving this maximization problem, we obtain the demand functions for q and m without fairness considerations:

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

After the implementation of the regulation, consumers' attention is drawn to the ratio between local and international prices. The maximization problem is now given by:

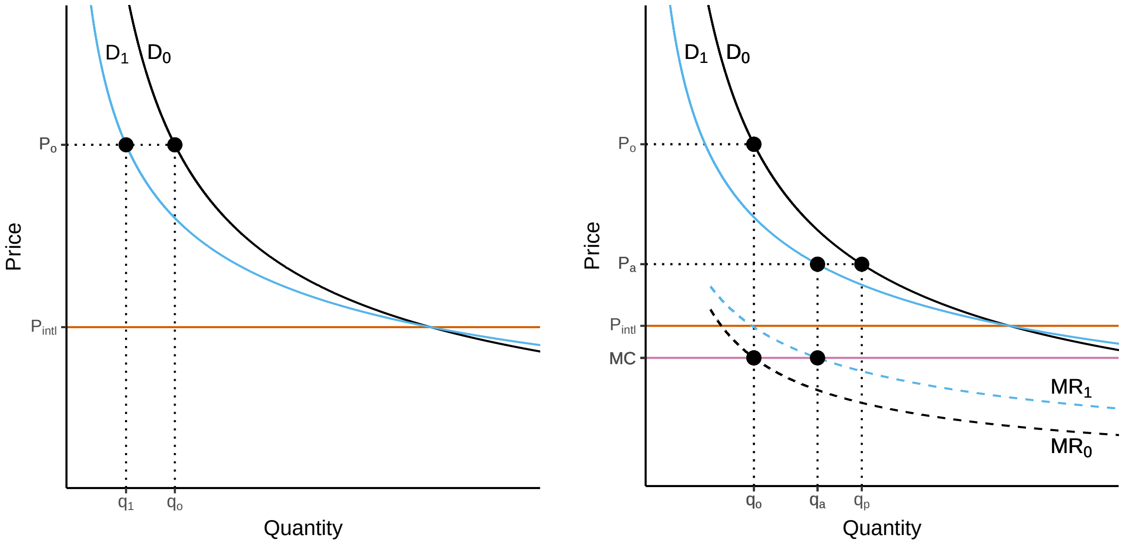
$$\begin{aligned} \max_{q,m} U(q,m) =& \frac{q^{1-\beta}}{1-\beta} \frac{1}{(1+\gamma S)} + m \\ s.t. \quad & q \times P_q + m \leq \text{Income}, \end{aligned} \tag{5}$$

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

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

Figure 1a illustrates the transition from the pre-shaming/standard demand curve to the post-shaming/fairness demand curve. As shown, after the implementation of the regulation, demand shifts inward, and for a given price consumers demand less. Next, we consider how a firm's optimal price changes before and after the price ratio becomes salient to consumers. A firm maximizes profits by setting its marginal revenue equal to its marginal cost. In the pre-shaming period, the solution to this maximization problem is given by q_o in Panel (b) in Figure 1. After the regulation, the firm also sets marginal cost equals to marginal revenue, which is now derived from the new demand curve. Importantly, the new marginal revenue curve increases relative to the marginal revenue curve before shaming. This occurs because for a given price reduction, the consumer is induced to buy more for two reasons. The first reason is the standard law of demand, implying that consumers buy more as prices fall. The second reason for the increased demand is due to the disutility the consumer gets when the price ratio is high. Accordingly, when the price falls, the disutility diminishes and the consumer demands more units. Thus, following the shaming regulation the firm has an incentive to reduce its price below the price it set before the regulation.[7] Figure 1b illustrates this point graphically.

[7] In Appendix B we provide an analytical solution for the firm's profit-maximizing solution, deriving the conditions under which post-shaming prices are lower than the prices before the shaming regulation, and showing that the quantity demanded is higher than in the pre-shaming period. In particular, we show that when demand is elastic and for values of γ between [0,1], the derivative of the optimal price of the monopoly is negative, and the derivative for its optimal quantity is positive.



(a) Consumer demand before and after shaming

(b) The retailer's optimal response to shaming

Figure 1: Change in consumer demand and retailer response

Notes: Panel (a) of Figure 1 shows how demand shifts inward once unfair prices become salient to the consumer. The black solid line represents the original demand curve and the blue solid line represents the new demand curve. The orange solid line denotes the international price of the product. As shown, for a given price (P_0) quantity falls from q_0 to q_1, and the two demand curves intersect when the local price equals the international price. Panel (b) of Figure 1 illustrates the impact of shaming on the optimal price and the quantity sold. P_o represents the original pre-shaming optimal price, derived from setting the pre-shaming marginal revenue equal to the marginal cost. After shaming, the firm maximizes its profits using the new demand and the corresponding marginal revenue curve. Since the new marginal revenue curve lies above the initial MR curve (see text for details), the post-shaming price P_A is lower than the original/pre-shaming price. Also, the actual quantity sold (q_A) is greater than the original quantity sold (q_o). Nonetheless, the post-shaming quantity sold is lower than what the consumer would have bought (denoted by q_p) at the new price had the demand curve remained unchanged.

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 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, and when demand is more elastic.

2.2 The change in profits and consumer surplus

The firm's profit decreases after the international price tags are displayed. We use a revealed-preference argument to show this. In the pre-shaming period, the firm could have chosen the price P_a and sell q_p units. Had it done so, its profits would have been the same or lower than the profits it earned in the pre-shaming period. Due to shaming, the firm sells only q_A when its sets P_a, which is less than q_p. This implies that profits are strictly lower in the post-shaming period. Unlike profits, the impact on consumer surplus due to shaming is ex-ante ambiguous. On one hand, prices fall and the quantity sold increases, implying that consumer surplus is supposed to increase. However, in the post-shaming period, consumers also observe that they are paying more than other consumers, and incur costs from consuming these product, making the overall impact on consumer surplus ex-ante unclear.

2.3 Testable predictions

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

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

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

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

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

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

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

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

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

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

3 Background, Data, and Descriptive Statistics

3.1 Industry background

Retail food prices in Israel are expensive relative to OECD countries (OECD 2013; Hendel, Lach and Spiegel 2017; Ater and Rigbi 2022). The high cost of living became a primary public policy issue after the large social protests in 2011. Despite various regulatory attempts, retail prices in Israel, mainly for imported brand products such as toiletries and hygiene products, remain high in international comparisons. The regulation we study is another attempt to reduce prices.

The shaming regulation. In an attempt to reduce prices of imported brand products, the Ministry of Economy advanced a regulation in which the international price of certain popular products will be displayed near the price of the exact same product sold in the local store. The products chosen for this regulation were popular products that exhibit high price differentials vis-á-vis the average international price of the exact UPC-level product sold abroad. In late 2017, the Ministry used data from Nielsen to identify products such products, and after hearing objections from importers and manufacturers, it approved the regulation in February 2018.[8] Starting in the following month (March 2018), retailers selling these products were required to display the international price of seven products along with the local price. In Israel, store tag prices are tax-inclusive and so the calculation of the international price also includes applicable taxes in the relevant countries. To reduce the burden on retailers, the signs were designed as simple as possible and were downloadable from the Ministry's website. Exhibit 1 in Appendix A presents an example of these "on-the-shelf" shaming labels. The regulation also set financial sanctions for non-compliance, and in some cases retailers had to pay fines incurred for non-compliance in specific stores. In December 2018, the composition of the products changed. Four products were excluded from the list after importers complained that these products are not exactly comparable to the international products. In addition, five other products were added. Below we refer to products included in March 2018 as first-wave products and to products added in December 2018 as second-wave products. Appendix A contains information on the 12 products included in the regulation. In April 2019, Nielsen exited the Israeli market, making the continued comparison and price-updating process of local and international prices of identical products inapplicable.[9]

3.2 Data and descriptive statistics

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

3.2.1 Price data

The price data cover the time period between November 2016 and October 2019, and include comprehensive price information for 126 products sold in 1,250 stores affiliated with 28 retailers. We obtain the price data from Pricez.co.il, a price comparison platform that collects prices of products sold by food retailers in Israel. The price data are available following Israel's price transparency regulation that made prices of all products sold by Israeli supermarket chains available online (Ater and Rigbi 2022). Throughout the analysis, we use the average monthly price at the chain level, and present results using either the full price or the promotional price. The 12 products included in the regulation are the treatment products. Figure 2 presents the ratio between the local and the international price 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 the local prices of the shaming products 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

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

[9]See (in Hebrew) 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. Anecdotal evidence suggests that Nielsen's exit from Israel was related to pressure exerted on Nielsen from the international manufacturers (Procter & Gamble and Unilever) who produce the products in the regulation and hence considered Nielsen a de-facto associate with the shaming regulation.

also shows that after the regulation was implemented, the entire price distribution shifted to the left, implying that prices dropped. Nevertheless, even after the regulation, local prices remain considerably higher than international prices.

