

# Price Transparency, Media and Informative Advertising\*

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## Abstract

We study the effects of a regulation that required Israeli supermarkets to post online the prices of all items sold in their brick-and-mortar stores. 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, primarily in premium chains. Price dispersion has also dropped as chains adopted a uniform pricing strategy, setting similar prices across same-chain stores. To uncover the underlying mechanisms, we test predictions based on Robert and Stahl (1993). Consistent with these predictions we find that following the transparency regulation: (1) hard-discount chains extensively used ads stressing their low prices; (2) to gain credibility these ads referenced to price-comparison surveys which were frequently conducted by the media; (3) the use of media-based ads increased during weeks in which prices declined; (4) price-comparison websites that became available were hardly accessed by consumers. Our findings highlight the importance of the media in facilitating informative advertising, and the role of advertising in promoting competition.

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# 1 Introduction

Information is an essential ingredient of efficient markets and perfect competition. In recent years, lawmakers aiming to reduce prices in different markets have introduced price transparency regulations that require firms to disclose their prices online. Such regulations typically take advantage of the Internet as an effective, cheap means to disseminate price information. For instance, gasoline prices in Germany, Italy, Australia, South Korea and Chile are now available online. Attempts to curb health costs have also triggered regulations that require health care providers to disclose online price information.<sup>1</sup> In Argentina, Uruguay and Mexico, governments require food retailers to post online the prices of many of the products that they sell.<sup>2</sup> Despite the growing popularity of price transparency regulations, little is known on their effects on market equilibrium outcomes, such as price levels, price dispersion and advertising choices. Given that sales in brick-and-mortar markets still account for about 85-90% of retail sales,<sup>3</sup> one can expect that the adoption of online price transparency regulations will further expand, making the study of the effects of such regulations of interest to consumers, firms, and policy-makers alike.

In this paper, we begin to fill these gaps by studying the impact of a price transparency regulation in the Israeli food retail industry. The food retail industry is a meaningful domain in which to begin unpacking the economic effects of price transparency regulations. First, consumers spend about one-sixth of their disposable income on food, making the potential welfare impact of such regulation considerably large. Second, analyzing choices by firms that sell thousands of products, like supermarkets, can be interesting from a theoretical perspective, especially since standard theoretical models of consumer search and firm advertising consider single-product settings,

In 2011, social protests in Israel regarding, among other concerns, the high prices of food ultimately culminated in the legislation of the Food Act in March 2014. According to the Food Act, supermarket chains were required starting in May 2015 to post online the prices of each and every item sold in their stores and to update these prices continuously. Independent websites began to offer consumers free price comparison services shortly after. We take advantage of these changes to study the impact of marketwide information on food prices, and to characterize the post-transparency equilibrium. In doing so, we illustrate how pricing, advertising and consumer search choices are linked and can be explained based on the equilibrium framework developed by Robert

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<sup>1</sup>In the US, [www.wsj.com/articles/white-house-pushes-for-more-transparency-on-health-care-prices-11557945220](http://www.wsj.com/articles/white-house-pushes-for-more-transparency-on-health-care-prices-11557945220) and worldwide, [www.economist.com/business/2019/05/21/the-global-battle-over-high-drug-prices?cid=cust/dailypicks/n/bl/n/20190521n/owned/n/n/dailypicks/n/n/NA/243352/n](http://www.economist.com/business/2019/05/21/the-global-battle-over-high-drug-prices?cid=cust/dailypicks/n/bl/n/20190521n/owned/n/n/dailypicks/n/n/NA/243352/n).

<sup>2</sup>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>).

<sup>3</sup>According to the US Census Bureau, sales from e-commerce for U.S. retailers were \$ 389.1 billion in 2016 - up 14.4 percent from \$340.2 billion in 2015 - overall accounting for 8% of total retail sales. <https://www.census.gov/content/dam/Census/library/publications/2018/econ/e16-estats.pdf> In the UK, e-commerce turnover in 2017 was 15.6 billion Eur - 13.65% increase from 2016 - overall accounting for 16.4% of total retail sales. See, <https://ecommercenews.eu/ecommerce-in-uk-grew-to-e15-6-billion-in-2017/>.

and Stahl (1993). To the best of our knowledge, this is the first study that uses an equilibrium framework to explain how firms and markets respond to changes in advertising and search costs. Obtaining better understanding how price transparency, advertising and search interact, and jointly determine equilibrium outcomes is essential for the design of 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 such data might not be readily available. A second challenge is to control for additional factors, aside from transparency, 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. Our research design enables us to address these concerns. 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 covered multiple items sold in multiple stores and chains throughout Israel. For the period after the regulation went into effect (the post-transparency period), we collected data from one of the price comparison platforms that began to operate after the transparency regulation became effective. To address the second, and perhaps more concerning challenge, we rely on several distinct complementary control groups which enable us to identify the effects of the transparency regulation. That is, the identification comes from comparing changes in prices of “treatment” items whose prices became transparent only after the regulation, against price changes in four distinct control groups, as follows.

The first control group consists of the same products included in the treatment group, but sold in the online channels of the supermarket chains whose products are used in the analysis. These items constitute a useful control group because their prices were transparent both before and after the transparency regulation became effective. The second control group consists of products that are sold in traditional stores and do not overlap with the products in our treatment group and whose prices are periodically collected by the Israeli Consumer Council (ICC). The prices of these products are often cited in the media and mentioned 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. The third and fourth control groups consist of products that overlap with the items in the treatment group, but are sold in stores that were exempt from the transparency regulation: drugstores and mom-and-pop grocery stores, respectively. Although each of the control groups might be subject to critique, they complement one another, such that when taken together, they enable us to rule out many alternative explanations for any effects observed. Notably, our analyses yield consistent results

across the four control groups, giving us confidence that the 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 prices within chains were diverse before the regulation, and that after prices became transparent price dispersion dropped. In particular, we show that the drop in price dispersion was driven by supermarket chains' decision to adopt a uniform pricing strategy, setting identical prices across the stores affiliated with a single chain. Figure 1 presents a time series of the average number of distinct prices per item in the treatment group and for the first and second control groups, i.e., items that were sold through chains' online channels, and items in the ICC basket. According to the figure, before the transparency regulation came into effect, the average number of distinct prices in each of the two control groups was smaller than the number of distinct prices in the treatment group. Quickly 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, prices of items in the treatment group decreased 4 to 5 percent more than did the prices of items in the various control groups. We also find that prices primarily decreased among chains that were more expensive and in supermarkets that faced weaker local competition.<sup>4</sup>

