Consumers' Activism: The Cottage Cheese Boycott*

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Abstract

We study a consumer boycott on cottage cheese that was organized in Israel on Facebook in the summer of 2011 following a steep increase in prices after price controls were lifted in 2006. The boycott led to an immediate decline in prices which remain low until the present day (January 2017). We find that (i) demand at the start of the boycott, at the new low prices, would have been 30% higher but for the boycott, (ii) own price elasticities and especially cross price elasticities increased substantially after the boycott, and (iii) post-boycott prices are substantially below the levels implied by the post-boycott demand elasticities, suggesting that firms lowered prices due to fears of threat of renewed price controls and the boycott spreading to other products.

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1 Introduction

Consumer activism, and boycotts in particular, can serve as an effective counter measure to market power. Consumers can discipline firms directly through product boycotts and can also affect business strategy by exerting public pressure on regulators to intervene on their behalf (Wolfram, 1999, and Ellison and Wolfram 2006). We study these intertwined aspects of consumer activism as they evolved during the consumer boycott of cottage cheese organized in Israel on Facebook during the summer of 2011.

The cottage cheese boycott was intended to pressure firms to lower their prices. The price of cottage cheese, which is a staple food in Israel, increased by 43% since deregulation in 2006 (The Knesset Research and Information Center, 2011). Following the steep increase, and the ensuing extensive news coverage, a Facebook event calling for a boycott of cottage cheese was created on June 14, 2011, demanding a price reduction from about 7 NIS to 5 NIS per 250 grams container.[1] The Facebook event was an instant success: a day after it started nearly 30,000 Facebook users joined it; by June 30, the number surpassed 105,000. The boycott was also a success as the average price of cottage dropped by 24% virtually overnight, and it remains well below the 2011 price even today, more than 5 years after the boycott. This long-lasting effect is due not only to consumers' becoming more price sensitive after the boycott, but also to firms' realization that they cannot ignore the possibility that increasing prices may trigger massive public backlash in the form of renewed government regulation in the market.

Social media such as Facebook and Twitter play an increasingly important role in facilitating political mobilization.[2] It is therefore not surprising that social media can also become a powerful tool for mobilizing consumers to pressure firms to lower prices as the cottage cheese boycott demonstrates. Another recent example, also organized via social media, is the 2011 boycott on Bank of America, Wells Fargo, JPMorgan Chase, and SunTrust following their plan to charge a $5 monthly fee on debit cards.[3] Because of the rapid and widespread growth of social media we

[1] See https://www.facebook.com/events/203744079670103/

[2] The 2009-2010 Iranian election protests and the 2011 uprisings in Egypt and Tunisia are often referred to as "the Facebook revolution" or "the Twitter revolution" (Andersen, 2011). Facebook and Twitter played an important role in facilitating protests in Bulgaria, Turkey, Brazil, and Bosnia in 2013 (e.g., Faiola and Moura, 2013) and in Russia in 2011-2012 (Enikolopov, Makarin, and Petrova, 2016). For recent papers that study the effect of social networks on political participation in various countries, see Acemoglu, Hassan, and Tahoun (2014), Iskander (2011), Breuer (2012), Enjolras, Steen-Johnsen, and Wollebaek (2012), Tufekci and Wilson (2012), Valenzuela, Arriagada, and Scherman (2012), and Gonzalez-Bailon and Wang (2013). There is also a recent literature that studies the link between the internet and voters turnout in elections in different European countries (e.g. Campante, Durante, and Sobbrio (2013), Czernich (2012), Falck, Gold, and Heblich (2014), Gavazza, Nardotto, and Valletti (2015), and Miner (2015)).

[3] A month after the boycott started, Bank of America announced that "We have listened to our customers very closely over the last few weeks and recognize their concern with our proposed debit usage fee... As a result, we are not currently charging the fee and will not be moving forward with any additional plans to do so." See

are likely to witness more such cases in the future and the lessons from the cottage cheese boycott should therefore be of interest to consumers, firms, and policymakers alike.

We use daily, store level, data from all supermarkets and most grocery stores in Israel to estimate a demand system which we use to quantify the harm the boycott inflicted on firms, to study its long-run impact on demand and, finally, to understand firms' reactions to the boycott. Our main findings are as follows.

First, we use the estimated demand functions to compute counterfactual sales during the boycott. Given the new low prices, sales at the start of the boycott would have been 30% higher, but for the boycott. The effect was particularly strong in areas with higher exposure to social networks. After about six weeks, however, sales recovered and matched the expected demand at observed prices.

Second, the boycott had a long lasting impact on demand. We compare estimated demand before and after the boycott. We find substantially higher own and –especially– cross price elasticities after the boycott, possibly reflecting increased price awareness and more willingness to substitute across brands. Interestingly, the magnitude of these changes is not uniform and varies across brands. The increased price elasticities inflict an additional harm on firms by forcing them to set lower prices.

Third, we follow the Industrial Organization tradition and use the conditions for a Nash equilibrium in the cottage cheese market together with the estimated price elasticities to show that the observed price decline following the boycott was much larger than the decline implied by the increase in demand elasticities. This unexplained part of the observed price decline could be due to firms' concerns about the boycott spreading to other products and their wanting to protect their brand and image, and also to their concern about public backlash in the form of regulatory intervention or class action law suits. To examine the latter possibility, we present of simple model of firm behavior under the threat of public backlash in the spirit of Glazer and McMillan (1992) and Tanaka (2011). Using the model along with our demand estimates and external information on the marginal cost for one of the brands we proxy the cost of public backlash associated with a price increase. We find that the boycott has substantially increased the firm's perception about the cost of potential backlash: the firm perceived that an increase in price of 1 NIS entailed a loss of 0.27 NIS per unit due to potential backlash.

Our findings highlight the limitations of using first order conditions, and elasticities, to capture firms' incentives. This traditional Industrial Organization approach may miss important considerations which affect firm behavior, like reputation, image, and the concern for regulatory intervention. The threat of regulation appears to have shaped the pricing of cottage cheese, but such incentives are not captured in the traditional analysis. The cottage boycott was successful partly because it put pressure on policymakers to act which, in turn, induced firms to restrain their

http://www.nytimes.com/2011/11/02/business/bank-of-america-drops-plan-for-debit-card-fee.html?_r=0

prices.

There is a small empirical literature that examines firms' pricing to curb public pressure for regulatory intervention. Erfle and McMillan (1990) show that during the 1979 oil crisis, major U.S. oil firms held down the prices of home heating oil and diesel fuel more than the prices of less visible fuels used by electric power generators because the former were subject to public scrutiny and therefore likely to trigger regulatory intervention. The effect was greatest for highly visible firms. Wolfram (1999) finds that the markups of British electricity generators were below average in the four weeks after the energy regulator has released price statements expressing dissatisfaction with the high prices of electricity, but were above average in the four weeks preceding the release of the price statements. Electricity generators appear to restrain prices after the statements are released and attract public attention, but may deliberately raise prices before the statements are released, realizing that contemporaneous price data is not incorporated into the price statements. Ellison and Wolfram (2006) find evidence that pharmaceutical companies possibly altered their price increases during the early years of the Clinton Administration to forestall potential regulatory intervention. Similarly, Stango (2006) reports that credit card issuers lowered interest rates following threatened legislation to cap rates.

The additional considerations that appear to have influenced firms (fear of the spread of the boycott, of re-regulation, etc.) also constitute the main difference between our paper and other papers on consumer boycotts. Most of these papers study "proxy boycotts," namely, boycotts in which firms are punished as a proxy for their country of origin. Proxy boycotts have a fundamentally different underlying cause than boycotts intended to curb market power and, more importantly, have little implications for business strategy and public policy as firms cannot do much to avert the harm. The cottage boycott, instead, was geared to counter market power.[4] Consumer activism on social media was apparently able to discipline firms and had a long lasting impact on business strategy. For example, in January 2013, the Chief Marketing Officer of Tnuva (the market leader) said in the annual meeting of the Israel Marketing Association that "The cottage cheese crisis taught us a lesson of modesty and humility" and in July 2013, Tnuva's CEO said that "The cottage protests caused Tnuva to emphasize the opinion of the consumer and his needs. Part of this policy is putting cottage under self-regulation." The notion of self regulation seems to be working: the ministry of Agriculture and Rural Development decided to re-regulate the price of "white cheese" (a close substitute for cottage cheese, that was deregulated around the time cottage cheese was deregulated) as of the start of 2014 due to "exceptional profitability," but found no need to re-regulate the price of cottage cheese for the time being because it did not find "unreasonable

[4] The cottage boycott is an example of private politics (e.g., Baron and Diermeier, 2007) where dairy manufacturers and retailers seem to be self regulating due to consumers' activism, as in the Bank of America, Wells Fargo, JPMorgan Chase, and SunTrust cases mentioned earlier.

profitability as in the past."[5] The cottage boycott demonstrates that consumers can indeed get organized on social media and apply pressure on manufacturers and retailers to lower prices.[6]

A necessary condition for the success of a consumer boycott is that activists or organizers garner the support of a group of followers who feel strongly enough about the issue.[7] Unlike many other consumer boycotts, which are organized by interest groups (like Greenpeace), the cottage boycott did not have organized backing. Social media was essential for getting the message out and coordinating action. Moreover, boycotts are susceptible to a commons problem: consumers realize that unless others join the cause, their personal sacrifice is futile. Social media like Facebook and Twitter can credibly convey the number of followers rallying behind the cause and hence encourage others to join. Indeed, we show results which suggest that the boycott's negative impact on demand was stronger in areas with higher exposure to social networks.

To the best of our knowledge, our paper is the first to study a boycott intended to curb firms' exercise of market power, and to directly quantify the boycott's impact on actual sales (revenue). Perhaps due to lack of firm-level data, most of the empirical literature on consumer boycotts examined stock market price reactions. Stock market studies (Friedman (1985), Pruitt and Friedman (1986), Pruitt, Wei, and White (1988), and Davidson, Worrell, and El-Jelly (1995), Koku, Akhigbe, and Springer (1997), Teoh, Welch, and Wazzan (1999), Epstein and Schnietz (2002)) find mixed evidence for boycott effects.[8] Our paper, in contrast, uses daily, store-level data on prices and quantities sold allowing us to study the direct effect of the boycott on store-level sales.

A few papers study the effects of calls for consumer boycotts on firms' sales. These papers, however, exclusively study proxy boycotts where there is little room for firms' reactions. Bentzen and Smith (2002) study how sales of French wine in Denmark was affected by a call for a boycott of French products in response to the French nuclear testing in the South Pacific in $1995 - 1996$; Chavis and Leslie (2009) and Ashenfelter, Ciccarella, and Shatz (2007) study whether French wine was boycotted in the U.S. following the French opposition to the Iraq war in early 2003; Hong et. al. (2011) study the boycott of French automobiles in 2008 in China following the disruption of the

[5] The ministry stated however that it will continue to monitor the profitability of cottage cheese and it does not rule out re-regulation should its profitability become "unreasonable" (http://www.moag.gov.il/NR/exeres/E911B43C-9BAD-488D-8493-A27069275754,frameless .htm?NRMODE=Published).

[6] For analysis of self regulation see Harrison and Scorse (2010) and Abito, Besanko and Diermeier (2015).

[7] Public outrage is one of the four factors Diermeier (2012) mentions as necessary for a boycott's success: (i) customers must care passionately about the issue, (ii) the cost of participation must be low (relatively small sacrifice by consumers), (iii) the issues must be easy to understand, and (iv) the boycott should be widely covered in the mass media.

[8] More recently, Fisman, Hamao, and Wang (2014) find that adverse shocks to Sino-Japanese relations in 2005 and 2010 had a negative effect on the stock prices of Japanese firms with high China exposure and on Chinese firms with high Japanese exposure. They also find a larger negative effect on Japanese firms operating in industries dominated by Chinese state-owned enterprises, but a smaller effect on firms with high Chinese employment.

Olympic torch relay in Paris in April 2008 and the French President's decision to meet with the Dalai Lama in late 2008; and Clerides, Davis, and Michis (2013) study the effect of anti-American sentiment (but not an open boycott) caused by the 2003 Iraq war on sales of U.S. soft drinks and laundry detergents in nine Arab countries.[9]

The paper is organized as follows. In Section 2 we describe the background leading to the boycott. Section 3 introduces the data, while Section 4 describes the evolution of prices and quantities and demand. In Section 5 we test whether price elasticities changed after the boycott. In Section 6 we look at the effect of demographics proxying for social networks. In Section 7 we examine how firms' incentives were affected. Conclusions appear in Section 8.

2 Background

Cottage cheese is a staple food and one of the best-selling food products in Israel. It is sold in various milkfat contents and flavours, though by far, the most popular variety is the plain 5% fat content which accounts for about 80% of sales. The closest substitute for cottage cheese is a fresh, soft, spreadable white cheese. In 2010, 31,027 tons of cottage cheese and 45,960 tons of white cheese (including all fat contents) were sold in Israel (Israeli Dairy Board, annual reports for 2011).

Cottage cheese is produced in Israel by three large dairies: Tnuva, Strauss, and Tara, three of the four largest food suppliers in the country (there are no imports due to high tariffs).[10] Until July 2006, the prices of 20 dairy products (cottage cheese both 5% and 9%, fresh milk, cream, sour cream, semi-hard cheese, and dairy desserts) were controlled by the government.[11] From July 2006 to June 2009, the government gradually deregulated the prices of 10 of those products, including cottage and white cheese, leading to sharp price increases relative to the CPI.

Figure 1 shows the evolution of the monthly average price of a standard container of 250 grams of 5% cottage cheese from January 1999 to May 2011 (just before the start of the cottage boycott).[12] Figure 1 also shows the prices – relative to January 1999 – of raw milk and wages in

[9] Fershtman and Gandal (1998) use product-level data to study the effect of the Arab boycott on Israel on consumer and producer welfare in the Israeli automobile market. This boycott however was imposed by Arab countries on Japanese car manufacturers rather than by consumers.

