Healthy foods, healthy sales? Cross-category effects of a loyalty program promoting sales of fruit and vegetables

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Abstract

Globally, consumption of Fruit and Vegetables (F&V) remains below nutritional guidelines. With retailers accounting for a large portion of F&V sales, marketing can be key to increase F&V consumption at household level. However, a key challenge is the design of strategies that benefit retailers, e.g., improving loyalty, whilst promoting societal goals. This study evaluates a points-plus-cash loyalty program where participants received points by purchasing selected F&V, redeemable against a reward (plush toys in the shape of F&V). We estimate the impact of the program by comparing expenditures in several categories before, during, and after the promotional period, across two different years, and comparing consumers who redeemed a reward and those who did not. We use loyalty card data from a Croatian retailer, containing food expenditure in five categories for 268,359 consumers, over 27 weeks for 2 years. We find that the loyalty program increased F&V expenditures at the focal retailer during the promotional period. However, the increase was only for reward-redeemers, for whom the program increased expenditures in F&V as well as in other food categories. This effect persisted – at a declining rate – after the program stopped. Exposure only had a limited effect during the campaign, leading to a reduction in expenditure after the promotional period. Results indicate that a loyalty program promoting sales of F&V can create win-win benefits to both society and the retailer: it increases expenditures on healthy foods (F&V), while improving overall loyalty (i.e., expenditures) to the retailer amongst motivated consumers.
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Introduction

Loyalty programs have become ubiquitous in retail environments (Bombaij and Dekimpe 2019; Dorotic, Verhoef, Fok, and Bijmolt 2014; Kopalle et al. 2012; Lal and Bell 2003; Lewis 2004; Mauri 2003; Sharp and Sharp 1997; Stourm, Bradlow, and Fader 2015; Stourm et al. 2020; Taylor and Neslin 2005). Such programs allow consumers to earn points through their purchases at a focal retailer or the retailer's partners (Bijmolt, Dorotic, and Verhoef 2011; Blattberg, Kim, and Neslin 2008), with rewards accessible after reaching a certain threshold (e.g., a free coffee after purchasing nine; a free upgrade when flying more than 5000

miles with the same airline). Through these programs, retailers can improve customer loyalty in competitive environments by providing incentives for repeat custom, increasing the retailer's share of wallet (Meyer-Waarden 2007). Consequently, a key feature of these programs is the ability to create loyalty between the retailer and the consumer, which translates into an increase in patronage and sales (Liu 2007; Liu and Yang 2009; Meyer-Waarden 2007).

Increasingly, loyalty programs are used to encourage lifestyle choices, promoting products linked to personal or societal improvements (Kekes-Szabo 2021; Stourm et al. 2020; Wise Marketeer 2022). For instance, the insurance company Vitality promotes the linkage of an activity tracker to user accounts, rewarding any detected physical activity through points as part of "Vitality status"; while Walgreens provide a cash bonus worth up to $2 if consumers successfully achieve

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physical activity and lifestyle goals (Kekes-Szabo 2021). Some companies also reward sustainability: for instance, the airline Quantas awards points to consumers who purchase carbon offsetting for their flights (Stourm et al. 2020); H&M award "conscious points" for purchases from their "conscious" line, which consists of products made from 50% or more sustainably-sourced materials (e.g., organic cotton), or for recycling clothes (Kekes-Szabo 2021); while the skincare brand Kiehl's gives stamps for recycling empty containers, rewarding the 10th stamp with a travel-sized product (Garai 2022). In all these cases, retailers give consumers hard rewards that have a monetary equivalent, and a softer reward through the "warm glow" associated with the act of shopping morally or consciously. The hard reward increases supply costs or forgoes earnings for the retailer, making the schemes expensive to run. In the case of Vitality, the reward may compensate e.g., through lower insurance payouts due to people being healthier; but in the other cases, the scheme is only profitable if it attracts new customers and increases loyalty, therefore leading to higher sales.