The empirical findings regarding price levels and price dispersion suggest that the availability of information facilitated by the transparency regulation was driving 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 price advertising and optimal consumer search into one theoretical framework. Robert and Stahl characterize a unique price-dispersion equilibrium in which a firm either charges high price that is not advertised, or sets a lower price that is advertised. They further show that advertising will increase during periods in which prices are set lower, and that in equilibrium consumers do not engage in search. To test these predictions, we use detailed advertising data which includes, inter alia, the specific content of each ad, the advertiser identity and the cost of each ad. We show that after prices became transparent, hard-discount supermarket chains spent considerably more resources on ads that highlighted their low prices, while other chains did not. In particular, we show that ads by hard-discount chains specifically referenced to price-comparison surveys which were extensively conducted by the media after the regulation. The media was conducting more price-comparison surveys after the regulation

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<sup>4</sup>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 private-label products, and that prices of popular and cheaper goods fell less.

because the cost of implementing such surveys has fallen dramatically in light of the regulation. Thus, hard-discount chains used price-surveys by the media to provide consumers with credible information about prices. We also provide support to the other predictions of [Robert and Stahl \(1993\)](#). We show that the use of media-based ads increased when prices decreased, and consumer usage of the freely available price-comparison websites is limited. Thus, our findings 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 obtain price information. Subsequently, large literatures emerged on both consumer search and firm advertising <sup>5</sup> The rise of the Internet and e-commerce provided researchers a unique opportunity to test the role of consumer search. Somewhat surprisingly, this massive research effort ignored the second channel highlighted by Stigler – that firms themselves could take advantage of the readily available information and through advertising provide it to consumers.<sup>6</sup> Our paper addresses this gap in the literature and offers several contributions. First, we contribute to the advertising literature by illustrating how supply-side incentives of advertisers change as prices become transparent, or alternatively when the cost of informative advertising falls. In their survey, [DellaVigna and Gentzkow \(2010\)](#) mention there are only two studies ([Glazer \(1981\)](#), [Milyo and Waldfogel \(1999\)](#)) that exploit inter-temporal variation in the cost of advertising to examine its impact on prices.<sup>7</sup> Our study adds to this small set of papers using a considerably larger set of products, and being able to better address concerns regarding the selection of products being advertised. Perhaps more importantly, to the best of our knowledge, we are the first that use an equilibrium framework to examine how market outcomes change following the change in the cost of advertising. We are also the first to consider both both the role of firm advertising and consumer search as two interrelated channels through which prices are determined in equilibrium.

Second, our findings are valuable to understanding the effects of mandatory price disclosures, which various countries have either adopted or consider to adopt. The outcome of such regulations is ex-ante not clear 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. \(2005\)](#)). Furthermore, unlike the vast literature on voluntary price disclosure, typically in online markets (e.g., [Brown and Goolsbee \(2002\)](#), [Brynjolfsson and Smith \(2000\)](#) and the

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<sup>5</sup>Related surveys are: [Baye et al. \(2006\)](#), [Anderson and Renault \(2016\)](#) for search; and [Bagwell \(2007\)](#) and [Renault \(2015\)](#) for advertising.

<sup>6</sup>In fact, recent papers have emphasized ways that firms can manipulate online information, trying to increase consumer search costs. For instance, [Ellison and Ellison \(2009\)](#), [Spiegler \(2011\)](#), [Allender et al. \(2018\)](#).

<sup>7</sup>[Milyo and Waldfogel \(1999\)](#) 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.

survey by [Goldfarb and Tucker \(2019\)](#)), very few studies examine the impact of mandatory price disclosure. The distinction between voluntary and mandatory disclosure is important because selection concerns regarding the decision to disclose prices, or which retailers decide to disclose their prices can potentially bias the results. The few previous 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 required firms to post prices online. He finds that gasoline prices in Chile have increased after prices become transparent, and obtains inconclusive evidence regarding price dispersion.<sup>8</sup> In contrast to these studies, this paper studies a marketwide online transparency regulation in the supermarket industry, an industry that firms are typically larger than gasoline stations, advertise more, and sell thousands of products. Our results on both price dispersion and price levels are different from the results in the gasoline market, and we also highlight the role of advertising and the media as important information channels.

Third, study adds to the media literature showing how it used by firms to gain credibility for their ads, and how such decisions affect equilibrium prices. The importance of the media as a reliable aggregator of data is likely more important for multi-product firms which cannot advertise the prices of all the items that they sell.<sup>9</sup> Furthermore, our findings that retailers use media reports as a credible information source speak to the persuasive role of the media ([DellaVigna and Gentzkow \(2010\)](#)). Fourth, recent research (e.g., [DellaVigna and Gentzkow \(Forthcoming\)](#), [Cavallo \(2018\)](#)) has been exploring the prevalence of uniform pricing in various retail markets, trying to explain why retailers prefer it over price discriminating across locations, as standard theory predicts. Our findings, showing that retailers moved to setting similar prices in all stores affiliated with the same chain shortly after prices became transparent, suggest that brand-image concerns are likely driving this decision. Finally, 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 have contributed to low levels of inflation in recent years in the US. Our findings offer the first evidence for a causal link between online price transparency and price levels.<sup>10</sup>

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<sup>8</sup>Two other studies that we are aware of that examine 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 the 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 prices of ready-mixed concrete changed.

<sup>9</sup>Loss leader pricing is another means to address such difficulties (e.g., [Lal and Matutes \(1994\)](#), [Ellison \(2005\)](#)).

<sup>10</sup>Our study is also related to studies on the retail industry in general ([Basker \(2016\)](#), [Hitsch et al. \(2017\)](#)) and in the supermarket industry in Israel and elsewhere (e.g., [Hendel et al. \(2017\)](#), [Eizenberg et al. \(2017\)](#), [Matsa \(2011\)](#), [Pozzi \(2013\)](#)).