[10] As of 2011 Tnuva had a market share of almost 57% in the dairy market, the Strauss Group almost 23%, and Tara 10%. Until 2013, the effective tariff on fresh cheese was 126%, but following the cottage cheese boycott, the government decided to lower this tariff gradually from 2013 onward. See http://taxes.gov.il/customs/Documents/Mekach/help%201696.pdf

[11] The 20 regulated dairy products accounted for about 30% of the total expenditure on dairy products (State Comptroller of Israel, 2012, p. 36). These prices were set by a Government committee that consists of two representatives from the Ministry of Finance and two representatives from the Ministry of Agriculture. The committee sets prices such that dairy producers can cover their costs and earn a rate of return of $6\% - 12\%$ on their invested capital. Prices were updated every 12 month or earlier if input prices change by more than 3%. For more details, see State Comptroller of Israel (2012).

[12] The price plotted in the figure is based on monthly prices of cottage cheese collected from a cross-section of stores

the food industry, two of the main cost drivers of cottage cheese (plotted on the right hand side axis).

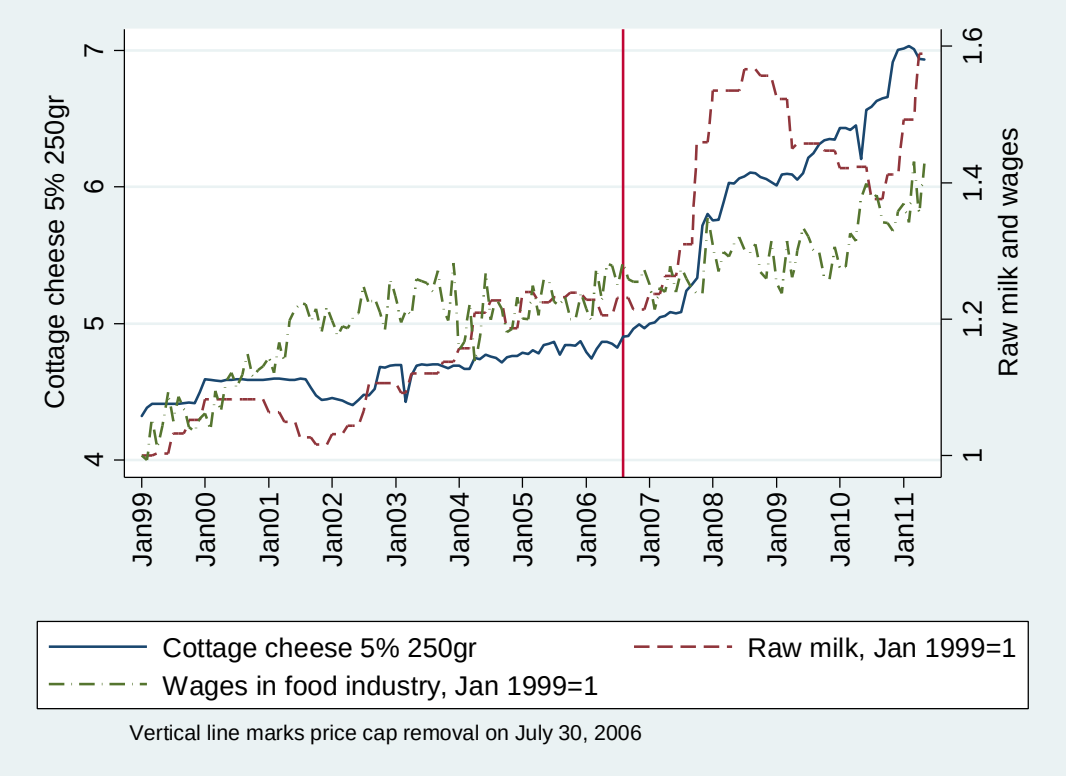


Figure 1: Cottage cheese and input prices

As the figure shows, the price of cottage cheese hovered around $4.5 - 5$ NIS until its deregulation on July 30, 2006. Following deregulation, the price increased sharply, reaching 7 NIS on the eve of the boycott. This represents a 43% increase between July 2006 and May 2011. By comparison, the mean price of regulated dairy products increased by 10% over the same period (State Comptroller of Israel, 2012, p. 34), while the index of food prices increased from 2005 to 2011 by 31.6% (The Knesset Research and Information Center, 2011, p. 2). The price of raw milk also increased sharply in 2007, and this can account for part of the steep rise in the price of cottage cheese.[13] However, the decline in the price of raw milk, which started at the end of 2008, was not passed-through to cottage prices. Wages exhibited less fluctuations over time, increasing by about 11% during the post deregulation period. Thus, only part of the price increase of cottage cheese after deregulation can be attributed to increases in input prices.

in Israel by the Central Bureau of Statistics for the purposes of computing the monthly CPI. The figure plots the cross-sectional mean of prices. The data in the figure come from Ofek (2012).

[13] The cost of raw milk accounted for 36.5% of the retail price of cottage cheese in January 2006 and 27.8% of the price of cottage cheese in June 2011 (see The Knesset Research and Information Center, 2011).

2.1 The Cottage boycott

In general, food prices in Israel increased substantially since 2005.[14] Starting on May 31, 2011, a series of articles, describing this surge in food prices, as well as the general high cost of living in Israel, were published in newspapers and on TV.[15] The news reports were followed by a sequence of events summarized in Appendix A.

On June 14, 2011, a Facebook event was created calling for a boycott of cottage cheese, starting on July 1, 2011. The Facebook event was widely covered by radio, TV, and newspapers. A day after the Facebook event started, nearly 30,000 Facebook users joined, and three days later, the number grew to 70,000. By June 30, 2011, the number surpassed 105,000. As a result of this success, the event leaders announced on June 16, 2011 that the boycott will start immediately rather than on July 1, 2011, and recommended buying cottage and white cheese only if their prices drop under 5 NIS.

The effect of the boycott was almost immediate: several supermarket chains started, already on June 14, to offer cottage cheese and other dairy products at a special sale price.[16] The protest leaders, however, argued that they will not stop the protest until the price of cottage falls permanently under 5 NIS. Some politicians and Government ministers also called for various measures to control food prices.

On June 24, the chairperson of Tnuva's board, announced in a TV interview that Tnuva will not unilaterally lower its cottage cheese prices.[17] Following the interview, three new groups formed on Facebook calling to boycott Tnuva's products. In response to the new threats, Tnuva lowered the wholesale price of cottage cheese to 4.55 NIS, and soon after, the Strauss Group and Tara followed suit.

On July 2011, the "tents protest" which also started on Facebook led thousands of people to set up tents in the center of cities around the country to protest the rising cost of living and demanding social justice. Motivated by the protest, the student associations in 12 colleges and

[14] The cumulative annual growth rate of food prices in Israel between September 2005 and June 2011 was 5%, compared with 2.1% for the period January 2000 to September 2005, and compared with 3.2% in the OECD countries for the 2005-2011 period (see the Kedmi Committee report, 2012, p. 8).

[15] The stories were first published in the evening financial newspaper Globes, see http://www.globes.co.il/news/article.aspx?did=1000655975 though other newspapers and TV news soon followed.

[16] For instance, Rami Levy announced that they will offer Tnuva, Strauss, and Tara cottage cheese for a few days at a special price of 4.90 NIS, instead of the regular price of 6.50 NIS, while Shufersal, which is the largest supermarket chain in Israel, announced a special "buy one get one free" sale for a few days on Tnuva and Tara cottage cheese for shoppers who spend more than 75 NIS. See http://www.calcalist.co.il/marketing/articles/0,7340,L-3520937,00.html and http://www.ynet.co.il/articles/0,7340,L-4082055,00.html

[17] Specifically, the chairperson said that Tnuva will agree to lower its prices only if both dairy farmers, supermarkets, and the government will contribute to the price reduction. See http://qa-galatz.scepia-sites.co.il/1404-38999-he/Galatz.aspx

universities announced at the beginning of September 2011, that they intend to boycott Tnuva until it lowers its prices.

In response to the boycott, the government appointed on June 27, 2011, a joint committee to review the level of competition and prices in Israel (the Kedmi Committee). The committee submitted its recommendations on the dairy market by mid July 2011. Among other things, it recommended a gradual opening of the dairy market to competition, removing import tariffs, and eliminating the exemptions to produce distributors from antitrust action.

On September 25, 2011, the Israeli Antitrust Authority (IAA) raided Tnuva's offices, as part of an open investigation on the extent of competition in the dairy industry. According to the press, the IAA seized, among other things, a 2008 McKinsey report which advised Tnuva to raise prices by at least 15% due to inelastic demand.[18] Shortly after the raid, on October 2, 2011, the chairperson of Tnuva's board announced her resignation, which was followed by price cuts of around 15% on dozens of products.

3 Data, sample selection, and aggregation

We purchased data from a private company providing data services to the retail sector. The raw data record the daily transactions of the cottage and white cheese categories in 2,169 stores throughout the country, over the period January 1, 2010 - April 30, 2012. Each observation represents the total quantity and total revenue recorded by the cash register on a specific item - identified by its unique barcode - in a specific store and day. The raw dataset has over 22 million observations on 339 items over time and across stores. In Appendix B, we describe how we cleaned the data.

Items vary in terms of physical attributes (weight, flavors, fat content, packaging, kashrut standards, etc.), as well as manufacturer. We restrict attention to the most popular configurations: 250 grams containers of plain cottage and white cheese, with 3% and 5% fat content, produced by the three major manufacturers, which for confidentiality reasons we label A, B and C (we use the terms "brand" and "manufacturer" interchangeably). These configurations account for about 80% of cottage cheese sales in the original data, and 30% of white cheese sales. After eliminating from the sample 1,008 stores that sell the cheeses in our sample infrequently (two thirds of the deleted

[18] See http://www.haaretz.com/business/trustbuster-raids-tnuva-offices-questions-chiefs-1.386731 and http://www.haaretz.com/business/allegations-trustbuster-said-surprised-by-tnuva-s-overt-monopoly-pricing-1.389281. Apax Partners, which is a U.S. private equity fund, asked Mckinsey to review Tnuva's pricing policies after it acquired Tnuva in January 2008. Before the acquisition, Tnuva was a cooperative of 620 kibbutzim (collective, mostly agricultural, communities) and moshavim (non-collective agricultural communities). See http://www.globes.co.il/serveen/globes/docview.asp?did=1000657979&fid=1725 The article also reports that Tnuva's chief economist "warned the company that raising prices was liable to blow up in their faces."

stores are convenience stores),[19] as well as 298,657 observations corresponding to Saturdays (most stores are closed on Saturday for religious reasons), we are left with 6,596,052 observations from 1,127 stores over 729 days between January 1, 2010 and April 30, 2012 (excluding Saturdays). The deleted observations represent about 5% of the total sales.

Since the prices of the 3% and 5% fat varieties of the same brand are highly correlated (the correlation is above 95% for cottage cheese and around 85% for white cheese), we aggregated the sales of 3% and 5% cottage cheese and 3% and 5% white cheese of the same brand into a single product. Hence, our sample includes 6 products: one cottage cheese and one white cheese per brand. For instance, brand A cottage cheese refers to "brand A cottage cheese of 3% and 5% fat." In 55% of the store-date observations, all 6 products are sold. About 75% sell at least 5 products. Thus, in most observations, most of the products are being transacted, which is not surprising given the popularity of cottage and white cheeses.

The price per 250 grams (the standard size of a container) of cottage cheese of brand $b = A, B, C$, in store s at time t is computed as follows:

$$p^c_{bst} = 250 \times \frac{r^c_{bst}}{q^c_{bst}}, \tag{1}$$

where r^c_{bst} is the total revenue from selling 3% and 5% cottage cheese of brand b in store s at time t and q^c_{bst} is the corresponding quantity in grams.[20] The price of white cheese, p^w_{bst}, is defined similarly. These prices can be thought of as the quantity-weighted mean price across all daily individual transactions (for a given product and store).[21]

Table 1 shows the business formats of the 1,127 stores in our final dataset.

[19] The 1,008 eliminated stores have less than 2,000 observations on the 12 items that we study. The logic is as follows: if a store sells one of the 12 items at least once every weekday (virtually all shops are closed on Saturdays), we would expect 729 observations per store (the number of days between January 1, 2010 and April 30, 2012 , excluding Saturdays). And if a store sells all 12 items at least once a day, we should expect 8,748 observations per store (12×729). The deleted stores have on average 690 observations (the median is 546), indicating that they sell only a limited range of cottage and white cheeses and do so infrequently. In addition, we deleted 13 observations that were duplicated.

[20] These prices exhibit a few extreme values due to very low recorded revenues and relatively high quantities sold and vice-versa. We view these cases as keying errors (typos) and therefore deleted them from the sample. Specifically, we deleted from the sample 15,682 observations with prices per 250 grams below 3.75 NIS or above 9 NIS; these observations represent a quarter of one percent of the observations (the bottom and upper 1 percentiles are 4.60 NIS and 7.90 NIS, respectively).

[21] Weighting by quantity will only matter if prices differ across transactions within the same day (e.g., due to quantity discounts), but we are not aware of this happening in cottage and white cheeses. The price of an item not being sold in a store in a given day is set to missing.

Table 1: Distribution of stores

Store Format	Frequency	Percent	Percent of Sales
Convenience Stores	54	5	0.3
Grocery Stores	84	7	0.8
Minimarkets	320	28	8.9
Main Local Supermarket Chains	290	26	28.6
Main HD Supermarket Chains	227	20	36.6
Other HD Supermarket Chains	152	13	24.9
Total	1,127	100	100

Most stores – 46% – belong to the main supermarket chains and these stores are similarly distributed between hard-discount (HD) and local supermarkets.[22] These stores account for 65% of the sales in our sample. Other HD supermarkets account for only 13% of the stores in the sample, but for almost 25% of the sales. The smaller store formats (convenience stores, groceries, and minimarkets), represent 40% of the stores, but only 10% of the sales. The largest metropolitan area in Israel – the Tel Aviv region – accounts for almost a quarter of the stores. The remaining stores are equally distributed across the rest of the country.

4 Anatomy of the cottage boycott

We first look at the evolution of prices. We then turn to quantities in order to assess the harm consumers inflicted on manufacturers. We later estimate demand functions to assess the impact of the boycott on demand and examine how demand changes correlate with various demographics proxying for exposure to social networks.