In this article, we study a natural experiment with a loyalty program promoting sales of Fruit and Vegetables (F&V) at a large supermarket chain in Croatia. Globally, an important current policy objective is to increase consumption of F&V as part of a healthy diet (Albani, Butler, Traill, and Kennedy 2018; Bollinger et al. 2020; List, Samek, and Zhu 2015). Yet, F&V consumption is low in Western economies (Craveiro et al. 2021; Eurostat 2022); in Croatia specifically, only 9.8% of consumers eat 5 portions of F&V per day[1] (Eurostat 2022). Previous research proposed increasing F&V consumption through discounted prices (50% off total F&V expenditures in Polacsek et al. 2018), monetary rewards ($1 reward when buying 5+ cups of F&V in List, Samek, and Zhu 2015; or 25% off when increasing spend on healthy food by 5% in Schwartz et al. 2014), or nutrition labeling (Bollinger et al. 2020; Dubois et al. 2020). While discounts and subsidies have proved effective in experiments, there is a need to upscale them to whole populations (List 2022), but the costs of implementing such interventions make them unattractive for retailers and policymakers; at the same time, the effect of nutritional labelling on food consumption is often weak (Breck, Mijanovich, Weitzman, and Elbel 2017). Consequently, there is a need to identify alternative strategies to increase F&V consumption. The program presented in this article asked consumers to purchase selected F&V to accumulate points, which could be used jointly with money to redeem a reward, a soft toy shaped as a fruit or a vegetable, in a "points-plus-cash" loyalty program (Montoya and Flores 2019).

The aim of this study is to determine – and quantify – the potential for loyalty programs to increase expenditures on healthy foods (F&V), while also exploring the impact of such a program on consumer expenditures in other categories.

While experimental and quasi-experimental research finds that retailers can play an important role in delivering large-scale changes in consumer behavior (Kanay et al. 2021; Panzone et al. 2021a; Stourm et al. 2020; Trewern et al. 2021), the promotion of specific goods with societal benefits can be complex and expensive for retailers. For instance, marketing promotions on F&V are rare, with UK estimates indicating that less than 2% of food and drink advertising expenditure relating to F&V (Dimbleby 2021). The limited use of promotions to stimulate sales of F&V can be explained by the financial costs of such a campaign: promotion in store would not be paid by manufacturers, as customary for processed food categories, and retailers would need to finance the campaign themselves without any procurement income. Consequently, to be worthwhile to the retailer, a campaign promoting F&V needs to generate a significant increase in sales which more than offsets the costs of the program.

Loyalty programs could be an effective way to promote goods with societal benefits (Stourm et al. 2020). A key feature of loyalty programs is their ability to strengthen consumer-retailer relationships interactions, increasing shopping frequency, and facilitating the acquisition of new shoppers (Bijmolt, Dorotic, and Verhoef 2011; Bombaij and Dekimpe 2019; Sharp and Sharp 1997). The increased patronage can result in an increase in target category sales, due to the change in incentives provided (e.g., lower prices, or higher number of points). However, for multi-category retailers an important question is whether a loyalty program can also increase sales in categories not targeted by the program. This may occur, for instance, through consumers spending more time in store, and purchasing complementary products (Wei and Xiao 2015). However, the literature to date pays limited attention to cross-category (spillover) effects of targeted loyalty programs, despite their importance to the overall financial viability of loyalty programs. Consequently, our two research questions are: firstly, can loyalty programs motivate consumers to purchase goods with societal benefits both during and after the promotional period, leading to a win-win outcome for consumers as well as retailers? Secondly, can loyalty programs that seek to motivate consumers to purchase goods with societal benefits increase a retailer's sales within non-promoted product categories?

