Price Transparency, Media and Informative Advertising*

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Abstract

We study the effects of a regulation passed in Israel that required supermarket chains to make the prices of all items sold in their brick-and-mortar stores publicly available online. Using a differences-in-differences research design and multiple complementary control groups, we show that prices have declined by 4% to 5% after the regulation. Price dispersion has also dropped as chains have begun setting identical prices across their stores. To uncover the underlying mechanisms, we test predictions from Robert and Stahl (1993). Consistent with their model, in the post-transparency period: (1) media outlets used freely available price information to conduct extensive price-comparison surveys; (2) hard-discount chains took advantage of the favorable media coverage they received by explicitly mentioning these surveys in their ads; (3) the use of media-based ads increased when prices declined; (4) consumers visited the price-comparison websites infrequently. Our findings highlight the importance of the media in facilitating informative advertising, and the pro-competitive role of advertising.

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1 Introduction

Information is an essential component of efficient markets and perfect competition. In recent years, in an effort to foster competition and reduce consumer prices, lawmakers in several countries have introduced price transparency regulations requiring firms to disclose their prices online. These regulations take advantage of the Internet as an effective, cheap means to disseminate price information. For instance, in Germany, Italy, Australia, South Korea and Chile gasoline prices are now available online. Attempts to curb health costs have led to regulations requiring that health care providers also disclose price information online.[1] In Argentina, Uruguay and Mexico, governments require food retailers to post price of many of their products online.[2] Despite the increasing number of price transparency regulations, very little is known about their effects on the market, making the study of such regulations of interest to consumers, firms, and policy-makers alike.[3]

We begin to fill these gaps in the literature by studying the impact of a price transparency regulation implemented in the Israeli food retail industry. In 2011, social protests in Israel over high prices of food (among other things) ultimately culminated in the legislation of the Food Act in March 2014. Effective from May 2015, the Food Act requires supermarket chains to make the prices of each and every item sold in their stores available online and to update these prices continuously. Independent websites began to offer consumers free price comparison services shortly thereafter. We take advantage of these changes to study the impact of market-wide information on food prices, and to characterize the post-transparency equilibrium. The food retail industry is a meaningful domain to examine the economic effects of price transparency regulations. From a public-policy perspective, consumers spend about one-sixth of their disposable income on food, allowing considerable scope for regulatory impact on consumers. From a theoretical perspective, analyzing the choices made by firms that sell thousands of products is interesting because standard theoretical models of search and advertising tend to focus on single product firms.

Our analysis illustrates how pricing, advertising and consumer search choices are interrelated and can be rationalized based on the theoretical framework developed by Robert and Stahl (1993). To the best of our knowledge, this is the first study to use an equilibrium framework to explain how consumers and firms respond to actual changes in search and advertising costs. Understanding how price transparency, advertising and search jointly determine equilibrium outcomes is essential

[1] www.wsj.com/articles/white-house-pushes-for-more-transparency-on-health-care-prices-11557945220, https://www.nytimes.com/2019/06/24/upshot/health-care-price-transparency-trump.html?module=inline and worldwide, www.economist.com/business/2019/05/21/the-global-battle-over-high-drug-prices?cid1=cust/dailypicks/n/bl/n/20190521n/owned/n/n/dailypicks/n/n/NA/243352/n.

[2] In 2015, the Argentinian government forced retailers to submit daily prices for a basket of goods to be posted on a website that allows consumers to compare prices (see https://www.preciosclaros.gob.ar).

[3] The adoption of online price transparency regulations is likely to further expand given that sales in brick-and-mortar stores account for about 85-90% of retail sales. In the US e-commerce account for 8% of total US retail sales in 2016 (https://www.census.gov/content/dam/Census/library/publications/2018/econ/e16-estats.pdf). In the UK, e-commerce in 2017 was 16.4% of total retail sales (https://ecommercenews.eu/ecommerce-in-uk-grew-to-e15-6-billion-in-2017/).

for the design of better information-enhancing policies.

Any attempt to reliably identify the impact of transparency on prices must overcome several challenges. First, it is necessary to obtain price data corresponding to the period before the change in transparency, a period for which data might not be readily available. Second is the need to control for additional factors that might affect pricing decisions (e.g., local competition, costs, seasonality). Because these factors may change over time, it is inherently difficult to attribute changes in prices to a change in transparency over a given time period. To address the first challenge, we exploited the fact that the transparency regulation went into effect more than a year after it passed in the parliament and hired a survey firm to collect prices in physical stores over the course of that year. The price data were collected at several points in time and on multiple items sold in multiple stores and chains throughout Israel. After the regulation went into effect, we collected data from one of the price comparison platforms launched after the transparency regulation became effective. To address the second, and perhaps more concerning challenge, we rely on several complementary control groups which enable us to identify the effects of the transparency regulation on prices. That is, the identification of the impact of transparency on prices comes from comparing price changes of "treated" products whose prices became transparent only after the regulation, against price changes in four distinct control groups of products.

The first control group consists of products that are identical to those in the treatment group, but sold through the online channel of the supermarket chains whose in-store products are included in the treatment group. The items sold online are a useful control group because their prices were transparent both before and after the transparency regulation became effective. Because we are tracking the prices of the same products sold in the same week and by the same chains, we are able to account for unobserved changes in the marginal costs of these products. The second control group consists of products which differ from the products in our treatment group but were sold in the same brick-and-mortar stores as the items in the treatment group. The prices of these items were periodically collected by the Israeli Consumer Council (ICC) before and after the regulation, and were often cited in the media and in chains' ad campaigns as a reliable source of price data. Thus, effectively, the ICC products constitute a set of items whose prices were transparent before and after the transparency regulation went into effect. Since the products in this group were sold in the same stores as the products in the treatment group, we are able to control for unobserved demand and cost changes at the store level. The third and fourth control groups consist of products that are similar to the products in the treatment group, but were sold in brick-and-mortar stores that were exempt from the transparency regulation: drugstores and mom-and-pop grocery stores, respectively. We use these groups to compare the changes in prices of products that became transparent against changes in the prices of the same products, which remained non-transparent during the relevant period. Although each of the control groups might be subject to critique, they complement the other, such that when taken together they enable us to rule out many alternative explanations for any observed effects. Notably, our analyses yield consistent results across the four control groups, giving us confidence that our results indeed reflect the impact of transparency on prices.

Our first set of results concerns the impact of transparency on price dispersion. We show that product prices within chains were diverse before the regulation, and that price dispersion abruptly dropped shortly afterwards. This drop was mainly driven by supermarket chains adopting a uniform pricing strategy and setting identical prices across stores affiliated with the same chain. Figure 1 presents a time series of the average number of different prices per item in the treatment group as well as for the first and second control groups (i.e., items sold online, and ICC tracked items). As seen in the figure, before the transparency regulation went into effect, the average number of different prices per item in each of the two control groups was smaller than in the treatment group. Shortly after the regulation went into effect, the differences between the treatment and the control groups diminished. As we elaborate in Section 4.2, we claim that the decision to adopt uniform pricing was driven by fairness or brand-image concerns that were exacerbated once consumers could easily observe the prices of similar items sold at different stores of the same chain. Next, we examine the impact of transparency on price levels. Our results indicate that after the regulation took effect, the prices of items in the treatment group decreased 4% to 5% more than the prices of the items in the control groups. We also find that prices primarily decreased at chains that were more expensive before the regulation, and at supermarkets that faced weaker local competition. In Online Appendix 1 we present additional results based on the heterogeneity analysis for the effect of transparency. For instance, we find that prices of branded products fell more than store brands (i.e., private-label) products, and that prices of popular and cheaper goods fell less.

Our empirical findings regarding price levels and price dispersion strongly suggest that the availability of information facilitated by the transparency regulation drove these changes. To uncover the particular mechanisms through which information reached the market, we rely on the model by Robert and Stahl (1993), who were the first to incorporate both advertising and optimal consumer search into one theoretical framework. In his review of the literature, Bagwell (2007) notes that their model fits an established industry, like the supermarket industry, where similar products are sold in different stores, and consumers are aware of retailers' existence but unaware of the prices they set. Robert and Stahl characterize a unique price-dispersion equilibrium in which a firm either charges a high price that is not advertised, or sets a lower price that is advertised. They predict that in equilibrium only low-price firms advertise prices; that advertising increases during periods in which prices are low and that consumers do not engage in search, irrespective of the cost of search. In section 4.1 we modify these predictions to a setting involving multi-product retailers. We contend that it is prohibitively costly for multi-product retailers to include the prices of all the items that they sell in their ads. Instead, chains can rely on representative price-comparison surveys conducted by third-parties, like the media, to reliably convey price information to consumers.

To test the predictions from Robert and Stahl, we use data on access to price-comparison websites and detailed ad-level data. The ad-level data include, inter alia, the specific content of each ad, the advertiser identity and the list price of each ad. We first show that as food prices became available online, the Israeli media conducted large price-comparison surveys, covering hundreds of items and stores. These surveys became common because the cost of taking such surveys dramatically fell after the regulation. We then use the ad-level data to show that hard-discount supermarket chains spent considerably more on ads that celebrated their low prices, while other chains did not. In particular, the hard-discount chains specifically mentioned in their ads price-comparison surveys that were conducted by the media. In contrast, chains that set higher prices did not receive positive media coverage and therefore could not follow the same advertising strategy. Our analysis also provides support for other predictions made by Robert and Stahl (1993). First, the use of informative media-based ads by the hard-discount chains increased when prices decreased. Second, consumer usage of the freely available price-comparison websites was limited. Finally, we note that our initial results regarding the drop in price levels and price dispersion are also consistent with the model. Thus, our findings strongly indicate that firm advertising was a key factor facilitating the more competitive environment in the post-transparency period.

In his seminal paper, "The Economics of Information", Stigler (1961) highlighted consumer search and firm advertising as two channels through which consumers can obtain price information. A large body of literatures subsequently emerged on both channels.[4] The rise of the Internet and e-commerce provided researchers with a unique opportunity to test the role of consumer search. Somewhat surprisingly, this massive empirical literature largely ignored the second channel highlighted by Stigler – that firms themselves could take advantage of the readily available information and provide it to consumers through advertising.[5] Our paper addresses this gap in the literature and offers several contributions to the literature.

First, we contribute to the advertising literature by illustrating how the supply-side incentives of advertisers change as prices become transparent and the cost of informative advertising falls. DellaVigna and Gentzkow (2010) mention that there are only two empirical studies (Glazer, 1981; Milyo and Waldfoegel, 1999) that exploit inter-temporal variation in the cost of advertising to

[4]Related surveys are: Baye et al. (2006), Anderson and Renault (2016) for search; and Bagwell (2007) and Renault (2015) for advertising.

[5]In fact, recent papers have emphasized ways by which firms can do the opposite and manipulate information in order to increase consumer search costs (Ellison and Ellison (2009), Spiegler (2011). Allender et al. (2018)).

examine its impact on prices.[6] Perhaps more importantly, our analysis builds on an equilibrium framework to empirically test predictions regarding market outcomes. In doing so, we are able to consider both the role of firm advertising and consumer search as two interrelated channels through which prices are determined in equilibrium. Our study also addresses concerns regarding the selection of products being advertised and uses a considerably larger set of products compared to previous studies.

Second, our paper contributes to the understanding of mandatory price disclosures. Despite the growing popularity of price transparency regulations, little is known about their effects on market outcomes, such as price levels, price dispersion and advertising choices. The desirability of such regulations is not clear ex-ante given that transparency may also help firms to monitor their rivals' prices and facilitate tacit collusion (e.g., Green and Porter (1984), Rotemberg and Saloner (1986), Campbell et al. (2005)). Unlike the vast empirical literature on voluntary price disclosure, typically in online markets (e.g., Brown and Goolsbee (2002), Brynjolfsson and Smith (2000) and the survey by Goldfarb and Tucker (2019)), very few studies have examined the impact of mandatory price disclosure. The distinction between voluntary and mandatory disclosure is important because selection concerns regarding the decision to disclose prices, the timing of disclosure and the prices of which products are disclosed can potentially bias the results. The few studies that examine the effect of price transparency regulations focused on the gasoline markets, where retailers sell a single homogeneous good. In particular, Luco (2019) uses price data before and after a price transparency regulation that required gasoline stations to post prices online. He finds that gasoline prices in Chile increased after prices became transparent, and obtains inconclusive evidence regarding price dispersion.[7] In contrast, our paper studies a market-wide online transparency regulation in the supermarket industry, where firms are typically larger than gasoline stations, advertise more, sell thousands of products and enjoy high price-cost mark-ups (Arcidiacono et al. (Forthcoming). Our results on both price dispersion and price levels differ from the results in the gasoline market, and we highlight the role of advertising and the media as important information channels.

Third, this study adds to the media literature by showing how the media is used by multi-product firms to gain credibility for their ads, and how subsequent advertising decisions affect equilibrium prices. Thus, our findings highlight the importance of the media as a reliable and impartial source of data, and speak both to the persuasive role of the media (DellaVigna and

[6] Milyo and Waldfoegel (1999) investigate how removing a ban on advertising prices of alcohol products affected prices. Glazer (1981) exploit a 1978 newspaper strike in New York which limited the availability of ads to examine the effect on food prices. More recently, Dubois et al. (2017) develop a structural model to analyze the effects of banning advertising for potato chips, though without exploiting actual variation in the cost of advertising.

[7] Two other studies that examine the impact of transparency regulation in the retail gasoline market are: Rossi and Chintagunta (2016) who study the impact of mandatory highway signs on gasoline prices in Italy, and Montag and Winter (2019) who investigate the gasoline price transparency regulation in Germany. Also related are Byrne and De Roos (2019) who use price data from a post-transparency period to study how gasoline stations coordinate their prices, Brown (Forthcoming) who study how the introduction of a website that reports prices of medical imaging procedures in New Hampshire affects prices, and Albek et al. (1997) who use wholesale post-transparency prices to study how the prices of ready-mixed concrete changed.

Gentzkow (2010)) and to papers on certification (Jin and Leslie (2003)). Fourth, recent studies (e.g., DellaVigna and Gentzkow (2019), Cavallo (2018), Adams and Williams (2019)) explore the prevalence of uniform pricing, trying to explain why retailers prefer it over price discriminating across locations, as standard theory predicts. Our findings, showing that retailers adopted uniform pricing shortly after prices became transparent, suggest that brand-image concerns are likely driving this decision. Fifth, recent studies in the macroeconomic literature have explored the potential relationship between online markets and the frequency and magnitude of price changes in traditional markets (Cavallo (2017), Gorodnichenko et al. (2018), Goolsbee and Klenow (2018), Cavallo (2018)). One conjecture discussed in these papers is that the combination of uniform pricing and the availability of online prices in recent years have contributed to the low levels of inflation in the US. To our knowledge, our findings offer the first evidence for a causal link between online price transparency, uniform pricing and slower price increases.[8]

The remainder of the paper is organized as follows. In Section 2 we provide the necessary background on the Israeli food retail market. In Section 3 we discuss the data that we use, the empirical methodology and the estimation results concerning prices. In Section 4 we derive testable predictions for the mechanisms underlying our results and subsequently test these predictions. In Section 5 we present robustness results. Section 6 concludes.

2 Institutional Background

The average household expenditure on food items in Israel in 2015 accounts for 16.3% of disposable income.[9] The Israeli retail food market is considered quite concentrated and was ranked 7th among OECD countries according to the CR3 criterion (OECD (2013)). Herein we consider five large Israeli supermarket chains. Shufersal, the largest chain in the country, operated 283 stores at the end of 2014, and Mega, the second largest chain, operated 197 stores at the end of 2014. The other chains we consider operated fewer stores at the end of 2014: Rami Levy, a hard-discount chain, operated 27 large stores; Victory operated 28 stores and Yeinot Bitan operated 67 stores.[10] We selected these supermarket chains because of their substantial collective market share, 63% of supermarkets sales in 2011, and because each of these chains also offers an online grocery service (prices in the online segment are one of the control groups that we use). Online grocery sales in Israel are growing but still account for only a small share of total food sales, about 3% in the relevant period. In addition, sales of private-label/store brand items are growing but still account

[8] Our study is also related to studies on the supermarket industry in general (e.g., Basker (2016), Matsa (2011), Pozzi (2013)) and in Israel (e.g., Hendel et al. (2017), Eizenberg et al. (2017)).

[9] http://www.cbs.gov.il/statistical/mb158h.pdf

[10] The market description relies on various sources, such as financial reports, reports by government agencies and media coverage. For instance, see the Analysis by the Ministry of Finance of prices in the Israeli retail food: https://mof.gov.il/chiefecon/economyandresearch/doclib/skiracalcalit_20180429.pdf and https://www.storenext.co.il/wp-content/uploads/2016/01/Summary-of-2015-English.pdf.

for a relatively small fraction of total grocery sales in the Israeli food market, about 5% in 2014. The Israeli Antitrust law was enforced rather strictly over the relevant time period. For instance, in 2013 Shufersal's CEO was sentenced for 2 months jail time for violating terms set by the antitrust authority for not-blocking a merger in 2005 between two supermarket chains.[11]

Food prices in Israel had been rising fast between 2005 and 2011.[12] A main driver for the rise in prices was a worldwide increase in commodity prices. However, other factors, such as increased concentration among food retailers and suppliers and removal of price regulations, also contributed to this trend. The steep rise in prices was a main driver behind the massive social protests that took place in Israel in the summer of 2011. In these protests, hundred of thousands of Israeli protesters demanded the adoption of policies that would lower the cost of living. It is often said that, following the social protests, Israeli consumers became more price-conscious, and retailers more sensitive to consumers' response and perception (Hendel et al. (2017)). One measure that likely captures the change in the competitive food retail landscape before and after the social protests is the gross profits of the two largest supermarket chains, Shufersal and Mega. In the second quarter of 2011, before the summer protests, the gross profit percentages of Shufersal and Mega were 26.6 percent and 27.5 percent, respectively. In contrast, in the second quarter of 2014, the two chains' gross profit percentages fell to 23 percent and 24.9 percent, respectively. Moreover, during the same time period, the hard-discount chains were able to increase their market shares. Following the change in the competitive landscape and other managerial issues, Mega, the second largest chain, faced profound financial difficulties. In June 2016, towards the end of our sample (i.e., July 2016), the Israeli antitrust authority allowed Yeinot Bitan, another large chain, to purchase Mega. A direct consequence of Israel's 2011 social protests was the formation of a special committee on food prices. Following the recommendations of the committee and a long legislation process, in March 2014 the Israeli parliament passed the "Food Act". A primary component of the new legislation was a transparency clause requiring each chain to upload real-time price information on all products sold in all its stores to a publicly available database. The regulation requires each supermarket chain to upload to a designated website files, one for each store, containing information about prices and promotions for each product sold in each store. The files are updated on a daily basis if no price changes have occurred, and within an hour if a price change has occurred during the day.[13]

[11] https://en.globes.co.il/en/article-1000536001.