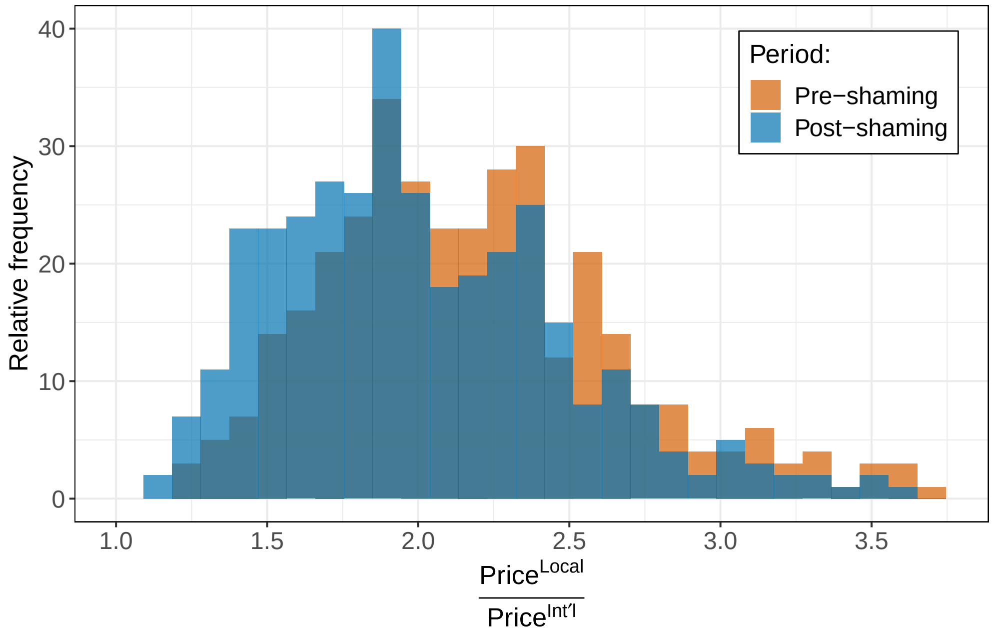


Figure 2: Price ratios, before and after the shaming regulation

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. The figure illustrates that following the regulation, the distribution of price ratios moved to the left. Yet, local prices remain higher than the international prices also after the regulation.

Control groups for non-shaming products. We use the price data for other products to construct three comparison groups. **Main control group.** We use price data for 23 products that were not included in the regulation ("non-shaming products") as our main control group. The products in this group serve similar needs as the treatment products but are nevertheless not strong substitutes. For example, we use mouthwash, toothpicks, and children's toothpaste as controls for toothpaste products included in the shaming regulation. We further use the fact that men's deodorants in the shaming list are gel deodorants, and therefore include spray deodorants in the main control group. On the other hand, the women's deodorant on the list is a spray deodorant, so we use a women's gel deodorant in the control group. For the feminine hygiene items, we use menstrual pads as a control for daily liners, and tampons with an applicator as control for tampons without an applicator in the shaming list. Panel (a) of Table 1 presents descriptive statistics for the 12 shaming products and the 23 non-shaming products in the main control group, before and after the regulation became effective. As seen in the table, the prices of shaming products fell by 9% after the regulation, while the prices of non-shaming products fell by 1%. Price dispersion among shaming products increased more than in the control group, suggesting that the effect of the regulation is not uniform across retailers. In separate analyses presented in the Appendix D, we repeat the regression analysis presented below also using alternative groups of control products. These alternative control groups include products that likely exhibit either strong or weak substitution patterns with the products in the shaming list. We obtain similar results to the main specification.

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%

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

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

Close substitutes group. We also use price information on 17 products that we consider very close substitutes to products included in the regulation. These products include same brand, and mostly same size products as those in the shaming list. For instance, this group contains other

100ml Colgate toothpastes, 150ml Dove deodorants, and speed-stick deodorants. Due to the high substitution between these products and shaming products, we expect that the results from the regression analysis using this group will be downward bias relative to the main comparison group. We nevertheless use this group to show that consumers' and retailers' response is driven by the saliency of price tags, and unlikely driven by consumers making inference on the expensiveness of all similar products. Table 2 in Appendix A presents examples of products included in each of the three groups.

3.2.2 Sales data

The second main 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 2013 and 2019. The scanner data, purchased from Storenext.co.il, contain information on 11 products: seven first-wave shaming products and four products that we use as control. Panel (b) of Table 1 presents descriptive statistics on the sales data. Unlike the price data, the scanner data do not include information on the identity of the chain or on the location of the store. Comparing the change before and after the regulation, we observe that the the average number of units sold of shaming products increased by 15.8%, whereas the turnover only increased by 4.1%. These patterns are consistent with lower prices and a mild increase in quantity sold. For non-shaming products, we see that after the regulation, quantity decreased from an average of 3.7 units per week to 3.3 units. The drop in the volume for non-shaming products is also in the same range. Finally, as seen in the table, shaming products 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 test H1, we compare changes in prices of treated products (shaming products) before and after the regulation against price changes in products that belong to the three comparison groups described above. In subsequent analyses we also test whether the price drop was larger for products with higher pre-shaming price ratios (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.

Table 2: The effect of shaming on prices

	log(price)			log(promotional price)		
	Main control	Shaming candidates	Close substitutes	Main control	Shaming candidates	Close substitutes
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Shaming	-0.085***	-0.066***	-0.047***	-0.055***	-0.036***	-0.025*
	(0.013)	(0.016)	(0.012)	(0.012)	(0.011)	(0.013)
Observations	29,046	16,405	24,936	29,046	16,405	24,936
R^2	0.93	0.87	0.88	0.92	0.85	0.86

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 suggest that prices fell significantly after the implementation of the regulation. For the main control group, we find that regular prices dropped by 8.5% and by 5.5% when using promotional prices. We also observe a significant fall in prices (6.6% in regular prices, 3.6% in promotional prices) when we use the shaming candidates group. As expected, the results show a smaller drop in prices, though still large and significant, when we use the close substitutes group (4.7% in regular prices, 2.5% in promotional prices). 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. $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

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 the first wave, and one for the products in the second wave. The two black vertical dashed lines indicate the first full month that the regulation was effective for each wave (March and December 2018, respectively). We also denote with a blue vertical dashed line the month in which Nielsen exited Israel, which is the date on which the regulation became ineffective. The figure shows that prices of products included in both waves fell abruptly soon after the regulation became effective, and that the effect on the first-wave products is twice as large as the effect on the second-wave products. The effect on the prices of products in the second wave dissipates over time and is statistically indistinguishable from zero after Nielsen exits the Israeli market. The coefficients on the last pre-implementation months are slightly negative because the effective date for the two waves was during the second half of these months. The figure is also useful for examining the common-trend assumption, showing that for both time series, the monthly effect is statistically equal to zero prior to the implementation of the regulation.