4.1 Firms' reaction to the boycott: prices

Figure 2 shows the daily, quantity-weighted mean price of cottage cheese by brand.[23] Several points are worth mentioning. First, the prices of the three brands are fairly close to each other, which is surprising in light of the very different own price elasticities reported in the next section.

[22] "HD supermarkets" are large format stores that offer deep discounts. "Local Supermarkets" are smaller stores, carry fewer products, and tend to have higher prices. The "Other HD Supermarkets" comprises smaller chains which were founded for the most part in the 1990s and operate 10-30 stores each.

[23] Prices are computed using equation (1), for each brand $b = A, B, C$, and averaged across stores using quantity weights. The price lines are not smooth because the weights change on a daily basis, even though prices change less frequently. These prices are consistent with the Central Bureau of Statistics data shown earlier in Figure 1.

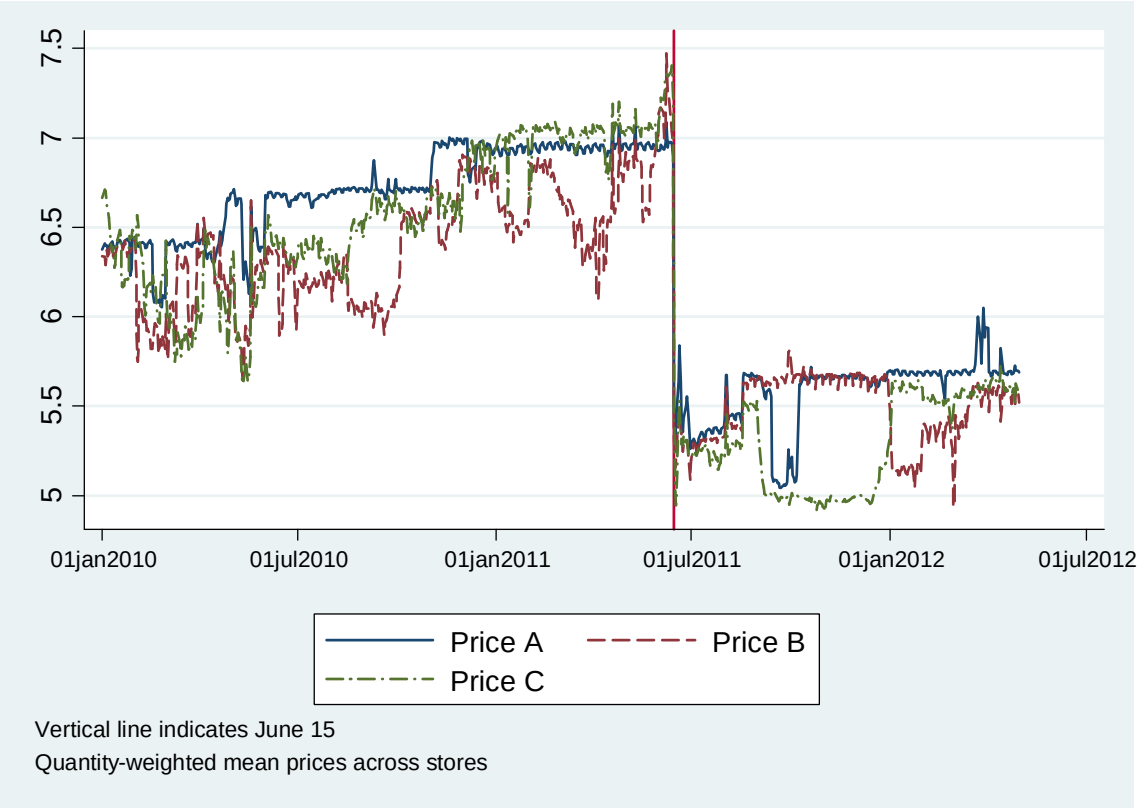


Figure 2: Daily mean price of cottage cheese by brand

Second, the price responses to the boycott were almost immediate: the quantity-weighted average price (across all brands) dropped by 24% between June 14 and June 16. We do not know whether the price concessions were initiated by the manufacturers or by the retailers, although we will be able to shed some light on this issue below.

Third, the mean prices of all three brands decreased after the boycott started to about 5.50 NIS, close to the boycott organizers' demand of 5 NIS, and remained at the new level until the end of the sample period.

The immediate price decline may give the impression that the dairies and retailers fully complied with the demands of the boycott organizers and that the boycott ended (almost) as soon as it started. However, as described in Section 2.1, not only did the initial boycott remain active (since demands were not fully met) but additional boycotting groups were organized later in the summer of 2011.

Figure 3 zooms in on the period May 15 to July 15 (i.e., from one month before to one month after the boycott started), and plots the quantity-weighted mean price by store formats. The swift decline in prices occurred mainly at the supermarket chains where prices dropped from June 14 to June 16 by 33% in the hard-discount stores belonging to the main supermarket chains, 24% in the non-HD stores belonging to the main supermarket chains, and 15% in the hard-discount stores

which belong to smaller supermarket chains. By contrast, the price reaction of the smaller formats (convenience stores, groceries, and minimarkets) lagged by about 10 days and was substantially smaller, with prices dropping between June 14 and June 30, by 16% in convenience stores, 15% in groceries, and 18% in minimarkets.

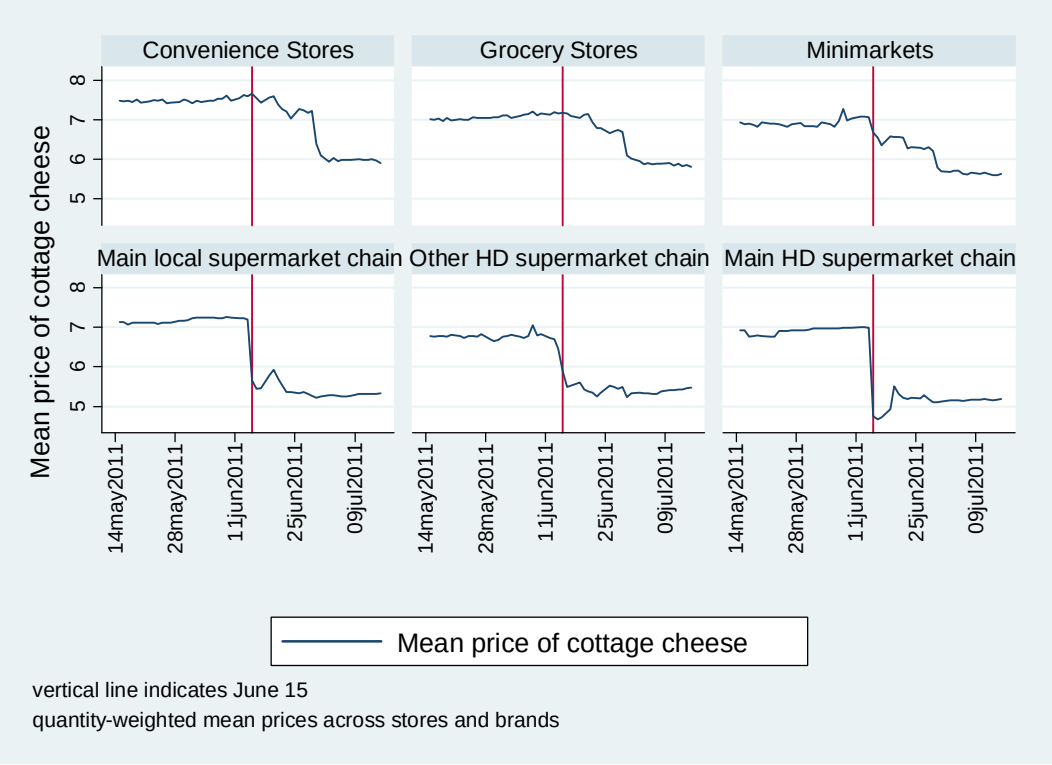


Figure 3: Mean price of cottage cheese by store format around the boycott period

Figure 4 shows the standard deviation of prices by store format. The price cuts varied a lot across stores even within the same store format. This is particularly so within the group of supermarkets, especially those that belong to the main supermarket chains.

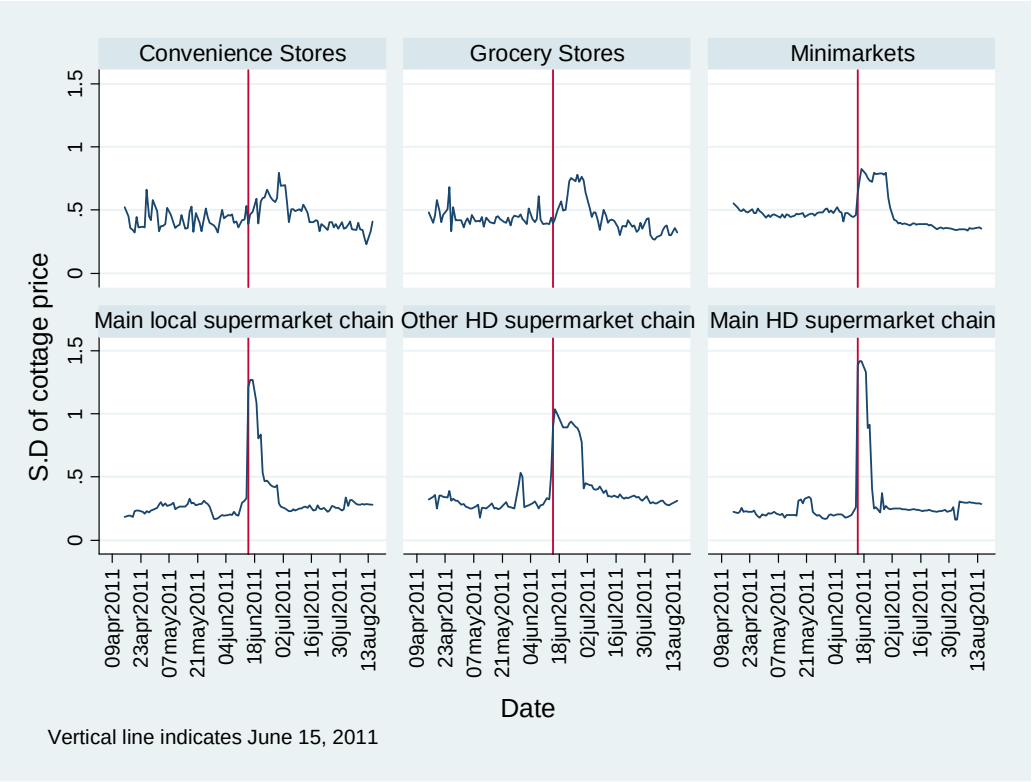


Figure 4: Standard deviations of cottage cheese price by store format around the boycott period

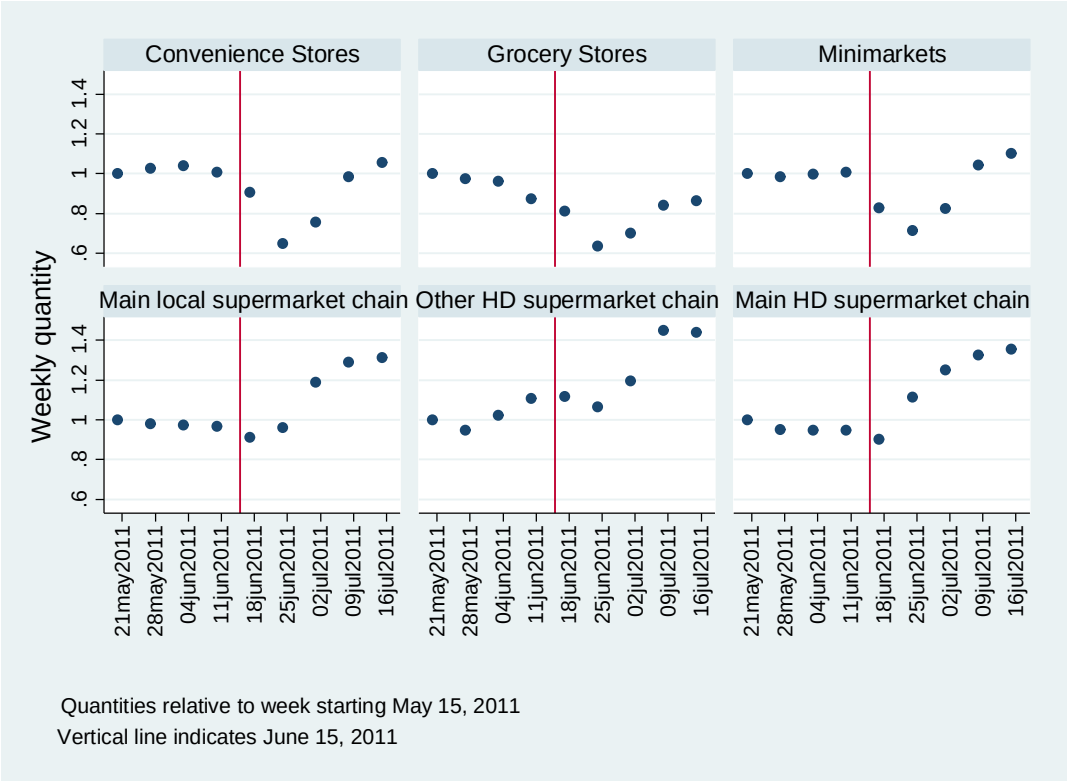
While we cannot tell from the data whether manufacturers or retailers took the lead in lowering prices – and keeping them low – there are indications suggesting that large retailers were the first to react to the boycott, while manufacturers lowered wholesale prices later. First, as shown in Figure 4, the steep increase in price dispersion following the boycott is consistent with the stores, rather than the manufacturers, taking the initiative of reducing prices. Second, price declines were quite uniform across brands within a store, also suggesting that the decision to cut prices was made at the store (or chain) level rather than at the manufacturer level. Indeed, redoing Figures 3 and 4 by brand shows essentially the same picture. Third, small retailers dropped prices only after the manufacturers publicly announced cuts in their wholesale prices.

A possible explanation to why large retailers took the initiative in reacting to the boycott is that, in light of the attention garnered by the product category, lowering prices worked as a sort of loss leader. This interpretation is consistent with the evidence mentioned in Section 2.1 that several large supermarket chains announced special temporary deals as soon as the boycott started. By contrast, Tnuva – the largest manufacturer – initially announced it would not cut prices, but towards the end of June, after three new groups formed on Facebook calling for the boycott of all of Tnuva's products, Tnuva announced wholesale price concessions. The other two manufacturers – Strauss and Tara – followed Tnuva's lead. We turn to the longer run price effects of the boycott in Section 7.1 below.