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.<sup>11</sup> 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. 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 items are growing but still account for a relatively small fraction of total grocery sales in the Israeli food market, about 5% in 2014.<sup>12</sup> 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.<sup>13</sup>

Food prices in Israel had been rising fast between 2005 and 2011.<sup>14</sup> 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 social protests that took place in Israel in the summer of 2011 (Hendel et al. (2017)). It is often said that, following the social protests, Israeli consumers became more price-conscious and more likely to search for

<sup>11</sup><http://www.cbs.gov.il/statistical/mb158h.pdf>

<sup>12</sup>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](https://mof.gov.il/chiefecon/economyandresearch/doclib/skiracalcalit_20180429.pdf) and <https://www.storenex.co.il/wp-content/uploads/2016/01/Summary-of-2015-English.pdf>.

<sup>13</sup><https://en.globes.co.il/en/article-1000536001>.

<sup>14</sup>According to the Kedmi Committee report, the cumulative annual growth rate of food prices between was 5%, compared with 2.1% increase for the period January 2000 to September 2005, and compared with 3.2% in OECD countries for the same period. See page 8 in <http://economy.gov.il/publications/publications/documents/kedmiereport2012.pdf>.

low-priced items. 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 (the Kedmi Committee). 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.<sup>15</sup>

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."<sup>16</sup> In an op-ed, Prof. Yossi Spiegel called on the government "to reconsider the mass experiment that consumers are subjected to."<sup>17</sup> Perhaps more surprising was that supermarket chains also opposed the transparency regulation on the ground that it may help chains 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.<sup>18</sup>

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

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<sup>15</sup>The regulation requires each supermarket chain to upload to a designated website files 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. 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 the Online Appendix, 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>

<sup>16</sup>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)).

<sup>17</sup>See <http://www.themarket.com/opinion/1.2506245>.

<sup>18</sup><https://www.themarket.com/markerweek/1.2288058>.



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](http://MySupermarket.co.il), [Pricez.co.il](http://Pricez.co.il) and [Zapmarket.co.il](http://Zapmarket.co.il). Figures 1 and 2 in the online Appendix present photos taken from [Mysupermarket.co.il](http://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 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 offer a challenging setting for the study of pricing decisions, as they sell thousands of items, which may all 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

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 rich post-transparency data that correspond to a larger array of products and stores, in addition to data on local competition and on products' characteristics. These data will be primarily used to examine the effects of transparency on price dispersion and price levels. After describing the price data, we discuss the data sources on advertising expenditures and on usage of the price-comparison websites, which we use in subsection 4.1 to examine the potential channels underlying 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 the Online Appendix 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. During the pre-transparency period, we used a market survey firm to collect the prices of these items. The data collection by the market survey firm 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.<sup>19</sup>

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

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<sup>19</sup>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 rely on data from the Israeli Census (CBS) for the pre- and post- time periods and show that our results are qualitatively similar.

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. Unlike prices at brick-and-mortar stores, which were typically determined locally and varied across stores (even within a single chain), prices of items sold online are determined at the national level and are not dependent on the customer’s location. 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 the Online Appendix shows a screenshot from the online platform, where consumers can compare and choose among the online retailers. 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.* This control group comprises 38 products sold in hundreds of stores throughout Israel, whose prices are collected by the ICC, the largest consumer organization 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 point 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 are 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.<sup>20</sup> 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.<sup>21</sup> In this figure, we observe that pre-transparency prices of products in the control group ICC and in the treatment behave quite similarly. Furthermore, after prices became transparent, prices of items in the treatment group declined substantially more than did the items in the ICC 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 were not available for sale online.<sup>22</sup> The prices at Super-Pharm stores were collected by our 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 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 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. Given the small number of items in the latter 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. Table XX in Online Appendix 2 provides more details on the

<sup>20</sup>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 the Online Appendix.

<sup>21</sup>The choice of these pairs also follows from a more systematic measure of distance across product characteristics.

<sup>22</sup>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 at Super-Pharm declined soon after its prices became transparent.

products associated with the treatment and each of the control groups.

*Additional data for the price analyses.* Most of our analyses rely on the data collected for the treatment and control groups, as elaborated above. After the transparency regulation went into effect, the price collection became less cumbersome; therefore, for this period, we were able to obtain from a price comparison website more expansive and finer-grained data for further investigation. Specifically, we use weekly reports on the prices of nearly 355 products sold in 589 stores of the 5 chains, including the chains' online stores. 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 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. 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 all the ads and classified the ads based on whether they include a reference to media coverage, particularly price surveys carried by a media outlet. We define such ads as "media-based" ads. Figures 5 and 6 contain examples of newspaper ads that refer to specific 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 the 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 potentially 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 difference between control group 2 (ICC products) and the treatment group — which includes different products — 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, using 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 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 single control group. Formally, we estimate the following equation:

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

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 regulatory 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 as a control variable. The coefficient of interest,  $\beta$  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:

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

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 ( $\gamma_t$ ), store ( $\eta_s$ ) and item ( $\mu_i$ ) 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  $\beta$  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 also, as we elaborate in Section 4.1, one of the predictions of the model by Robert and Stahl (1993) is that as search costs decline, the prices at more expensive chains/stores will fall more than in other chains/stores. To do so, we modify Eq. 2 in two ways. First, we interact the *After \* Treatment* variable in Eq. 2 with a premium/discount indicator for the type of the supermarket chain (in Online Appendix 2 we repeat this analysis with a chain-specific interaction term.) Second, we examine how the local market conditions affected price levels in the wake of the transparency regulation. To do so, we interact the *After \* Treatment* variable in Eq. 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. 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.<sup>2324</sup>

Table 4 presents the point estimates obtained for a modification of Equation 2 that simultaneously estimates the transparency effect, once we distinguish between premium and discount supermarket chains. The regression results illustrate 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 5 in Online Appendix 1 presents the results when we include a chain-specific interaction variable. We find that the effect of the transparency was large and negative for the chains that set relatively

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<sup>23</sup>We also estimated the same equation using subsets of the treatment group and of control group 2 (the ICC group), namely the “comparable baskets” of goods discussed above (see Figure 4). We obtain similar qualitative results (presented in Table 3 in Online Appendix 2). We also obtain similar estimates when price promotions are taken into account (see Table 4 in Online Appendix 2).