Conceptual framework

Loyalty programs (also known as frequency rewards programs) are initiatives that aim to create customer loyalty by giving consumers rewards linked to their engagement with the retailer (Bijmolt, Dorotic, and Verhoef 2011; Blattberg, Kim, and Neslin 2008; Kim, Steinhoff, and Palmatier 2021). In a loyalty program, consumers collect points by shopping at the focal retailer, earning points through their in-store spending that can be accumulated over time (Blattberg, Kim, and Neslin 2008; Kopalle et al. 2012; Sharp and Sharp 1997). Consumers can then redeem a reward using only their points (as in Taylor and Neslin 2005), or – in "points-plus-cash" pro-

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[1] The same source indicates that 61.7% of the population consumes between 1-4 portions of F&V per day, and 25.8% consumes 0 portions per day.

grams – through a mixture of money and points (Montoya and Flores 2019).

The retailing literature indicates that loyalty programs affect consumers who engage with the program through two mechanisms (Dorotic et al. 2014; Kim, Steinhoff, and Palmatier 2021; Kopalle et al. 2012; Taylor and Neslin 2005). The **points pressure mechanism** reflects customers' increasing expenditure and/or their purchase rate *during* the promotional period to accumulate points (Kivetz, Urminsky, and Zheng 2006; Kopalle et al. 2012; Taylor and Neslin 2005). The **rewarded behavior mechanism** refers to the long-term impact of the promotion, where consumers increase their purchase rate *after* redeeming the reward (Blattberg, Kim, and Neslin 2008; Taylor and Neslin 2005). This rewarded behavior mechanism characterizes both short-term (Lal and Bell 2003; Taylor and Neslin 2005) and on-going programs (Dorotic et al. 2014; Kopalle et al. 2012), and can erode rapidly at the end of the program (Dorotic et al. 2014). The redemption of the reward releases the points pressure, which can, however, persist if the consumer can obtain multiple rewards during the same promotional window.

Loyalty programs that encourage lifestyle changes, such as a switch to healthier and more sustainable diets, not only affect behavior through the presence of incentives (points and rewards), but also via an **exposure mechanism**. This type of loyalty program provides information about the long-term benefits of such choices (Stourm et al. 2020), which are framed as personally or socially desirable: using the examples above, carbon offset points awarded by Quantas highlight the desirability of reducing flight-related carbon emissions; while the Vitality reward points emphasize the importance of physical activity for personal health. Unlike points pressure and rewarded behavior, information on the campaign affects everyone who is exposed to it (e.g., through media, or in-store), irrespective of their actual engagement with the campaign. For instance, a campaign promoting F&V informs all consumers about the benefits of their consumption, irrespective of whether consumers actually purchase F&V. Consumers can also use the knowledge acquired during the campaign after the loyalty program has ended, with a potential **post-exposure mechanism**.

Within-category and cross-category points pressure mechanisms

Within a loyalty program, points pressure is driven by changing incentives in the marketplace, with higher benefits – through points – associated to the retailer's products that feature in the program (Meyer-Waarden 2007; Stourm, Bradlow, and Fader 2015). Points pressure is motivated by the desire to obtain a reward, and the purchase of goods makes the reward more accessible during the promotion (Belli et al. 2022; Bijmolt, Dorotic, and Verhoef 2011; Bombaij and Dekimpe 2019; Henderson, Beck, and Palmatier 2011; Kim, Steinhoff, and Palmatier 2021; Kivetz, Urminsky, and Zheng 2006). The presence of points associated to the purchase of goods in the focal category implies that points pressure is

linked to expenditures on points earning items (e.g., clothes made with organic cotton in the H&M example), without which the likelihood to obtain a reward is low, with an expected positive effect on sales. This expectation is consistent with the findings of List, Samek, and Zhu (2015) and Schwartz et al. (2014) who show that promotions targeting F&V increase sales during a targeted promotional campaign. Consequently, we expect the loyalty program to increase the purchase of points-earning products during the campaign by consumers with an interest in the reward, resulting in greater behavioral loyalty during the promotional period – a within-category points pressure.