4.1.1 Heterogeneous price effects

Figure 4a plots the effect of the regulation on prices of shaming products at each retailer against the average price level at that retailer. Specifically, we estimate Equation (7) allowing the effect of the shaming to vary across retailers. The retailer's average price level on the horizontal axis is the retailer's fixed effect in the regression. The figure suggests that retailers' response to the regulation was not uniform, where some retailers reduced prices by more than 30% whereas other retailers did not change prices and in few cases raised them. We do not observe a clear pattern that high-priced retailers reduced prices more or less than low-priced retailers. However, the figure reveals that

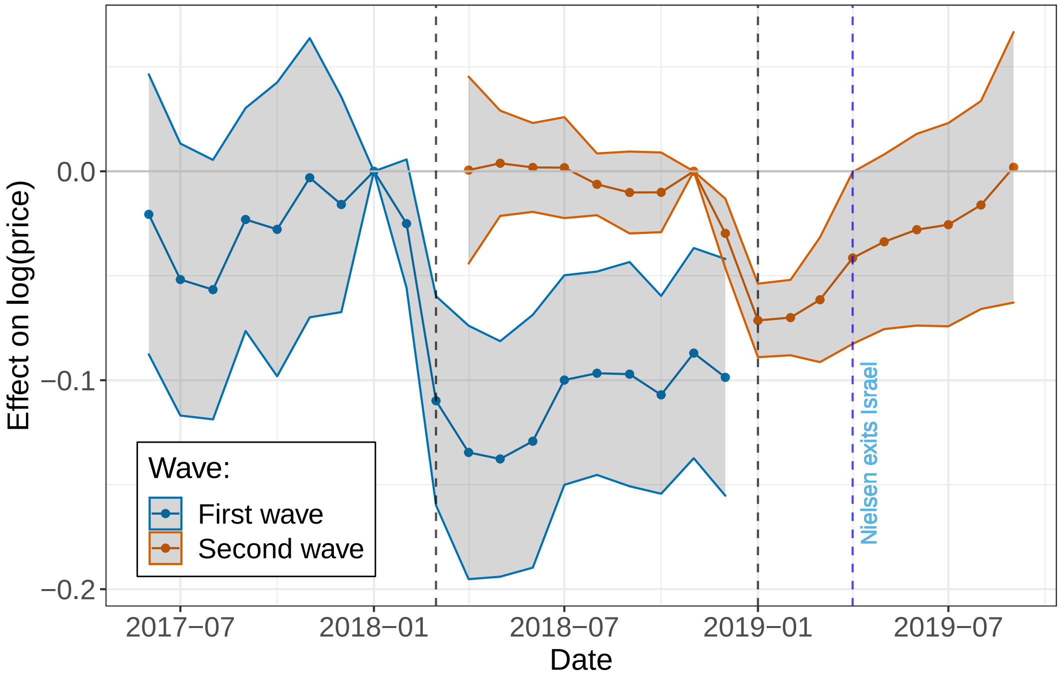


Figure 3: The monthly effect of the shaming regulation on prices

The figure shows the per-month change in the log(price) of products included in the shaming regulation relative to prices of products included in the control group. The figure distinguishes between the two waves of the regulation, separately showing a time series for products included in the first and second waves. The two black vertical dashed lines indicate the first full month that the shaming signs were placed in stores. The blue vertical dashed line represents the month in which Nielsen exited Israel, effectively ending the regulation. For each month, we present the coefficient for the monthly effect and the corresponding 95% confidence interval. The figure shows that prices of products included in both waves fell significantly after the regulation became effective, and that the effect on the first-wave products is twice as big as the effect on the second-wave products. The effect on prices of products in the second wave is short-lived and is statistically indistinguishable from zero after Nielsen exited the Israeli market. Before the implementation of the regulation, we do not see a downward trend in prices, consistent with the common-trend assumption. The coefficients on the last pre-implementation months are negative, likely because the implementation of the two waves began in the middle of each implementation month.

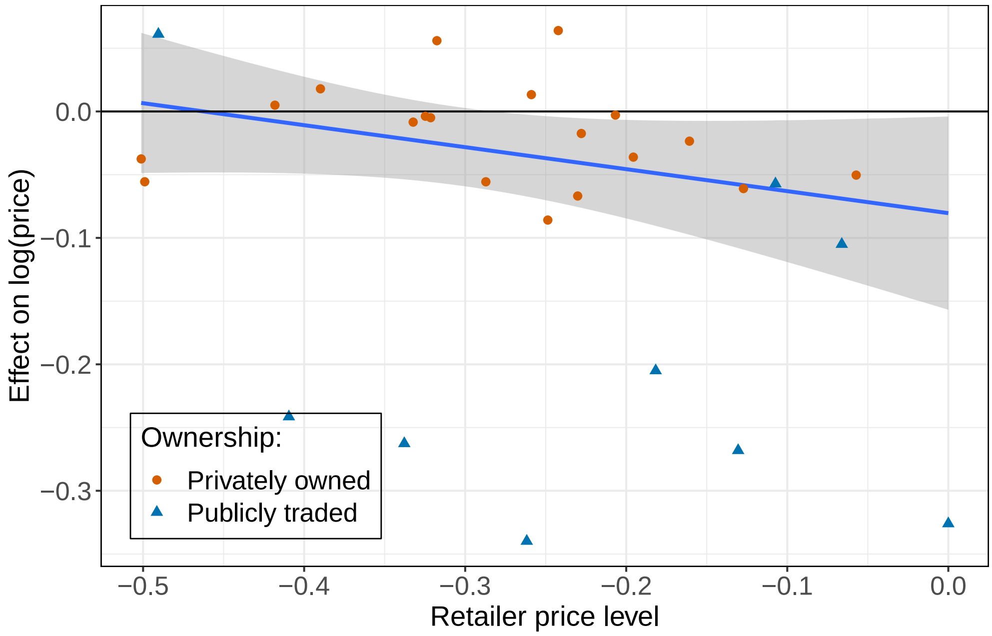
publicly-traded retailers (denoted by blue triangles) reduced prices more than privately-owned retailers (denoted by orange circles). Motivated by Figure 4a, when we separately estimate Equation 7 for publicly-traded and privately-owned retailers, we find that prices of shaming products sold by publicly-traded retailers fell by 18%, whereas the effect is small and statistically insignificant among privately-owned retailers. Using promotional prices, the effect is -10.4% for products sold by publicly-traded retailers, and is -1.7% for products sold by privately-owned retailers. A possible explanation for the difference between privately-owned and publicly-traded retailers is that perhaps publicly-traded retailers take into account fairness or brand-image concerns more than privately-owned retailers. Next, we turn to test H4 – that the price drop following the regulation is larger for products with a higher pre-shaming price ratio. To do so, we divide the products into quartiles based on their price ratio at each retailer. Thus, the three products with the highest pre-shaming ratio at a given retailer are included in this retailer's top quartile. Overall, there are

348 product-retailer pairs, and each quartile contains 87 product-retailer pairs. We use a version of Equation (7), and examine the relationship between the pre-shaming price ratio and the price reduction following the regulation. The estimation results are presented in Figure 4b. The results indicate that retailers reduced the prices of products with large price ratios more than they did for products having smaller price ratios. Since the partition of products implies that products sold by a given retailer are assigned to different quartiles, this analysis controls for potential differences across retailers. As seen in the figure, and consistent with our previous results, the effects of shaming on products with a higher price ratio is considerably larger at publicly-traded retailers than in privately-owned retailers.