[12] A committee appointed by the government found that the cumulative annual growth rate of food prices in Israel between 2005 and 2011 was 5%, compared with 3.2% in OECD countries for the same period, and 2.1% increase for the period between January 2000 to September 2005. See page 8 in http://economy.gov.il/publications/publications/documents/kedmireport2012.pdf.

[13] The Ministry of Economy and Industry lists on its website links to the designated website of each of the chains. See, http://economy.gov.il/Trade/ConsumerProtection/Pages/PriceTransparencyRegulations.aspx. In Figure 12 in Online Appendix 2, we added a translation of the transparency regulations, detailing the structure and the updating protocols of each file that the chains need to submit. The Israeli Food Law has two additional components. These components came into effect in January 2015, several months before the transparency regulation. Given the different timing of these changes and the control groups that we use, we do not think that these changes pose a threat to our identification. For more details on the Food Law see https://www.fas.usda.gov/data/israel-tel-aviv-tidbits-development-israel-s-agriculture-and-food-sector-2

During the legislation process of the transparency regulation and soon afterwards, managers of supermarket chains, politicians, and academics voiced concerns regarding the effectiveness of the new regulation. The head of the economic committee in the Israeli parliament, MP Professor Avishay Braverman remarked "I am not convinced that transparency will result in good news. I hope that prices will go down in the process, though I doubt it and hope to be wrong."[14] In an op-ed, Prof. Yossi Spiegel called on the government "to reconsider the mass experiment that consumers are subjected to."[15] Perhaps less intuitive was that supermarket chains opposed the transparency regulation on the ground that it may help them to coordinate prices at the detriment of consumers. For instance, Itzik Aberkohen, the CEO of Shufersal said that "there is a concern that transparent prices will be used as a platform to coordinate prices under the law". Likewise, Eyal Ravid, CEO of Victory argued that online transparency would facilitate collusion.[16]

Despite the calls to abolish the regulation, on May 20, 2015, the transparency clause went into effect, and retailers began uploading price data to dedicated websites. Given that the raw price data uploaded by each chain were not easy to use, independent websites began making the data more accessible to consumers. During August 2015, websites began providing "beta" versions of price comparison services for food items sold in brick-and-mortar retail food stores across Israel. Information from personal communications indicates that food retailers and suppliers also obtained data from these websites. As of 2016, three websites offered food price comparison services: MySupermarket.co.il, Pricez.co.il and Zapmarket.co.il. Figures 1 and 2 in Online Appendix 2 present photos taken from Mysupermarket.co.il. Figure 1 shows a price comparison of a single item and Figure 2 shows a price comparison of a basket consisting of 42 items. The different websites offer visitors several features such as the option to follow a fixed grocery list and use the same address when they return to the website. Despite initial hopes, however, these websites failed to attract considerable traffic.

3 Data, Empirical Strategy and Results

Identifying causal effects of transparency on prices is a challenging task for several reasons. First, such an endeavor requires an exogenous shock to the level of transparency. In the absence of such a shock, it would be difficult to argue that a change in transparency is the source of observed price changes. Furthermore, if price transparency is endogenously determined by firms, then selection is another valid concern. That is, the firms that choose to advertise their prices, and the products they choose to advertise may not be representative of all firms or all products. This

[14]See http://www.globes.co.il/news/article.aspx?did=1000921890. Interestingly, in his academic career, Braverman published an important study on consumer search (Braverman (1980)).

[15]See http://www.themarker.com/opinion/1.2506245.

[16]https://www.themarker.com/markerweek/1.2288058.

selection issue is likely to bias the analysis of the effect of transparency. Second, given that an exogenous shock to transparency has taken place, identifying the impact of this shock requires data from both before and after the regulation. Collecting post-transparency data is likely to be straightforward; however, obtaining data from a period in which such information was not readily available is likely to be more complex. Third, pricing decisions take into account various factors, such as cost, local competition and seasonality. These factors may very well change alongside changes in transparency. Thus, to identify the impact of transparency on prices one needs to account for potential changes in other determinants of pricing decisions that might have taken place concurrently with the implementation of the transparency regulation. Finally, supermarkets sell thousands of items, which may be subject to different pricing considerations. Accordingly, to obtain a reasonable estimate of the overall impact of transparency on prices, it is necessary to investigate a large sample of items. Our data and differences-in-differences research design, discussed in detail below, offer a unique opportunity to address these empirical challenges.

In what follows we discuss the various sources for the price data used for the treatment group and the control groups. We also discuss the limitations of these control groups and how, we think, the use of multiple control groups mitigates these concerns. After describing the data, we provide additional details on the estimation and sources of identification.

3.1 Data and descriptive statistics

To examine the effects of transparency on price levels and price dispersion we collected price data for a treatment group of products, as well as for four control groups of products. We supplemented these price data with information on local competition and on products' characteristics. In some specifications, we use only post-transparency data that correspond to a considerably larger array of products and stores. After describing the price data, we discuss the data sources on advertising expenditures and on the usage of price-comparison websites. We use these latter data sources in subsection 4.1 to examine the mechanisms driving our results.

3.1.1 Price data

Treatment group: The treatment group comprises 69 products sold in 61 stores located in 27 different cities and operated by the 5 supermarkets chains under consideration. Figure 3 in Online Appendix 2 shows the locations of these stores across Israel. The products in the treatment group belong to several product categories (e.g., dairy products, drinks, prepared meals, household cleaning, health and beauty) and different price levels. We did not include meat and produce items in the treatment group because the quality of these goods might differ considerably across stores. Our reliance on a large set of items and stores mitigates concerns that the price changes are driven by unobserved local trends or changes that are relevant to specific type of products. The actual collection of the prices of the items in the treatment group was conducted by a market survey firm that we hired during the pre-transparency period. The data collection was carried out during the last week of the following 8 months: July, August, September, October and December 2014, and February, March and April 2015. Post-transparency prices for these products and stores were obtained on a weekly basis from one of the price comparison websites.[17] Figure 2 presents a time series of the average basket price for each of the five supermarket chains in our data, for the year prior to the regulation and in the year after. As can be observed in the figure, there is a declining trend in prices. In addition, chains' average prices seem to have converged after prices became transparent. The figure can also be used to rank the five chains according to basket price. The prices of the basket at the two largest chains: Mega and Shufersal are higher than at the other chains; in particular, the basket price at Rami Levy, the hard-discount chain, is the cheapest. The patterns observed in the figure might be driven by other factors besides price transparency. To take these factors into account, we collected data on four control groups of products described below.

Control group 1: products sold online. The first control group relies on the fact that each of the chains we consider also offers an online retail service. The prices of products available through these online channels were transparent both before and after the transparency regulation. Since July 2014 we have been collecting on a weekly basis the prices of all the items included in the treatment group but sold online through the websites of each of the five grocery chains. The prices were collected from an online platform that allowed consumers to compare and purchase grocery items from the various chains that offered an online grocery service. Figure 4 in Online Appendix 2 shows a screenshot from the online platform, where consumers can compare and choose among the online retailers. Unlike prices at brick-and-mortar stores, prices of items sold online are determined at the national level and are not dependent on the customer's location. Figure 3 presents a time series of the total price of a basket of items in the treatment group and a time series of a basket of items sold online, starting in July 2014 and ending in July 2016; each data point represents the average across all stores in the respective group. The figure reveals that prices online are generally cheaper than the prices of the same items sold in brick-and-mortar stores. Importantly, we also see that the price gap between online and traditional stores diminished after May 2015, when prices in traditional stores became transparent.

Control group 2: ICC products. The ICC control group comprises 38 products sold in hundreds of stores throughout Israel, whose prices are collected by the ICC, the largest consumer organization

[17] A potential concern with the data that we use is that we rely on two different data sources for the pre and the post periods. In Section 5.1 we address this concern. For instance, we use data collected by the Israeli Census (CBS) in both the pre- and post- time periods and show that our results are qualitatively similar.

in Israel. These products do not overlap with the products in our treatment group. We obtained the ICC's monthly reports of the products' prices for the period between July 2014 and July 2015, and for the post-transparency period we obtain the price data from the price comparison website. Importantly, the 61 treatment-group supermarkets, i.e. the stores where the market survey firm visited, are a subset of the stores from which the ICC collected the price data. The prices of the products in the ICC basket are frequently cited in media reports informing consumers about the prices of food items. For instance, a TV program called "Saving Plan", one of the top-rated programs in Israel, devoted a weekly segment to updating the public about the ICC's price collection and comparison initiative. In addition to the media reports, supermarket chains often mentioned the ICC reports as a credible reference when advertising their own low prices. Mega, the second-largest supermarket chain, dedicated about 40% of its advertising budget in 2014 to ads mentioning the ICC price comparison initiative. Finally, the ICC website offered a weekly comparison of basket prices across the stores visited. Accordingly, it is reasonable to assume that supermarket chains and consumers were well aware of the price of items collected by the ICC, or in other words, that the prices of these items were already transparent before the regulation went into effect.[18] Figure 4 presents a time series of six items from the treatment group and a time series of six comparable items from the control group 2. In other words, each product in one group has a close substitute in the other group. For instance, a 200- gram jar of Nescafé Taster's Choice instant coffee, included in the ICC group, is matched to a 200- gram jar of Jacobs Kronung Coffee (another quality brand of instant coffee), included in the treatment group. Similarly, we match a 700- ml bottle of Hawaii shampoo in the ICC group to a 700-ml bottle of Crema Nourishing Cream Wash in the treatment group.[19] In this figure, we observe that pre-transparency prices of products in the ICC control group and in the treatment behave quite similarly. However, after prices became transparent, prices of items in the treatment group declined more than did the prices of items in the ICC control group.

Control group 3: products sold at Super-Pharm. The third control group comprises 28 products sold at 32 stores affiliated with Super-Pharm, the largest drugstore chain in Israel. These items provide a useful control group because drugstore chains were exempt from the Food Act and their prices were not available online.[20] The prices at Super-Pharm stores were collected by RAs at two points before the transparency regulation law came into effect — in late October 2014 and in late April 2015— and at two points in the post-transparency period — in late October 2015 and in late

[18] More details on the items in the ICC control group are described in Ater and Gerlitz (2017). We found further suggestive evidence that the ICC basket prices can serve as a reasonable transparent control group when we examine the change in the ICC basket price after the ICC began collecting the prices of these items. In particular, the price of the basket of ICC items declined substantially few months after the ICC began collecting and advertising these prices. See Figure 5 in Online Appendix 2.

[19] The choice of these pairs also follows from a more systematic measure of distance across product characteristics.

[20] Starting in July 2017, drugstore chains also became subject to the transparency regulation. In Table 1 of Online Appendix 2 we present regression results demonstrating that prices and price dispersion at Super-Pharm declined after its prices became transparent.

April 2016. Given that drugstores do not sell the full array of products sold in supermarkets, we do not have full overlap between items in the treatment group and the items in the Super-Pharm control group.

Control group 4: products sold in small grocery stores. Our fourth control group includes 12 products, whose prices were collected by the Central Bureau of Statistics ('CBS') from both mom-and-pop grocery stores and supermarkets across Israel; the mom-and-pop grocery stores, like drugstores, were not subject to the transparency regulation. Using the CBS data is important because it alleviates concerns that our results might be biased because our price data for the pre- and post transparency period come from different sources. Given the small number of items in this group, unavailable information (e.g., on the identity of the specific supermarket chain in which the products were sold at, advertising expenditures, and the week during the month in which the prices were collected) and confidentiality concerns, we cannot use this group in all of our analyses. Thus, we present results corresponding to this control group only in the robustness section.

Table 1 presents summary statistics for the number of products and observations in the treatment group and in the first three control groups. Figures 9-11 in Online Appendix 2 provide more details on the products associated with the treatment and each of the control groups.

Additional data for the price analyses. After the transparency regulation went into effect, the price collection became less cumbersome; therefore, for this period, we obtained more expansive and finer-grained data from a price comparison website. Specifically, we use weekly reports on the prices of nearly 355 products sold in 589 stores of the 5 chains. The 355 products include the treatment group products and other items, such as private-label goods. In addition to obtaining price data, we also constructed measures of local competition. These measures are based on the number of supermarkets operated by rival chains within a certain distance of a given store.

3.1.2 Advertising and Price-comparison websites data

We use the following data on advertising and access to the price comparison websites to explore the roles of firm advertising and consumer search in driving the observed changes in prices.

Advertising data. To explore the relationship between advertising and prices, we collected ad-level data for the five supermarket chains in our data. These data, collected from 'Ifat', the leading Israeli company for tracking and monitoring advertising, contain detailed data on advertising content and expenditures for the time period from July 2014 to June 2016 (Genesove and Simhon (2015) also use the same source of data.). For each ad, we have the following information: the name of the ad campaign, the advertising retail chain; the date that the ad was posted; media channel used (e.g., television, newspapers, radio, Internet), a classification of the ad into promotion/image classification, the expenditure on each ad based on list prices, and the ad itself. We further viewed or listened to all the ads and classified the ads based on whether they include a reference to media coverage, particularly price surveys carried by the media. We define such ads as "media-based" ads. Figures 5 and 6 contain examples of newspaper ads that refer to price comparison surveys conducted by the media. Figure 6 in Online Appendix 2 includes an example of a promotional ad, yet one that does not mention any particular media source.

Price comparison websites data. To examine the usage of the price-comparison websites we obtained from Similarweb, a digital market intelligence company, data on the number of viewers and the total number of pages viewed on each of the three websites that were offering price comparison services during the relevant time period (*MySupermarket.co.il, Pricez.co.il and ZapMarket.co.il*). These data, at the monthly level, cover the time period from July 2014 to July 2016. Data on the number of visitors are available for MySupermarket and for Pricez also in the pre-transparency period, because MySupermarket's main business is in the online grocery segment, and Pricez offered a price comparison service based on consumer reports.

3.2 Empirical strategy

The graphical illustration presented in figures 3 and 4 suggests that the mandatory disclosure of prices resulted in lower prices. Nevertheless, the figures do not account for time and item specific changes that may have occurred over the relevant time period. In this section, we elaborate on our identification strategy, which enables us to argue why these preliminary findings indeed reflect the effects of price transparency. To identify the effect of transparency, we compare price changes in the treatment group before and after the regulation took effect, with the corresponding changes in each of the control groups. A significant difference between a change in the treatment group and a change in the control group can arguably be attributed to the effect of transparency. Importantly, while concerns can be raised regarding the validity of each of the control groups, the use of the other control groups helps to mitigate these concerns. For instance, a difference between the treatment group and control group 1 (i.e., the online channel) might actually be a result of an unobserved change that took place in the online segment at the time the transparency regulation took effect. Control group 2 — comprising the ICC items that were sold in the same traditional store as items in the treatment group — is not vulnerable to this concern. Similarly, a significant change in the relative prices of items in control group 2 (ICC products) and items in the treatment group might be related to intertemporal changes in the marginal costs of the products that the two groups contain, rather than to changes in transparency. Control groups 1, 3 and 4 are not susceptible to this concern, as they contain the same items as the treatment group. Finally, one might be concerned that our results using control group 3 (drugstore prices) are biased because the transparency regulation changed the level of competition between supermarket chains and drugstores. Yet, the use of control group 2 which focuses on different items sold in the same store is less vulnerable to this concern. In the robustness section we present additional findings and analyses that further show that such concerns are unlikely to affect our results. More generally, the use of different control groups, and the fact that we obtain similar results using these alternative control groups, provides confidence that our estimates are indeed driven by the transparency regulation rather than by other changes in the market.

3.2.1 Price dispersion

Our first specification focuses on the relationship between transparency and price dispersion. To capture changes in price dispersion, we aggregate the price-store-date data to the product-date level and in some specifications to the product-chain-date level. We use three measures of price dispersion: the number of distinct prices that a given product i is sold for in a given period t, the coefficient of variation of a given product i in a given time period t, and the percentage price range of a given product i in a given time period t. In each regression, we compare the treatment group to a different control group. Formally, we estimate the following equation:

$$y_{it} = \mu_i + \gamma_t + \beta \times After_t \times Treatment_{it} + \epsilon_{it} \qquad (1)$$

where the dependent variable is one of the three measures of price dispersion. The $After$ indicator equals one if the time period t in which the product's prices were collected is after May 2015 (when the transparency regulation took effect), and zero otherwise. The $Treatment$ indicator takes the value of one for observations in the treatment group, and zero for observations in the control group. The equation also includes fixed effects for the product and for the time period in which the prices were collected. The product fixed effects capture time-invariant characteristics of each item, such as its mean cost of production. The time period fixed effects capture the impact of seasonality on pricing and other changes that might have affected chains' costs and pricing decisions. We also accommodate the possibility of pricing trends that may vary across items by incorporating linear product-specific time trends. Standard errors are clustered at the product level. In some specifications, we verify that the results are similar if we add the number of times that a price of a certain product was recorded in each period s a control variable. The coefficient of interest, β captures the change in price dispersion in the treatment group of items after prices became transparent relative to the corresponding change in dispersion in the control group.

3.2.2 Price levels

We use the following difference-in-differences specification to identify the impact of transparency on price levels:

$$log(p_{ist}) = \mu_i + \eta_s + \gamma_t + \beta \times After_t \times Treatment_{is} + \epsilon_{ist} \tag{2}$$

In this specification an observation is a product-store-date tuple, and the dependent variable is the log(price) of product i sold in store s in week t. To control for other factors that potentially affect prices we also include time period (γ_t), store (η_s) and item (μ_i) fixed effects. The weekly fixed effects capture the impact of seasonality on pricing and other regulatory changes that might have affected chains' costs and pricing decisions. For instance, the value-added tax in Israel dropped from 18 to 17 percent in October 2015 and the minimum wage in Israel increased in April 2016. These changes have likely affected retail chains' pricing decisions. Yet, such an effect on pricing should be captured by the week fixed effects. The store fixed effects capture time-invariant local competition conditions and the socio-demographic characteristics of local customers. Note that the estimation does not separately include a treatment variable as it is subsumed by the other fixed effects (e.g., the product fixed effects subsume the treatment variable when using the ICC control group and the chain fixed effects subsume the treatment variable when using the drugstore control group). Finally, we cluster the standard errors at the store level.

The main parameter of interest is β which is the coefficient on the interaction between the $After$ and the $Treatment$ indicators in equation 2. The identifying assumption is that the only systematic difference between the control groups and the treatment group is the amount of price-related information available to consumers before the law took effect. Per our discussion above regarding the use of the different control groups, and given that the treatment and control groups contain a substantial number of products in several categories, with overlapping manufacturers and different retailers, we believe that this is a reasonable assumption.

3.2.3 Additional specifications

We also examine whether transparency affected differently prices in chains or stores facing different market environments. This is interesting by itself but is particularly relevant because, as we elaborate in Section 4.1, one of the predictions of Robert and Stahl (1993) is that as search costs decline, the prices of items sold at more expensive chains/stores will fall more than in other chains/stores.