<sup>24</sup>Note that 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.

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 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. We also stress that our findings above, that examine how the change in information affect price levels and price dispersion are also consistent with the predictions of their model.

## 4 Mechanisms

In this section we examine the role of informative advertising in driving our results, and show how our findings can be rationalized based on an equilibrium framework. Next, we also discuss why fairness concerns explain retailers' decision to adopt a uniform pricing strategy.

### 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.<sup>25</sup> 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. [Bagwell \(2007\)](#) notes that their model fits an established industry, where similar products are sold in different stores (like the supermarket industry). Although the model considers firms that sell one good

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<sup>25</sup>[Butters \(1977\)](#) consider 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 \(2015\)](#).

while our setting involves multiproduct firms, as we further explain below we view the media as an intermediary which can aggregate price information on multiple items into one “representative” price. 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 other are not (uninformed ads). The model generates the following testable predictions:

**Hypothesis 1 (H1):** *The use of informative advertising will increase as 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 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 can be less effective and consumers may suspiciously view 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, low-price firms 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 (say, holiday seasons), we expect H3 to hold. This latter hypothesis further the potential of informative advertising for enhancing price competition.

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

H4 follows from the use of informative advertising by low-price chains and from pricing decisions by the high-price non-advertising chains. Ads provide relevant information for the consumers who get exposed to these ads and hence discourage search by these consumers. In addition, consumers who are not exposed to ads will not continue to search after visiting a store because high-price chains set prices at a level that dissuade subsequent search. At those price levels, consumers

are indifferent between buying and incurring a cost of searching further. A related implication of the model is that following a reduction in search cost, high-price firms will set lower prices aiming to discourage consumers from searching further. In Table 4 we showed that this is the case. 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.

#### 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. 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.<sup>26</sup> The media seems to embrace its role in highlighting market-related concerns: The year 2017, was the first in which 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](http://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.<sup>27</sup> On January 12, 2016, Channel 2 News, Israel's

<sup>26</sup>[www.haaretz.com/israel-celebrates-67th-independence-day-1.5354235](http://www.haaretz.com/israel-celebrates-67th-independence-day-1.5354235)

<sup>27</sup>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>

most popular news program, ran a 4.5-minute item on a new price competition among supermarket chains in the city of Modi'in.<sup>28</sup> 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.<sup>29</sup>

### 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 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 advertising". 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 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 disappeared once prices became accessible online. Regression results presented in column 1 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. These results support H1 and H2. In column 2 in the table we provide a falsification test, showing expenditures on promotional ads (i.e., ads mentioning specific price promotions) by Rami Levy did not increase relative to

<sup>28</sup>[www.mako.co.il/news-channel2/Channel-2-Newscast-q1\\_2016/Article-996f23598873251004.htm](http://www.mako.co.il/news-channel2/Channel-2-Newscast-q1_2016/Article-996f23598873251004.htm).

<sup>29</sup>See [www.themarker.com/advertising/1.3006498](http://www.themarker.com/advertising/1.3006498) and [www.themarker.com/advertising/1.3116830](http://www.themarker.com/advertising/1.3116830).

expenditures on such ads by the other retailers. In other words, this analysis suggests that 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. According to H3, the use of media-based advertising 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 estimated effect of transparency on the prices grew larger. As can be seen in the figure, this negative relationship is even more pronounced when we use promotional prices instead of regular prices. In figure . . 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. Furthermore, this relationship also holds when we estimate a treatment intensity version of Equation 2, replacing the transparency indicator in the original specification with a standardized measure of expenditures on media-based ads by Rami Levy in a given month. We present the results in column 3 in Table ???. 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 in equilibrium do not actually search. 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 first rely on a survey conducted by an Israeli consumer organization, asking a representative sample of consumers on their search habits in retail markets. According to survey, only 4% of respondents have accessed the price-comparison website in the year preceding the survey. We also obtain qualitatively similar patterns when we use data, described in subsection 3.1.2, on the actual 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.<sup>30</sup> 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

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<sup>30</sup>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.

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.<sup>31</sup> Despite these efforts and initiatives, they have failed to deliver sustained traffic into the price-comparison websites.<sup>32</sup> 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 can 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 (Forthcoming)). These findings are counter-intuitive given that standard economic models predict that pricing decisions should take into account local consumer and market conditions. DellaVigna and Gentzkow (Forthcoming) discuss potential explanations for uniform pricing, and highlight fixed costs of managerial decisions and brand-image concerns as two primary explanations.<sup>33</sup>

Our setting is useful to shed further light on the reasons why retailers adopt uniform pricing, and underscore the relationship between transparency, uniform pricing and brand-image concerns. In particular, we propose that brand-image concerns best explain the effect of transparency on the decision of each chain to adopt a nearly uniform pricing policy. That is, 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.<sup>34</sup> Echoing

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<sup>31</sup>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>.

<sup>32</sup>For more details, see <https://www.calcalist.co.il/articles/0,7340,L-3751446,00.html>.

<sup>33</sup>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.

<sup>34</sup>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. [www.themarker.com/consumer/1.2291031](http://www.themarker.com/consumer/1.2291031).

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.<sup>35</sup> 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.<sup>36</sup> Conversations we had with retailers also confirm that the decision to set uniform pricing was driven by the public discontent. Finally, [Hendel et al. \(2017\)](#) also provide evidence that the price-setting by Israeli food retailers, particularly following the social protest in 2011, takes into account potential negative public backlash.

## 5 Robustness

### 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 our results 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.<sup>37</sup> Thus, if there are systematic measurement errors associated with one of these methodologies 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 results 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 examine how the regulation affected prices in supermarkets (which were subject to the regulation)

<sup>35</sup><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](http://www.knesset.gov.il/protocols/data/rtf/kalkala/2012-07-24-02.rtf).

<sup>36</sup>E.g., <https://www.themarket.com/advertising/1.1613349>.

<sup>37</sup>For the Super-Pharm and online control groups the same data sources were used before and after 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.