While the effect of a category-linked points pressure on the focal category or the focal retailer is well documented in the literature (for excellent reviews, see Belli et al. 2022; Henderson, Beck, and Palmatier 2011; Kim, Steinhoff, and Palmatier 2021), there is more limited understanding of the potential spillover effects of such programs on other categories (see e.g., Wei and Xiao 2015). However, a frequent objective of a loyalty program is to encourage positive spillover effects, so that consumers increase patronage of the focal retailer, and spend a larger share of wallet in-store (Liu and Yang 2009; Meyer-Waarden 2007). Participants motivated by the reward would then be expected to spend more in the store running the program, either going there more frequently, or staying there longer, or both; the increased footfall is then expected to drive in-store expenditures (Panzone, Larcom, and She 2021). While points pressure will primarily promote an increase in spending on points earning items (in our case, F&V), spending more time in the retailer's stores can increase expenditure in other categories (Manchanda, Ansari, and Gupta 1999; Richards, Hamilton, and Yonezawa 2018). Hence, we expect the loyalty program to increase sales of non-points earning product categories during the campaign by consumers with an interest in the reward, resulting in greater behavioral loyalty during the promotional period – a cross-category points pressure.

Within-category and cross-category rewarded behavior mechanism

The primary aim of a loyalty program is to increase loyalty towards the focal retailer, therefore increasing patronage and share of wallet, even after the end of the promotion (Meyer-Waarden 2007). This rewarded behavior mechanism (Liu 2007; Taylor and Neslin 2005) operates through two main pathways. The first pathway relates to quality expectations (Zeithaml 1988): the promotion may motivate consumers to interact more frequently with the retailer, giving them an opportunity to revise their expectations regarding the quality of the shopping experience, both in terms of product quality and store ambience, therefore increasing (reducing) the likelihood of future patronage if expectations are met (not met).

A second psychological pathway suggests that a successful attempt to improve oneself on a virtuous dimension (e.g., healthy eating) in response to the campaign self-signals virtue achievement in the decision-maker, caus-

ing an increase in self-esteem through a self-attribution process (Gneezy, Gneezy, Riener, and Nelson 2012a; Gneezy et al. 2012b). At the same time, the literature indicates that consumers often feel gratitude towards a retailer following the achievement of a loyalty reward, with a positive effect on attitudinal and behavioral loyalty (Belli et al. 2022; Du, Bhattacharya, and Sen 2007; Kim, Steinhoff, and Palmatier 2021; van Doorn, Onrust, Verhoef, and Bügel 2017). Consequently, achieving a reward associated with healthy choices may motivate an increase in sales of the focal category even after the end of the program. Notably, List, Samek, and Zhu (2015) found that a voucher conditional on the purchase of F&V increased consumer expenditure in the category also after the removal of the incentives, supporting the potential presence of a behavioral reward mechanism in this study. Consequently, it is expected that a retailer's loyalty program increases purchases of points-earning products after the campaign has ended by consumers who redeemed a reward during the promotional period, with an overall increase in behavioral loyalty post-promotion – a within-category rewarded behavior.

The increase in loyalty associated to the quality expectation pathway discussed above is expected to have an impact beyond the points-earning category. In a multi-category retailer, increased patronage will lead to an increase in sales across the store during the promotion (Manchanda, Ansari, and Gupta 1999; Richards, Hamilton, and Yonezawa 2018), as consumers spend more time in the focal retailer's stores. During this time, consumers may revise their expectations over the quality of the products in stock, spilling over to an increase in behavioral loyalty even after the end of the promotional campaign. In previous research, Wei and Xiao (2015) show that rewards programs can indeed increase cross-category purchase incidence; however, in their case consumers could collect points usable to buy products at a discount in other categories (a cross-subsidization process), whereas in our case consumers could only spend points on a reward during the promotional window. As a result, a retailer's rewards program is expected to increase purchases of non-points earning products after the campaign has ended by consumers who redeemed a reward during the lifetime of the program, with an overall increase in behavioral loyalty post-promotion – a cross-category rewarded behavior.