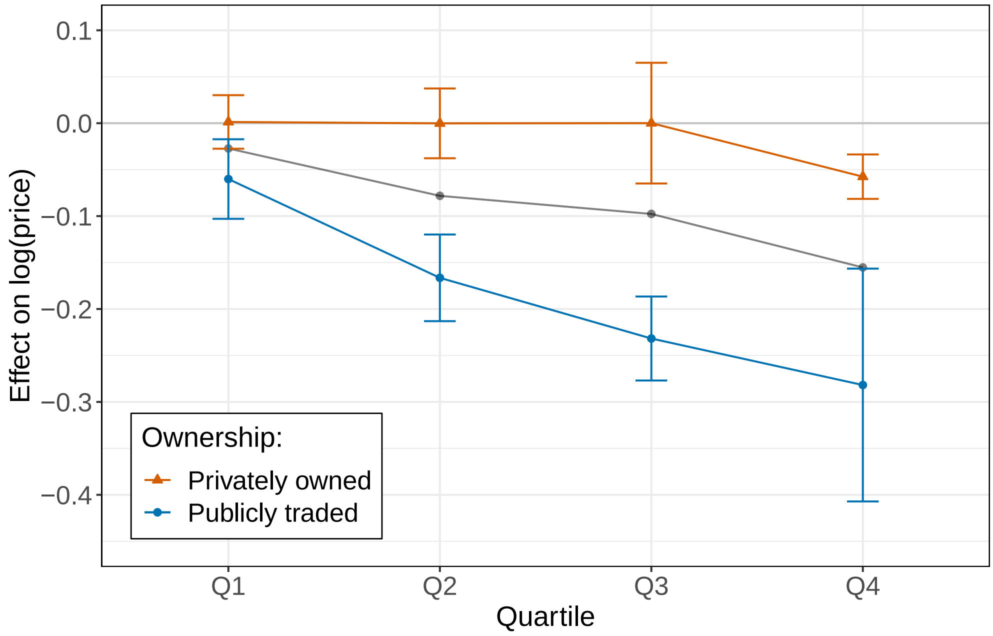
Overall, the analysis provides strong support to H1 and H4. Prices fell after the regulation and this price drop is considerably larger for products with a larger price ratio. In the next section, we move to test the impact of the regulation on the quantities sold by retailers (2,3, and 5).

4.1.2 Robustness tests of the effect on prices

Appendix D describes additional exercises we conduct to demonstrate the robustness of our findings. We first test whether our main results regarding the drop in prices are sensitive to the products included in the control groups. The first alternative control group consists of substitute products, and the second such group consists of unrelated hygiene products. We find a qualitatively similar results using both groups. We also conduct falsification tests using data for prior periods and do not find an effect when running these tests. Finally, we estimate different specifications of Equation (7), without weighting, using retailer and product linear time trends, and using product and retailer fixed effects separately. All the results are qualitatively similar to the results of the main specifications.



(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

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

4.2 The effect on quantities sold

In this section we examine how quantities sold of shaming products changed following the regulation. Since prices of shaming products dropped, we expect that consumers will buy more (H2). However, our aim is to examine whether displaying the price tags had an effect on quantities sold above and beyond the effect driven by the price reduction. Presumably, with the price tags consumers will purchase fewer units relative to the number of units they would have purchased in the absence of the international price tags (H3). To examine hypotheses (H3) and (H5), we need a measure of predicted quantity sold of each product. That is, the quantity consumers would have bought had prices dropped with no in-store price tags displayed. To obtain this measure, we estimate demand elasticities for each of the 7 shaming products in the first wave. These demand elasticities are computed using only data from the pre-regulation time period. We use these demand elasticities and the price reductions following the regulation to compute the measures of predicted quantities sold, which we later compare with the actual changes in quantities. We also test how the difference between the predicted and the actual quantities depends on the post-shaming expensiveness of the local price vis-â-vis the international price. we expect that pricier products should exhibit a larger drop in sales relative to the predicted quantity sold in the absence of the international price tags (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 and the main independent variable is (log) price. An observation is product i sold in store s in week t. This specification is directly related to the theoretical model in Section 2, where $-1/\beta$ is the own-price elasticity of demand. We allow for store-product and month-product fixed effects, and estimate the following equation separately for each product j:

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

The coefficient of interest is η_{jk}, which is the own-price elasticity of demand of product j in store k. To address the endogeneity of the price of product j in store k, we use the log of the average price of product j in other stores of the same retailer in the same month, as an instrument for p_{jmt}, controlling for product-month and product-store fixed effects (similar to Nevo 2001; DellaVigna and Gentzkow 2019; Goldin, Homonoff and Meckel 2022). The underlying assumption is that local demand shocks are unrelated to retailer-level pricing. This assumption seems reasonable given retailers' use of uniform pricing. We present the matrix of demand elasticities in Figure 1 in Appendix C. The own-price elasticities in the main diagonal are all negative and less than -1, implying elastic demand for these products. We use these elasticities to calculate the predicted changes in quantities sold following the price change triggered by the regulation, and compare these predicted changes with the actual changes in quantities sold.

4.2.2 Comparing predicted and actual quantities sold

The comparison between predicted and actual changes in quantities sold is presented in Figure 5. On the vertical axis, we report the change in the prices of the 11 products, and on the horizontal axis we present the predicted (orange) and the actual (blue) changes in quantities sold for each product. The seven shaming products are denoted by small triangles and the four control products are denoted by small circles. As seen in the bottom-right square, prices of shaming products fell. On average, the price of shaming products included in the first wave fell by 10.5%.[10] The predicted change in quantity sold for each product is denoted by an orange triangle. Given the actual price reductions, the predicted increase in quantity is on average 18.5%. Yet, the actual increase in quantities sold is much smaller, on average, 10.5%.

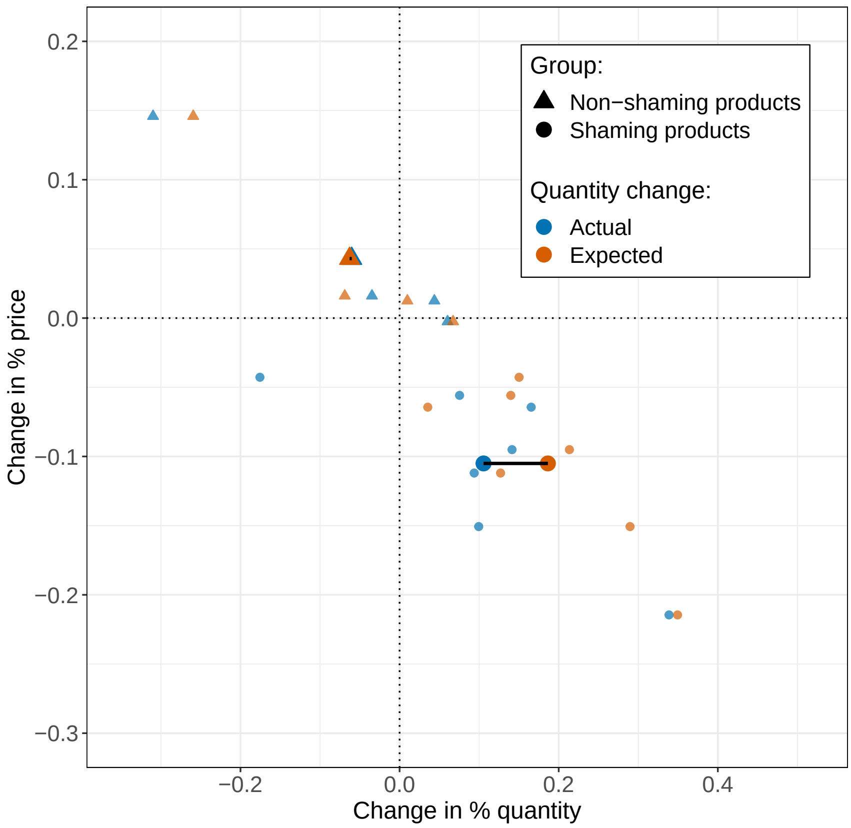


Figure 5: Actual and predicted changes in quantities sold by price drop

In Figure 5 we use the estimated demand elasticities to calculate the expected change in quantities sold. We compare the expected changes for each product (orange) with the actual changes in quantities sold (blue). The figure shows that the prices of shaming products fell (-10.5%), and hence the predicted changes in quantities sold is positive (on average 18.5%). Yet, the actual changes in quantities sold are smaller than predicted (10.5% on average). For the control group, the difference between the actual and predicted quantities sold is negligible.

The comparison between predicted and actual quantities sold against the actual change in price is useful to obtain a measure of the impact of the regulation. In particular, we calculate the price change that could have explained the actual change in quantity (i.e. an increase 10.5%), and compare it with the actual change in price. Based on the pre-shaming elasticities, a price reduction of about 6% could have explained the observed change in quantities sold. However, since prices actually declined by 10.5% we claim that the effect of shaming on demand is equal to an average increase of 4.5% in prices. In Section 5, we use the theoretical model to quantify the impact of

[10]The retailers, products and the time frame in this analysis are not the same as those included in the price analysis. We also focus on products included in the first wave. Therefore, we do not get the exact same results like in the price analysis.

international price tags, while taking into account also the price ratio of each product.