To test how prices in more concentrated markets or more expensive chains changed following the regulation, we modify Equation 2 in two ways. First, we interact the $After * Treatment$ variable in Equation 2 with a premium/discount indicator for the type of the supermarket chain. Second, we examine how the local market conditions affected price levels in the wake of the transparency regulation. In particular, we interact the $After * Treatment$ variable in Equation 2 with a measure of local competition that we constructed based on the number of other food retailers operating in the local market. We construct two such measures. One is a binary variable indicating whether a store's local environment is characterized by high versus low competition (i.e., store concentration above versus below the median). The other is a continuous measure of local competition. Notably, in this analysis we explore whether stores that are affiliated with the same supermarket chain but face different local competitive conditions respond differently to the transparency regulation. Thus, we compare pricing decisions by same-chain brick-and-mortar stores, and therefore only use control group 2 (the ICC basket).

In separate analyses (described in more detail in Online Appendix 1) we also examine whether price transparency differently affected the price levels of different types of products (e.g., private label vs. branded products, cheap vs. expensive items and or more vs. less popular items). In this analysis we rely on the prices of items collected only after the regulation went into effect, and therefore include a much larger set of items and stores (355 items sold in 589 stores). In particular, we re-estimate Equation 2 with interaction terms capturing different product characteristics, and compare price changes of these items to those of a control group comprising the same products sold online by the same chains, similar to control group 1 in the main analysis.

3.3 Estimation results on prices

3.3.1 Price dispersion

The regression results of Equation 1 are shown in Table 2. The table includes the estimates for each of the three measures of price dispersion: the number of unique prices, the coefficient of variation and the percentage price range. Each of the three columns includes not only the point estimate of the parameter of interest but also the average value of the dependent variable. Although the magnitude of the transparency effect varies across dispersion measures and control groups, the results indicate that following the transparency regulation had an economically and statistically significant negative effect on price dispersion. For instance, in columns 1-3 we observe that, after the transparency regulation went into effect, the number of distinct prices charged for a product in a given time period decreased by 8 to 16 distinct prices, depending on the control group that we use. This decrease is quite substantial, given that the average number of distinct prices for a product in the pre-transparency period was between 16 to 19.[21] We also performed the regression analysis on the effect on price dispersion using the median monthly price of each item to compute dispersion measures. This analysis allows us to focus on the inter-chain price dispersion after the regulation. The regression results, presented in Table 3 in Online Appendix 2, suggest that the inter-chain price dispersion has also declined after the regulation.

[21] In Table 2 in Online Appendix 2, we present the estimation results of a specification that captures the effect on the number of unique prices for each of the chains. The table reveals significant effect for each of the chains, suggesting that no single chain is responsible for the results shown in Table 2.

3.3.2 Price levels

Table 3 presents the regression results of Equation 2, which reflects the effect of mandatory disclosure of prices on price levels. The point estimates of the main parameter of interest are roughly similar across the three control groups and indicate that after the transparency regulation went into effect prices in traditional supermarkets decreased by 4 to 5 percent relative to the prices in the control groups. We also estimated the same equation using the items in the "comparable baskets" (see Figure 4), and obtained similar qualitative results (shown in Table 3 in Online Appendix 2). We also obtain similar estimates when price promotions are taken into account (Table 4 in Online Appendix 2).[22]

Table 4 presents the point estimates obtained from estimating a modification of Equation 2 in which we distinguish between premium and discount supermarket chains. The regression results indicate that the reduction in prices attributed to the transparency regulation took place among the premium chains. For the discount chains we do not find strong evidence that prices decreased after the transparency regulation went into effect. Table 6 in Online Appendix 1 presents the results when we include a chain-specific interaction variable. Similarly, we find that the effect of the transparency was large and negative for the chains that set relatively high prices and considerably smaller for the chains that set relatively low prices (see the ranking of the total basket price, shown in figure 2). Table 5 presents the results of an analysis that explores whether the effect of transparency on prices depends on the nature of competition a store faces in the local market. Column 1 presents the results of a specification in which competition is captured by a binary variable reflecting whether the market in which the focal store is operating is more (or less) concentrated than the median degree of concentration. Column 2 presents the results of a second specification, which imposes a linear effect of local market concentration on the effect of transparency on prices. The regression results suggest that the changes in prices following the transparency regulation were greater in stores that enjoyed market power in their local market. This result might also be driven by chains' decision to set similar prices across stores.

Our findings regarding price levels and price dispersion indicate that the increased availability of price information in the post-transparency period was driving the changes in prices. Yet, the exact channel through which consumers obtained this information is unclear. In the next section, we explore the potential mechanisms underlying these results and highlight the important roles of the media and informative advertising in driving these changes. To do so, we derive testable predictions based on Robert and Stahl (1993), and subsequently test these predictions. Before continuing to the next section, we also stress that our findings presented above: the reduction in

[22]The regression analysis assumes equal weights to all the products. As we show in our analysis in Online Appendix 1, the prices of more popular products have declined less than less popular products. Accordingly, the impact on consumers' actual spending may have been smaller than the estimates reported in the table.

price dispersion, the decline in price levels and even the greater price drop among premium chains are also consistent with the predictions of the model by Robert and Stahl.

4 Mechanisms

Section 4.1 contains an analysis that examine the role of advertising and the media in driving our results. In particular, we show how our findings can be rationalized based on the equilibrium framework developed by Robert and Stahl (1993). Next, in section 4.2 we discuss why fairness concerns explain retailers' decision to adopt a uniform pricing strategy. We separately consider the two mechanisms because they are conceptually different, and also - as shown in Figure 1 in Online Appendix 1 - because the change in uniform pricing occurred several months before other changes in prices materialized.

4.1 The media, informative advertising and prices

4.1.1 Theoretical framework and testable predictions

Robert and Stahl (1993) were the first to consider optimal consumer search and informative advertising in one framework.[23] They characterize a unique, symmetric price-dispersion equilibrium, for an environment where firms sell a homogeneous good, consumers are aware of firms' existence, and learn about their prices through either costly search or from exposure to ads. In the model, firms simultaneously choose prices and advertising levels, where depending on the level of advertising chosen endogenously by the firms, some consumers are exposed to ads (informed consumers) while others are not (uninformed ads). While their model considers firms that sell one good, our setting involves multiproduct firms. As we explain below we view the media as an intermediary which aggregates price information on multiple items into one "representative" price. The model generates the following predictions:

Hypothesis 1 (H1): *The use of informative advertising will increase as the costs of providing it falls.*

As we elaborate below, following the transparency regulation the Israeli media covered the topic of retail food prices comprehensively, reporting price comparison surveys for hundreds of products and stores. As the media coverage expanded, hard-discount chains (which received favorable media coverage in these price-surveys) were able to undertake advertising campaigns that mentioned the price surveys conducted by the media. Thus, the transparency regulation reduced the media's

[23] In an important contribution to the literature, Butters (1977) considers advertising and search in his model, but does not model optimal search. Theoretical papers that consider both channels are: Janssen and Non (2008), Janssen and Non (2009), Wang (2017), and Board and Lu (2018). For a simplified version of the model by Robert and Stahl, see Renault (2015).

cost of covering supermarket prices, and indirectly facilitated the use of informative advertising by chains. Notably, because supermarkets sell thousands of products in each store, traditional price advertising is less effective and consumers may suspiciously consider ads for only a subset of items (Rhodes (2014)). The use of the media as a third-party certifier addresses this concern and facilitates informative advertising campaigns.

Hypothesis 2 (H2): *In equilibrium, chains that set high prices will not use informative advertising. In contrast, chains that set low prices will use informative advertising.*

Hypothesis 3 (H3): *In equilibrium, chains setting low prices will use informative advertising more in periods in which prices are lower.*

The intuition for H2 follows from the fact that chains that set high prices sell only to uninformed consumers and prefer to set high prices. In contrast, chains that set low prices want to inform consumers about their prices and will therefore invest in informative advertising. Furthermore, because the marginal benefit of informative advertising is greater during periods that prices are lower, we expect H3 to hold.

Hypothesis 4 (H4): *In equilibrium, consumer search is limited.*

The intuition for H4 follows from the use of ads by low-price chains and from pricing decisions by the high-price chains. Ads provide relevant price information for consumers who get exposed to ads and hence discourage search by these consumers. The reason why consumers who are not exposed to ads will not search further after visiting a store is that high-price stores will set prices exactly at a level that dissuade subsequent search by uninformed consumers. Thus, another implication of the model is that following a reduction in search cost, we should expect that high-price chains will set lower prices. Indeed, in Table 4 we show that prices primarily fell among premium chains.[24]

4.1.2 The media

For many years now, the Israeli media has been actively involved in supporting pro-market agendas, criticizing attempts to gain market power and denouncing price increases. News outlets report regularly on consumer issues, typically taking a pro-consumer point of view. Following the social protests in 2011 and the cottage cheese boycott, media coverage of the food market became substantial and influential. In 2012, for instance, TheMarker, a prominent business newspaper in Israel, selected Rami Levy, the man who owns and manages the hard-discount chain Rami Levy (the third largest supermarket chain in Israel) as the most influential figure in Israel in that year.

[24] The no-search prediction arises in other standard search cost models for homogeneous goods. Introducing some product or consumer heterogeneity often leads to some level of consumer search in equilibrium.

Three years later, on Israel's Independence day in 2015, Rami Levy received one of the most prestigious national symbols, along the inventors of the application Waze and the developers of the Iron Dome defense system.[25] The media seems to embrace its role in promoting and advocating pro-market and pro-consumer initiatives. In 2017, for the first time, a reporter covering consumer issues has won the Israel's Journalists' Association's prestigious life-time achievement award.

The Israeli media coverage of consumer-related topics also involves comparisons of prices across different supermarket stores. Before the transparency regulation, these comparison were also common but were limited in scope as reporters had to physically visit stores and wander through the aisles to find the price of each product. After the regulation went into effect, the costs of collecting and comparing prices dropped significantly, providing the media with ample opportunities to report on price differences across numerous stores and products, much more than before prices were transparent. For instance, on April 7, 2016, the news site Ynet, the most popular Israeli website in Israel, published a comprehensive price comparison across dozens of supermarket stores throughout the country. The comparison, based on information from Pricez.co.il, included information from 18 geographic regions; for each region, the names and the addresses of the three stores that offered the cheapest basket were reported. The number of items included in the basket varied across regions, ranging between 130 and 210.[26] On January 12, 2016, Channel 2 News, Israel's most popular news program, ran a 4.5-minute item on a new price competition among supermarket chains in the city of Modi'in.[27] In this case, too, the reporter used the Pricez mobile app to compare prices across supermarket chains. Another example of the role of the media relates to the merger between two large supermarket chains: Mega and Yeinot Bitan. The merger took place in June 2016, towards the end of our data collection period. In this case, TheMarker, reported prices at the merged chains before versus after the merger, and compared them against the corresponding price differences at another supermarket chain that did not take part in the merger. TheMarker used price data from one of the price comparison platforms and repeated this exercise a few weeks after the merger and then again a few months after the merger.[28]

4.1.3 Multi-product retailers, media-based advertising and prices

Supermarkets sell thousands of items in each store and therefore cannot price advertise all the items sold in their stores. Advertising the prices of only a subset of items may also be ineffective if consumers realize these prices do not represent well the prices of other items they desire. How

[25] www.haaretz.com/israel-celebrates-67th-independence-day-1.5354235

[26] See http://www.globes.co.il/news/article.aspx?did=1001108062 and http://www.yediot.co.il/articles/0,7340,L-4858377,00.html for additional examples. Price comparisons are also highlighted in local media, in addition to national media: For instance, the local newspaper of Petach Tikva, the fifth largest city in Israel, used a price comparison platform to report on the supermarkets with the cheapest prices in Petach Tikva. See https://goo.gl/YsVT9a

[27] www.mako.co.il/news-channel2/Channel-2-Newscast-q1_2016/Article-996f23598873251004.htm.

[28] See www.themarker.com/advertising/1.3006498 and www.themarker.com/advertising/1.3116830.

then the extensive media coverage can help retailers use advertising to inform consumers about food prices? We argue that price-comparison surveys conducted by the media provided hard-discount chains an opportunity to mention these surveys in their ads as a credible, unbiased source of information for their low prices. We build on this insight and use detailed data on all ads by supermarket chains to classify ads that specifically mention media price-surveys reports as "media-based" ads. Figures 5 and 6 show examples of ads in which chains referred to price-comparison surveys conducted by a popular newspaper, a TV channel and a radio station. Not surprisingly, the advertising chain was ranked as having the cheapest basket in the respective media survey. We use the timing of these media-based ads, the identity of the advertising chains, and the monetary cost of these ads to generate our variable of interests in the empirical analysis.

Figure 7 presents the expenditures on media-based advertising for the year before and for the year after the transparency regulation came into effect, divided into the hard-discount chain in our sample and the other chains combined. As can be seen in the figure, after the transparency regulation the expenditures by the hard discount chain increased significantly. In contrast, the combined expenditures on media-based ads by the 4 other supermarket chains practically zeroed once prices became accessible online.[29]

Regression results presented in columns 1 and 2 of Table 6 confirm these patterns, showing that the expenditures on media-based ads by Rami Levy sharply increased relative to the expenditures by other supermarket chains. In column 1 we use the share of spending on media-based ads relative to the total spending on ads, while in column 2 we use the absolute spending on media-based ads as the dependent variable. These results support H1 and H2.[30]

According to H3, the use of media-based ads increases during periods in which prices are lower. Thus, we should find a negative relationship between prices and spending on media-based ads. Figure 8 illustrates this negative relationship well. According to the figure, as spending on media-based ads by the hard-discount chain increased, the negative effect of transparency on prices also increased. This relationship is even more pronounced when we use promotional prices instead of regular prices. In Figure 8 in Online Appendix 2 we show that this negative relationship holds also when we use the average prices of the basket instead of the monthly regression coefficients. This relationship also holds when we estimate a treatment intensity version of Equation 2, replacing the transparency indicator in the original specification with a measure of expenditures on media-based ads by Rami Levy in a given month. We present the results using either regular or promotional

[29] Most of the spending on media-based ads in the pre-transparency period was on media coverage related to the ICC basket. Unlike the media coverage of the ICC basket, the surveys conducted by the media in the post-transparency period did not follow a particular list of items. Also, the number of products and the timing of surveys were not known to retailers.

[30] As a falsification test, we also checked that the expenditures on promotional ads (i.e., ads mentioning specific price promotions) by Rami Levy did not increase relative to expenditures on such ads by the other retailers. In other words, the increase in media-based ads is not driven by an aggregate change in advertising spending but rather by a change in spending devoted to media-based ads.

prices, respectively in columns 3 and 4 in Table 6. Thus, the results support H3 indicating that expenditures on media-based ads increase at times that prices fall.

4.1.4 Usage of price-comparison websites

We now turn to examine the role of consumer search as another channel through which consumers may have gained price information. According to H4 consumers do not actually search in equilibrium. Admittedly, it is difficult to show that consumers do not engage at all in search. Nevertheless, we believe we can show that the use of the price-comparison websites that became freely available after the transparency regulation is limited.

To make this point, we use the data described in subsection 3.1.2 on usage of the three price-comparison websites. In particular, the monthly average number of unique visitors to Pricez.co.il and Zapmarket.co.il between October 2015 and July 2016 was 21,414, and 16,992, respectively.[31] These figures combined account for about 2% of the number Israeli households. It is likely that some of those who accessed these websites used to search in stores in the pre-transparency period. Thus, these numbers may even overstate the increase in search activity for food prices. To increase consumer traffic to these websites, the Ministry of Economy supported a large TV advertising campaign, and announced a competition among price-comparison websites, in which the first and second prizes (175k and 75k New Israeli Shekels) will be given to websites that will have more than 300K and 75k monthly users, respectively.[32] These efforts failed to deliver sustained traffic into the price-comparison websites.[33] Conversations we had with insiders at both Pricez.co.il and Myspurmarket.co.il further indicate that traffic to their price comparison websites is quite negligible. To make a living, these websites offer market participants BI services which are based on the price data that they generate. Thus, consistent with H4 we tend to conclude that consumer search activity is rather limited in the post-transparency period.

4.2 Brand-image concerns and uniform pricing

Recent papers show that retail chains often set similar prices for items sold in very different locations (e.g., Cavallo et al. (2014), DellaVigna and Gentzkow (2019)). These findings are counter-intuitive given that standard economic models predict that pricing decisions should take into account local consumer and market characteristics. Our analysis shows that before prices were

[31] Mysupermarket.co.il, the third price-comparison website, offers as its main business an online grocery service so we cannot disentangle customers who visit Mysupermarket to shop online (e.g., at Shufersal online) from visitors who want to obtain price information in traditional stores. Yet, we note that the average number of total visitors to Mysupermarket has marginally declined from 182k in the year preceding the regulation to 176K in the year after.

[32] The Israeli media also promoted the use of the price comparison platforms: in December 2015, the Israeli Internet Association, together with Google and the Israeli Fair Trade Authority, launched a competition for the development of the best food price comparison application. See http://www.globes.co.il/news/article.aspx?did=1001056276 and http://www.globes.co.il/news/article.aspx?did=1001074618.

[33] For more details, see https://www.calcalist.co.il/articles/0,7340,L-3751446,00.html.

transparent to consumers, supermarket chains set different prices for similar products sold in different stores. This pricing strategy has changed in the post-transparency period - shortly after the the regulation became effective, chains adopted a uniform pricing strategy, charging identical prices across stores affiliated with the same chain.

DellaVigna and Gentzkow (2019) discuss potential explanations for uniform pricing, and highlight managerial inertia and brand-image concerns as two primary explanations.[34] Our setting is useful to shed further light on the reasons why retailers adopt uniform pricing, and it underscores the relationship between transparency, uniform pricing and brand-image concerns. In particular, brand-image concerns best explain the effect of transparency on the decision of each chain to adopt a nearly uniform pricing policy. That is, our findings are consistent with the view that retailers reduced the number of unique prices they set for each product because they were concerned that consumers would find price differences across same-chain stores to be unfair, and that a public outcry would take place if consumers observed that chains were engaging in that practice. Rotemberg (2011) offers a theoretical framework that takes into account fairness into firms' pricing decisions.

There are several reasons why we think that brand-image or fairness concerns are driving retailers' decision to adopt uniform pricing. First, such concerns were an integral part of the public debate regarding retail food prices in Israel in the relevant time period. Many media reports denounced the fact that a chain sets different prices for similar products sold in different stores. Such media reports often emphasized that prices in stores located in rural and poorer areas are more expensive than prices of the same items sold in stores in affluent areas.[35] The anti-firm sentiment grew following the 2011 social protest, making firms much more concerned about consumer response (Hendel et al. (2017). Echoing the critique, shortly before the transparency regulation came into effect, a legislative attempt requiring food retailers to set the same price in all stores of the same chain nearly passed in the Israeli parliament.[36] Retail chains tried to address the public critique by attributing the price differences to higher transportation costs to rural areas and by announcing that they would reduce the price differences. Others have noted that chains were able to set high prices in the periphery because fewer stores operated in these areas.[37] Second, conversations we had with retailers also confirm that the decision to set uniform pricing once prices became transparent was driven by the concern that consumers and the media will find price differences as unfair. Third, the fact that prices in the online channel were uniform across locations served by the same chain, and transparent both before and after the regulation, also suggest that

[34]Interestingly, Stigler (1961) also mentions the practice of uniform pricing and suggests that lowering consumer search is another potential reason for the use of uniform pricing.