4.2 Consumers' reaction to the boycott: quantities

A key for the success of a boycott is the harm that boycotters can inflict on the target. In this case, there were at least three potential channels through which firms can be harmed: (i) the immediate loss of sales, (ii) the risk of the government deciding to re-regulate prices or to introduce market reforms (such as eliminating various restrictions on imports), and (iii) the risk of class action on the grounds that prices are excessive.[24,25]

While it is hard to quantify the risk of government intervention and the risk of class actions, we can use our data to examine the direct loss of sales due to the boycott. Figure 5 shows the changes in the quantity of cottage cheese sold during the period May 15 to July 15 by store format. Because sales vary considerably within the week (high sales on Thursdays and Fridays and low sales on Sundays and Mondays), we present weekly totals and express them relative to the total quantity during the first week of this period (the data being displayed on the first day of the week, a Sunday).



[24] Indeed, the government decided to re-regulate the price of white cheese from January 1, 2014 (see http://www.moag.gov.il/agri/yhidotmisrad/dovrut/publication/2013/prices_change_jan_2014.htm.)

[25] The latter is relevant for Tnuva, which was declared a monopoly in the "milk and milk products" market by the IAA in 1989; the Israeli antitrust law prohibits a monopoly from abusing its dominant position, among other things, by charging "unfair prices." Among other things, the declaration can serve as prima facie evidence for the firm's dominant position in any legal proceeding, including class action law suits. Indeed on July 2011, a class action lawsuit was filled in the Tel Aviv district court, alleging that Tnuva has abused its monopoly position.

Figure 5: Quantity of cottage cheese sold by store format around the boycott period

Quantities dropped only slightly during the first week of the boycott, which is not too surprising given the 24% price decline around June 15th. Most of the decline occurred in the smaller store formats (convenience, grocery stores, and minimarkets), which did not cut prices immediately. The quantity data, however, conflates two opposing effects: an inward shift in demand due to the boycott and a downward movement along the new demand curve following the steep price reduction. In order to disentangle the two effects and infer the boycott effect on demand, we estimate a demand system and use it to impute the level of demand, given the new low prices but for the boycott.

While the purchase decision at the household level is a discrete choice – how many units and what brands to purchase – in the absence of consumer level data, we can only estimate an aggregate demand system. We could still estimate a discrete choice model of aggregate demand, but we do not think it is necessary. Discrete choice modeling is handy when the choice set is large, requiring many parameters to be estimated relative to the available data. In our application the choice set is quite limited (only six products), while the store-level daily data provide us with a large number of observations.

Our basic specification assumes that the demand for brand j at store s in day t is linear in logs:

$$\log q_{jst} = \alpha_{sj} - \beta_j \log p_{jt} + \sum_k \gamma_{jk} \log p_{kt} + x_t\delta + \varepsilon_{jst}, \qquad j = 1,2,3 \qquad k \neq j \tag{2}$$

where α_{sj} is a brand-specific intercept for each store s, x_t are exogenous covariates that vary only over time (day-of-the-week dummies and week dummies), and ε_{jst} is an $i.i.d.$ shock.

Price endogeneity is always a concern when estimating demand functions. First, there is a cross-sectional concern that stores may be of heterogeneous quality (service, location, product assortment, etc.), and quality may determine both sales and prices. Ignoring store heterogeneity may bias the estimated price elasticities. We expect a downward bias in the estimated elasticities because higher prices are associated with higher unobserved quality and therefore more sales. The structure of our data allows us to control for brand-store fixed effects to deal with this type of endogeneity at the brand-store level. In addition, there is a time dimension concern if unobserved demand shocks drive both prices and quantities. We therefore include "day of the week" dummies to control for within-week consumption variation, and dummies for each of the 121 weeks in the sample to control, in a flexible way, for main holidays, seasonality and other trends for each brand of cottage cheese. The price variation used for estimation is, therefore, store-level deviations from the daily mean price (which itself evolves over time) for each brand. As suggested by Figure 1, most of the variation in prices is over time and can be traced to national-level (wholesale) changes generated by manufacturers. As shown in Figure 4, however, there is also some variation in prices across stores even after controlling for store format. For example, in supermarkets belonging to

the main retail chains, prices are likely to be set at the chain level rather than by individual store managers. Discussions with insiders suggest that the main retail chains set prices by geographical and socioeconomic areas (unknown to us), which in turn generates variation in prices across stores at a given point in time. In other words, the variation in store-level prices is related to the differential timing and depth by which wholesale price changes are passed through to local store levels. Importantly, wholesale price changes are not likely to be driven by changes in store-specific demand. Thus, given our understanding of pricing in this market and using the added controls, we believe that endogeneity of store-level prices is not a major concern in this context.[26]

An additional endogeneity concern, not addressed by store and week fixed effects, is due to store- or chain-specific promotions. While cottage cheese products are not the subject of specific promotions (as indicated to us by industry insiders) there are retailer-brand-level promotions (including cottage cheese) which may create a spurious relation between prices and quantity. We expect the estimated elasticities to be upward biased (in absolute value) as low prices may capture promotional activities.

To verify that promotional activity does not substantially affect our estimated elasticities, we use prices in other cities, prices of other chains in the same city and prices of other chains in other cities to instrument for prices in equation (2). Instrumenting leads to very limited qualitative differences; elasticities remain of the same order of magnitude. These estimates are shown in Appendix E. The IV estimates, however, are sensitive to which specific instruments and which fixed effects are used, and often result in negative cross prices effects.[27] For these reasons, we are more confident in our OLS-fixed effect estimator of equation (2), which we adopt for the rest of the paper. Notice also that our interest is in "before and after" and "across locations" comparisons and therefore our conclusions should remain valid as long as any potential biases are not systematically different across these dimensions.

OLS-fixed effects estimates of the demand parameters are shown in Table 2 and described later in Section 5. For now, we only use the estimated parameters for the pre-boycott period (January 1, 2010 – June 14, 2011) from the basic specification (columns (1)-(3)) to predict quantity under the pre-boycott demand function at post-boycott prices. Formally, we define the boycott index at time t as follows:

$$BI(p_t, q_t) = 100 \times \left(\frac{q_t}{\widehat{q}_{pre}(p_t)} - 1 \right),$$

[26] Decomposing the variation of (log) price for each of the three brands we find that, on average, store and week dummies account for 13% and 64% of the total variation, respectively (the differences across brands is minor). "Day of the week" dummies account for almost nothing. Thus, most of the variation in prices is over time. Naturally, the week dummies capture the break in prices due to the boycott but, redoing the variance decomposition for the subperiod before the boycott (before May 15, 2011) and for the subperiod after the boycott (after October 2, 2011) we find that week dummies account for a substantial 27% of (log) price variation.

[27] A possible reason for this fragility is that the retail chain information is less reliable than our price data since it was put together by matching store's addresses to information available in the Internet on retail chain branches.

where t is a period after the boycott started, $\widehat{q}_{pre}(p_t)$ is the predicted quantity under the pre-boycott demand function at observed prices p_t, and q_t is observed sales at time t.

The index $BI(p_t, q_t)$ captures the gap, in percentage terms, between observed sales and predicted sales at observed post-boycott prices. It measures how much lower demand in period t is relative to what it would have been expected at prices p_t had the boycott not occurred. Negative values of the index indicate that sales were below their expected level. The more negative the index, the more intense the boycott effect is. The BI index proxies foregone sales and will help us to evaluate the initial impact of the boycott, as well as its evolution throughout the summer of 2011.

Details of the computation of $BI(p_t, q_t)$ are presented in Appendix C. Figure 6 shows $BI(p_t, q_t)$ from the start of the boycott on June 14, 2011 until the end of August, 2011. For ease of exposition, we show a normalized BI index obtained by subtracting its value on June 14, 2011.

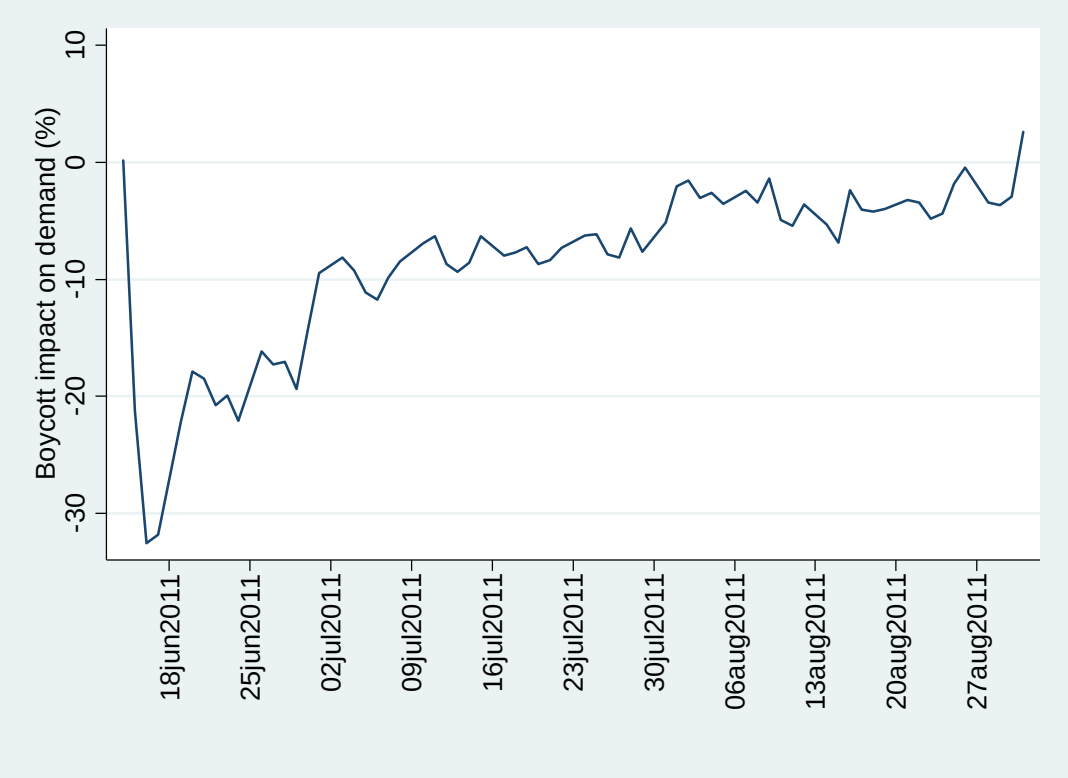


Figure 6: Boycott impact-on-demand index (all brands)

Figure 6 shows an immediate and quite strong effect: sales are much lower than anticipated given the substantial price reductions. The toll on profits (or revenues) inflicted on firms at the beginning of the boycott is quite serious. Gradually, the boycott impact diminishes. About six weeks after its start, the boycott effect all but fizzled out. While sales recovered and surpassed pre-boycott levels due to the lower prices, they matched the expected demand at observed prices.

Underlying the evolution of the BI index is a downward shift of demand as illustrated in Figure 7. On the eve of the boycott, the quantity sold and average price were (q_0, p_0). Once the boycott started, average prices dropped by 24% to p_1 virtually overnight and quantity sold decreased slightly to q_1. The BI index shows that the predicted demand at the new low price, $\widehat{q}_{pre}(p_1)$, should have been 30% higher than q_1 had the demand function not been affected by the boycott. Gradually, the boycott effect fizzled out: towards the end of August 2011 the quantity sold at the new average price p_1 converged to $\widehat{q}_{pre}(p_1)$. In other words, the post-boycott demand curve passes through $(\widehat{q}_{pre}(p_1), p_1)$. As we will show in Section 5, the post-boycott demand curve is more elastic than the pre-boycott demand curve.

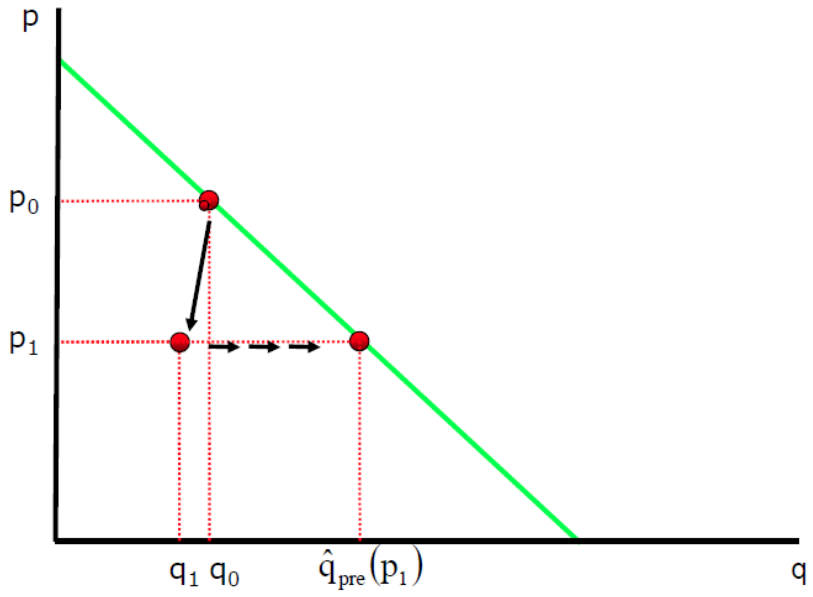


Figure 7: The evolution of the BI index

Judging by the evolution of the BI index, firms rightfully reacted with immediate price concessions, but then correctly perceived there was no need for further price reductions, despite the creation of additional boycott groups on Facebook. The public appears to have been satisfied with their initial accomplishments.

5 What did the boycott do?

The previous sections show that, by and large, the public rallied behind the boycott organizers, forcing the three dairies and retailers to cut prices. In this section we examine the lasting impact of the boycott campaign on demand.