The next step of the analysis focuses on explaining the variation across products in the difference between the actual and the predicted quantities sold. According to H5, we expect that a product with a high post-shaming price ratio will exhibit a larger difference between predicted and actual quantities sold. Figure 6 illustrates this relationship. The horizontal axis shows the difference between predicted and actual quantities sold for the seven first-wave products. The vertical axis shows the post-shaming price ratio difference. As can be seen, for 6 out of 7 products, the actual quantity sold was lower than what we predict based on the demand elasticities. Strikingly, the relative drop in sales is strongly negatively correlated with the post-shaming price ratio. Products that remain relatively more expensive compared to the international price suffered a greater drop in quantities sold after the shaming regulation. For the product that remained the most expensive (2.2 times more expensive than the international price of the product), the difference between the predicted and actual quantities sold is the largest and is above 35%. Other products are less pricey and show a smaller difference between the predicted and actual quantities sold. For 5 out of the 7 products, this difference is statistically different from zero. A similar exercise for non-shaming products shows that the difference between the actual predicted quantities sold is statistically different from zero only for one out of four products.

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

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

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 ($\bar{Q}^{ns}$,$\bar{P}^{ns}$). We present the results for this estimation in Table 3.

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

5 Sensitivity to Unfair Prices and Consumer Surplus

In this section we estimate the sensitivity to unfair/salient prices (the parameter (γ) in the theoretical model). This parameter will enable us to compare a change in the price of the product itself and a change in the ratio between the local and international prices, and then to quantify the change in consumer utility.

5.1 Quantifying the sensitivity to salient unfair prices

We use Equation 6 from the theoretical model in Section 2 to quantify the sensitivity to unfair salient prices. The equation describes the quantity sold in the post-shaming period as a function

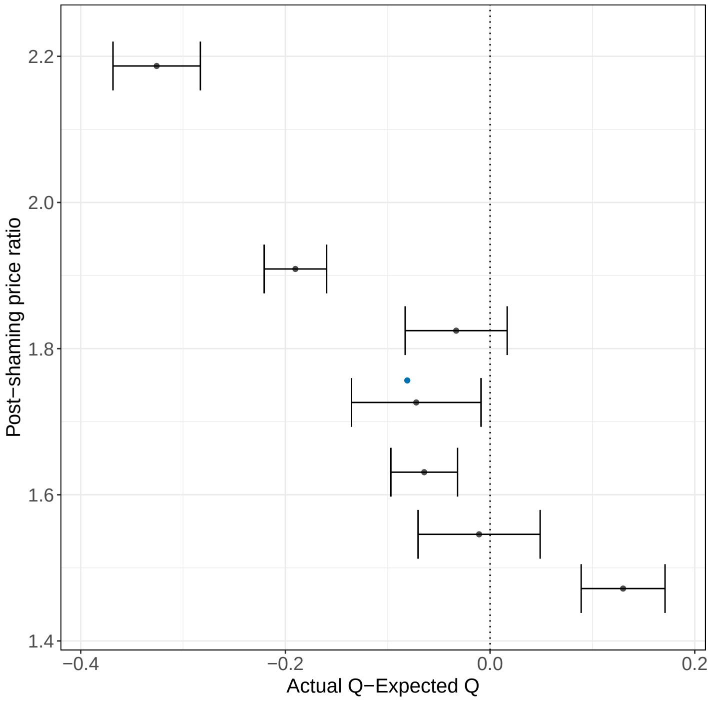


Figure 6: The difference between predicted and actual quantity

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

of the perceived price of a product. This perceived price incorporates the price paid and the ratio between that price and the international price of that product. Formally, applying a log transformation of Equation 6, we estimate:

$$\log(q_{ist}) = \eta \log(\tilde{P}_{ist})) + \mu_{is} + \delta_t + \epsilon_{ist}, \text{where} \tag{10}$$

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

The parameters of interest in Equation 10 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).[11]

[11] Equation 10 includes several fixed effects, making the optimization harder. To reduce the number of dimensions involved in the optimization, we estimate the equation twice on two subsets of the data. First, we use only non-shaming products to recover the time fixed-effects. Second, we estimate the regression using only pre-shaming data, and keep the *product* $\times$ *store* fixed-effects. This approach reduces the number of dimensions of the problem to only three unknown parameters – γ, η, and the variance of the error σ^2. We provide more details on the sample and the empirical strategy in Appendix E.

Table 3: Post-shaming price ratio and the difference between actual and predicted quantities sold

	Actual - Expected change in quantities (PP)		
	(1)	(2)	(3)
Price Ratio	-0.476**	-0.425*	-0.567**
	(0.183)	(0.209)	(0.245)
Fixed-effects			
Product	✓		
Store	✓		
Month	✓	✓	✓
Product × Retailer		✓	
Product × Store			✓
Observations	16,623	16,623	16,623
R^2	0.21	0.13	0.56

Notes: The table presents regression results of Equation (9) which tests H5. i.e., the relationship between the difference between the expected and the actual changes in quantities sold and the post-shaming price ratio of a product. According to the results, and consistent with H5, products characterized by a higher post-shaming price ratio exhibit a larger difference between the expected and actual quantities sold. All specifications include month fixed effects. Standard errors are clustered at the retailer level; *p<0.1; **p<0.05;

To estimate the equation using GMM we use the following assumptions on the error ϵ:

$$\epsilon \sim \mathcal{N}(0, \sigma^2) \tag{11a}$$

$$E[Z\epsilon] = 0. \tag{11b}$$

We use Equation 11a to derive the moments for the mean and variance of the error. We use the average prices in other stores as an instrument for the price in the local store. Finally, as a second instrument, we interact the first instrument with the post-shaming indicator I. We denote these variables as Z and ZI, respectively. Formally, we construct the following population moments:

$$11a \implies E[\epsilon] = 0 \tag{12a}$$

$$11a \implies V(\epsilon) = E[\epsilon^2] - E[\epsilon]^2 = \sigma^2 \implies E[\epsilon^2 - \sigma^2] = 0 \tag{12b}$$

$$11b \implies E[Z\epsilon] = 0 \tag{12c}$$

$$11b \implies E[ZI\epsilon] = 0. \tag{12d}$$

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

5.2 The effect of shaming on consumer utility

To compute the change in consumer utility following the regulation, we use the average quantities sold before and after the regulation for the seven products. We plug these quantities together with the values of 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 dropped for 4 products, and increased for 3 out of the 7 products. Products with high price ratios exhibited an increase in utility, whereas products with low price ratios show a decline in utility. A possible explanation for this pattern is that prices of products with high price ratios fell significantly more than products with a low price ratio (H4). As a result, the consumption of these products increased considerably leading to higher utility for these products. For products whose prices changed little, the change in quantities sold is small and the adverse effect on utility from observing that other consumers pay less is relatively important. Figure 7 illustrates this relationship for an internal solution, in which we set the level of income at 1000.

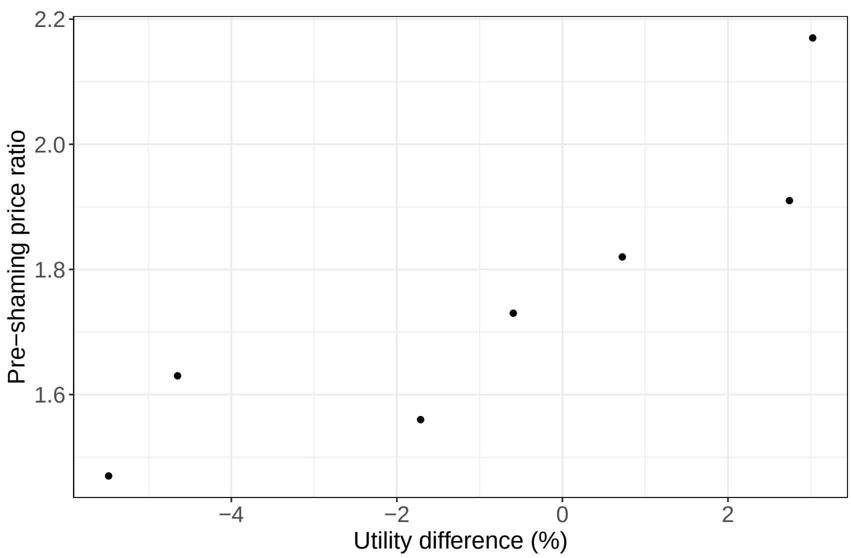


Figure 7: Utility difference before and after the shaming

The figure illustrates the utility change after the introduction of the international price tags. For this exercise we separately plug into the utility function 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.