[35]For instance, in April 2014, TheMarker surveyed prices of several items at different Shufersal stores and found that prices in the periphery are substantially higher than in the center of Israel. www.themarker.com/consumer/1.2291031.

[36]http://www.ynet.co.il/articles/0,7340,L-4252811,00.html and www.knesset.gov.il/protocols/data/rtf/kalkala/2012-07-24-02.rtf.

[37]E.g., https://www.themarker.com/advertising/1.1613349.

brand-image concerns are important. Finally, we do not think that costs of compliance to the new regulation are driving the decision to adopt uniform pricing. Supermarket chains uploaded a separate file of prices and for promotions for each store they operate. Accordingly, in instances in which chains do set different prices across locations, they are required to update the specific files of particular stores.

5 Robustness

In this section we describe several robustness tests that we performed. These Analyses mostly concerned the robustness of our findings regarding the change in prices following the transparency regulation. Other results which concern the robustness of our findings regarding the underlying mechanisms are mentioned in the text above and in the online appendices.

5.1 Measurement errors and grocery stores as a control group

Our regression analysis indicates that after the transparency regulation went into effect, prices of items in the treatment group fell 4-5 percent more than did the prices of items in the different control groups. A potential concern with this result is that they might have been affected by the changes in the sources of data used for the analysis. In particular, the source of data for the treatment group and the ICC control group in the pre-transparency period were a market survey firm and the ICC, respectively. After the regulation, the data for these groups came from a price comparison website.[38] Thus, if there are systematic measurement errors associated with one of these data sources then our results are potentially biased. In particular, if (due to the collection method) the prices recorded in the treatment group during the pre-transparency period were systematically higher than the actual prices, then our estimates are potentially biased upward (in absolute values).

To address this concern, we obtained data collected by the Israeli Central Bureau of Statistics ("CBS") for the same time period as our main analysis. We obtained data on the prices of 39 items, which are regularly collected by the CBS to construct the Israeli consumer price index. Importantly, the methodology to collect the prices of these items did not change over the relevant time period. The CBS data include, for each item, a product identifier, price, store identifier, city name, the month in which the price was collected, and an indication of whether the store belongs to a supermarket chain or is a mom-and-pop grocery store. For confidentiality, these data do not include a specific address, chain affiliation or exact date. Thus, we cannot directly compare this data set with the other sources of data that we use. Nevertheless, we can use the CBS data to

[38] For the Super-Pharm and online control groups the same data sources were used before and after the regulation.

examine how the regulation affected prices in supermarkets (which were subject to the regulation) relative to prices in mom-and-pop grocery stores (which were not subject to the regulation). Out of the 39 products, 27 products are products that are included in the ICC basket. Thus, we first focus on the remaining 12 products, and estimated Equations 1 and 2. The results of these analyses, which are presented in Table 7, indicate that after the transparency regulation went into effect, both price dispersion and price levels decreased to a greater extent in supermarket chains than in mom-and-pop grocery stores. The magnitude of the estimated effect on prices is 1.9%. If we restrict attention to the 8 items, for which there are on average more than 10 observations per month, we obtain an estimated effect of 2.2%. Given that the sample of items used in this analysis is a small subset of the products that we used in the main analysis, we view these results as providing additional support for the findings presented in the main analysis.

We also use the CBS price data for the 27 products which are included in the ICC control group. These price data are useful because we can use them to indirectly test the validity of the ICC control group. In particular, the rationale for using the prices of ICC products sold in supermarkets was that these prices were transparent before and after the regulation. In contrast, the ICC did not survey grocery stores and hence the prices of these 27 products which were sold in grocery stores can be considered non-transparent both before and after the regulation. Accordingly, we can expect that the difference in prices of these 27 products between supermarkets and grocery stores should not significantly change following the transparency regulation. Indeed, we do not find an effect (p-value = 0.64). Similarly, we find a non-significant result if we again restrict attention to products for which we have more than 10 observations per month. Finally, we note that using the prices in grocery stores as a control group is useful because, as further discussed in Section 5.5, it is unlikely that the owners of these small, independent stores had strategically responded to the transparency regulation by raising their prices.

5.2 Different sampling frequencies

Another implication of using different data sources before and after the regulation concerns the frequencies and particular timing that different data were collected. For instance, in the pre-transparency period, prices of the items in the ICC control group were collected in the same month, though not necessarily always on the same day. In contrast, in the post-transparency period, these data were collected on the same day. This difference may mechanically lead to a higher number of unique prices in the pre-transparency period for the ICC group compared with the number of unique prices in the post-transparency period.[39] To address this concern, we experimented with different specifications in which we simulate the post-transparency period to also be at the

[39]For the treatment group, the prices in the pre-transparency period were collected in the last week of a given month and almost always on the same day.

monthly level. For instance, for the post-transparency period we used price data for the treatment group only from the last week of the month (like in the pre-transparency period). Moreover, in the specification using the ICC control group, we use price data from a randomly chosen week in the post-transparency period. In other words, we make the pre- and post periods comparable in terms of their data-collection frequencies. Likewise, for the online control group we use price data collected in the last week of the month, similar to the treatment group. The results for these different specifications, and for three different measures of price dispersion, are shown in Table 7 in Online Appendix 2. In all specifications, the qualitative results are unchanged.

5.3 Parallel time trends

The identifying assumption in a differences-in-differences research design is that the control and treatment groups share the same time trend. Given the multiplicity of control groups used here, we find it useful to graphically demonstrate that the control groups shares a similar time trend with the treatment group. To this end, we estimated specifications using log(price) as the dependent variables and also add month-specific effects for each specification (treatment group vs. control group). The results are plotted in Figure 7 of Online Appendix 2. The figure demonstrates that the treatment group time trend follow a similar time trend as the corresponding control group time trend. Formally, we cannot reject the null hypothesis that the two time trends follow the same pattern when using the online control group. We obtain similar qualitative results when using the ICC control group.

5.4 Placebo tests

A potential threat to identification when using a differences-in-differences research design is the possibility that the estimated effects are not driven by the treatment, but rather by other unobserved factors. To address this concern, we conducted a placebo test by considering a sample that started in July 2014 and ended in July 2015. We then re-estimated the regression in which (log) price level is used as the dependent variable (Equation 2), defining a fictitious date for the "effective" date of the transparency regulation. Since the treatment group was sampled eight times in the (actual) pre-transparency period, and given that we want the placebo pre-regulation period and the placebo post-regulation period to incorporate at least two data pulls each, we are left with at most five possible points in time at which to set the fictitious regulation dates. We conducted the test for both the online and the ICC control groups. The results, which show no significant effect of the fictitious regulation, are presented in Table 8 of Online Appendix 2. These results mitigate the concern that another event that occurred prior to the implementation of the regulation explains our findings.

5.5 Strategic responses by prices in the control groups

Another potential concern with the interpretation of our findings is that prices of items in the control groups may have reacted to the transparency regulation. For instance, if prices set by Super Pharm (control group 3) or in chains' online channel declined as a response to the decline in prices in brick-and-mortar stores, then our results might be biased. Note, however, that this would imply that our estimates using these control groups are a lower bound to the actual impact of transparency.

If, however, following the transparency regulation Super-Pharm stores decided to target price-insensitive consumers by raising prices, then our results may overstate the impact of the regulation. While we believe that it is unlikely that Super-Pharm would raise its prices in the wake of a regulation enabling consumers to more easily compare prices across different retailers, it is not theoretically impossible. To address this concern, we classified Super-Pharm stores in our sample as 'close' or 'far', according to their proximity to a supermarket store. We then checked whether the price changes in 'close' Super-Pharm stores differed from the price changes in 'far' stores. Arguably, if the above concern holds, we should expect prices in 'close' stores to rise more than prices in 'far' stores. The estimation results, presented in Table 9 in Online Appendix 2, provide no evidence for such a relationship. Second, as mentioned in Section 5.1, we use prices of items sold in individual grocery stores as an additional control group and find qualitatively similar results. This analysis further suggests that our main results are not driven by a strategic response by Super-Pharm. With regards to the concern about online prices, we also note that prices in traditional stores have declined also in areas where online grocery services is very limited, further mitigating this concern.

5.6 Anticipation of the policy change

One might be concerned that because the Food Act was enacted about a year before the transparency regulation came into effect, supermarket chains might have lowered their prices before the actual implementation of the regulation. We believe this concern is unfounded for several reasons. First, the abrupt change in price dispersion that takes place shortly after the policy came into effect strongly suggests that chains responded shortly after the regulation became effective (not months before it was effective). Second, from a profit-maximizing perspective it is not obvious why chains should set lower prices well before prices become transparent. Finally, if chains did set lower prices well before the regulation came into effect then our estimates are potentially biased downward.

6 Concluding Remarks

In this paper, we study the impact of price transparency regulation regarding food items sold in Israeli traditional brick-and-mortar stores. While the impact of price information is at the core of Industrial Organization, to our knowledge, almost no study has examined this issue empirically, and those that have were typically limited in scope: e.g., they had to assume away selection issues and did not consider firms' advertising choices. Our analysis addresses this gap, using a large data set of prices from the Israeli supermarket industry in the period surrounding the implementation of mandatory transparency regulation. We first show that following the transparency regulation supermarket chains adopted a uniform pricing strategy, setting the same price across different stores affiliated with the chain, and that price levels fell. The fall was particularly pronounced in stores affiliated with more pricey chains or stores that faced weaker competition in their local markets. Our estimates suggest that the magnitude of the effect of transparency on prices is not trivial. Relying on the 5% price reduction estimate, we can use back-of-the envelope calculations to assess consumer savings and firms' revenue losses from the increased transparency. In particular, we find that chains lost about $46 million in revenue each month, and that the average household saved about $27 per month (about 1.5% of the median wage in Israel in 2015).[40]

Our findings highlight the important role of the media and ads that use the media as a reliable and credible source of information on the prices charged by retailers. In particular, we show that hard-discount chains extensively referenced to price surveys conducted by the media in their ad campaigns. These ad campaigns were used especially during time periods in which prices were lower. Our findings provide strong support to the theoretical model by Robert and Stahl (1993) who were the first to incorporate optimal consumer search and advertising into one framework. We are not aware of previous empirical studies that jointly examine the effects of search cost and advertising, and more generally papers that use an equilibrium framework to analyze the impact of ads on prices and on competition.

While our findings may support the adoption of similar transparency policies, we also stress that our analysis focuses on a relatively short time period, and that the results regarding the change in prices may change in the long run. Furthermore, information disclosure requirements have the potential to affect other decisions made by the firms. For instance, transparency can also potentially alter retailers' bargaining power vis-a-vis suppliers. In addition, transparency may affect the frequency at which retailers adjust their prices, their price promotion strategies or product availability. The change in the competitive landscape may also result in exit of inefficient chains and consolidation. We leave these issues for future research.

[40] http://www.cbs.gov.il/statistical/mb158h.pdf

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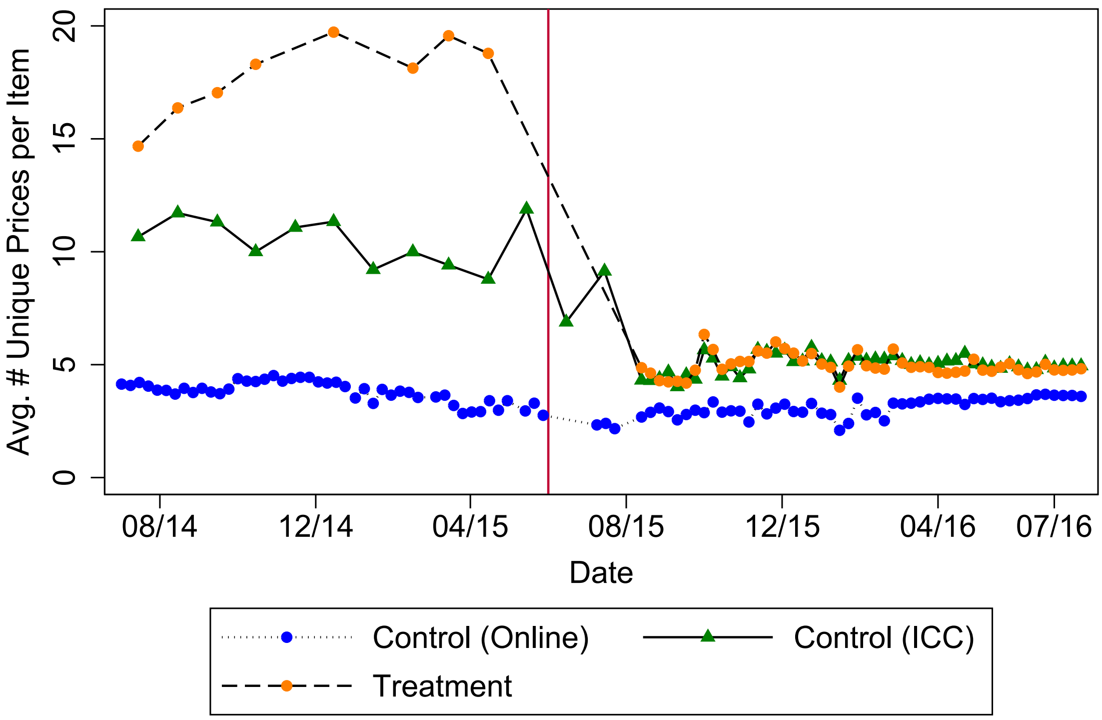
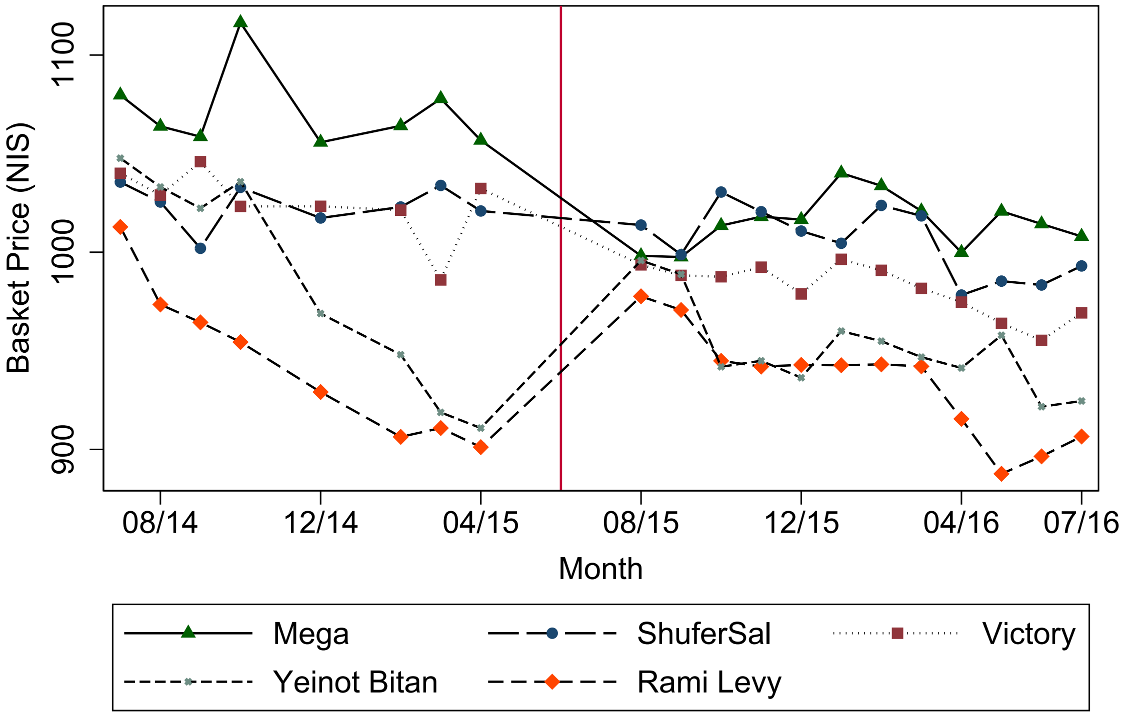
Figure 1: Number of unique prices



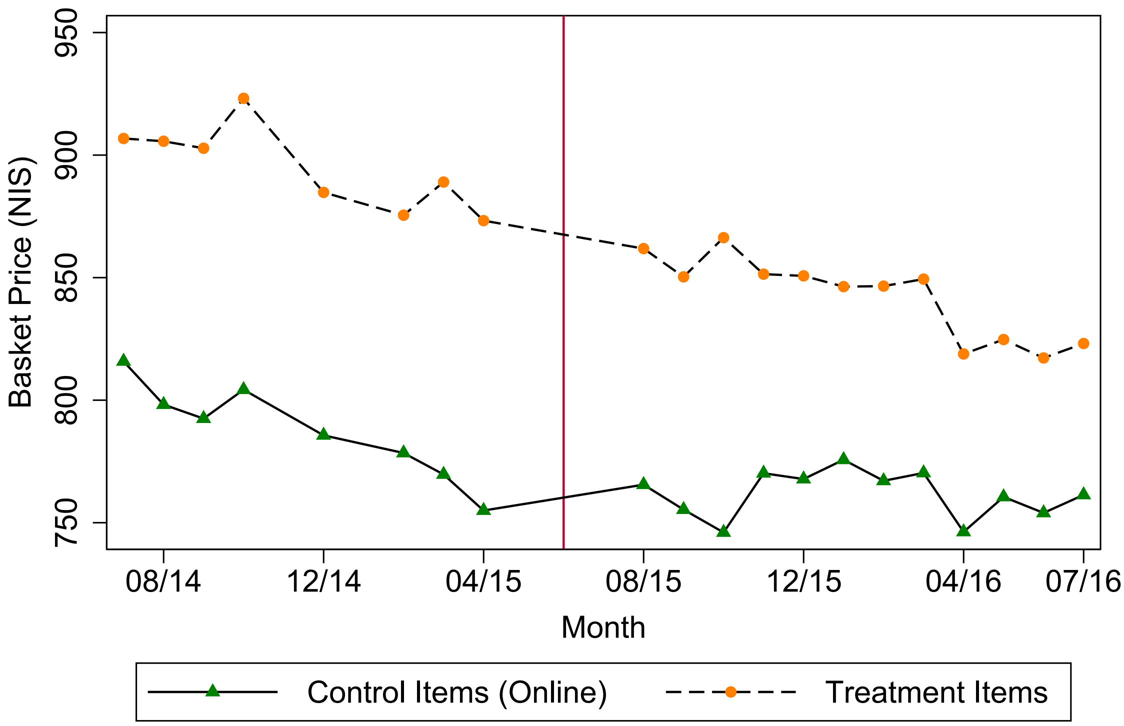
The figure shows a time series of the average number of unique prices for the treatment group of items, the online control group and the ICC control group. The vertical line denotes the date in which the transparency regulation came into effect. According to the figure, the number of unique prices per item in the treatment group fell significantly after the regulation.