As in most boycotts, the organizers based their argument on claims of unfair business practices in order to motivate the public to join the cause. This animosity can lead to a drop in demand,

a temporary or a long-lasting one, should the reputation of the target firms be tarnished. As documented in previous sections, demand did decline but, judging by the BI index, only temporarily. In addition, by raising the public's awareness to the high prices in the product category, the boycott may change consumers' shopping habits, possibly inducing them to search more and compare prices across brands, products, and store formats.[28] One would expect increased consumers' awareness to translate into higher own and cross price elasticities.

We use the demand system presented in Section 4.2, to study whether demand changed following the boycott. We estimate variants of equation (2) interacting each regressor, including the store fixed effects, with a before/after indicator. Thus, our estimates of the change in price elasticity account for differential effects of the boycott on the level of sales of different stores. The sample period is January 1, 2010 until April 30, 2012, excluding the subperiod May 15, 2011 - October 2, 2011. This subperiod covers the boycott, as well as the tents protest, and is excluded because we want to use data from periods when consumer preferences are stable.[29] We estimate each equation separately because there are no efficiency gains to joint (SUR) estimation. Table 2 reports OLS elasticity estimates, controlling for the various fixed effects.

In Columns (1)-(3) we only include cottage cheese prices – own price and the price of the other two brands. Own (brand) price elasticities are negative and of reasonable size. They increase, in absolute value after the boycott suggesting that consumers become more price sensitive, though the increase is statistically significant only for brands B and C. Interestingly, brand A's own price elasticity, which did not significantly change after the boycott, is a lot smaller than that of the other two brands.[30] This is interesting because all three brands were similarly priced before the boycott, despite the large difference in price elasticities. We return to this point in Section 7.

Cross-price elasticities are all positive, so that brands are perceived by consumers as substitutes. The cross-price elasticities also increase significantly after the boycott: consumers become more willing to substitute. The increase in cross price elasticities is quite substantial: the average of the six cross-brand price elasticities, over the three equations, was 0.198 before the boycott and increased five-fold to 1.002 after the boycott. Especially large is the increase in substitutability between brands A and C.

The change in own and in cross-price elasticities is consistent with the boycott having increased consumers' awareness prompting them to engage in more active search for lower prices

[28] Indeed, a consumer survey from August 2011, reported in the press, showed that following the boycott, a third of the respondents reported that they buy fewer consumer products, including dairy products, and 60% reported that they search for cheaper products (see http://www.globes.co.il/news/article.aspx?did=1000674348).

[29] We also excluded the subperiod corresponding to a strike at one of the manufacturers (March 18, 2012-April 3, 2012)

[30] The finding that A's own price elasticity did not change significantly could be the result of a composition effect. While all buyers (including those of A) may have became more price sensitive, the more price sensitive consumers may have migrated away from A, leaving A's own-price elasticity unchanged.

and in more substitution across brands.

In Columns (4)-(6) we add the prices of the three brands of white cheese. The number of observations is reduced by about 23% since many stores do not sell all six products on any given day. Although many of the estimated white cheese price coefficients are significant, in most cases, the cottage cheese price elasticities do not change much. Because the latter are the main focus of the paper, we omit white cheese prices from the regressions that follow for the sake of parsimony and in order to use a larger sample.[31]

[31] Our estimates are robust to different specifications of the regression model and clustering. For example, aggregating the data to a weekly frequency gives similar estimates of the price elasticities. Clustering at the city level to account for spatial correlations among stores in the same city generates very similar standard errors and does not change the statistical significance of any of the estimates.

Table 2: Cottage cheese own and cross price elasticities

Dependent Variable: log quantity						
	(1)	(2)	(3)	(4)	(5)	(6)
Brand	A	B	C	A	B	C
Constant	9.352***	9.578***	9.922***	10.623***	9.694***	11.761***
	0.11	0.105	0.154	0.101	0.115	0.172
Constant × after	-1.426***	-1.927***	-1.24***	-1.382***	-1.094***	-2.108***
	0.152	0.23	0.281	0.154	0.235	0.34
Log Price A	-1.564***	0.505***	0.144	-1.283***	0.603***	0.274***
	0.101	0.072	0.095	0.092	0.074	0.101
Log Price A × after	-0.13	1.548***	1.628***	-0.289	1.410***	1.536***
	0.161	0.211	0.235	.204	0.216	0.27
Log Price B	0.108***	-3.632***	0.114***	0.09***	-3.446***	0.226***
	0.022	0.058	0.043	0.019	0.06	0.05
Log Price B ×after	0.161***	-1.075***	0.482***	0.147***	-0.992***	0.289***
	0.049	0.099	0.076	0.043	0.105	0.072
Log Price C	0.031	0.238***	-4.300***	0.092**	0.285***	-3.85***
				0.028	0.046	0.108
Log Price C × after	0.436***	0.569***	-0.771***	0.372***	0.365**	-1.931***
	0.033	0.042	0.105	0.065	0.113	0.208
Log Price A white cheese	–	–	–	-0.207***	-0.084*	-0.166***
				0.029	0.038	0.051
Log Price A white cheese × after	–	–	–	0.127*	0.187	0.521***
				0.074	0.105	0.114
Log Price B white cheese	–	–	–	0.012	0.019	0.034
				0.015	0.024	0.032
Log Price B white cheese × after	–	–	–	0.009	0.364***	-0.019
				0.044	0.086	0.073
Log Price C white cheese	–	–	–	-0.037*	0.003	-0.373***
				0.021	0.034	0.051
Log Price C white cheese × after	–	–	–	0.074*	0.192**	1.053***
				0.044	0.08	0.115
Number of observations	431,954	431,954	431,954	330,907	330,907	330,907
R squared	0.88	0.74	0.72	0.87	0.72	0.71

Daily price data are used. The sample period is from January 1, 2010 until April 30, 2012, excluding the boycott period (May 15, 2011-October 2, 2011) and the period corresponding to a strike at Tnuva (March 18, 2012-April 3, 2012). The coefficients for the interactions with the "after"

indicator represent the additional effect after the boycott. All regressions include "day of the week" and store effects whose values are allowed to change after the boycott, as well as a set of week dummies to capture weekly aggregate effects over the sample period. Standard errors clustered at the store level in small numerals. *p<0.10; **p<0.05; *** p<0.01

Besides its effect on cottage cheese, the boycott also had an effect on the demand for white cheese. As mentioned in Section 2.1, the boycott leaders announced on June 16, 2011, that the boycott also applies to white cheese. Figure 8 shows that shortly after this announcement the quantity-weighted mean price of all three brands of white cheese dropped significantly.

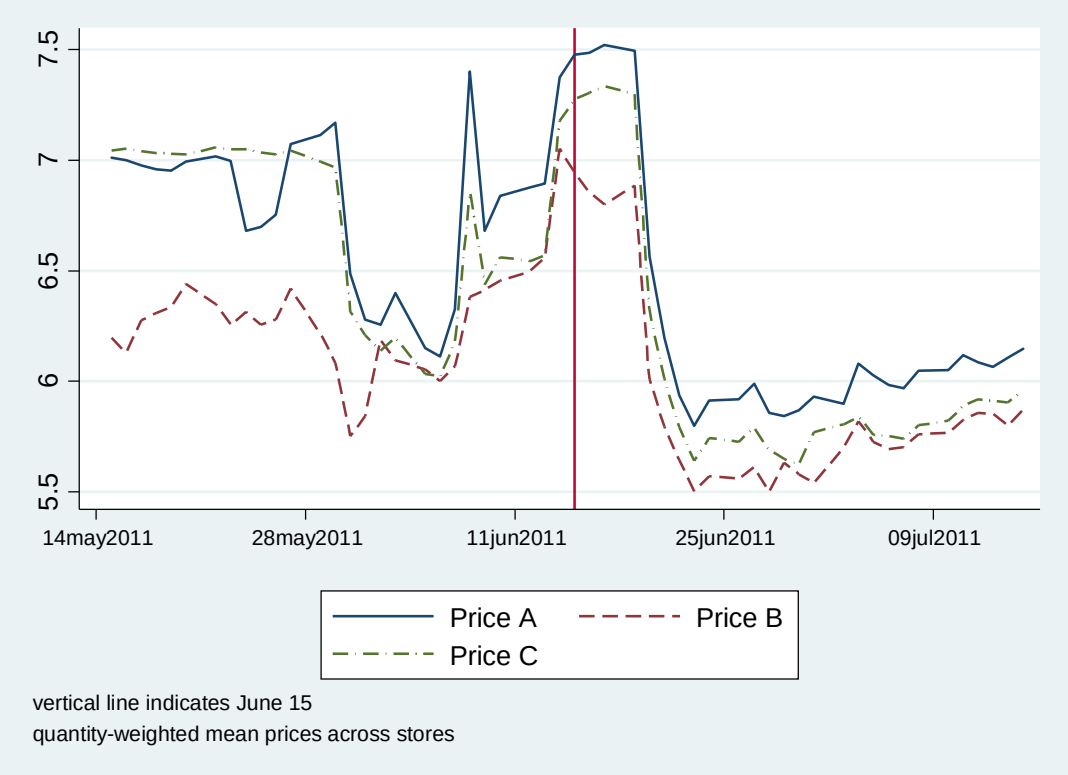


Figure 8: Daily mean price of white cheese by brand

To study the long-term effect of the boycott on white cheese, we estimate the demand function (2) for white cheese, using the same specifications as in Table 2. The results, which appear in Table F1 in Appendix F, show that, similarly to cottage cheese, the own (brand) price elasticities increased in absolute value after the boycott, though the increase is statistically significant only for brands B and C, and the cross-brand price elasticities increased substantially after the boycott.

6 Demographics and social networks

Although the boycott led to a swift decrease in the price of cottage cheese all over the country, the intensity of the boycott and its impact on price elasticities were not uniform across regions. In this section we examine the reaction of consumers in more detail by correlating the impact of the boycott on demand and the changes in price elasticities with demographic variables. Some of these variables (e.g., Internet connection) may serve as proxies for the use of social networks.

The demographic data come from the 2008 Israel Census of Population conducted by the Central Bureau of Statistics. They correspond, when available, to the statistical area in which the store is located. A statistical area is a relatively small, homogenous, geographical area (with population between $2,000$ and $5,000$) within cities, defined by the Central Bureau of Statistics (similarly to census tracts in the US). When we do not have data at the statistical area, the match is done using demographic data at the subquarter, quarter, or city level.

6.1 Who participated in the boycott?

To examine how the impact of the boycott on demand varied across different regions, we define for each store s, the average BI index for that store over the period June 15 – August 31, 2011:

$$BI_s = \frac{1}{T_s}\sum_{t=1}^{T_s} 100 \times \left(\frac{q_{st}}{\widehat{q}_{pre}(p_{st})} - 1\right),$$

where T_s is the number of days for which we have price and quantity observations for store s during the period. The index BI_s shows the average daily percentage point decrease in sales of cottage cheese in store s during June 15 – August 31, 2011 relative to what would have been expected at post-boycott prices had the boycott not occurred.

We then regressed BI_s on six demographic variables measured at the stores' location; we run separate OLS regressions for each demographic variable (each store is an observation). The estimated coefficients are reported in Table 3.

Table 3: Correlation between BI_s and demographics

	BI_s	Number of observations
Coefficient of:		
% of those aged 15 and over with bachelor's degree	$-.658^{***}$	838
	0.138	
% of men over 15 who study in a "yeshiva" (religious school)	$.195^{***}$	817
	0.048	
% of those aged 65+	$-.007$	886
	0.07	
% of households using a PC	$-.362^{***}$	882
	0.059	
% of households with an Internet subscription	$-.360^{***}$	882
	0.077	
Average number of mobile phones per household	-7.96^{***}	882
	1.639	

Standard errors clustered at the statistical area level in small numerals. *** p<0.001

The percentage of the adult population with a bachelor degree is negatively correlated with the BI_s index, while the percentage of the population who study in a religious school is positively correlated with the BI_s index. This means that the decrease in demand for cottage cheese was stronger in areas with more educated and less religious population. The correlations also indicate that the boycott effect was stronger in areas where more households had a PC, mobile phones, and Internet connection. To the extent that these variables are positively correlated with exposure to social media, these results suggest that the boycott impact on demand was stronger in areas with higher exposure to social networks. Of course, our demographic proxies do not reveal the causal effect of social media on the boycott's impact because they are also correlated with other unobserved characteristics that are likely to affect quantity demanded. Nevertheless, they seem to work in the anticipated direction: namely, the impact of the boycott is stronger in locations where the demographics would suggest that the population was more likely to be exposed to social networks. This finding validates our conclusion that the boycott had a negative impact on the demand for cottage cheese.

6.2 Who was influenced by the boycott?

We now examine whether demand changed differentially by demographic composition. To this end we estimated the demand functions for each brand of cottage cheese, allowing the elasticities to

vary with demographics, as well as with the boycott. We do this by interacting prices, as well as the store effects, with two indicators: one for the store's location being above the median value of each demographic variable, and the other for the period after the boycott. We can thus assess the relation between demographics and demand elasticity and, more importantly, the relation between demographics and changes in elasticities following the boycott.

In Table 4 we report the own-price elasticities for each brand in locations where the corresponding demographic variable – the percentage of households using a PC and the percentage of population aged 15 and over with a bachelor's degree – is above and below the median, as well as before and after the boycott. We display above-below and after-before differences and their estimated difference-in-difference (in the bottom right cell). Results for the other four demographic variables appear in Table D1 in Appendix D (the underlying estimates of the demand function are shown in Tables D2-D4).