6 Discussion

6.1 Implications for salient thinking

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

First, our paper considers a situation where a regulator intervenes in the market and changes the level of saliency. This intervention allows us to examine how firms and consumers respond to the change in saliency. Previous studies concerned situations where a firm or researchers manipulated the level of saliency, and the analysis explored how consumers responded. Since we rely on arguably exogenous intervention, we can study how firms and consumers respond. In addition, we can also examine how the scope of competition changes when consumers' attention shifts from quality to price. In their model, Bordalo, Gennaioli and Shleifer (2016) discuss such scenarios and show how such a change leads to price cuts. Second, the shaming regulation included several products and we can therefore construct a measure of saliency – the ratio between local and international price – for each product before and after the regulation is implemented. Importantly, we can use this measure to rank products by their level of saliency and examine its impact on consumers' and on firms' responses. This feature allows us to connect the empirical analysis with theoretical models that emphasize that a heightened saliency should trigger a greater behavioral response, what Bordalo, Gennaioli and Shleifer (2012, 2013, 2020) consider as the ordering property.

Third, Bordalo, Gennaioli and Shleifer 2022 discuss three sources of stimuli that affect saliency: contrast, surprise, and prominence. Existing studies predominantly focus on changes in saliency due to surprise and prominence. For instance, Chetty, Looney and Kroft (2009) examine if a commodity tax has a larger effect on sales of non-food products if the tax is included in the posted price that customers see when shopping, and hence is more salient. Finkelstein (2009) examine how the introduction of electronic tolls affect drivers sensitivity to the price they pay.[12] These and other studies concern situations where the price of a product itself becomes less or more salient, and therefore its prominence changes. In our setting, saliency changes due to the introduction of the international price, via its contrast with the price of the product in the local store. According to Bordalo, Gennaioli and Shleifer (2022), contrast captures the idea that a specific attribute of a good may stand out when the good is compared to alternatives. We are not aware of papers that use field data to examine the role of contrast/saliency on consumer choice.[13] Fourth, we examine the welfare implications of a change in saliency. According to our results, consumers might be worse off although the change in saliency led to lower prices and increased consumption. This interpretation is relevant to the debate regarding the effectiveness of policies that manipulate the choice architecture through nudges and reminders (e.g., Thaler (2018), Thaler, Sunstein and Balz (2014)), and to the distinction between FAST (Forgetful And Salient Thinkers) and FBOR (Forgetful But Otherwise Rational) consumers (Bordalo, Gennaioli and Shleifer 2022).

6.2 Implications for optimal pricing strategy and price rigidity

Classic textbook pricing models show how price discrimination schemes increase firms' profits and affect consumers surplus. In general, these models do not consider the observability of the price paid by other consumers as an important or a relevant factor. If, however, consumers have fairness concerns then such pricing schemes are less effective then we usually think Li and Jain 2016;

[12] The distinction between the three sources of stimuli is not always trivial. For instance, Hartzmark and Shue (2018) show that investors mistakenly perceive earnings news today as more impressive if yesterday's earnings surprise was bad and less impressive if yesterday's surprise was good. They attribute this behavior to contrast effects while their description is likely relevant mostly to the effect of surprise.

[13] 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 higher prices in the first. 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.

Cohen, Elmachtoub and Lei Forthcoming. Below, we discuss potential implications of our findings for firms' pricing strategies, obfuscation strategies and for price rigidity.

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

Our findings could shed light on the question why multi-store retailers tend to set similar prices in environments characterized by very different demographic and competition conditions (e.g., DellaVigna and Gentzkow 2019, Hitsch, Hortaçsu and Lin 2021). In particular, our findings suggest that retailers adopt uniform pricing to limit consumer antagonism in case prices by the same retailer would differ across stores. Indeed, Ater and Rigbi (2022) show that Israeli retailers adopted uniform pricing shortly after prices became transparent in the Israeli retail food market. Second, consumer antagonism toward unfair prices could also explain why firms in online markets often engage in price obfuscation practices, making it difficult for consumers to realize what the final price is. A common explanation for these practices is that they are used confuse customers about the final price of the product they are considering to buy. We propose that obfuscation is actually meant to make it difficult for consumers to observe the price that other consumers paid for the same product. Third, our findings could have implications for price rigidity and inflation. If consumers' antagonism towards prices that other consumers previously paid for the same product, then changing prices today entails costs that sellers may want to avoid in the future. In some circumstances, consumers may therefore decide not to change prices. Thus, fairness concerns constitute a form of menu costs that needs to be taken into account. Rotemberg (2005, 2011), and Eyster, Madarász and Michaillat (2020) offer related theoretical models.

6.3 Alternative explanations

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

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

Second, another concern is that informing consumers about the price of the same products abroad might sway consumers from buying in local stores. This force might also result in lower in-store demand. We believe this explanations is also unlikely for two main reasons. First, customs and shipping costs in Israel are significant, making buying the shaming products abroad for an individual not cost-ineffective. Second, the overall quantity of shaming products increased, whereas if buying internationally would have become the norm, we would expect overall quantities to fall. Finally, if these channel is important we would expect the prices in high-priced retailers would be more sensitive to the regulation, whereas we do not find such relationship.

Third, our results might be driven by retailers and importers concerns that the government is planning additional interventions in the market. Accordingly, the drop in prices we observe is a way to appease the regulator. While we cannot completely rule out that such concerns exist, we can test whether prices of products that were almost included in the regulation also changed. Presumably, concerns from future interventions should also be reflected in the prices of these products. The regression results using the shaming candidates products suggest that the prices of these products did not significantly change following the regulation. Thus, we can argue that such concerns are unlikely to drive the results we document for the shaming products.

7 Concluding Remarks

Standard choice models assume that decision-makers evaluate each of the options they face and choose the option that maximizes their utility. Information on the price of options that are unavailable is irrelevant for consumers, and accordingly the price a firm sets in one market does not depend on the price it sets in other markets.

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

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

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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 × 4 units	
Always Menstrual Pads Ultra Long - 12 × 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

$$\eta_{X,P_x} = \frac{\partial X}{\partial P_x}\frac{P_x}{X} = \frac{1}{-\beta}\frac{\left[1+\gamma I\left(2\frac{P}{P_{int}}-1\right)\right]}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]} \tag{13}$$

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

$$\frac{\partial}{\partial\gamma}\left(\frac{1}{-\beta}\frac{\left[1+\gamma I\left(2\frac{P}{P_{int}}-1\right)\right]}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]}\right) = \frac{1}{-\beta}\frac{I\frac{P}{P_{int}}}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]^2} \leq 0. \tag{14}$$

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 are more price sensitive, regardless of the price ratio. Similarly, the display international prices leads to a similar results. Elasticity decreases for any positive value of γ and unchanged when consumers are insensitive to salient prices.