Figure 2: Retailer-specific basket price



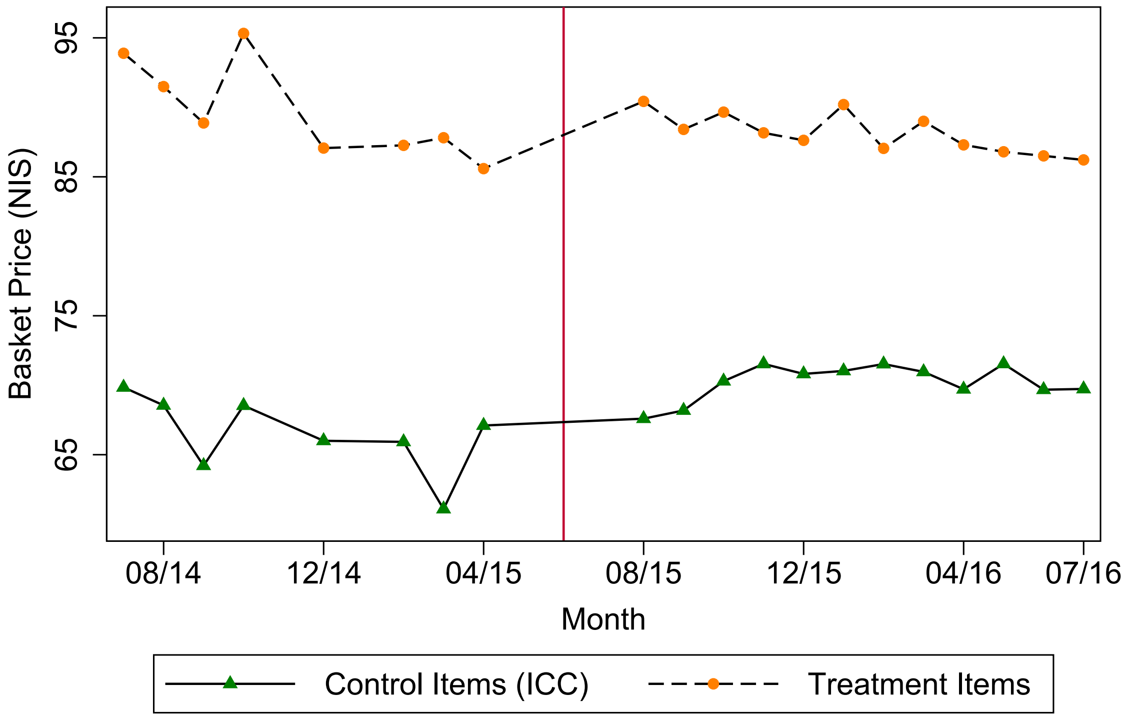
The figure shows a time series of the total basket price for each of the five food retailers. The vertical line denotes the date in which the transparency regulation came into effect. A basket consists of 58 items. Monthly basket price is the sum of items average price, where the average is taken over the retailers' stores. Missing price are imputed. The figure suggests that both price dispersion and price levels have decreased after prices became transparent.

Figure 3: Basket price in the online control and the treatment groups



The figure shows a time series of the total basket price, divided into the online (control group) channel and the brick-and-mortar (treatment group) channel. The vertical line denotes the date in which the transparency regulation came into effect. In each channel, prices are averaged across stores and chains and missing prices are imputed. The figure shows that throughout the period the online basket is cheaper than the same basket purchased in the traditional channel. Yet, the difference between the two channels diminishes after the prices in traditional stores become transparent. Similar patterns are observed when we use log(price) instead of price levels.

Figure 4: Comparable basket price



The figure shows a time series of the total basket price for two baskets. One basket consists of six ICC control items and the other consists of six close substitutes items from the treatment group. For instance, a 200- gram jar of Nescafé Taster's Choice instant coffee, included in the ICC group, is matched to a 200-gram jar of Jacobs Kronung Coffee (another quality brand of instant coffee), included in the treatment group. Similarly, we match a 700- ml bottle of Hawaii shampoo in the ICC group to a 700-ml bottle of Crema Nourishing Cream Wash in the treatment group. The figure shows that before prices in the treatment group became transparent, the two baskets exhibited similar patterns, and after prices became transparent the difference between the expenditures on the two baskets diminished.

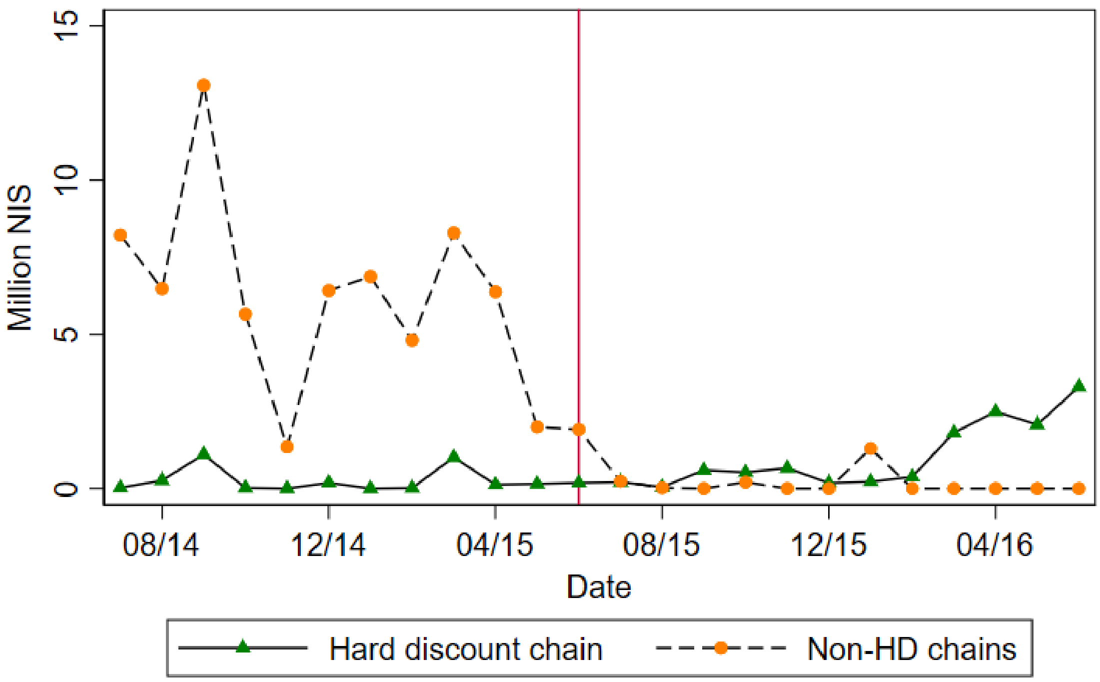
Figure 5: An example of media-based advertising (1)

The figure shows an example of an ad by the hard-discount chain Rami Levy in which the chain stresses it offers the cheapest basket in Israel. The ad specifically refers to two price-comparison surveys conducted by the media, One by the newspaper Yediot Aharonot (on September 4, 2015) and a second pre-holiday survey by TV channel 2.

Figure 6: An example of media-based advertising (2)

The Yeinot Bitan supermarket chain ad includes two references to comparisons of sales expenditures at supermarket chains which was conducted by a national radio station and a leading online news portal. In both examples, Yeinot Bitan offers the cheapest option.

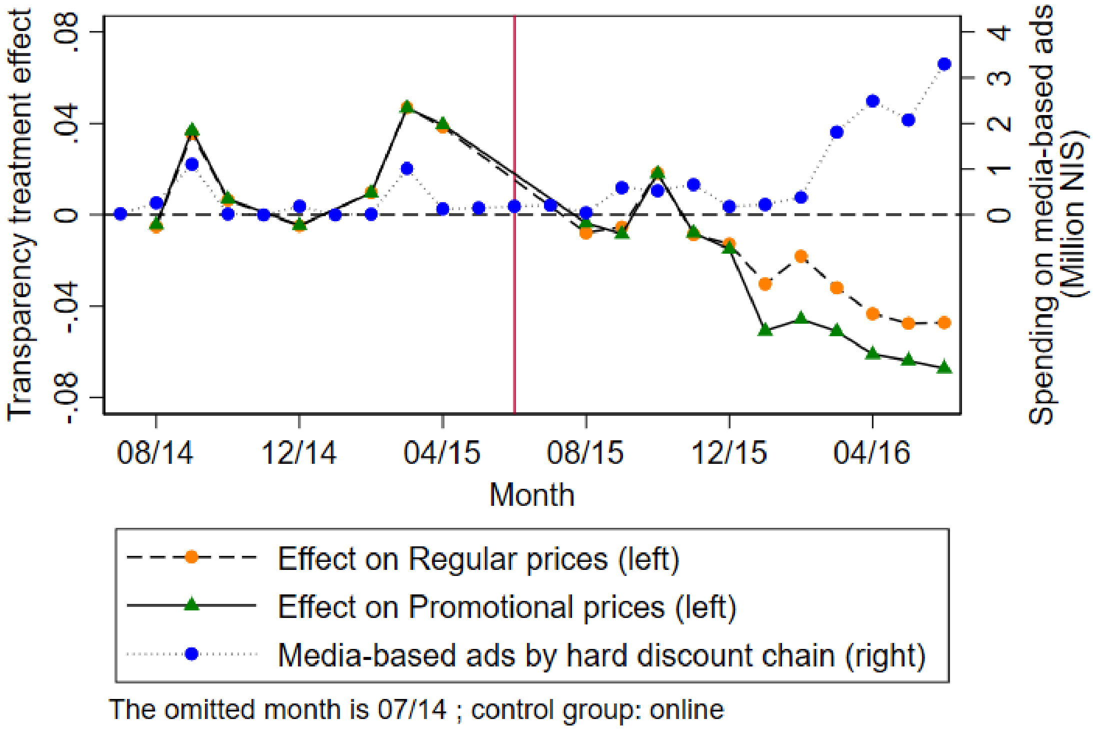
Figure 7: Spending on media-based ads by hard-discounters and other supermarket chains



Source: Ifat (Israeli company for tracking and monitoring advertising)

The figure shows (in blue) the monthly expenditures on media-based ads by Rami Levy, the largest hard discount chain in Israel, and (in red) the combined monthly expenditure on media-based ads by the other supermarket chains ($ 1 ≈ 3.5NIS). The vertical line corresponds to the date in which the transparency regulation became effective. The Figure shows that after the transparency regulation, expenditures on media-based ads increased for the hard discount chain and practically disappeared for the other chains. Similar patterns arise if we use the share of media-based ads out of total expenditures on ads.

Figure 8: Media-based ads and prices



The figure shows the relationship between informative advertising and prices. The solid green line corresponds to the monthly spending on media-based ads by the hard-discount chain (as shown on the right vertical axis). The dash/blue and dotted/red lines correspond to monthly regression coefficients of a regression that uses the online control channel to capture the effect of transparency on regular and promotional prices, respectively. We present the magnitude of these coefficients on the left vertical axis. The vertical line corresponds to the date in which the transparency regulation became effective. The Figure shows a clear negative relationship between spending on media-based ads by the HD chain and change in prices. Similar patterns arise if we use the mean basket price instead of the average treatment effect.

Table 1: Descriptive Statistics

Data Source		# Stores	# Items	# Data Pulls	N
Supermarkets					
	Treatment group	61	69	58	159,214
	Online	5	69	99	30,865
	ICC	61	38	63	115,749
Drugstore		32	28	4	2,789

The table presents information on the number of stores, items and periods for which prices have been collected in the treatment and each of the control groups. For instance, the 115,749 prices of the 38 items in the ICC control group were collected in 61 stores at 63 different weeks.

Table 2: The Effect of Price Transparency on Price Dispersion

	# Unique Prices			Standard Deviation/Avg.			Percentage Range ($100 * \frac{P_{max}-P_{min}}{P_{max}}$)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After*Treatment	-10.881**	-8.103**	-15.920**	-0.101**	-0.053**	-0.083**	-27.396**	-12.481**	-32.962**
	(0.549)	(0.812)	(1.700)	(0.011)	(0.012)	(0.024)	(1.679)	(2.436)	(6.300)
Week F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lin. Item Time Trend	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control Group	Online	ICC	Super Pharm	Online	ICC	Super Pharm	Online	ICC	Super Pharm
Dep. Var. Average Value	16.265	17.317	19.097	0.211	0.211	0.209	55.006	55.642	57.742
R^2	0.785	0.804	0.833	0.392	0.627	0.471	0.488	0.736	0.635
N	9636	6176	1525	9345	6120	1510	9636	6176	1525

The unit of observation in columns 1, 3, 4, 6, 7 & 9 is item i in date t in treatment/control group

The unit of observation in columns 2, 5 & 8 is item i in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by item

* $p < 0.05$, ** $p < 0.01$

The Table presents the regression results of Equation 1 using three different measures of price dispersion as the dependent variable, and each of the three control groups (drugstores, online and ICC). We use prices collected in the year before the transparency regulation for the pre-transparency period, and prices collected in the year after the regulation as our post-transparency regulation. To get a sense of the magnitude of the change in price dispersion following the transparency regulation, we also report the average value of the corresponding dependent variable. For all the measures of price dispersion and for each of the control groups, we find that price dispersion has significantly dropped after prices became transparent.

Table 3: The Effect of Price transparency on Price Levels

	(1) log(Price)	(2) log(Price)	(3) log(Price)
After*Treatment	-0.051**	-0.052**	-0.040**
	(0.008)	(0.005)	(0.014)
Store F.E.	✓	✓	✓
Date F.E.	✓	✓	✓
Item F.E.	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓
Control Group	Online	ICC	Super Pharm
R^2	0.937	0.961	0.909
N	186810	278228	58358

The unit of observation is item i in store j in time-period t

Time period covered 7/2014 - 6/2016

Errors are clustered by store

* $p < 0.05$, ** $p < 0.01$

The table presents the regression results of Equation 2, using prices collected during the year before the regulation as the pre-transparency period, and prices collected during the year after the regulation as the post-transparency period. Each column corresponds to a different control group. The results indicate that prices have declined by 4% - 5% after the prices in traditional stores became transparent.

Table 4: The Effect of Price Transparency on Prices in Different Retailers.

	(1) log(Price)	(2) log(Price)	(3) log(Price)
Premium: After*Treatment	-0.061**	-0.058**	-0.045**
	(0.008)	(0.006)	(0.014)
Discount: After*Treatment	-0.015	-0.026**	0.011
	(0.009)	(0.007)	(0.015)
P-Val: Premium Retailers = Discount Retailers	0.000	0.000	0.000
Store F.E.	✓	✓	✓
Date F.E.	✓	✓	✓
Item F.E.	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓
Control Group	Online	ICC	Super Pharm
R^2	0.937	0.961	0.909
N	186810	278228	58358

The unit of observation is item i in store j in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

The Table presents the regression results of a version of Equation 2 in which the post-transparency indicator is interacted with a supermarket type dummy (premium/discount). As shown in the table, the regression results (for each of the control groups) suggest that prices have significantly declined for the large, premium chains and have not changed for the discount chains. We obtain qualitatively results when performing this analysis at the chain-specific level.

Table 5: The Effect of Price Transparency on Prices, by Degree of Competition

	(1) log(Price)	(2) log(Price)
After*Treatment - Low Comp.	-0.059**	
	(0.006)	
After*Treatment - High Comp.:	-0.044**	
	(0.006)	
After*Treatment		-0.039**
		(0.007)
After*Treatment*Concentration		-0.040*
		(0.015)
Store F.E.	✓	✓
Date F.E.	✓	✓
Item F.E.	✓	✓
Linear Item Specific Time Trend	✓	✓
Control Group	ICC	ICC
P-Val: Low Comp = High Comp	.002	
R^2	0.962	0.962
N	259557	259557

Concentration ranges form 0 to 1, with 0 being perfect competition and 1 being monopoly

The $10^{th}, 50^{th}$ and 90^{th} percentiles of concentration are 0.13, 0.32 and 0.45, respectively

The unit of observation is item i in store j in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

In this table we present the regression results of a version of Equation 2 in which we interact the post-transparency indicator with a measure of the local competition faced by the supermarket store. In column 1, the local competition measure is a binary variable for high or low competition, and in column 2 we use a continuous measure of local competition. Because we want to compare price changes across stores that belong to the same chain but that face different local competition, we use only the ICC control group. The results suggest that prices in stores that faced weaker local competition have declined more than stores that faced stronger local competition.

Table 6: Media-based ads, transparency and prices

	Media-based ads (%)	Media-based ads (Million NIS)	log (price)	log (promotional prices)
	(1)	(2)	(3)	(4)
Hard Discount * After	48.846***	1.634***		
	(9.429)	(0.228)		
Exp. on Media-Based Ads by Hard Discount			-0.013***	-0.018***
			(0.004)	(0.004)
R^2	0.789	0.808	0.937	0.930
N	191	191	186810	186810

Time period covered is 7/2014 - 6/2016.

The unit of observation in columns 1 and 2 is chain type (hard-discount or not) in week t.

In columns 1 and 2, we use as dependent variables the share of media-based ads out of total ad expenditure, and absolute spending on media-based ads, respectively.

In columns 3 and 4 the unit of observation is item i in store j in date t .

We use the online control group and include date FE, item FE, store FE and item-specific linear time trend.

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

Columns 1 and 2 present regression results concerning the change in media-based ads after the transparency regulation. The results show that spending on media-based ads by the hard-discount chain increased significantly after the transparency regulation. These results hold either when we use as the dependent variable the fraction of spending on media-based ads out of total spending on ads (column 1) or when we use absolute spending on media-based ads (column 2). These results support (H1) and (H2).
In columns 3 and 4 we present regression results examining the relationship between price levels and the use of informative advertising. We estimate a treatment intensity version of Equation 2, using the prices of items in the online channel as a control group. The intensity considered is the monthly expenditure on media-based ads by the hard discount retailer. The dependent variable we use are regular prices (column 3) and promotional prices (column 4). In both specifications we find a negative relationship between prices and spending on media-based ads by the hard-discount chain. The regression results support (H3) and indicate that media-based ads were more heavily used in time periods in which prices were set lower.

Table 7: The Effect of Price Transparency on Price and Price Dispersion using CBS Data

	(1) # Unique Price	(2) Standard Deviation/Avg.	(3) Percentage Range $(100 * \frac{P_{max}-P_{min}}{P_{max}})$	(4) log(Price)
After*Treatment	-1.465**	-0.042**	-9.407**	-0.022**
	(0.288)	(0.004)	(0.726)	(0.007)
Date F.E.	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓	✓
Control Group	Grocery Stores	Grocery Stores	Grocery Stores	Grocery Stores
Dep. Var. Average Value	9.856	0.164	38.853	
R^2	0.832	0.905	0.778	0.975
N	400	400	400	9472

The unit of observation in columns 1-3 is item i in month t

The unit of observation in column 4 is item i in store j in month t

Time period covered 7/2014 - 6/2016

Errors are clustered by month in columns 1-3 and by store in column 4

* $p < 0.05$, ** $p < 0.01$

The table contains the regression results using small grocery stores, which were subject to the transparency regulation, as an additional control group, In this analysis, we rely on price data obtained from the Israeli Central Bureau of Statistics on 12 items. We repeat the analysis featured in Tables 2 and 3 using the three measures of price dispersion (columns 1 -3) and the price level (column 4). The results indicate that both price dispersion and price levels have significantly declined.