Table 4: The effect of demographics on cottage cheese own price elasticity

	% of households using a PC			% of population with first academic degree		
	Own-price elasticity A			Own-price elasticity A		
	Before boycott	After boycott	After - Before	Before boycott	After boycott	After - Before
Below median	-1.855^{***}	-1.923^{***}	-0.068	-1.928^{***}	-2.072^{***}	-0.144
	0.132	0.172	0.194	0.143	0.204	0.228
Above median	-1.174^{***}	-1.376^{***}	-0.202^{***}	-1.211^{***}	-1.266^{***}	-0.055
	0.107	0.195	0.213	0.106	0.149	0.170
Above - Below	0.681^{***}	0.547	-0.134	0.717^{***}	0.806^{***}	0.089
	0.152	0.211	0.243	0.160	0.202	0.239
	Own-price elasticity B			Own-price elasticity B		
Below median	-4.067^{***}	-5.128^{***}	-1.061^{***}	-4.129^{***}	-5.047^{***}	-0.918^{***}
	0.077	0.128	0.135	0.077	0.133	0.139
Above median	-3.144^{***}	-4.246^{***}	-1.102^{***}	-3.112	-4.445^{***}	-1.333^{***}
	0.079	0.112	0.139	0.080	0.116	0.148
Above - Below	0.923^{***}	0.882^{***}	-0.041	1.017^{***}	0.602^{***}	-0.415^{**}
	0.109	0.161	0.187	0.109	0.167	0.193
	Own-price elasticity C			Own-price elasticity C		
Below median	-4.886^{***}	-5.343^{***}	-0.457^{**}	-4.887^{***}	-5.419^{***}	-0.532^{**}
	0.133	0.177	0.216	0.139	0.178	0.220
Above median	-3.453^{***}	-4.784^{***}	-1.331^{***}	-3.503	-4.812^{***}	-1.309^{***}
	0.132	0.151	0.190	0.126	0.164	0.198
Above - Below	1.433^{***}	0.559^{***}	-0.874^{***}	1.384^{***}	0.607^{***}	-0.777^{***}
	0.181	0.151	0.210	0.180	0.156	0.216

Standard errors clustered at the store level in small numerals. *p<0.10; **p<0.05; ***p<0.01

Three results are worth mentioning. First, demand is less price elastic in localities with higher computer usage and with more educated population, both before and after the boycott has started (the above - below difference is always positive and significant in all but one case).[32] Since higher computer usage and a more educated population are likely to be associated with higher income levels (we do not have income data), our findings suggest, as one might expect, that richer households were less price sensitive both before and after the boycott has started. Second, the elasticities of brands B and C increase (in absolute value) after the boycott (the after - before difference is always negative and significant for brands B and C). In case of brand A, the after - before difference is also negative, but it is significant only in one case out of four. Third, there is some

[32] In the median location, 17% of the 15+ population has a bachelor's degree, and 78% of the households use a PC.

evidence that the (absolute) increase in price elasticity after the boycott was larger in locations with higher computer usage and with more educated population: the difference-in-difference estimate is negative for brands B and C (though is not significant for brand B in one of the two cases). To the extent that the demographics are correlated with exposure to social media, these findings suggest that locations which are more exposed to social media became more price sensitive after the boycott. As mentioned above, even if we cannot infer the causal effect of media utilization, the interactions between the change in elasticities and demographics help validate our estimation, as the implied boycott impact is stronger where it is expected to be.

7 Firms' behavior

There are at least three plausible hypotheses for the swift price reductions. First, firms may have been concerned that the boycott might spill over to other product categories and wanted to protect their brand and image. Second, firms may have responded optimally to the increase in the elasticities of demand. Third, firms may have feared public backlash in the form of government intervention (e.g., re-regulation of prices or the elimination of import barriers) or class action law suits. We will now consider the latter two alternative explanations in detail.[33]

7.1 Firms' response to the boycott

The evidence presented in Section 4.1 suggests that the swift price reduction following the boycott was initially due to temporary special sales by large supermarket chains which probably tried to draw customers to their stores with low prices of cottage cheese. In this section we turn to the long-run effects of the boycott, once a new equilibrium has been reached. Having estimated demand elasticities before and after the boycott, we can follow the Industrial Organization tradition and assume that the prices of the three brands were determined in a Nash equilibrium of a simultaneous pricing game.[34] We use the equilibrium conditions to solve for the expected price increase associated with the changes in demand elasticities. This exercise allows us to assess the extent to which the observed price decline can be explained by the change in preferences (elasticities).

[33] We don't have detailed data on other dairy products beside cottage and white cheese to examine whether the demands for these other products were affected by the boycott. Data from the Central Bureau of Statistics shows that prices of several dairy products like plain yogurt, hard cheese, and sour cream were not affected by the boycott although, as mentioned at the end of Section 2.1, Tnuva did cut the prices of dozens of products by about 15% shortly after the IAA dawn raid on October 2, 2011.

[34] If firms were colluding pre-boycott, prices might not have been determined by the first-order conditions. We believe, however, that pre-boycott collusion is unlikely because the three dairies were heavily scrutinized by the Israeli Antitrust Authority (including a dawn raid on Tnuva's offices in October 2011) and, as far as we know, no evidence for collusion was found. Moreover, none of the many class action law suits that were filled against the dairy manufacturers after the boycott alleges collusion (they are all based on abuse of dominant position arguments).

We begin by assuming that the price of each brand b was set jointly by retailers and the manufacturer. This assumption is a reasonable approximation: discussions with one of the manufacturers reveal that manufacturers and retailers bargain over many issues including wholesale prices, who bears the cost of various sales and promotions, slotting allowances, and annual bonuses. This implies that every pair of retailer and manufacturer sets prices to maximize the joint profits of the vertical structure. The inverse elasticity rule for each brand b is given by $\frac{p_b - c_b}{p_b} = \frac{1}{\eta_b}$, or $p_b = \frac{\eta_b c_b}{\eta_b - 1}$, where c_b represents marginal cost of brand b, and η_b is its pre-boycott own price elasticity. Assuming c_b did not change from before to after the boycott we have,

$$\frac{p'_b}{p_b} = \frac{\eta'_b}{\eta'_b - 1} \frac{(\eta_b - 1)}{\eta_b}, \tag{3}$$

where p'_b and η'_b are, respectively, the post-boycott price and own-price elasticity of demand of brand b.

It should be noted that since we estimate constant elasticities demand system (see equation (2)), the first-order condition of each brand is independent of the prices of rival brands. While this is a potential drawback of our approch, we do not believe it creates a problem for our main exercise, which involves the comparison of elasticities before and after the boycott. First, we estimate different elasticities before the boycott, when all prices were high, and after the boycott, when all prices, including those of rival brands, were much lower. Second, we also estimated a richer demand system, with the added terms $\delta_{ij} \log p_i \log p_j + \delta_{ik} \log p_i \log p_k$. Under this modified system, which can be interpreted as a flexible polynomial in logs, the elasticity of demand for brand j is given by $\beta_i - \delta_{ij} \log p_i \log p_j - \delta_{ik} \log p_i \log p_k$, so now the first-order condition of each brand does depend on the prices of other two brands. Although several of the interactions and cross prices elasticity estimates were not statistically significant, due to high collinearity, we were able to use the point estimates to compute elasticities. The new estimated elasticities differed from our reported elasticities by less than 1%.

Back to equation (3), we can now plug the estimated pre- and post-boycott price elasticities from Table 2 into equation (3), to examine which part of the price decline following the boycott can be explained by the change in the elasticities of demand. Since Table 2 shows no significant change in A's own-price elasticity, the 24% price drop of brand A cannot be explained by changes in preferences. And, although the own-price elasticities of demand of brands B and C did increase following the boycott, the computation shows that the post-boycott prices should have been only 8% below the pre-boycott price for brand B and only 5% below the pre-boycott price for brand C. Hence, the higher own-price elasticities of demand for brands B and C explain only a fraction of the 24% decline in their respective prices.

Although we assume realistically that the price of brand b is chosen to maximize the joint profit of the manufacturer and retailer, our conclusion continues to hold when we assume instead that the manufacturer of brand b unilaterally sets the wholesale price, w_b, while the retailers

unilaterally set the retail price, p_b. In Appendix G we show that the price of brand A should not have changed even in this alternative setting, while the prices of brands B and C should have dropped by only 15.4% and 8.6%, respectively; these estimates are still far below the actual drop of 24%.

The finding that actual prices were set substantially below the ones implied by the elasticities of demand highlights the fact that the tradition of using first order conditions to impute markups may miss important considerations about the business environment, which are not reflected in the demand function. In our case, it seems that the missing considerations have been the concern about public backlash in the form of damage to firms' images, or the possibility of government intervention in the market. We explore these possibilities in the next subsection.

Interestingly, we mentioned in Section 2.1 that according to the press, the IAA raid on Tnuva's headquarters seized a McKinsey report advising Tnuva back in 2008 to raise prices by at least 15%, due to low elasticity of demand. In retrospect, it seems that this advice may have contributed to the public backlash. Thus, a message of this paper is that insofar as pricing decisions are made solely on the basis of demand elasticities, ignoring features of the business environment, not easily captured by first order conditions, may lead to undesirable outcomes.

7.2 The threat of regulatory intervention

We now quantify the role of regulatory threat. We do so by imputing the threat which rationalizes the observed prices. Following Glazer and McMillan (1992) and Tanaka (2011), we allow for an expected loss from public backlash or government intervention, captured by $\mu(p)$, which is an increasing and convex function of the current price p. Each firm chooses its price p to maximize its value $V(p) = (p-c)Q(p) - \mu(p)$, where c is the per-unit cost. The first-order condition for p is

$$Q(p) + (p-c)\,Q'(p) - \mu'(p) = 0.$$

Assuming that $(p-c)Q(p)$ is concave in p, together with the convexity of $\mu(p)$, ensure that the first-order condition is sufficient for a maximum. At the optimum, firms trade off the effect of p on the short-run profit, $(p-c)Q(p)$, against the expected marginal loss from public backlash, $\mu'(p)$. Using η to denote the own price elasticity of demand, we can express the first-order condition as a modified inverse elasticity rule:

$$\frac{p - c - \frac{\mu'(p)}{Q'(p)}}{p} = \frac{1}{\eta}. \tag{4}$$

The expression $\frac{\mu'(p)}{Q'(p)}$ is the derivative of $\mu(p)$ with respect to the quantity produced (note that $\frac{\partial \mu(p)}{\partial Q} = \mu'(p)\frac{\partial p}{\partial Q} = \frac{\mu'(p)}{Q'(p)}$) and can therefore be interpreted as the marginal decrease in the expected loss from public backlash when output is expanded. Equation (4) shows that since $\frac{\mu'(p)}{Q'(p)} < 0$, the firm has an extra incentive to expand output when it faces a larger perceived threat of public backlash. Such perceived threat therefore leads to lower prices.

In the previous section, we used the standard first-order conditions to show that the increased elasticities cannot fully explain the observed price decline. The next step is to use equation (4) to back out $\frac{\mu'(p)}{Q'(p)}$.

Since we do not have precise cost data, we will perform a back of the envelope calculation based on data collected by the Ministry of Agriculture and Rural Development (MOAG). In what follows, we restrict our attention to brand A since the MOAG data are believed to be mostly relevant to this brand. The MOAG reports that the gross margin on cottage cheese (defined as the VAT-exclusive retail price net of the cost of raw milk) in 2010 was 13.30 NIS per kilogram, or 3.33 NIS per container (the Kahal report, 2011, second table in the Appendix). Since the average VAT-inclusive retail price of cottage cheese in 2010 was 25.86 NIS per kilogram, or 6.47 NIS per container (the Kahal report, 2011, Table 5), and since VAT was 16% in 2010 − 2011, the price of raw milk per container was equal to $\frac{6.47}{1.16} - 3.33 = 2.25$ NIS per container. According to the MOAG, raw milk accounts for 58.7% of the cost of dairy products.[35] Hence, the cost of a container of cottage cheese is estimated to be $\frac{2.25}{0.587} = 3.83$ NIS.

Using this cost estimate, recalling that the (16% VAT exclusive) pre- and post-boycott prices per container were $\frac{7}{1.16} = 6.03$ NIS and $\frac{5.5}{1.16} = 4.74$, and noting from Table 2 that the estimated own price elasticity of demand for brand A was 1.564 both before and after the boycott, equation (4) implies that $\frac{\mu'(p)}{Q'(p)}$ was −1.65 NIS before the boycott, but rose (in absolute value) to −2.12 NIS after the boycott. In other words, after the boycott, brand A chose its production level as if its marginal cost of production was reduced by 0.47 NIS and hence expanded output in a way that led to a 24% drop in the retail price.

Another way to examine the boycott's effect on prices is to rewrite equation (4) as follows:

$$\frac{p-c}{p} = \frac{1}{\eta}\left[1 - \frac{\mu'(p)}{Q(p)}\right]. \tag{5}$$

Here, $\frac{\mu'(p)}{Q(p)}$ represents the marginal loss of firm value due to public backlash per unit of output, which in our case is a 250 grams container. Substituting the same numbers as above into (5) reveals that $\frac{\mu'(p)}{Q(p)}$ for brand A was 0.43 NIS per container before the boycott, but rose by 0.27 NIS to 0.70 NIS after the boycott. This calculation suggests that the 24% drop in the retail price of brand A is consistent with a 63% NIS increase (from 0.43 NIS to 0.70 NIS) in the cost per container from of public backlash, as perceived by brand A.

8 Summary and conclusions

We study a consumer boycott organized through Facebook aimed at forcing manufacturers and retailers to lower prices in a concentrated market. We find that, on average, prices dropped virtually

[35] See

http://www.moag.gov.il/NR/rdonlyres/A9301A1D-C43D-4F87-B9E0-B8D45EE971BE/0/tyota_idkun_mehir_mutzrey_halav.pdf

over night by about 24%. The price decline was not uniform across stores and store formats. It was particularly large in the main supermarket chains, especially in the hard discount stores. Only after the main manufacturers announced a decrease in their wholesale prices, the retail price also fell in the small format stores, and remained at the new low level until the end of our sample period.

Demand declined by about 30% during the initial week of the boycott, relative to its predicted level had the boycott not occurred. The decline in demand was more pronounced in stores located in areas with more educated and less religious population and higher penetration of personal computers, internet, and mobile phones, where exposure to social networks is likely to be high. Although demand gradually rebounded within $6-8$ weeks, demand elasticities nonetheless become much larger than they were before the boycott. This increase is particularly large for cross-price elasticities which, on average, increased fivefold relative to their pre-boycott level. The increase in price elasticities can be due to increased price awareness. We find that the change in elasticities or preference only explains part of the price decline. The rest can be attributed to firms' fear of the boycott spreading to other products and to the fear of public backlash in the form or renewed regulation and possibly other market interventions.