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

$$\frac{\partial}{\partial\frac{P}{P_{int}}}\left(\frac{1}{-\beta}\frac{\left[1+\gamma I\left(2\frac{P}{P_{int}}-1\right)\right]}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]}\right) = \frac{1}{-\beta}\frac{\gamma I-(\gamma I)^2}{\left[1+\gamma I\left(\frac{P}{P_{int}}-1\right)\right]^2} \leq 0 \tag{15}$$

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

B.2 The firm problem

Profits are given by:

$$V = X(P)(P-c).$$

We write the maximization problem as

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

The first order condition is:

$$\begin{aligned}\frac{\partial V}{\partial P} =& (P\cdot(1+\gamma S(P,P_{int})I))^{\frac{1}{-\beta}} + \\ & \left(\frac{1}{-\beta}\right)(P-c)(P\cdot(1+\gamma S(P,P_{int})I))^{-1-\frac{1}{-\beta}}\left((1+\gamma S(P,P_{int})I)+\frac{\gamma IP}{P_{int}}\right) = 0\end{aligned}$$

We assume that the marginal costs, local and international prices are strictly positive. Also, $0 \leq \gamma < 1$ implying that the sensitivity for unfair prices is limited to a certain bound, and $0 < \beta < 1$ which implies that the demand is elastic. under these constraints, we can derive the optimal price set by a monopoly:

$$P^* = \begin{cases} \frac{\left(2\gamma Ic-P_{int}(1-\beta)(1-\gamma I)+\sqrt{(2c\gamma I-P_{int}(1-\beta)(1-\gamma I))^2+4P_{int}(2-\beta)c\gamma I(1-\gamma I)}\right)}{2\gamma I(2-\beta)} & ,\gamma I \neq 0 \\ \frac{c}{1-\beta} & ,\gamma I = 0 \end{cases} \tag{16}$$

The optimal price when $\gamma I = 0$ collapses to the standard monopoly price, which depends only on the marginal cost and demand elasticity. When $\gamma I \neq 0$, 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 comparative static analysis with regards to price and quantity following a change in γ for the first solution of P^*. The derivative of P^* with respect to γ is given by:

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

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 the derivative of $Q(P^*)$ with respect to γ:

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

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

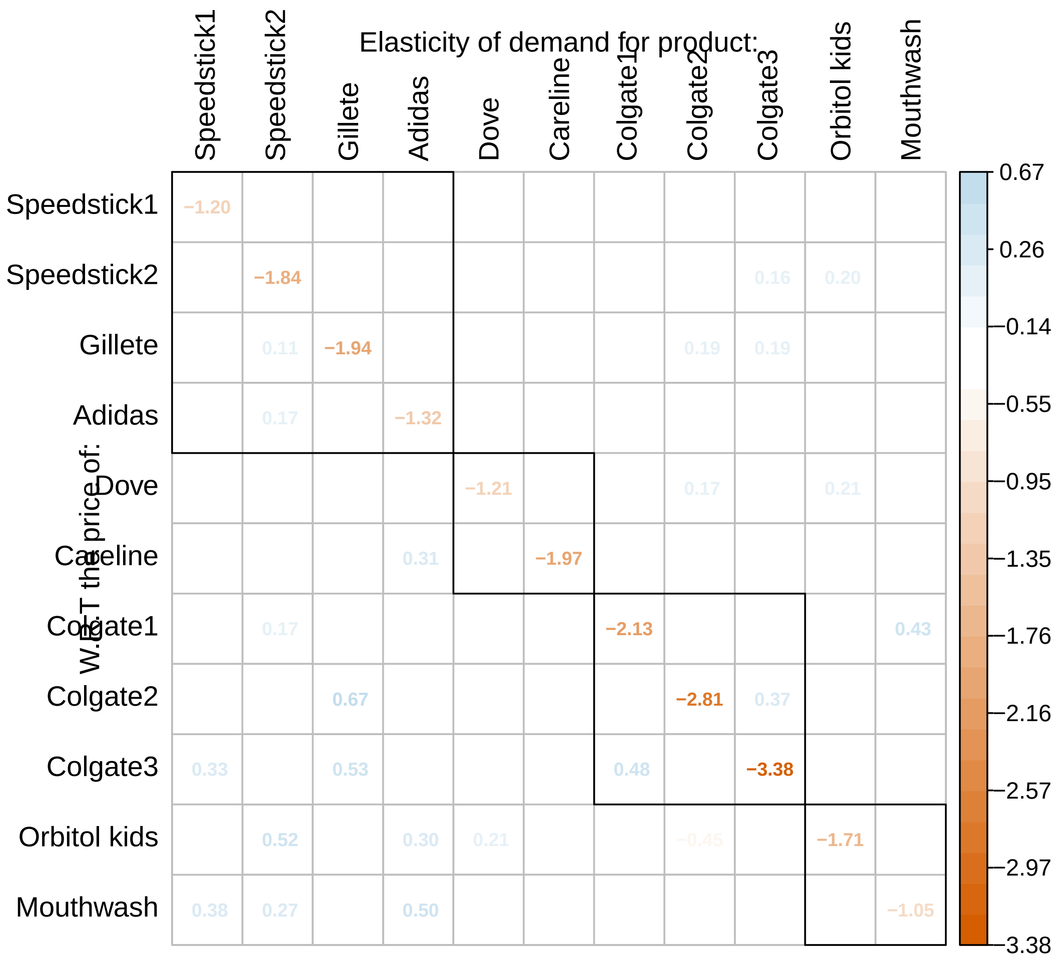


Figure 1: Price elasticities before shaming

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 sets of control products

To test whether our results depend on the control group we construct two alternative control groups. The first control group consists of close substitutes products to products in the shaming list. Items from the same category and same producers. Since the regulation identify treated products based on its barcode (UPC) different flavour or sizes of similar products are not directly treated. However, if prices of products in this control group are affected by the treatment, then the estimation results using this control group are a lower bound of the true effect. The second control group includes unrelated hygiene products, such as shampoo, toilet papers, diapers, razor etc. The full lists of products used in the various control groups are shown in appendix A. We estimate equation 7 separately using the two control groups and report the results in table 4. Similarly to our main specification results, The results of this robustness check suggests that the regulation decrease prices by 7.5%-10%, on average.

Table 4: Average effect on Prices

	Close Substitutes			Unrelated Hygiene Products		
	All	Publicly traded	Privately owned	All	Publicly traded	Privately owned
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A:log(price)						
post × shaming	-0.075***	-0.161***	-0.010	-0.099***	-0.191***	-0.029**
	(0.012)	(0.026)	(0.007)	(0.01)	(0.02)	(0.01)
R^2	0.87	0.88	0.88	0.96	0.96	0.96
Panel B:log(promotional price)						
post × shaming	-0.037***	-0.074***	-0.008	-0.061***	-0.102***	-0.030**
	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
R^2	0.84	0.84	0.86	0.96	0.96	0.96
Observations	52,162	18,064	34,098	26,530	9,182	17,348

Notes: All specifications includes item × retailer, and month fixed-effects. *p<0.1; **p<0.05; ***p<0.01

D.2 Different specifications

We also check that the estimation results of equation 7 are insensitive to chosen specifications. In table 5. The results of the ordinary least squares estimation are in column 1-3 in table 5. In column 4-9 we include and exclude different variables to test wether our results depends on the inclusion of a specific fixed-effect, or driven by some linear time trend. In panel A we present the results using the regular prices as our dependent variable, and in Panel B we use promotional prices. The results remain significant and qualitatively close to our main specification.

Table 5: 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

D.3 Placebo tests

Falsification test using data for prior periods. We falsely change the date in which the initiative started, using the pre-shaming period only. We have 17 months in our 'pre-shaming' period, and we repeat this exercise 14 times, specifying each time a different month in which the initiative falsely started. We limit our exercise that each period consists of at least two months. We present the results of this exercise in figure 2. The figure illustrates the point estimate and confidence interval of the parameter of interest. Having insignificant results in these estimates mitigates concerns that our main estimation capture an effect of other event that took place prior to the implementation of the initiative.

Falsification test using alternative placebo outcome. We estimate equation 7 using the monthly number of stores that sell a product by each retailer.[14] We present the regression results in table 6. The table shows that the initiative has no effect on the availability of the products. Getting a significant result in this exercise indicate that our estimation is biased, and confounds the effect of the regulation with unobserved sources.