The price data obtained from the CBS for the 27 products which are included in the ICC control group are also 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 prices of these products which were sold in grocery stores were not surveyed by the ICC and hence were non-transparent both before and after the regulation. Accordingly, we can expect that the difference in prices between supermarkets and grocery stores for these items 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. Using the prices in grocery stores as a control group is also useful because, as we further discuss in Section 5.5, it seems unlikely that the owners of these small, independent stores would have responded strategically to the transparency regulation by changing 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.<sup>38</sup> To address this concern, we experimented with different specifications in which we simulate the post-transparency period to also be at the monthly level. For instance, for the post-transparency period we used price data for the treatment

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<sup>38</sup>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.

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  $\log(\text{price})$  as the dependent variables and also add month-specific effects for each specification (treatment group vs. control group). The results are plotted in Figure 8 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 Discussion and Concluding Remarks

Since the beginning of 2017 alone, several large retail chains, including Macy's, JC Penney, Sears and Payless ShoeSource have announced the closing of hundreds of brick-and-mortar stores and the layoffs of many thousands of employees.<sup>39</sup> This dismal trend of the retail market is often attributed to the highly competitive digital age and the strength of online giants such as Amazon. One important traditional retail market which seems relatively immune to this trend is the grocery market, probably due to the unique characteristics of the products sold in grocery stores.

Amazon decision's to purchase Whole Foods on June 2017 for \$13.7 billion seems to suggest that blending the online channel and the traditional retail food world can offer substantial complementary benefits. For instance, it might result in traditional food stores voluntarily displaying their prices online. Alternatively, government policies may require food retailers to post their prices online. Will this information result in higher or lower food prices? Economic theory offers mixed predictions. On the one hand, the availability of price information is essential for the efficient functioning of markets. On the other hand, several recent papers have shown that firms may manipulate information to make it harder for consumers to find cheap alternatives. How will then the rapid growth of the online market affect the traditional retail food market? What are the implications of price transparency regulations on price levels, price dispersion and price discrimination strategies?

In this paper, we study the impact of a price transparency regulation of food items sold in Israeli traditional brick-and-mortar stores. While the impact of price information is at the core of IO, to our knowledge, thus far hardly no studies were able to examine this issue empirically, and those that have were typically limited in scope: they had to assume away selection issues and have not considered firms' advertising response. Our analysis addresses this gap, using a large set of price data from the Israeli supermarket industry in the period surrounding the implementation of a 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 have fallen. The decrease 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 dollars in revenue each month, and average household saved about \$27 per month (about 1.5% of the median wage in Israel in 2015).<sup>40</sup>

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<sup>39</sup>See <https://goo.gl/R8pyTJ>

<sup>40</sup><http://www.cbs.gov.il/statistical/mb158h.pdf>

We further highlight the important role of the media and media-based advertising in generating these price reductions. We show that hard discount chains extensively relied in their ad campaigns on price surveys conducted by the media as an objective and reliable source of information. These ad campaigns were used especially during time periods in which prices were lower. Remarkably, our findings provide strong support to the theoretical model by [Robert and Stahl \(1993\)](#) who were the first to incorporate optima 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.

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 improve 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.

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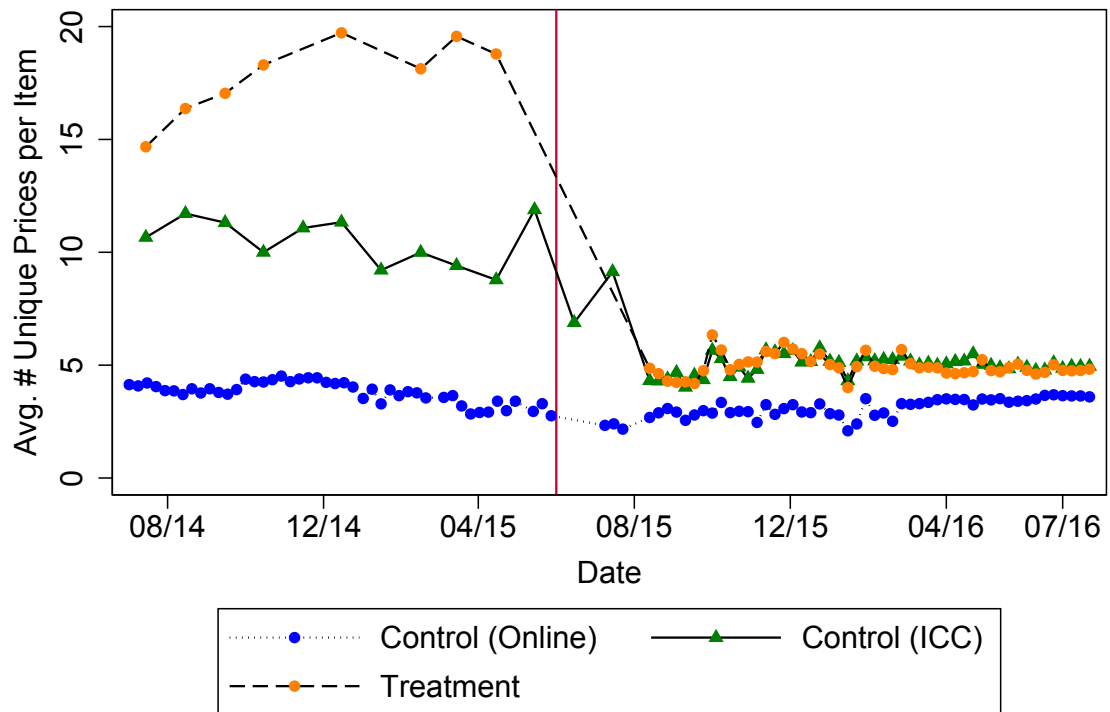
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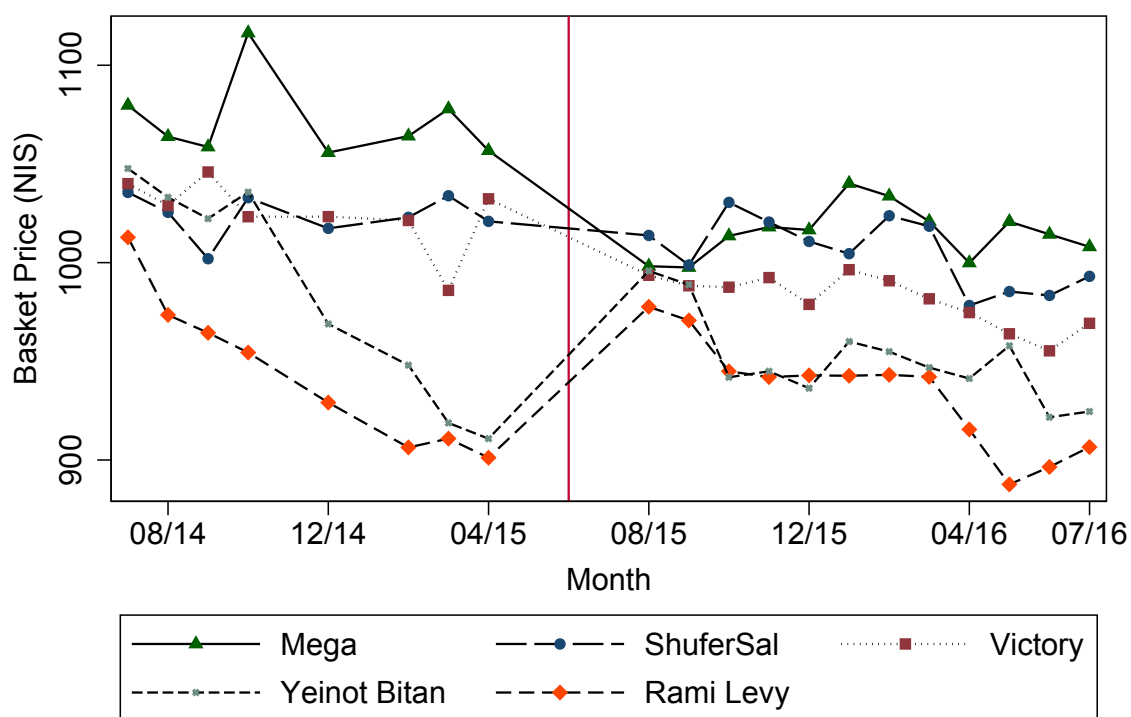