Overall, it appears that the consumer boycott was successful. Prices dropped from around 7 NIS per container to about 5.5 NIS per container, and while the boycotters' demands to lower the price of cottage cheese to 5 NIS per container were never met in full, the price of cottage cheese remains relatively low even today, more than five years after the boycott. This is particularly striking given that over the same period, the prices of many other dairy products increased, some quite substantially.[36]

The economic literature has already shown that the Internet can provide timely and cheap information on prices and thereby enhance competition and lower prices. Our paper describes a detailed example of how social media, such as Facebook, can play a role in allowing atomistic consumers to organize into an effective force that disciplines firms into lowering prices.

[36] For instance, the average price of unsalted butter rose between May 2011 and April 2013 by 25%, the average price of natural yogurt rose by 18%, and the average prices of fresh milk and hard cheese rose by 8%. Over the same period, the average price of cottage cheese dropped by 12% and the average price of white cheese dropped by 6% (see the Center for Research and Information, Israeli Knesset, 2013).

A Summary of main events

Summary of main events

Date	Event
May 31, 2011	News articles describing the surge in food prices in Israel begin to be published
June 7-9, 2011	Shavuot holiday (traditionally a peak demand for dairy products)
June 14, 2011	A Facebook event is created, calling for a boycott of cottage cheese, starting on July 1, 2011
June 14, 2011	Several supermarket chains announce special sales of cottage cheese and other dairy products
June 15, 2011	The number of users who join the Facebook event approaches $30,000$[37]
June 16, 2001	The leaders of the Facebook event announce that the boycott will start immediately and recommend buying cottage and white cheese only if their prices drop under 5 NIS[38]
June 17, 2011	The number of users who join the Facebook event passes $70,000$[39]
June 24, 2011	Mrs. Zehavit Cohen, the chairperson of Tnuva's board, announces in a TV interview that Tnuva will not unilaterally lower the price of its cottage cheese Following the interview, three new groups who call for boycotting all of Tnuva's products were formed in Facebook Tnuva lowers the wholesale price of cottage cheese to 4.55 NIS; soon after, Strauss and Tara follow suit[40]
June 27, 2011	The government appoints the Kedmi committee to review competition and prices in food and consumption markets in Israel
June 30, 2011	The number of users who join the Facebook event surpasses $105,000$[41]
July 14, 2011	The "tents protest" starts on Rothschild Boulevard in Tel Aviv
July 17, 2011	The Kedmi committee recommends reforms in the dairy market
July 30, 2011	Mass rallies in major cities across Israel to protest the rising cost of living and demanding social justice
Sept. 3, 2011	Around $300,000$ people demonstrate in Tel Aviv against the rising cost of living and demanding social justice. This demonstration marks the peak of the social protest
Early Sept., 2011	12 student's associations announce their intention to boycott Tnuva until it lowers its prices[42]
Sept. 25, 2011	The Israeli Antitrust Authority raids Tnuva's central office as part of an open investigation of the extent of competition in the dairy industry
Oct. 2, 2011	Mrs. Zehavit Cohen announces its resignation as the chairperson of Tnuva's board. Tnuva announces that it will cut the prices of all its products by 15%.

B Data Appendix

In this Appendix we describe the process by which the initial working sample was generated. We start with $22,788,084$ observations, where each observation records the daily total volume of transactions recorded by the cash register on a specific item, in a specific store, in a specific day. An item is identified by its unique barcode.

1. **Negative values.** 77 observations had negative values for 3 key variables (number of items sold, total weight sold, total number of containers sold). The values of these variables were set to missing.

2. **Duplicates**. 955 observations had one additional duplicate observation and 290 additional observations had three additional duplicate observations. The $1,825$ additional "copies" were deleted and only one original observation was kept.

3. **Repeated observations**. Each observation should represent the total transactions in each store per day and item. That is, all the transactions for a given item are aggregated to a daily total. However, 105 (store, date, item) observations appear more than once. We keep these repeated observations (but not exact duplicates since the revenue and weight may vary) in the sample.

4. **Small revenue.** We delete $1,859$ observations with total daily revenue of less than 1 NIS.

After these changes were made to the original sample we were left with $22,784,400$ observations.

C Computation of the BI index

We compute the observed and predicted quantities for each brand separately and then add them up to get the (aggregate) BI index. We illustrate with brand A.

First, q_t is the daily quantity sold of brand A cottage cheese observed in the data. Second, $\widehat{q}_{pre}(p_t)$ is the predicted quantity sold of brand A under the pre-boycott demand at post-boycott prices p_t. This predicted quantity is computed in two steps. Denote by $\widehat{q}_{pre}(p)$ the fitted (predicted) quantity demanded estimated using the pre-boycott estimates. The expected increase in quantity attributed to the observed price decline (a move along the demand curve) is given by $\widehat{q}_{pre}(p_t) - \widehat{q}_{pre}(p_{t_0})$, where p_{t_0} are prices at a pre-boycott time t_0. Thus, predicted sales are:

$$\widehat{q}_{pre}(p_t) = q_{t_0} + \left[\widehat{q}_{pre}(p_t) - \widehat{q}_{pre}(p_{t_0})\right],$$

where q_{t_0} is the observed average quantity sold at the pre-boycott time t_0.

We use the demand function to estimate changes in quantity, rather than its level, because in this way we do not need to use the numerous estimated fixed effects, and we rely on observed quantities until the start of the boycott, making the predicted quantity at post-boycott prices more reliable.

We use the estimated parameters of the demand function appearing in the first three columns in Table 2 to compute the expected change in demand between the initial period t_0 and t, $\widehat{q}_{pre}(p_t) - \widehat{q}_{pre}(p_{t_0})$,

$$\widehat{\ln q}_A(p_t) - \widehat{\ln q}_A(p_{t_0}) = \hat{\beta}_A \left(\log p_{At} - \log p_{At_0}\right) + \hat{\gamma}_B \left(\log p_{Bt} - \log p_{Bt_0}\right) + \hat{\gamma}_C \left(\log p_{Ct} - \log p_{Ct_0}\right),$$

where $\hat{\beta}_A$, $\hat{\gamma}_B$ and $\hat{\gamma}_C$ are, respectively, the own and cross-price elasticities from the first column in Table 2 before the boycott started, and $\log p_{At_0}, \log p_{Bt_0}, \log p_{Ct_0}$ are prices in the pre-boycott period, being set equal to the mean price during June 9 – June 13, 2011.

We then have, for brand A,

$$\widehat{q}_{pre}(p_t) = q_{t_0} + e^{\widehat{\ln q}_A(p_t) - \widehat{\ln q}_A(p_{t_0})},$$

and similarly for the other brands.

We then add up the observed and predicted quantities over the three brands and compute the aggregate BI index. The daily variation in quantity sold during the week is also reflected in the BI index. We therefore remove "day-of-the week" effects by using the residuals from a regression of the BI index on day-of-the-week fixed effects. Furthermore, for ease of exposition, in Figure 6 we show a normalized BI index obtained by subtracting its value on June 14, 2011.

D Interactions with additional demographics

Table D1 shows the effects of internet subscription, number of mobile phones, religiosity, and share of older population in each locality on the own price elasticity of demand for cottage cheese. The results are quite similar to those reported in Table 4 for the other two demographic variables.

Table D1: The effect of demographics on cottage cheese own price elasticity

	% of households with Internet subscription			Average number of mobile phones per household		
	Own price elasticity A			Own price elasticity A		
	Before boycott	After boycott	After-Before	Before boycott	After boycott	After-Before
Below median	−1.84***	−1.887***	−0.047	−1.587***	−1.849***	−0.262
	0.136	0.167	0.191	0.130	0.169	0.190
Above median	−1.218***	−1.448***	−0.23	−1.536***	−1.52***	0.016
	0.104	0.199	0.216	0.129	0.191	0.216
Above-Below	0.622***	0.439**	0.183	0.051	0.329	0.278
	0.153	0.212	0.244	0.160	0.209	0.243
	Own price elasticity B			Own price elasticity B		
Below median	−4.083***	−4.976***	−0.893***	−3.641***	−4.942***	−1.301***
	0.078	0.125	0.132	0.078	0.117	0.129
Above median	−3.171***	−4.393***	−1.222***	−3.609***	−4.437***	−0.828***
	0.079	.121	0.144	0.084	0.126	0.141
Above-Below	0.912***	0.583***	−0.329*	0.032	0.505***	0.473**
	0.110	0.166	0.189	0.113	0.163	0.184
	Own price elasticity C			Own price elasticity C		
Below median	−4.825***	−5.342***	−0.517**	−4.299***	−5.197***	−0.898***
	0.141	0.167	0.212	0.138	0.165	0.208
Above median	−3.65***	−4.792***	−1.142***	−4.285***	−4.927***	−0.642***
	0.132	0.164	0.199	0.154	0.161	0.211
Above-Below	1.175***	0.55***	−0.625***	0.014	0.27*	0.256
	0.186	0.153	0.215	0.199	0.151	0.221

	% of Jewish men aged 15 and over who study in a "yeshiva"			% of those aged 65+		
	Own price elasticity A			Own price elasticity A		
	Before boycott	After boycott	After-Before	Before boycott	After boycott	After-Before
Below median	−1.386***	−1.763***	−0.377*	−1.644***	−1.63***	−0.014
	0.131	0.193	0.205	0.133	0.183	0.205
Above median	−1.831***	−1.67***	0.161	−1.506***	−1.795***	−0.289
	0.139	0.182	0.213	0.127	0.164	0.190
Above-Below	0.445***	0.093	0.583**	0.138	−0.165	−0.303
	0.169	0.216	0.250	0.162	0.200	0.235
	Own price elasticity B			Own price elasticity B		
Below median	−3.401***	−4.791***	−1.39***	−3.86***	−4.759***	−0.899***
	0.078	0.113	0.126	0.087	0.130	0.143
Above median	−3.893***	−4.789***	−0.896***	−3.42***	−4.673***	−1.253***
	0.086	0.135	0.143	0.072	0.117	0.128
Above-Below	−0.492***	0.002	0.494***	0.44***	0.086	−0.354*
	0.114	0.167	0.183	0.112	0.166	0.185
	Own price elasticity C			Own price elasticity C		
Below median	−4.109***	−4.893***	−0.784***	−4.395***	−5.183***	−0.788***
	0.156	0.174	0.224	0.144	0.160	0.204
Above median	−4.468***	−5.351***	−0.881***	−4.206***	−4.982***	−0.776***
	0.144	0.171	0.217	0.145	0.167	0.214
Above-Below	0.359*	−0.456***	−0.097	0.189	0.201	0.012
	0.205	0.158	0.231	0.197	0.153	0.222

Standard errors clustered at the store level. in small numerals.*p<0.10; **p<0.05; ***p<0.01

Tables D2–D4 present the estimated coefficients of the demand functions using interactions between the price regressors (and constant) and a full set of Above/Below (the median for each demographic variables) and After/Before (the boycott) indicators.

Table D2: Own and cross cottage cheese price elasticities and demographics

Dependent Var: log quantity						
	% of households using a PC			% of population with first academic degree		
	(1)	(2)	(3)	(4)	(5)	(6)
Brand	A	B	C	A	B	C
Constant (Before and Below)	12.508***	12.793***	13.483***	11.443***	11.784***	12.388***
	0.13	0.119	0.185	0.138	0.119	0.196
Constant × Above	-3.551***	-3.991***	-4.721***	-2.5***	-3.119***	-3.553***
	0.155	0.177	0.279	0.162	0.175	0.285
Constant × After	-2.328***	-1.543***	-1.153***	-0.476*	-2.381***	-1.581***
	0.181	0.265	0.314	0.198	0.299	0.338
Constant × Above × After	1.056***	0.066	0.825*	-0.882***	1.308***	1.353***
	0.223	0.327	0.4	0.225	0.323	0.405
Log Price A (Before and Below)	-1.855***	0.266**	-0.042	-1.928***	0.152	-0.072
	0.132	0.082	0.122	0.143	0.087	0.133
Log Price A × Above	0.681***	0.571***	0.457*	0.717***	0.720***	0.430*
	0.152	0.149	0.214	0.16	0.148	0.213
Log Price A × After	-0.068	1.927***	1.799***	-0.144	2.222***	2.091***
	0.194	0.247	0.276	0.228	0.276	0.287
Log Price A × Above × After	-0.134	0.816**	0.397	0.089	-1.278***	-0.815*
	0.243	0.31	0.348	0.239	0.304	0.357
Log Price B (Before and Below)	0.128***	-4.067***	0.07	0.105**	-4.129***	0.088
	0.032	0.077	0.056	0.032	0.077	0.057
Log Price B × Above	-0.029	0.923***	0.086	0.022	1.017***	0.099
	0.04	0.109	0.081	0.041	0.109	0.083
Log Price B × After	0.215**	-1.061***	0.541***	0.269**	-0.918***	0.513***
	0.081	0.135	0.105	0.083	0.139	0.103
Log Price B × Above × After	-0.135	-0.041	-0.147	-0.248*	-0.415*	-0.149
	0.097	0.187	0.143	0.099	0.193	0.148
Log Price C (Before and Below)	0.033	0.274***	-4.886***	0.023	0.251***	-4.887***
	0.046	0.047	0.133	0.048	0.047	0.139
Log Price C × Above	0.014	-0.075	1.433***	0.047	0.015	1.384***
	0.06	0.073	0.181	0.061	0.074	0.18
Log Price C × After	0.398***	0.492***	-0.457*	0.408***	0.587***	-0.532*
	0.08	0.101	0.215	0.087	0.104	0.22
Log Price C × Above × After	0.066	0.201	-0.874***	0.07	0.037	-0.777***
	0.094	0.125	0.21	0.095	0.128	0.216
Nobs	426,881	426,881	426,881	409,972	409,972	409,972
R squared	0.88	0.74	0.72	0.88	0.74	0.72

Daily price data are used. The sample period is from January 1, 2010 until April 30, 2012, excluding the boycott period (May 15, 2011-October 2, 2011) and the period corresponding to a strike at Tnuva (March 18, 2012-April 3, 2012). The coefficients for the interactions with the "After" indicator represent the additional effect after the boycott, while the coefficients for the interaction with the "Above" indicator indicate the additional effect for locations with above the median value of the corresponding demographic variable. All regressions include "day of the week" and store effects which are allowed to change after the boycott, as well as a set of week dummies to capture weekly aggregate effects over the sample period. Standard errors clustered at the store level in small numerals. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Table D3: Own and cross cottage cheese price elasticities and demographics