Online Appendix No.1 for "Price Transparency, Media and Informative Advertising"

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September 17, 2019

This appendix contains additional results and figures that uses price data from the post-transparency period and are referred to from the main text.

1 Effects of transparency across products

In this section we report additional results using a larger set of products and stores which are available in the post-transparency period. To undertake this analysis we first show that the change in price levels became significant only in the beginning of 2016, few months after prices became transparent. We rely on this finding to perform a modified difference-in-differences analysis explained below. We also note that while we think that these additional results offer valuable insights on the effect of the transparency policy, we are also aware of the potential limitations of relying on post-transparency data and therefore cautiously interpret the results of this analysis.

To examine the pace at which the change in price dispersion and price levels took place, we estimate the monthly effect of price transparency on measures of price dispersion and price levels for each month included in our 2 years sample. We estimated the month-specific effects using modified versions of Equations 1 and 2 in the main text. Figure 1 below presents the monthly effects of the transparency regulation on the number of distinct prices (as a measure for price dispersion) and on the (log) price levels. The figure demonstrates that price dispersion diminished shortly after the transparency regulation went into effect, whereas the effect of transparency on price levels was essentially indistinguishable from zero for several months. Only at the beginning of 2016 did the effect of transparency on price levels become negative and statistically significant. We exploit this fact and carry out a series of differences-in-differences analyses for the post-transparency period using panel price data on 355 products from 589 stores. In these analyses the comparisons are made between the prices of products sold in traditional stores (the treatment group) and the price of the same products sold online by the same chain (as a control group).

In our first analysis in this series, we evaluate the overall extent to which price levels dropped in 2016. We obtain similar results to the those reported in Table 3 in the main text. That is, among traditional stores, the price difference between the January-August, 2016 period and the August-December, 2015 period was 3.2% lower compared to the corresponding price difference of the same items sold through the online channel. This finding, shown in column 1 of Table 1, suggests that our initial sample of treatment products is largely representative of the products sold in supermarkets.

Next, we use regression analysis to characterize which products experienced a greater drop in prices during 2016, relative to the control group. First, we divide the 355 products into 10 price deciles based on their mean price and estimate a specific treatment effect for the set of products within each of the mean price deciles. As shown in Figure 2, we find a strong negative relationship between the price level and the corresponding decline in price. That is, more expensive product experienced a greater drop in prices. Next, we examine how the observed price reductions correlate with product popularity. To this end, we assign each product a popularity score which is based on a list of the top 500 selling items at `Mysupermarket.co.il`.[1] We then interact this measure of popularity with a dummy variable indicating whether the item's price corresponds to the period before or after January 2016 and add this interaction variable to the estimated specification. The regression results are shown in column 2 of Table 1. As can be seen in the table, the results suggest that the prices of more popular products declined less than the prices of less-frequently-bought items. One potential explanation for this finding is that in the pre-transparency period consumers paid closer attention to products that they purchased more frequently. As a result, prices for these products were a priori relatively low, and the impact of the transparency regulation on prices was greater for less popular goods. Furthermore, these findings suggest that estimating a quantity-weighted regression of the effect of transparency would indicate that the effect of the transparency policy on consumer surplus is somewhat smaller than the effect we report in the main text.

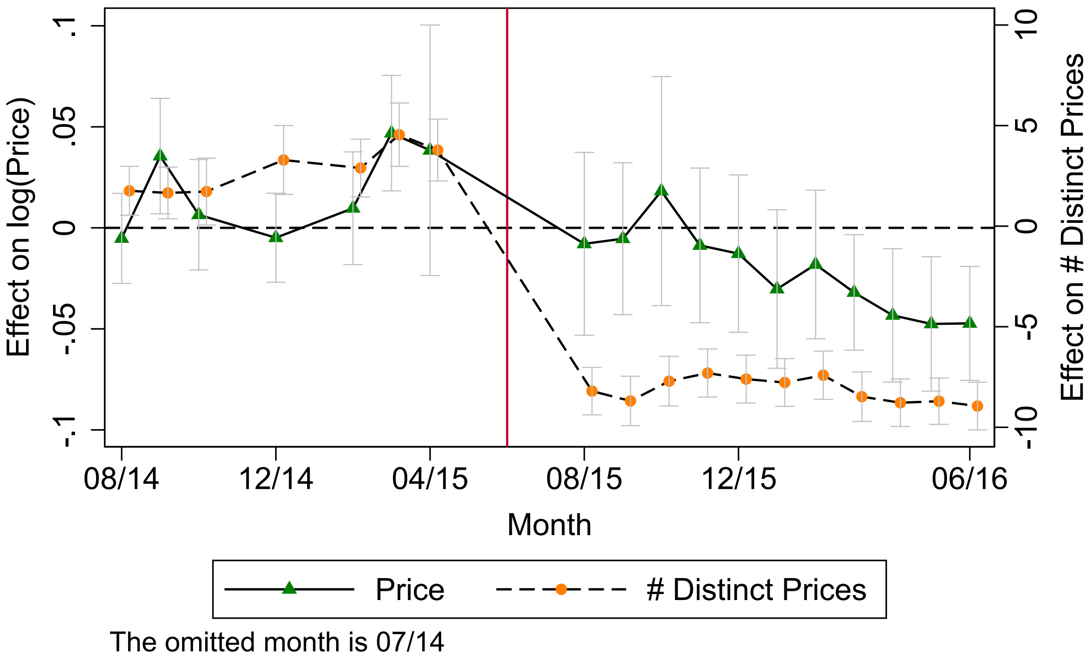
We now turn to evaluate whether price changes differed between private-label and branded products in the same category. To capture this difference, we estimate an equation similar to Equation 2 and also include two interaction terms. One term is an interaction between an indicator for the post-January-2016 period and an indicator for a private-label product. The second term is an interaction between an indicator for the post-January-2016 period and a branded-product indicator. In this specification the sample of products consists only of the 12 categories that contain private label products. The results, presented in column 3, indicate that the prices of branded

[1]Because more than half of the products in our sample are not included in the top 500 products, we cannot directly match the list with each product. Instead we use a more coarse classification for popularity. The results are robust to different classifications.

products dropped significantly more than the prices of private-label products. These findings may suggest that following the transparency regulation, consumers found it easier to compare the prices of branded products than to compare the prices of private-label products, which differ across chains.

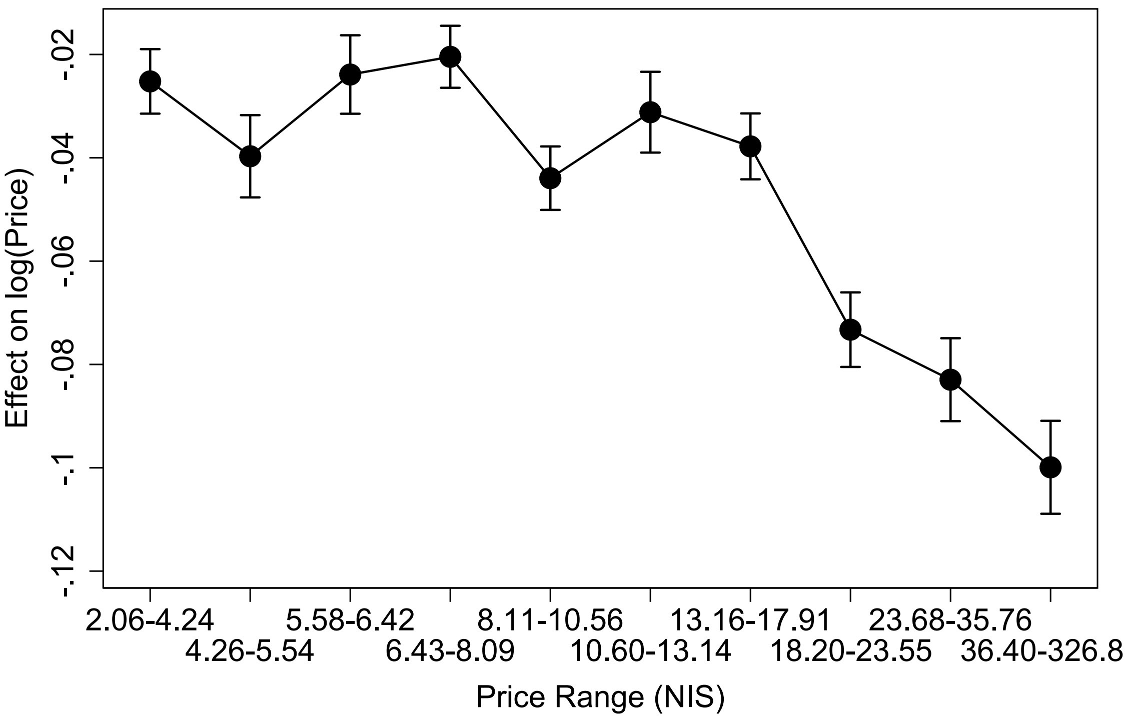
Finally, we also examine the prices of products that are likely to have been characterized by a high degree of consumer search, even prior to the transparency regulation. We expect that frequently-searched products are likely to have undergone smaller price reductions following the transparency regulation compared with similar, less search-intensive products. In particular, for a given product category, we compare price changes among products that offer the most stringent kosher requirement ("Mehadrin Kosher") with price changes among corresponding products carrying the regular kosher label only. For example, we match a 25-gram package of Osem Bamba peanut snack in the Mehadrin kosher set with a 100-gram package of Osem Bamba peanut snack in the regular kosher set. Ceteris paribus, the majority of Israeli consumers are indifferent between the two kosher options. Yet, certain groups of religious Jewish consumers purchase only goods that fulfill the more stringent kosher requirement, and are thus likely to track their prices. The results, presented in column 4, suggest that the prices of Mehadrin kosher goods decreased significantly less than did those of the corresponding regular kosher products. Overall, these results may suggest that the prices of products that can be characterized by a high degree of search before the transparency regulation decreased less compared with the prices of less-searched-for products.

Figure 1: Monthly Effect on Price Level and Price Dispersion



The figure shows the monthly F.E. from two variants of Equations 1 and 2 in which the effect is estimated for each and every month before and after the regulation went into effect. For each monthly estimate the 95% confidence interval is presented. The figure shows that the change in price dispersion occurred shortly after the regulation became effective, and that the change in price levels materialized later, at the beginning of 2016.

Figure 2: The effects of transparency on prices, by price ranges



The figure shows the relationship between the average price of a group of products and the estimated reduction in prices of that group of products. In particular, we use the post-transparency price data and divide the products into 10 deciles based on the mean price. Each dot in the figure corresponds to one decile and as shown there is a clear negative relationship between the average price and the price reduction. That is, more expensive products experienced a larger price drop.

Table 1: The effect of Price Transparency on Prices of different Types of Products

	Baseline Spec.	Popularity	Private Label 3	Mehadrin Kosher
	(1)	(2)	(3)	(4)
After*Treatment	-0.032**			
	(0.009)			
After*Treatment (property turned off)		-0.046**	-0.030**	-0.033**
		(0.009)	(0.010)	(0.009)
After*Treatment (property turned on)		-0.003	-0.010	0.047**
		(0.009)	(0.010)	(0.011)
P-Val: Property On = Property Off		0.000	0.000	0.000
Store F.E.	✓	✓	✓	✓
Date F.E.	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓	✓
R^2	0.983	0.983	0.978	0.983
N	4981472	4981472	1005062	4981472

The unit of observation is item i in store j in date t

Time period covered 8/2015 - 6/2016

Data set is based on 355 items and 589 stores

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

The table presents regression results using only data from the post-transparency period, focusing on the changes in the prices of 355 items sold in 589 stores affiliated with the five supermarket chains used in the main analysis. In this analysis, the control group is the prices of the same items sold through the online channel of each the chains. The post-transparency period begins in January 2016. In column 1, we estimate Equation **??** and find results qualitatively similar to the ones shown in Table **??**. In column 2, we examine the change in prices of items that are classified based on their popularity. In column 3 we examine the change in prices of private label and branded products including only categories with private label products. In column 5 we examine changes in the prices of items that either follow the more stringent kosher (Mehadrin Kosher) requirements or items that offer standard kosher items including only categories with Mehadrin Kosher products.

Online Appendix No. 2 for "Price Transparency, Media and Informative Advertising"

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September 17, 2019

This appendix contains additional regression results and figures that are referred to from the main text.

- Tables -
  - Table 1 - reports the regression results for effect of price transparency on prices in drugstores, where disclosure was mandated on July 1, 2017.
  - Table 2 - reports the regression results of a chain-specific effect of transparency on price dispersion.
  - Table 3 - reports the regression results that examine the effect of transparency on price dispersion, using the median price of each item sold in each chain in a given month.
  - Table 4 - reports the regression results of price transparency on prices, including a fourth column that focuses on 6 pairs of matched- items, each pair consists from an ICC control item and close substitute item from the treatment group.
  - Table 5 - reports the regression results of price transparency using promotional prices the dependent variable instead of list prices, as shown in the main text.
  - Table 6 - reports the regression results for the differential effect of price transparency on prices set at the five supermarket chains.
  - Table - 7 the effect of price transparency on price dispersion using similar data sampling frequencies before and after the regulation.
  - Table 8 - reports placebo tests using pre-transparency data only, and focusing on five fictitious dates for the beginning date of the transparency implementation.
  - Table 9 - examines strategic response by Super-Pharm to the transparency regulation by allowing the effect on Super-Pharm's prices to depend on the distance of a Super-Pharm store from the nearest supermarket

- Figures -
  - Figures 1 - 2 present photos taken from Mysupermarket.co.il, a price comparison website. Figure 1 demonstrates a price comparison for a single item – Nature Valley bar 6-pack – sold by different retailers. Figure 2 shows a price comparison for a basket of 42 items.
  - Figure 3 - shows a map that marks the locations of the 27 cities in which the 61 treatment group stores are located.
  - Figure 4 - presents a screenshot from Mysupermarket.co.il in which consumers observe prices offered by the online retailers and can choose their preferred retailer to make an online grocery order.
  - Figure 5 shows data on prices for the period after the Israeli Consumer Council began collecting prices in March 2014.
  - Figure 6 shows an example of an ad that advertises specific prices of several items, without a reference to the media
  - Figure 7 - presents the pre-transparency regulation monthly fixed effects from estimating log(price) as the outcome variable and either the online or the ICC control groups
  - Figure 8 - shows the the monthly average basket price and spending on media-based advertising
  - Figures 9, 10 and 11 contain the list of products used in the treatment and in the different control groups
  - Figure 12 - a translation from Hebrew of the transparency regulation

Table 1: The effect of transparency on prices in Drugstores

	(1) # Unique Price	(2) Standard Deviation/Avg.	(3) Percentage Range ($100 * \frac{P_{max}-P_{min}}{P_{max}}$)	(4) log(Price)
After*Treatment	-2.861*	-0.030	-12.880	-0.069**
	(1.226)	(0.048)	(8.845)	(0.013)
Date F.E.	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓	✓
Control Group	Non-Prescription Drugs	Non-Prescription Drugs	Non-Prescription Drugs	Non-Prescription Drugs
Dep. Var. Average Value	8.000	0.173	41.585	
R^2	0.906	0.845	0.818	0.734
N	157	157	157	7867

The unit of observation in column 1 is item i in store j in month t

The unit of observation in columns 2-4 is item i in month t

Panel consists of 5 monthly observations - 10/16, 02/17, 04/17, 07/17 and 08/17

Errors are clustered by store in columns 1-3 and by item in column 4

* $p < 0.05$, ** $p < 0.01$

The table includes the results from a supplementary analysis that exploits a follow up transparency regulation (effective starting on July 1, 2017) which required drug stores to post their prices online. This regulation excludes the prices of non-prescription drugs, which we use as a control group. The price data for all the items during the period before July 1, 2017 and for the non-prescription drugs after July 1, 2017 were collected by RAs. After July 1 2017, we use a price-comparison website to obtain the prices for other products sold in drugstores. Similar to the results described in the main text, the table demonstrates that following the price transparency regulation, price dispersion and price levels decrease.

Table 2: Retailer-specific effect of price transparency on the number of unique prices

	(1) # Unique Prices	(2) # Unique Prices	(3) # Unique Prices
Mega: After*Treatment	-3.431**	-1.667**	-5.644**
	(0.107)	(0.183)	(1.183)
Shufersal: After*Treatment	-3.858**	-1.975**	-7.905**
	(0.147)	(0.189)	(1.232)
Victory: After*Treatment	-2.622**	-1.132**	-2.780*
	(0.095)	(0.198)	(1.249)
Yeinot Bitan: After*Treatment	-3.009**	-1.305**	-3.085*
	(0.086)	(0.189)	(1.252)
Rami Levi: After*Treatment	-3.313**	-1.881**	-4.198**
	(0.094)	(0.198)	(1.266)
Week F.E.	✓	✓	✓
Item F.E.	✓	✓	✓
Lin. Item Time Trend	✓	✓	✓
Control Group	Online	ICC	Super Pharm
R^2	0.681	0.599	0.793
N	37685	25978	6120

The unit of observation in columns 1 and 2 is item i in date t in chain c in treatment/control group

The unit of observation in column 3 is item i in date t in chain c

Time period covered 7/2014 - 6/2016

Errors are clustered by items

* $p < 0.05$, ** $p < 0.01$

The table presents regression results of Equation 1 in the main text, where each column corresponds to a different control group. To account for the size heterogeneity between retailers, each regression controls also for the number of observations that the dependent variable is based on. The results indicate that the reduction in the number of unique prices took place in all chains.

Table 3: The effect of transparency on inter-chain price dispersion

	Standard Deviation/Avg.			Percentage Range ($100 * \frac{P_{max}-P_{min}}{P_{max}}$)		
	(1)	(2)	(3)	(4)	(5)	(6)
After*Treatment	-0.018*	-0.002	-0.013	-4.135**	-2.338**	-5.965*
	(0.008)	(0.002)	(0.012)	(1.351)	(0.378)	(2.167)
Week F.E.	✓	✓	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓	✓	✓
Lin. Item Time Trend	✓	✓	✓	✓	✓	✓
Control Group	Online	ICC	Super Pharm	Online	ICC	Super Pharm
Dep. Var. Average Value	0.136	0.137	0.143	25.458	32.195	30.342
R^2	0.484	0.660	0.618	0.427	0.623	0.708
N	2578	2034	539	2657	2056	539

The unit of observation in columns 1, 3, 4, 6, 7 & 9 is item i in date t in treatment/control group

The unit of observation in columns 2, 5 & 8 is item i in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by items

* $p < 0.05$, ** $p < 0.01$

The Table presents the regression results that examines the change in price dispersion after the transparency regulation. Unlike the analysis in the main text, the sample of prices used for this analysis includes the monthly median price of each item sold in each chain. By using the median price for each chain we focus attention on inter-chain change in price dispersion. The estimates suggest that inter-chain price dispersion has also fallen after the transparency regulation. Yet, most of the change in price dispersion is driven by chains' decision to charge uniform pricing across stores.