Exposure mechanism in loyalty programs promoting healthy categories

Promotional campaigns promoting lifestyle choices may affect sales through an exposure mechanism, affecting behavioral loyalty through three channels. Firstly, information provided in a campaign through advertising and other promotional material (e.g., leaflets, posters) may provide new knowledge to consumers, or help consumers retrieve information already available in memory (Bollinger et al. 2020; Dubois et al. 2020; Trivedi, Sridhar, and Kumar 2016). Secondly, the information frames the shopping trip around a lifestyle goal (Bolderdijk et al. 2013; Kamenica 2012; Perino and Schwickert 2023; Shreedhar and Galizzi 2021),

therefore activating goal-congruent attitudes. Finally, the information may have a psychological impact, where the promotion of "desirable" (e.g., healthy) products may increase self-image concerns related to non-compliance (Baca-Motes et al. 2013; Dubé, Luo, and Fang 2017), motivating purchases in the focal category.

Information acquired during the loyalty program may have a persistent effect which continues once the loyalty program has ended, through a post-exposure mechanism. Firstly, consumers may internalize the information received or searched for during the life of program (Bollinger et al. 2020; Kanay et al. 2021), irrespective of whether they purchase points-awarding products. Similarly, the loyalty program may expose consumers to an alternative lifestyle choice that they enjoy, leading to a change in habit (Larcom, Rauch, and Willems 2017; Lee, Lee, and Jeong 2023; White, Habib, and Hardisty 2019). Finally, consumers who engage with the loyalty program may experience an increase in their self-esteem, feeling good for purchasing "desirable" goods during the campaign (irrespective of whether they collect points or not), an effect that may persist after the end of the loyalty program (Gneezy et al. 2012b; Shreedhar and Galizzi 2021). As an example, related to F&V demand, the persistent effect of vouchers on F&V sales observed in List, Samek, and Zhu (2015) may be driven – at least in part – by a post-exposure mechanism.

Because loyalty programs targeting lifestyle choices specifically focus on a narrow range of products (e.g., clothing, or F&V), information is specific, and exposure and post-exposure mechanisms are expected to increase expenditures in the focal category only, with no direct impact on other categories. However, negative cross-category effects may still occur indirectly: within the same retailer, a reduction in expenditures on other products may take place if consumers are unable or unwilling to expand their in-store budget, therefore substituting away from other goods to spend more in the focal category. As before, this effect may be independent from points redemption during the campaign.

Unlike the points pressure and behavioral reward mechanisms, the effect of the exposure mechanism for lifestyle-based loyalty programs could be negative: consumers might react negatively to the information provided, reducing, rather than increasing, in-store expenditure. This effect may occur because the loyalty program proposes a change in lifestyle, a message which consumers might perceive as intrusive or inappropriate (Espinosa and Treich 2021; Sunstein 2017; Zemack-Rugar, Moore, and Fitzsimons 2017). Reactance could cause a drop in expenditure in all categories through reduced engagement with the focal retailer during as well as after the campaign. Similarly, consumers who engage with the campaign to earn a reward (an extrinsic motivator) may increase expenditures in the focal category during the campaign, reducing it once the reward is removed (Dubé, Luo, and Fang 2017; Kamenica 2012). The literature does not yet provide evidence of exposure effects in loyalty programs targeting lifestyle changes, something we study in this article.

Data and variables

This study uses loyalty card data from Konzum, Croatia's leading retail chain. Konzum accounts for 25% of the Croatian grocery market, and possesses approximately 700 stores, 10,000 employees, and 500,000 customers a day. Part of the Fortenova Group, Konzum owns convenience stores (market share in the segment: 33.1%), supermarkets (15.9%), and hypermarkets (27.8%).