Figure 1: Number of unique prices



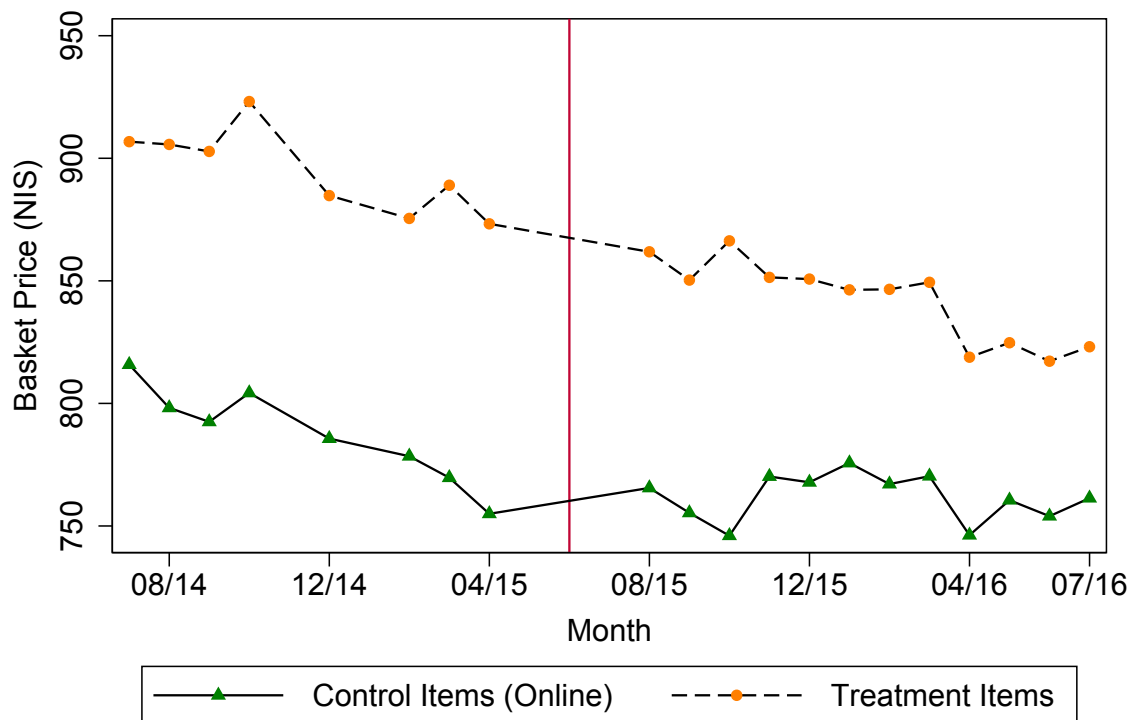
The figure shows a time series of the average number of unique prices for the treatment group of items, the online control group and the ICC control group. The vertical line denotes the date in which the transparency regulation came into effect. According to the figure, the number of unique prices per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