Table 4: The Effect of price transparency on prices of comparable items

	(1) log(Price)	(2) log(Price)	(3) log(Price)	(4) log(Price)
After*Treatment	-0.051**	-0.052**	-0.040**	-0.034**
	(0.008)	(0.005)	(0.014)	(0.006)
Store F.E.	✓	✓	✓	✓
Date F.E.	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓	✓
Control Group	Online	ICC	Super Pharm	ICC Comparable
R^2	0.937	0.961	0.909	0.982
N	186810	278228	58358	32988

The unit of observation is item i in store j in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

The table replicates Table 3 in the main text and adds a fourth column that uses prices of the 6 pairs of comparable items included in the treatment group and in the ICC control group. These items were used to construct Figure 4 in the main text. The table reveals a similar qualitative result of transparency on prices- a price reduction of 3.4%.

Table 5: The effect of price transparency using promotional prices

	(1) log(Special Price)	(2) log(Special Price)	(3) log(Special Price)
After*Treatment	-0.061**	-0.044**	-0.048**
	(0.007)	(0.006)	(0.014)
Store F.E.	✓	✓	✓
Date F.E.	✓	✓	✓
Item F.E.	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓
Control Group	Online	ICC	Super Pharm
R^2	0.928	0.950	0.900
N	186810	278228	58358

The unit of observation is item i in store j in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

The table replicates Table 3 in the main text but uses the (log) of promotional price rather than the (log) of list price as the dependent variable. These promotional prices refer to various promotions, such as quantity discounts or offers that are available only to club members. The table reveals similar qualitative result - a price reduction of 4.3-6.1%, depending on the control group being used.

Table 6: Retail-specific effect of price transparency on prices

	(1) log(Price)	(2) log(Price)	(3) log(Price)
Mega: After*Treatment	-0.084**	-0.047**	-0.060**
	(0.008)	(0.005)	(0.014)
Shufersal: After*Treatment	-0.048**	-0.053**	-0.035*
	(0.008)	(0.006)	(0.015)
Victory: After*Treatment	-0.062**	-0.044**	-0.052
	(0.020)	(0.007)	(0.026)
Yeinot Bitan: After*Treatment	-0.025	-0.048**	-0.006
	(0.014)	(0.006)	(0.016)
Rami Levi: After*Treatment	-0.009	-0.002	0.021
	(0.008)	(0.006)	(0.015)
Store F.E.	✓	✓	✓
Date F.E.	✓	✓	✓
Item F.E.	✓	✓	✓
Linear Item Specific Time Trend	✓	✓	✓
Control Group	Online	ICC	Super Pharm
R^2	0.937	0.962	0.911
N	186810	274669	57734

The unit of observation is item i in store j in date t

Time period covered 7/2014 - 6/2016

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

The Table presents the regression results of a version of Equation 2 in which the post-transparency indicator is interacted with each supermarket chain dummy. As shown in the table, the regression results, for each of the control groups, suggest that prices have significantly declined for the large, more upscale chains (i.e., Mega and Shufersal) and have not changed for the heavy discount chains (i.e. Rami Levy). These results support H3 in the main text.

Table 7: The effect of transparency on price dispersion, using similar sampling frequencies

	# Unique Prices			Standard Deviation/Avg.			Percentage Range ($100 * \frac{P_{max}-P_{min}}{P_{max}}$)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
After*Treatment	-10.941**	-8.278**	-8.082**	-0.151**	-0.053**	-0.049**	-37.600**	-12.824**	-11.712**
	(0.625)	(0.831)	(0.828)	(0.023)	(0.013)	(0.013)	(3.027)	(2.584)	(2.503)
Week F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lin. Item Time Trend	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control Group	Online	ICC 1	ICC 2	Online	ICC 1	ICC 2	Online	ICC 1	ICC 2
Dep. Var. Average Value	16.265	17.317	17.317	0.211	0.211	0.211	55.006	55.642	55.642
R^2	0.836	0.828	0.823	0.459	0.615	0.614	0.637	0.752	0.748
N	2657	2070	2068	2568	2042	2042	2657	2070	2068

ICC 1 refers to taking a single random week within month in the ICC-after period, but this week is the same for all stores

ICC 2 refers to taking a single random week within month in the ICC-after period, but this week may differ across stores

Time period covered 7/2014 - 6/2016

To account for the different sampling frequencies in the different data sources,

keep a single observation for each item-treatment-month tripplet.

For the treatment-after, and online before and after keep the last obs. per month

For the ICC after keep a single week chosen at random.

Errors are clustered by items

* $p < 0.05$, ** $p < 0.01$

The table presents several specifications that investigate the robustness of our findings on the impact of transparency on price dispersion. These specifications address the concern that the sources of our pre- and post- data are different and that may drive our results. More details on these specifications is presented in section 5.2 in the main text. The results of these additional checks confirm our initial analysis that the reduction in price dispersion and the shift to uniform pricing is driven by price transparency,

Table 8: The effect of transparency - placebo test for the implementation date of the regulation

	(1) log(Price)	(2) log(Price)	(3) log(Price)	(4) log(Price)	(5) log(Price)	(6) log(Price)	(7) log(Price)	(8) log(Price)	(9) log(Price)	(10) log(Price)
After*Treatment	0.024	0.003	0.010	0.021	0.028	0.000	0.001	-0.005	-0.008	0.011
	(0.013)	(0.018)	(0.021)	(0.023)	(0.035)	(0.008)	(0.007)	(0.008)	(0.016)	(0.007)
Placebo Date	15/9/14	15/10/14	15/12/14	15/2/15	15/3/15	15/9/14	15/10/14	15/12/14	15/2/15	15/3/15
Store F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Date F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Item F.E.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Linear Item Spec. Trend	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Control Group	Online	Online	Online	Online	Online	ICC	ICC	ICC	ICC	ICC
R^2	0.873	0.873	0.873	0.873	0.873	0.925	0.925	0.925	0.925	0.925
N	34417	34417	34417	34417	34417	42186	42186	42186	42186	42186

The unit of observation is item i in store j in date t

Time period covered 7/2014 - 7/2015

Five different placebo dates are used

Errors are clustered by stores

* $p < 0.05$, ** $p < 0.01$

The table contains placebo regressions using price data from time periods earlier than the implementation of the transparency regulation. It aims to address the concern that other (unobserved) events that occurred prior to the implementation of the reform are the driving forces of the results. Columns 1-5 uses the online control group and columns 6-10 uses the ICC control. For each control group, five specifications are estimated, each using a different date as the fictitious date for the implementation of the reform implementation. The non-significant point estimates of the $After \times Treatment$ variable demonstrate that it is unlikely that the results are driven by an (unobserved) event that occurred prior to the regulation.

Table 9: The effect of price transparency considering a strategic response by Super-Pharm

	(1) log(price)	(2) log(price)	(3) log(price)
04/15	0.011	0.014	0.013
	(0.010)	(0.017)	(0.013)
10/15	-0.036**	-0.028	-0.038**
	(0.010)	(0.016)	(0.014)
04/16	-0.049**	-0.041*	-0.048**
	(0.011)	(0.016)	(0.016)
04/15 * Close Competitor Indicator		-0.005	
		(0.020)	
10/15 * Close Competitor Indicator		-0.014	
		(0.020)	
04/16 * Close Competitor Indicator		-0.012	
		(0.020)	
10/15 * Distance (meter)			-0.000
			(0.000)
04/15 * Distance (meter)			0.000
			(0.000)
10/16 * Distance (meter)			-0.000
			(0.000)
Store F.E.	✓	✓	✓
Date F.E.	✓	✓	✓
Item F.E.	✓	✓	✓
R^2	0.887	0.887	0.887
N	2386	2386	2386

The unit of observation is item i in Super Pharm store j in month t

Data were collected in four months: 10/14, 04/15, 10/15 and 04/16

Errors are clustered by store

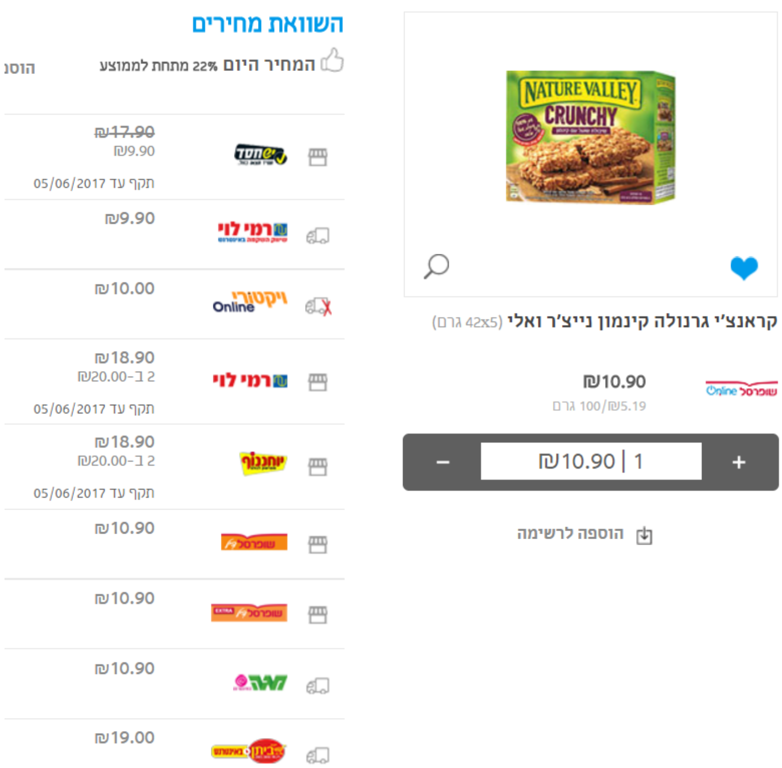
The omitted month is 10/15

Close competitor indicator = 1 if the closest supermerket is located less than 204 meter, which is the median distance

* $p < 0.05$, ** $p < 0.01$

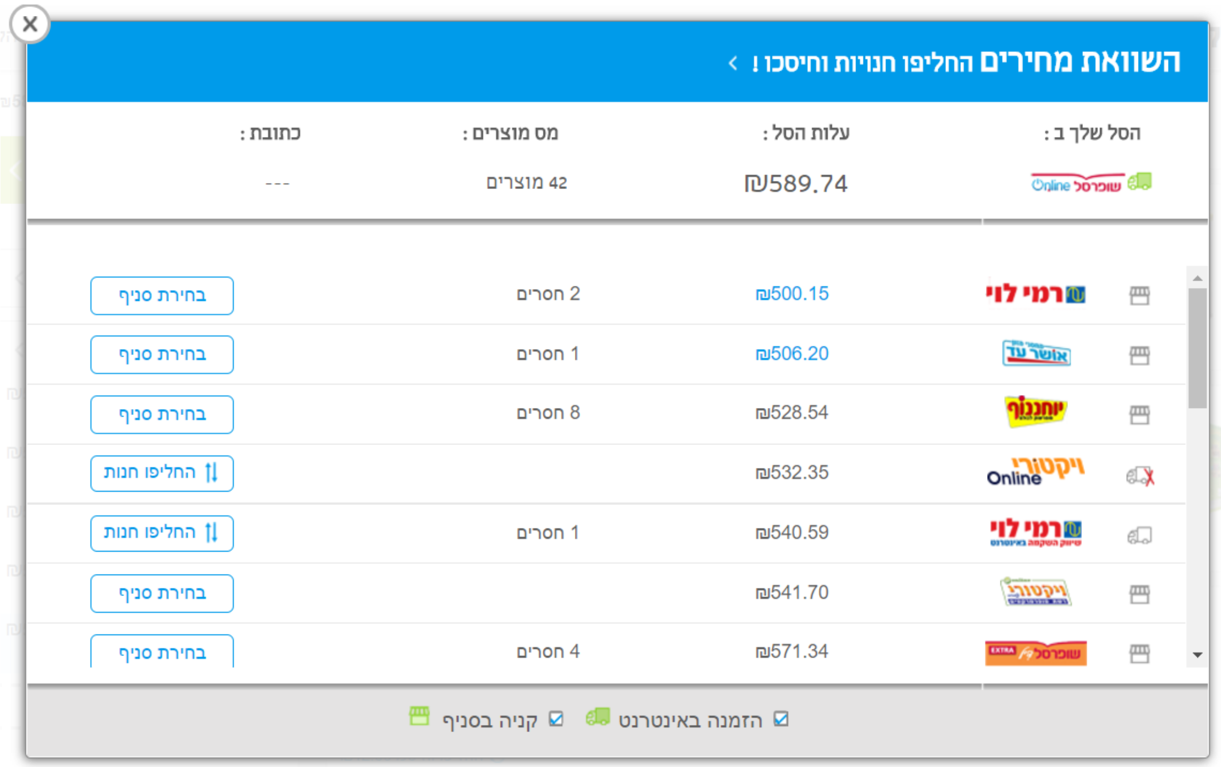
The table examines the extent to which Super-Pharm pricing is affected by the proximity to competing supermarkets. The analysis is based on price data from Super-Pharm's stores before and after the transparency regulation took effect in May 2015. For each drugstore, we measure the distance to the closest supermarket. The regression presented in column 1 abstracts from strategic response, while the regressions presented in columns 2 and 3 allow the month F.E. to depend on the distance from the closest supermarket. In column 2 the distinction is between stores that are below or above the median distance from the closest supermarket. In column 3 the effect of the distance on the month F.E. is assumed to be linear in the distance. The table demonstrates that while prices decreased over time, this price reduction is not correlated with the distance from the closest supermarket.

Figure 1: Single item price comparison



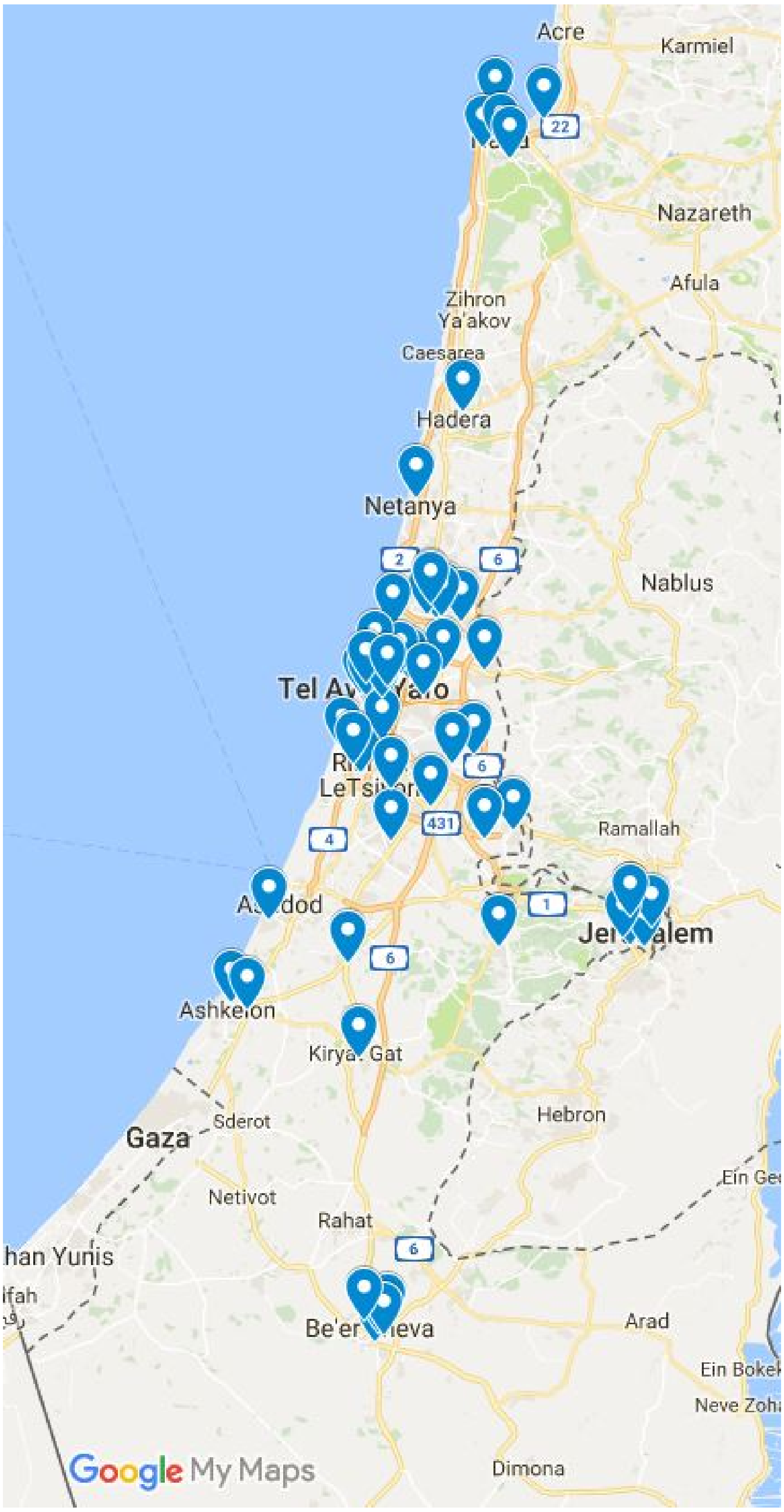
The left side of the figure includes a list of retailers, sorted by price, that sell the item whose photo is shown on the right side of the figure. The small icon located to the right of the retailer name indicates whether the quoted price refers to a physical store of that retailer (indicated by a stand) or to an online store (indicated by a truck).