Dependent Var: log quantity						
	% of households with Internet subscription			Average number of mobile phones per household		
	(1)	(2)	(3)	(4)	(5)	(6)
Brand	A	B	C	A	B	C
Constant (Before and Below)	9.604***	10.158***	10.538***	12.057***	11.597***	12.821***
	0.139	0.130	0.203	0.131	0.124	0.194
Constant × Above	2.901***	1.871***	2.210***	-2.682***	-2.051***	-2.943***
	0.157	0.177	0.283	0.163	0.186	0.293
Constant × After	-1.515***	-2.313***	-1.652***	-0.755***	-0.883***	-0.915**
	0.185	0.291	0.332	0.184	0.257	0.297
Constant × Above × After	1.059***	1.668***	1.161**	-0.829***	-1.508***	-0.406
	0.224	0.321	0.398	0.223	0.324	0.409
Log Price A (Before and Below)	-1.840***	0.334**	0.075	-1.587***	0.514***	0.133
	0.136	0.086	0.132	0.13	0.088	0.131
Log Price A × Above	0.622***	0.418***	0.199	0.051	-0.007	0.0435
	0.153	0.148	0.211	0.16	0.150	0.215
Log Price A × After	-0.047	1.795***	1.727***	-0.262	1.316***	1.628***
	0.191	0.267	0.28	0.19	0.228	0.260
Log Price A × Above × After	-0.183	0.55	-0.3	0.278	0.476	0
	0.244	0.3	0.349	0.243	0.312	0.355
Log Price B (Before and Below)	0.136***	-4.083***	0.087	0.128***	-3.641***	0.107
	0.034	0.078	0.057	0.029	0.078	0.055
Log Price B × Above	-0.045	0.912***	0.042	-0.036	0.032	0.013
	0.041	0.109	0.082	0.041	0.113	0.084
Log Price B × After	0.193*	-0.893***	0.517***	0.163*	-1.301***	0.490***
	0.079	0.132	0.102	0.07	0.129	0.095
Log Price B × Above × After	-0.098	-0.329	-0.092	-0.019	0.473*	-0.033
	0.095	0.189	0.144	0.099	0.184	0.147
Log Price C (Before and Below)	0.03	0.279***	-4.825***	0.066	0.233***	-4.299***
	0.049	0.049	0.141	0.047	0.049	0.138
Log Price C × Above	0.012	-0.091	1.175***	-0.068	0.013	0.014
	0.061	0.073	0.186	0.062	0.073	0.199
Log Price C × After	0.389***	0.465***	-0.517*	0.393***	0.515***	-0.898***
	0.084	0.1	0.212	0.08	0.099	0.208
Log Price C × Above × After	0.087	0.272*	-0.625**	0.092	0.143	0.256
	0.095	0.125	0.215	0.094	0.126	0.221
Nobs	426,881	426,881	426,881	426,881	426,881	426,881
R squared	0.88	0.74	0.72	0.88	0.74	0.72

See notes to Table D2.

Table D4: Own and cross cottage cheese price elasticities and demographics

Dependent Var: log quantity						
	% of Jewish men aged 15 and over who study in a "yeshiva"			% of those aged 65+		
	(1)	(2)	(3)	(4)	(5)	(6)
Brand	A	B	C	A	B	C
Constant (Before and Below)	10.885***	10.774***	11.398***	9.440***	9.861***	9.721***
	0.129	0.124	0.227	0.145	0.153	0.211
Constant × Above	-1.243***	-0.832***	-1.277***	2.731***	2.053***	3.153***
	0.169	0.184	0.299	0.163	0.185	0.286
Constant × After	-0.204	-1.440***	-0.890*	-1.586***	-2.051***	-1.184***
	0.183	0.291	0.376	0.195	0.293	0.353
Constant × Above × After	-1.490***	-0.949**	-0.448	-0.482*	0.913**	0.619
	0.233	0.342	0.418	0.22	0.323	0.393
Log Price A (Before and Below)	-1.386***	0.557***	0.101	-1.644***	0.437***	0.422**
	0.131	0.09	0.151	0.133	0.12	0.151
Log Price A × Above	-0.445**	-0.212	-0.048	0.138	0.142	-0.541**
	0.169	0.137	0.211	0.162	0.148	0.206
Log Price A × After	-0.377	1.576***	1.783***	0.014	1.550***	1.561***
	0.205	0.27	0.323	0.205	0.28	0.292
Log Price A × Above × After	-0.538*	0.335	0.052	-0.303	0.059	0.094
	0.249	0.318	0.363	0.235	0.306	0.343
Log Price B (Before and Below)	0.106***	-3.401***	0.165**	0.121***	-3.860***	0.13
	0.027	0.078	0.061	0.034	0.087	0.069
Log Price B × Above	0.007	-0.492***	-0.046	-0.024	0.440***	-0.025
	0.043	0.114	0.083	0.042	0.112	0.084
Log Price B × After	0.174*	-1.390***	0.417***	0.107	-0.899***	0.550***
	0.084	0.126	0.11	0.063	0.143	0.116
Log Price B × Above × After	-0.035	0.494**	0.047	0.103	-0.354	-0.134
	0.107	0.183	0.149	0.099	0.185	0.146
Log Price C (Before and Below)	0.053	0.182***	-4.109***	0.011	0.249***	-4.395***
	0.045	0.048	0.156	0.051	0.061	0.143
Log Price C × Above	-0.055	0.112	-0.359	0.047	-0.011	0.189
	0.065	0.068	0.205	0.062	0.072	0.197
Log Price C × After	0.499***	0.730***	-0.784***	0.515***	0.487***	-0.788***
	0.08	0.111	0.224	0.079	0.109	0.204
Log Price C × Above × After	-0.071	-0.233	-0.097	-0.144	0.174	0.012
	0.1	0.126	0.231	0.093	0.123	0.222
Nobs	399,753	399,753	399,753	428,359	428,359	428,359
R squared	0.87	0.74	0.72	0.88	0.74	0.72

See notes to Table D2

E An IV estimator

The IV estimation is based on the following procedure. We use information on the retail chain to which store s belongs and compute, for each brand, the (quantity-weighted) mean cottage price in stores that belong to other retail chains and are located in other cities (IV1), the (quantity-weighted) mean price in stores that belong to other retail chains but are located in the same city (IV2), and the (quantity-weighted) mean price among all stores in other cities (IV3).[43] The assumption is that these mean prices are not related to store (or chain)-specific unobserved demand factors in ε_{jst}. In a first-stage regression, one for each brand, a store's price is regressed on each of these mean prices for the three brands, as well as on all the fixed effects used in the estimation presented in Table 2. In addition, we interacted the mean price with store dummies to generate variation in the predicted prices across stores in the same city and retail chain. In a second-stage we estimate (2) using the store-specific predicted prices from the first-stage instead of the observed prices. (in practice estimation is done in one step).

Table E1 presents the results. Columns (1)-(3) show IV estimates based on the mean cottage price in stores that belong to other retail chains and are located in other cities (IV1), while columns (4)-(6) show IV estimates based on the mean price in stores that belong to other retail but are located in the same city (IV2). IV estimates based on the mean price among all stores in other cities are similar to IV1 and therefore not reported.

[43] Our data do not provide information on the retail chain to which a store belongs. Using public information available in the Internet we managed to identify the retail chain to which 659 out the 1127 stores belong. There are 44 different retails chains, though the two largest chains own 17 percent of all stores in our data. We suspect that most of the remaining stores do not belong to a retail chain but we cannot be completely sure.

Table E1: IV estimates of cottage cheese own and cross price elasticities

Dependent Variable: log quantity						
	IV1			IV2		
	(1)	(2)	(3)	(4)	(5)	(6)
Brand	A	B	C	A	B	C
Constant	12.258***	10.398***	15.311***	11.308***	9.002***	14.006***
	0.253	0.329	0.542	0.275	0.361	0.610
Constant × after	-1.957***	-1.648***	-6.668***	-1.153***	-0.328	-5.524***
	0.352	0.486	0.711	0.371	0.543	0.824
Log Price A	-2.392***	0.271	-2.132***	-1.845***	1.628***	-0.778
	0.239	0.319	0.504	0.263	0.380	0.563
Log Price A × after	0.009	2.194***	5.187***	-0.032	1.200**	3.992***
	0.453	0.567	0.742	0.411	0.581	0.830
Log Price B	0.045	-3.510***	0.027	0.340***	-3.609***	0.137
	0.066	0.091	0.120	0.091	0.109	0.159
Log Price B × after	-0.317	-1.092***	0.389	-0.072	-1.369***	0.163
	0.209	0.302	0.338	0.179	0.240	0.291
Log Price C	-0.156	-0.248	-5.540***	0.005	-0.025	-5.614***
	0.139	0.160	0.297	0.124	0.153	0.278
Log Price C × after	0.781***	0.938***	1.069**	0.400*	0.833**	1.311**
	0.214	0.307	0.471	0.229	0.352	0.528
Number of observations	313,511	313,511	313,511	290,773	290,773	290,773

Daily price data are used. The sample period is from January 1, 2010 until April 30, 2012, excluding the boycott period (May 15, 2011-October 2, 2011) and the period corresponding to a strike at Tnuva (March 18, 2012-April 3, 2012). The coefficients for the interactions with the "after" indicator represent the additional effect after the boycott. All regressions include "day of the week" and store effects whose values are allowed to change after the boycott, as well as a set of week dummies to capture weekly aggregate effects over the sample period. Standard errors clustered at the store level in parentheses.

*p<0.10; ** p<0.05; *** p<0.01

The estimated own price elasticities are qualitatively the same as, and of similar order of magnitude to, the OLS-fixed effect estimates in Table 2, except for brand C, where the elasticity declines (in absolute value) after the boycott. Cross price elasticities are sometimes negative. The

estimates are sensitive to the choice of IV.

F White cheese own and cross price elasticities

Table F1 below reports OLS elasticity estimates for white cheese, using the same specifications as in Table 2. As in the case of cottage cheese, the sample period is January 1, 2010 until April 30, 2012, excluding the subperiod May 15, 2011 - October 2, 2011.

Table F1: White cheese own and cross price elasticities

Dependent Variable: log quantity			
	(1)	(2)	(3)
Brand	A	B	C
Constant	8.730***	10.061***	9.447***
	0.071	0.096	0.079
Constant × after	-1.172***	-2.339***	-2.856***
	0.152	0.138	0.174
Log Price A	-2.919***	0.173***	-0.100***
	0.051	0.053	0.038
Log Price A × after	-0.183	0.254***	1.217***
	0.138	0.097	0.112
Log Price B	0.112***	-3.665***	0.041***
	0.017	0.048	0.019
Log Price B × after	0.255***	-0.589***	0.625***
	0.059	0.099	0.090
Log Price C	0.058**	-0.022	-2.797***
	0.027	0.045	0.067
Log Price C × after	0.532***	0.688***	-0.833***
	0.053	0.066	0.123
Number of observations	367,190	367,190	367,190
R squared	0.776	0.664	0.768

G The imputed post-boycott prices under double marginalization

Suppose that the manufacturer of brand b sets the wholesale price w_b, while the retailers set the retail price p_b. Let ε_b be the elasticity of demand faced by the manufacturer at the wholesale level, and recall that η_b is the elasticity of demand at the retail level. Then, the inverse elasticity rules at

the retail and at the wholesale levels imply that $p_b = \frac{\eta_b \frac{\varepsilon_b c_b}{\varepsilon_b - 1}}{\eta_b - 1} = \frac{\eta_b \varepsilon_b c_b}{(\eta_b - 1)(\varepsilon_b - 1)}$. To compute ε_b, recall from equation (2) that we assume that the demand for brand b is given by a constant elasticity demand function $q_b = A_b p_b^{-\eta_b}$, where η_b is the elasticity of demand for brand b at the retail level and A_b is a constant that depends on the prices of the rival brands, store-brand fixed effects, and demographics. The inverse demand function at the retail level is then $p_b = \left(\frac{q_b}{A_b}\right)^{-\frac{1}{\eta_b}}$ and the marginal revenue function, which is also the inverse demand function faced by the manufacturer, is given by $A_b^{\frac{1}{\eta_b}} \left(\frac{\eta_b - 1}{\eta_b}\right) q_b^{-\frac{1}{\eta_b}}$. Hence, given a wholesale price w_b, the wholesale demand function faced by the manufacturer is $q_b = A_b \left(\frac{\eta_b - 1}{\eta_b}\right)^{\eta_b} w_b^{-\eta_b}$. It is now easy to check that the elasticity of wholesale demand faced by the manufacturer is $\varepsilon_b = \eta_b$, just like the elasticity of demand at the retail level. Consequently, the equilibrium retail price should be $p_b = \frac{\eta_b \frac{\varepsilon_b c_b}{\varepsilon_b - 1}}{\eta_b - 1} = \left(\frac{\eta_b}{\eta_b - 1}\right)^2 c_b$, which in turn implies that $c_b = \left(\frac{\eta_b - 1}{\eta_b}\right)^2 p_b$. Hence, the post-boycott price of brand b, p_b', should be equal to

$$p_b' = \left(\frac{\eta_b'}{\eta_b' - 1}\right)^2 c_b = \left(\frac{\eta_b'}{\eta_b' - 1}\right)^2 \left(\frac{\eta_b - 1}{\eta_b}\right)^2 p_b, \tag{6}$$

where η_b' is the post-boycott own-price elasticity of demand of brand b.

As before, the boycott should not have affected the price of brand A since the own price elasticity of brand A did change significantly. Therefore it appears that the 24% decline in the price of brand A was fully due to an attempt to contain the potential repercussions of the boycott. Substituting $\eta_B = 3.632$ and $\eta_B' = 4.707$ for brand B, and $\eta_C = 4.3$ and $\eta_C' = 5.071$ for brand C into equation (6) reveals that the post-boycott prices should have been 15.4% below the pre-boycott price for brand B and 8.6% below the pre-boycott price for brand C. Since the actual price of brands B and C came down 24%, we can conclude again that the boycott directly influenced the pricing of brands B and C above and beyond what was implied by the higher own-price elasticities of demand.

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