Figure 2: Retailer-specific basket price



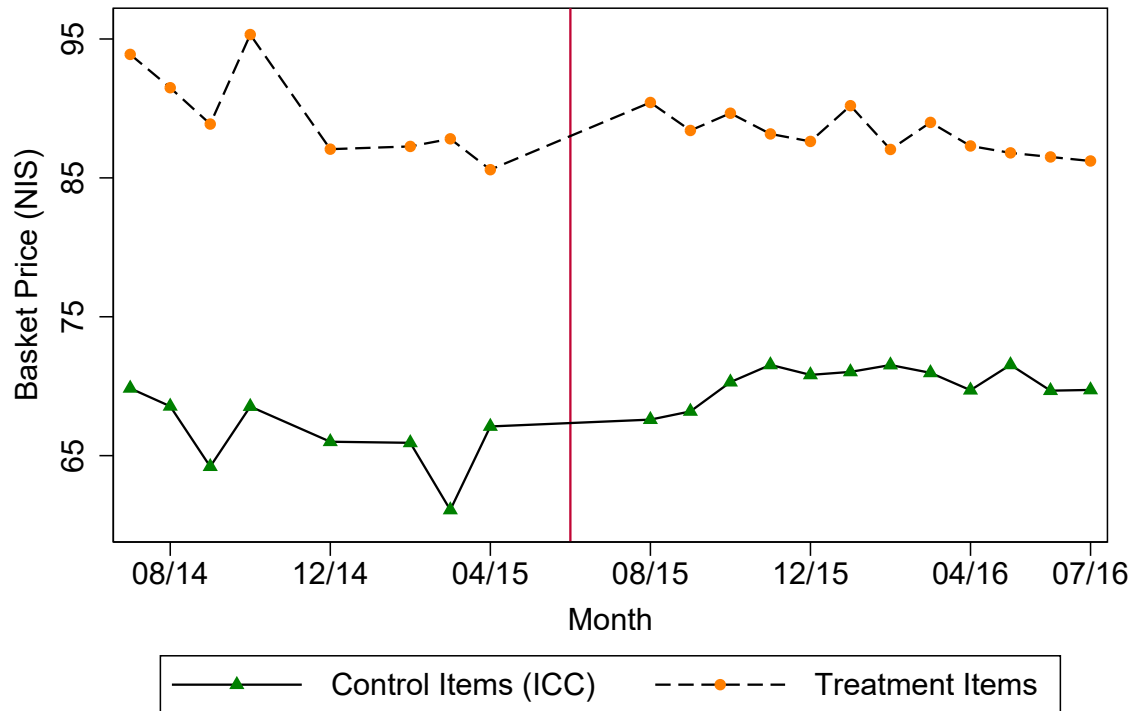
The figure shows a time series of the total basket price for each of the five food retailers. The vertical line denotes the date in which the transparency regulation came into effect. A basket consists of 58 items. Monthly basket price is the sum of items average price, where the average is taken over 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  $\log(\text{price})$  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 advertisement is a vertical banner with a red background. At the top, it says "שנה אחרי שנה כל הסקרים קובעים:" (Every year, all the surveys agree:). Below this is the Rami Levy logo and the text "רמי לוי שיווק השקמה" (Rami Levy Supermarket) and "סל הקניות הזול במדינה" (The cheapest shopping basket in the country). The main headline reads: "סקר 'ממון' ידיעות אחרונות של שושנה חן מתאריך 4.9.15 קבע ומצא: 'רמי לוי שיווק השקמה סל הקניות הזול במדינה'" (Survey 'Mamon' by Yediot Aharonot, conducted by Shoshana Chan on 4.9.15, determined and found: 'Rami Levy Supermarket is the cheapest shopping basket in the country'). Below this, it says: "סקר 'תכנית חיסכון' של ערוץ 2 לקראת החגים קובע: 'רמי לוי מנצח בנוקאאוט: רשת רמי לוי מובילה במחירים הנמוכים גם כאשר בודקים מוצרים שונים מהרגיל'" (Survey 'Tachnit Chisכון' by Channel 2 for the holidays determines: 'Rami Levy wins in the knockout: Rami Levy network leads in prices, even when checking different products than usual'). The bottom section features a banner for "שנה טובה ומתוקה לכל בית ישראל" (A good and sweet year for every home in Israel) with an image of a honey jar and a basket of fruit. On the right side of the bottom section, there is a small text block with a phone number: "תזיה במפעל לפרטים: 000-590-1599 או מובייל: 000-590-1599".

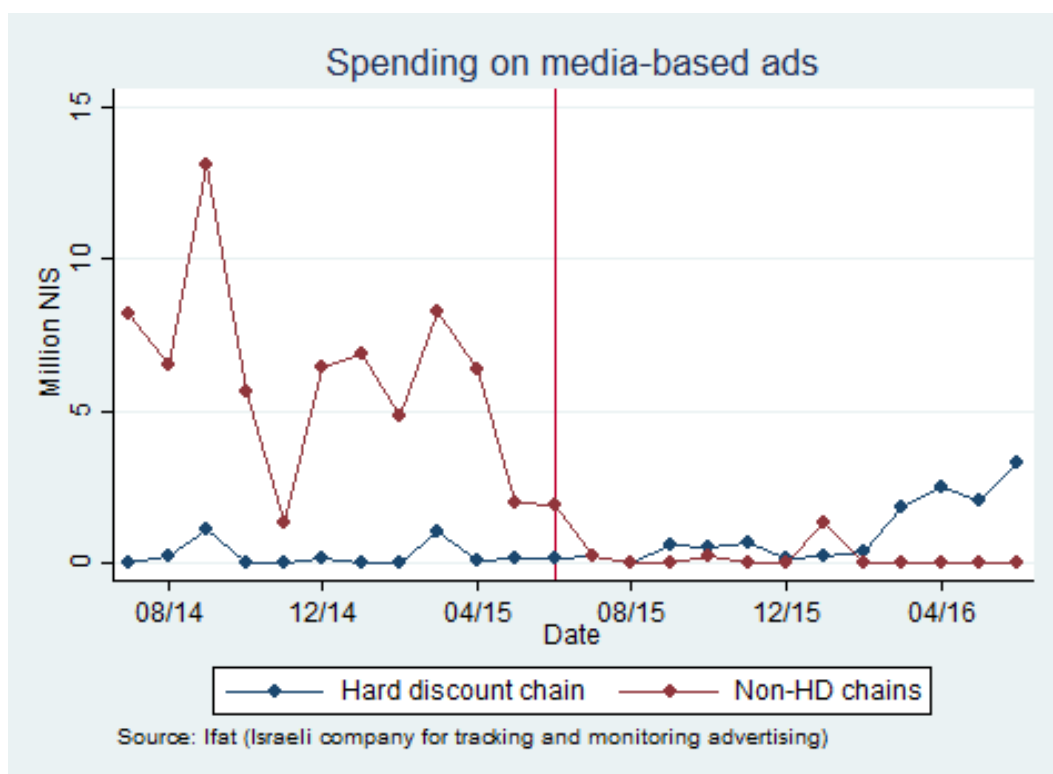
The figure shows an example of an ad by the hard-discount chain Rami Levy in which the chain stresses it offers the cheapest basket in Israel. The ad specifically refers to two price-comparison surveys conducted by the media, One by the newspaper Yediot Aharonot (on September 4, 2015) and a second pre-holiday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

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

The advertisement features a central slogan in large red letters: **לא נגענו... רק חסכנו!** (We didn't touch... we just saved!). Below the slogan, two shopping lists are presented as if they were torn from a notebook, comparing prices between Yeivot Bitan and other supermarket chains. The lists include items like bread, eggs, and various vegetables, with Yeivot Bitan consistently showing lower prices. The background is a collage of fresh food items including bread, grapes, carrots, and walnuts. At the bottom left is the Yeivot Bitan logo, and at the bottom right is contact information including the website [www.ybitan.co.il](http://www.ybitan.co.il), a phone number, and a QR code.