Figure 2: An example for a price comparison from a price comparison platform



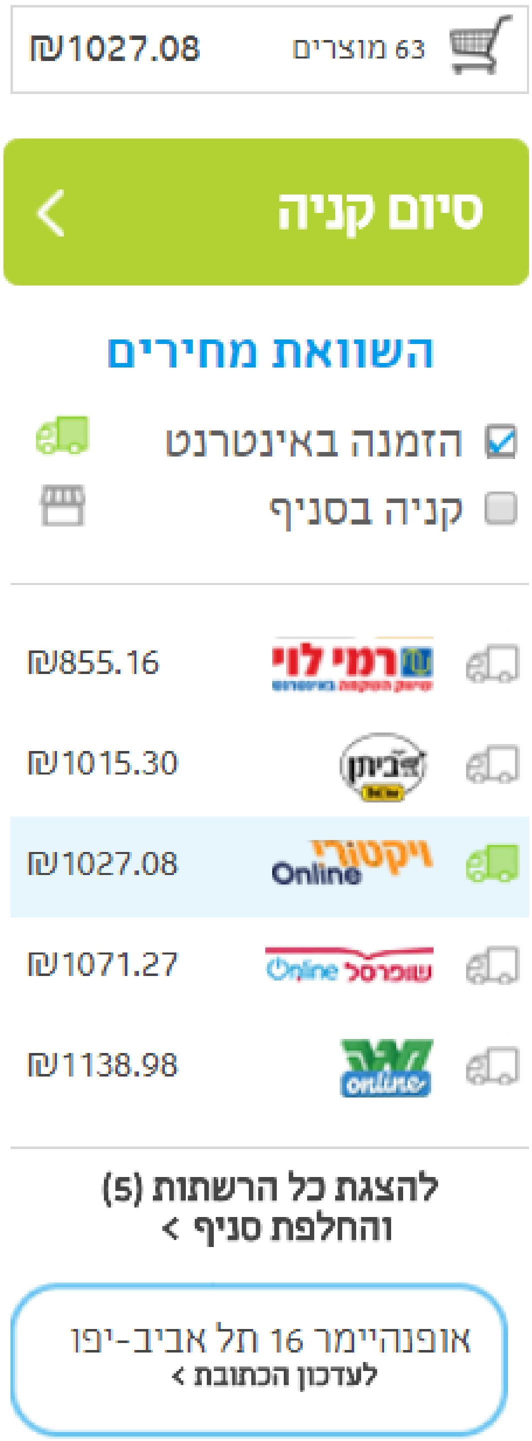
The Figure shows a comparison of the price of a basket of items taken from mysupermarket.co.il, a price comparison platform. The baskets are sorted by price. The first column refers to the name of the retailer. The second refers to the basket price and the third indicates the number of items that are unavailable in the corresponding retailer. The small icon located to the right of the retailer name in the first column indicates whether the quoted basket price refers to a physical store of that retailer (indicated by a stand) or to an online store (indicated by a truck).

Figure 3: Map of store locations



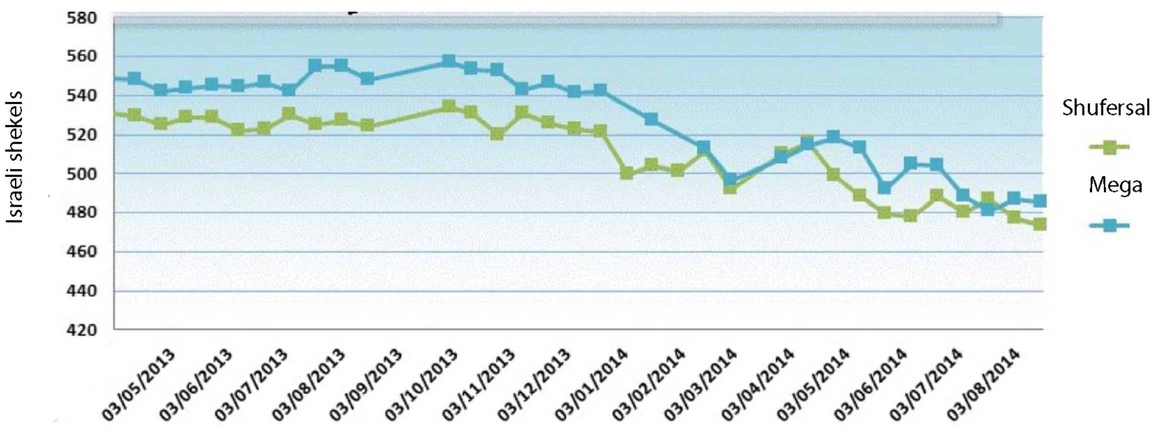
The figure shows the locations of the 61 stores comprise the treatment group. These stores are located in 27 different cities.

Figure 4: Online shopping platform



The Figure shows a screenshot from MySupermarket.co.il webpage where consumers observe the respective price by each online retailer and can choose which online retailer they want to order from. Rami Levi, the heavy discount chain offers the cheapest price for this basket (855 shekels).

Figure 5: ICC basket prices

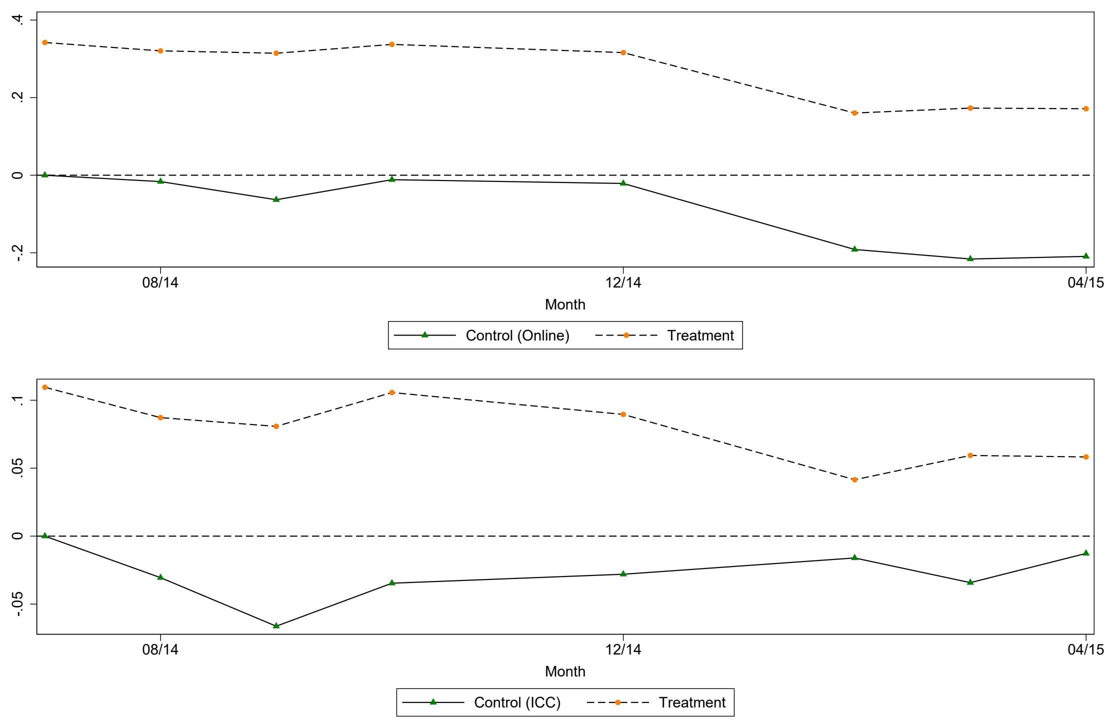


The figure shows the basket price of ICC products after the ICC began collecting prices in April 2013, nearly 2 years before the transparency regulation came into effect. The figure shows that prices of the ICC items have declined few months after the ICC began collecting these prices, providing suggestive evidence that transparency resulted in lower prices for these items.

Figure 6: An example of promotional/price advertising

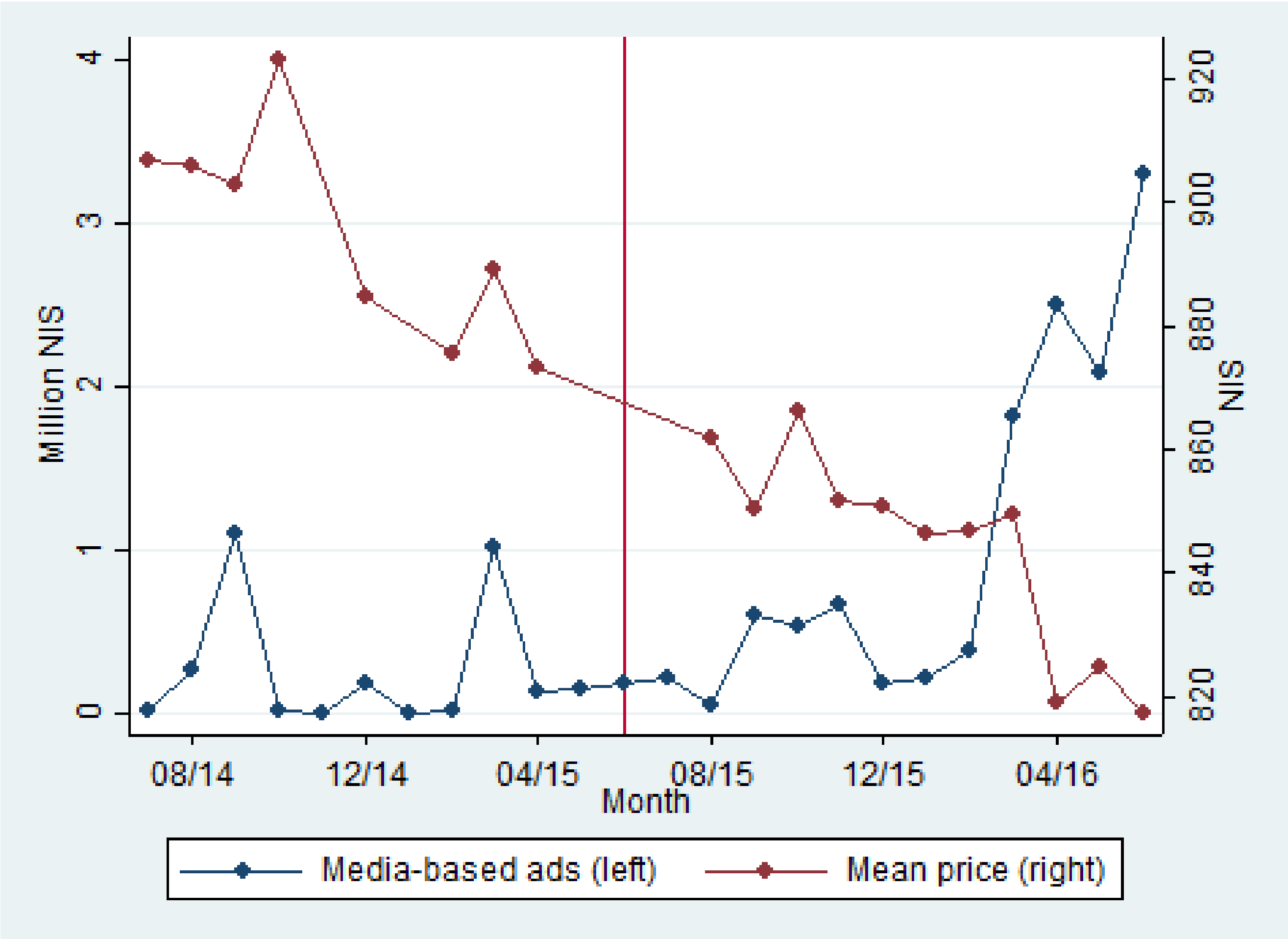
The Victory supermarket chain ad includes several price promotions for products sold in its stores. Unlike the previous examples, there is no reference to a particular media source.

Figure 7: Validating the parallel time trend assumption



Each figure presents the pre-regulation period group specific monthly effects estimated in regressions using log(price) as the dependent variable. Figures are distinguished by the control group used in each of them. The upper figure is based on the online control and the lower figure is based on the ICC control.

Figure 8: Basket price and spending on media-based ads



The figure shows the monthly average price of the basket of items in the treatment group (blue, left vertical axis) and spending by the hard-discount chain on media-based ads (red, right vertical axis). As can be seen in the figure, after the transparency regulation came into effect, item prices fell as spending on media-based ads increased. This figure complement Figure 8 in the main text which shows that as spending on media-based ads increased the estimated effect of transparency on prices became more negative.

Figure 9: List of products in the treatment group (1)

Product name + size	Producer/Brand
H&S shampoo & classic formula (600 ml)	**P&G**
roll-on deodorant original (50 ml)	**Dove**
mouthwash (500 ml)	**Aquafresh**
laundry detergent (112, 4.5 liters)	**Ariel**
nourishing body wash (750 ml)	**Dove**
toothpaste rapid relief (75ml)	**Sensodyne**
chocolate chip and cereal bars (18x8 g)	**Thelma**
organic ketchup (750 grams)	**Oleander**
trash bags (60, 65x54)	**Sano**
trash bags with string (64x52, 60)	**Nicol**
aluminum foil (30cm)	**Nicol**
aluminum foil (30cm)	**Diamond**
dishwashing liquid classic (750 ml)	**Palmolive**
fabric softener blue (4 liters)	**Badin**
razor blades mach3 (4)	**Gillette**
sensitive skin shave gel (200 ml)	**Gillette**
sensitive skin shave gel (200 ml)	**Edge**
deodorant gel blue for men, 24/7 (85g)	**Speedstick**
classic snack timeout (45 grams)	**Elite**
deodorant gel clear sound wave (70 ml)	**Gillette**
toothpaste gel (100ml)	**Colgate**
mouthwash (400 ml)	**Meridol**
insecticide k300 (630 ml)	**Sano**
dry hair conditioner (700 ml)	**Hawaii**
body wash passion fruit (750 ml)	**Crema**
classic corn flakes champions (750 g)	**Thelma**
instant coffee kroning (200g)	**Jacobs**
dishwashing liquid classic (750 ml)	**Fairy**
decaffeinated diet coke (1.5 liter)	*Coca cola*
green tea (25)	*Vysotsky*
bbq-flavored potato chips (169 g)	*Pringles*
bisli flavored snack grill (200g)	*Osem*
chocolate milk 2% (2 liters)	*Yotvata*
heineken beer (330x6 ml)	*Heineken*
actimel (100x8 ml)	Danone
aluminum foil (30cm)	Sano
aluminum foil (30cm)	Private label
buorekas cheese (frozen, 16 pieces - 800 g)	Soglowek
canned corn (550g)	Yakhin
chicken flavor base soup (mehadrin, 400g)	Knorr
chicken sausages (1kg)	Soglowek
chicken schnitzel (frozen, 700g)	Of tov
chocolate milk 2% (225x8 ml)	Yotvata
chocolate powder (500g)	Elite Strauss
chocolate powder (500g)	Private label

The figure presents the list of products in the treatment and in the online control groups. Items in bold are also used in the Super Pharm control group, and underlined text items are used in the analysis of the comparable group of items. In figures 9 and 11 we present the remaining items in the treatment group and the items in the ICC control group.

Figure 10: List of products in the treatment group (2)

chocolate wafers (1 kg)	Elite Strauss
classis corn flakes (750 g)	Kellogg's
cornflakes (750g)	Private label
dry dog food (3 kg)	Bonzo
fresh yeast (50 g)	Shimrit
healthy tofu (300g)	Rural health
instant coffee (200g)	Private label
ketchup (700ml)	Heinz
ketchup (700ml)	Private label
mayonnaise (394ml)	Helman's
mayonnaise (430ml)	Heinz
mayonnaise (500ml)	Thelma
mayonnaise (500ml)	Private label
trash bags (65x52, 60)	Private label
pastrami tabor 1% fat (330 grams)	Soglowek
red cabbage salad (400g)	Sabra
sliced mushrooms (400g)	Willifood
squeezed orange juice (1 liter)	Primor
thousand island dressing (290 ml)	Osem
trash bags with string (60, 65x52)	Glillonit
whole wheat crackers with bran (230 g)	Osem
whole wheat spaghetti	Barilla
whole wheat spaghetti (500g)	Osem
coke (1.5x6 liter)	*Coca cola*

The figure presents the remaining list of products in the treatment and in the online control groups.

Figure 11: List of products in the ICC control group

ICC items	Producer/Brand
cottage cheese (5% 250g)	Tnuva
green olives without beads (560g)	Bet Hashita
instant coffee (200g)	Elite
milky chocolate puding (170 ml)	Strauss
preapred cake (400g)	Osem
advance plus baby formula (step 1, 900g)	Similac
bio white yoghurt (3%, 200g)	Yoplait
canned corn (550g)	Pri hagalil
canola oil (1 liter)	Olive tree
chicken breast (1200g)	Chicken oz
chicken breast (500g)	Tevaof
chocolate bar para (100g)	Elite
chocolate spread (500g)	Hashachar
corn schnitzel (frozen, 750g)	Tivol
cucumbers in vinegar (medium, 560g)	Bet Hashita
hummus (500g)	Strauss
ketchup (750ml)	Osem
mineral water (1.5x6 liter)	Neviot
moisturizing shampoo for dry hair (700ml)	Hawaii
orange soft drink (1.5 liters)	Spring
rice (1kg)	Sugat
sliced semi-hard cheese (28%, 200g)	Emek Tnuva
sour cream, Ski (250g)	Strauss
toilet paper (48)	Molett
turkish coffee (100g)	Elite
whole wheat spaghetti (500g)	Osem
taster's choice instant coffee (200g)	*Nescafe*
classic dishwashing liquid (750 ml)	Sod
coke (1.5 liters)	*Coca-cola*
tea classic (100)	*Vysotsky*
natural ruffles tapuchips (50g)	*Elite*
bamba peanut snack (80g)	*Osem*
bulgarian cheese (5%, 250g)	*Piraeus*
selected merlot wine (750 ml)	*Carmel*
white sugar (1 kg)	Sugat
lemons (1kg)	
rice (1kg)	Private label
chicken breast	Private label
canned corn	Private label
apples (1kg)	
onions (1kg)	
tomtatos (1kg)	
potatos (1kg)	
carrots (1kg)	

The figure presents the list in the ICC control group. Items in underlined text are also used in the analysis of comparable products discussed in the main text.

Figure 12: Translation of the transparency regulations

Regulations for Promotion of Competition in the Food Industry (Price Transparency)

1. In these regulations -
"Website" - a website of a large retailer;
"Barcode" - an identification number imprinted on or related to the product, used to identify the product of a large retailer;
"Total price" - as defined in section 29 of the Law.

2. A large retailer will publish to the public on its website, its chain of stores and, separately for each of its stores, the updated total price at the time of publication of each commodity sold in its stores in this manner:
(1) The website of the retail chain will be published on the website, as well as the file of commodities and prices and a collection of promotions for each of its stores separately (hereinafter - the files);
(2) file names must contain a fixed prefix consisting of network code, subnet code, and store number; In addition, each file name will include a time stamp (TIME STAMP) that includes the time and time of the file delivery;
(3) The chain of stores of the chain shall be in a uniform structure and shall include all and only the fields, as specified in the First Addition;
(4) The list of commodities and prices shall be in a uniform structure and shall include all and all the fields, as specified in the Second Addition;
(5) The promotion file shall be in a uniform structure and shall include fields as specified in the Third Addition.
(6) The promotional code shall be as specified in the Fourth Addition;
(7) The promotional data files will be in an XML format.

3. A large retailer will update the files on the website as follows:

(1) Every day on which a branch of a large retailer is opened, a large retailer shall publish the file of goods and prices and the complete list of promotions, no later than the opening hour of the store;
(2) no later than one hour from the date of update in the store's stores as stated in section 30 (a) of the Law, a large retailer will publish an update to the list of commodities and prices and the promotions, including all updates that occurred on that day. This update will include, inter alia, changes in the prices of commodities, including promotions, the addition of records for new commodities and the removal of records of goods whose sale has ceased;

4. A large retailer will allow access to advertising on the website in this manner:

(1) The files may be downloaded in XML, Excel, Gzip and Deflate format as well as printing them;
(2) Every surfer will be able to retrieve any file on an ongoing basis; For this purpose, sufficient capacity of computer resources will be provided for recording, storing, and retrieving files;
(3) The availability of the website will be at least 99.5%.

5. A large retailer will keep the files, including their updating, for a period of three months from the date of their publication.