Table 6: Average effect on the number of stores - Shaming Act

	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 offer each item on a given month. The table shows that retailers did not significantly change the availability of the items after the regulation began. While removing the items from the shelves can be retailers strategic behaviour to the regulation, however, could also raise a concern that the comparison group is flawed. The fact that we find no effect on outcome that is not affected directly by the regulation mitigate such concerns. Standard errors are clustered by item, Observations are not weighed, $^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

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

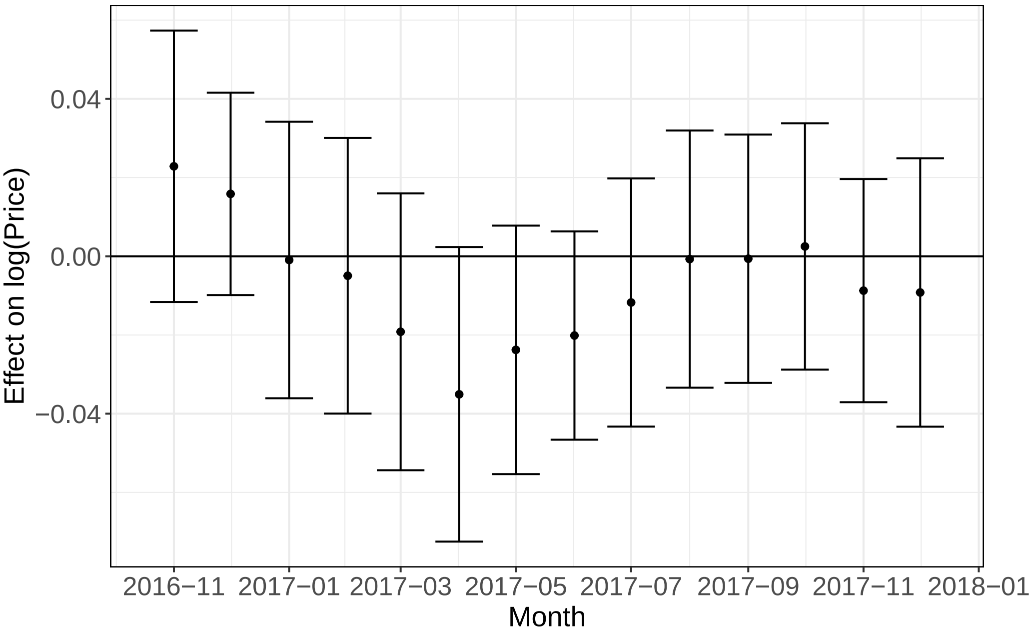


Figure 2: Falsification test using data for prior periods

In this figure we present the estimation of equation 7, using 7 fictitious months in which the regulation started. We also present the 95% confidence interval for each coefficient. The figure suggests that none of the regression we estimate using different date is significant, and help to mitigate concerns that our results are driven by another event that occurred prior to the regulation implementation date.

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

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

E.1 GMM

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

$$m_{1i}(\theta, Y, X) = \epsilon_i \tag{17a}$$
$$m_{2i}(\theta, Y, X) = \epsilon_i^2 - \sigma^2 \tag{17b}$$
$$m_{3i}(\theta, Y, X) = Z_i \tag{17c}$$
$$m_{4i}(\theta, Y, X) = Z_i I_i \epsilon_i \tag{17d}$$

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

The sample counterpart of moment condition k is:

$$\bar{m}_k(\tilde{\theta}) = \frac{1}{N}\sum_{1}^{N}(m_k(\tilde{\theta}, Y, X)) \tag{18}$$

The GMM estimator 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 confidence interval.

	Coef	conf.low	conf.upper
γ	0.049	0.0312	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 10 using GMM. To estimate confidence interval we use cluster-bootstrap on the retailer × item level, with 1000 replications. Column (1) shows the coefficients using the full sample, and columns (2) and (3) presents the 99% confidence interval from the bootstrap exercise.

Table 7: 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 10.[15] 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 3a shows the sensitivity of each of the moment to different values of γ. All of the moments are based on the (log) quantity sold of product i in store s during month t:

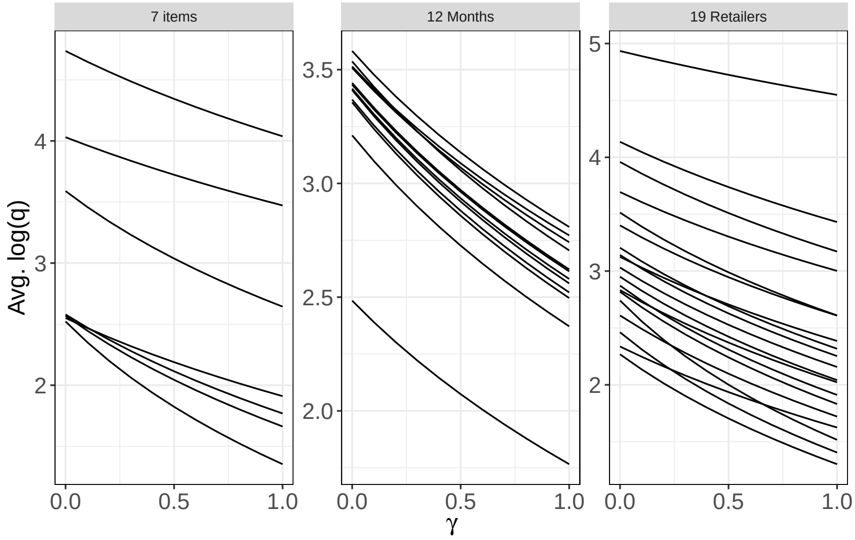
- Monthly averages from the post-shaming period only. $M_T = \frac{\sum_i \sum_s \log(q_{i,s,t\in T})}{\sum_i \sum_s 1}$ (12 moments).
- Average quantity by retailer (19 moments).
- Average quantity by product (per store s in time t), for treated products (7 moments).

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:

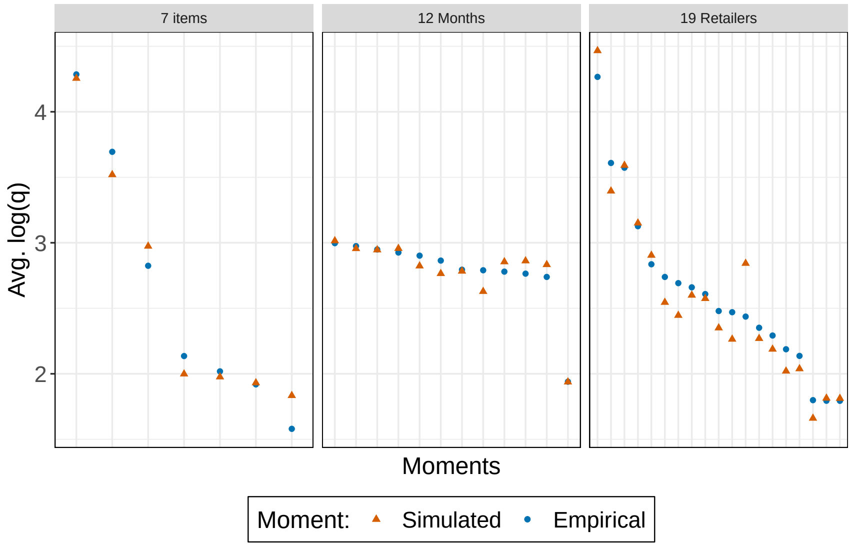
$$\hat{\theta} = \text{argmin}(\tilde{M}_S - M_D)' W (\tilde{M}_S - M_D), \tag{19}$$

where $\tilde{M}_S$ are the average of k draws of simulated moments M_S, M_D are the empirical moments, and W is the weighting matrix. To estimate the optimal weighting matrix we follow the two-steps procedure described in **Analytical Methods for Dynamic Modelers** (2015). As the MSM involves an optimization

[15] Similarly to the GMM estimation, we uses 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 3: Simulated moments

Panel (a) of Figure 3a presents the relationship between values of γ (the paramter 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 remain for negative elasticities. We repeat this one-dimension analysis holding γ fixed, and changing the demand elasticity η and find similar patterns. In Figure 3b, the X-axis denote the different moments and for each moment we present both the empirical and simulated moment. The simulated moments are generated based on the estimated unknown parameters, i.e, the parameters that minimizes the weighted differences between the empirical and simulated moments.

process, we need to check that the optimization converges to a global minimum. To address this concern, we repeat the optimization process using different initial values, seeds, and number of draws k we use to evaluate each average of simulated moment, and the number of draws L for the number of draws used for estimating the optimal weighting matrix. We reject any statistical association between those values and the estimated parameters. Figure 3a presents the empirical and simulated moments, and Table 8 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.

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

Table 8: MSM Estimation results