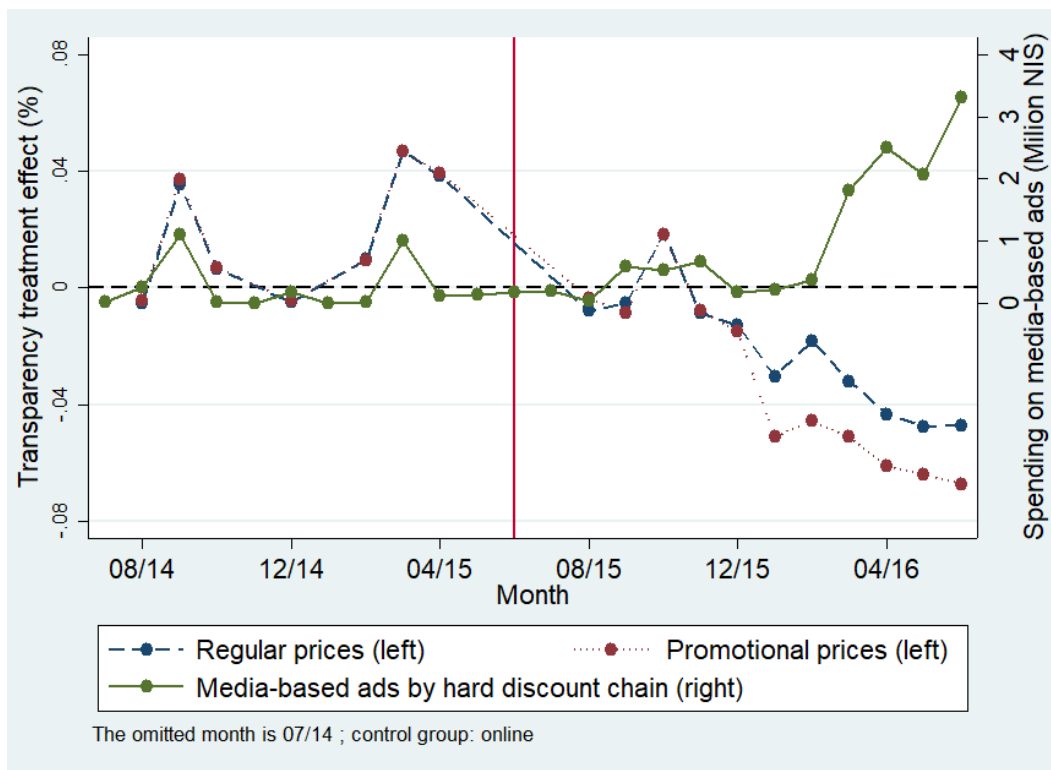
The Yeivot Bitan supermarket chain ad includes two references to comparisons of sales expenditures at supermarket chains which was conducted by a national radio station and a leading online news portal. In both examples, Yeivot Bitan offers the cheapest option.

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



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 ( $1\text{\$} \approx 3.5\text{NIS}$ ). 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	$N$
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** (0.549)	-8.103** (0.812)	-15.920** (1.700)	-0.101** (0.011)	-0.053** (0.012)	-0.083** (0.024)	-27.396** (1.679)	-12.481** (2.436)	-32.962** (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)	(2)	(3)
	log(Price)	log(Price)	log(Price)
After*Treatment	-0.051** (0.008)	-0.052** (0.005)	-0.040** (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)	(2)	(3)
	log(Price)	log(Price)	log(Price)
Premium: After*Treatment	-0.061** (0.008)	-0.058** (0.006)	-0.045** (0.014)
Discount: After*Treatment	-0.015 (0.009)	-0.026** (0.007)	0.011 (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)	(2)
	log(Price)	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 from 0 to 1, with 0 being perfect competition and 1 being monopoly

The 10<sup>th</sup>, 50<sup>th</sup> and 90<sup>th</sup> 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 super-market 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 (1)	Media-based ads (Million NIS) (2)	log(Price) (3)	(4)
Hard Discount * After	48.846*** (9.429)	1.634*** (0.227)		
Hard Discount Media-Based Ads. Exp.			-0.013*** (0.004)	-0.018*** (0.004)
$R^2$	0.789	0.808	0.937	0.930
N	191	191	186810	186810

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

Columns 1 and 2 present regression results concerning the change in informative advertising after the transparency regulation. The unit of observation is week  $\times$  hard-discount chain dummy. In column 1 we use the share of spending on media-based ads out of total spending on ads, while in column 2 we use the absolute spending on these ads. The results indicate that spending by the hard-discount chains on media-based ads increased significantly after the transparency regulation. 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. The unit of observation is item  $i$  in store  $j$  in date  $t$ . Column 3 uses regular prices and in column 4 we use promotional prices as the dependent variable. In both, we estimate a treatment intensity version of Equation 2, using the prices of items in the online channel as control. The intensity considered is the monthly absolute spending on media-based ads. The regression results support (H3) and suggest 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)	(2)	(3)	(4)
	# Unique Price	Standard Deviation / Avg.	Percentage Range	$\log(\text{Price})$
	$\frac{P_{max} - P_{min}}{P_{max}}$		$100 * \frac{P_{max} - P_{min}}{P_{max}}$	
After*Treatment	-1.465** (0.288)	-0.042** (0.004)	-9.407** (0.726)	-0.022** (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	0.975
$R^2$	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.