The "Zdravoljupci" campaign

In 2018, Konzum launched the *Zdravoljupci* campaign, a name which translates as "health lovers", in all its Croatian retail outlets. The campaign ran in stores for nine consecutive weeks, from August 23rd to October 28th, 2018. The campaign was framed to the public around the promotion of healthy eating habits, a message that was heavily advertised via various channels, including social networks and TV stations.[2] Ultimately, the campaign aimed to increase the sales of F&V in Konzum stores[3], without reducing the price of F&V.

The campaign required consumers to purchase selected F&V in order to obtain points – in the form of stickers – that could only be redeemed for the purchase of the reward, in the form of one of seven plush toys. The soft toys were a set of colorful F&V cartoon characters: Banana Bela, Broccoli Branko, Strawberry Jana, Carrot Mirko, Eggplant Patrik, Garlic Luka, Pear Klara (Fig. A1 in Web Appendix 1); overall, the campaign resulted in 570,000 plush toys being purchased (Fig. A3 in Web Appendix 1). Eligible F&V (those providing a sticker) varied on a weekly basis, consisting of exotic as well as more commonly eaten products; a sample flier advertising stickers for the purchase of strawberries and eggplants can be found in Fig. A2 in Web Appendix 1. Participants also received one sticker for every 50 kuna (ca $7.40) spent, and by purchasing other selected grocery products. Points were only redeemable during the 9-week period of the *Zdravoljupci* campaign, and only for *Zdravoljupci* plush toys. The *Zdravoljupci* campaign was a "points-plus-cash" program (Montoya and Flores 2019): points only provided an "entitlement" to the purchase of the reward, which required consumers to pay an additional price: soft toys "cost" either 20 points and 50 HRK (ca. $7.40), or 50 points and 10 HRK (ca. $1.48).

The retailer also published *Zdravoljupci* sticker books promoting healthy eating, which consumers could purchase for 20 HRK (∼3 euros) in 2018 (throughout the period covered by the data). This sticker book contained educational material and recipes, and it could be completed with 120 stickers that were given in free packs when shopping in store.

The data

In the analysis, we focus on 268,359 active customers, defined as loyalty card holders who purchased food at least once in each of the six 9-week periods we study. As a second criterion for inclusion, consumers had to have purchased at least one point-awarding food item (not necessarily restricted to F&V) during the promotional period in 2018. Notably, the sample includes 173 individuals who only collected points from food products other than F&V, of which 23 redeemed a reward[4]; we retain these consumers as they satisfy our inclusion criteria.

Dependent variable: expenditures

The article uses weekly household expenditure data in Konzum stores, reported in Croatian Kuna[5], recorded through loyalty cards, for the following categories: fruit; vegetables; dried F&V; any other foods (i.e., everything except F&V); and all food (including F&V). Expenditures are often used as a measure of behavioral loyalty, as they capture the strength of the relationship between a focal retailer and consumers in terms of the frequency of interactions (Belli et al. 2022; Kim, Steinhoff, and Palmatier 2021; Taylor and Neslin 2005). While the dataset starts with weekly expenditures (54 observations per consumer, 14,491,386 data points), we aggregate them in six 9-week period-level total expenditures (6 observations per consumer, 1,610,154 data points) to reduce the occurrence of zeros within a category.

In 2018, the data relates to expenditures recorded between June 21st to December 26th, 2018, split into three 9-week periods: the 9 pre-campaign weeks (weeks 1–9); the 9 campaign weeks (weeks 10–18); and the 9 post-campaign weeks (weeks 19–27). In 2017, the data covers the same 27 weeks running from June 22nd to December 27th, 2017, split again in three 9-week periods. A year-on-year comparison removes the influence of natural market trends in the data: for instance, the campaign started in the summer and ended in winter, accompanying a decline in in-store availability of some F&V due to seasonality.

Table 1 summarizes consumer expenditure by category and reward redemption behavior across the six 9-week periods in the study. The table shows an increase in consumer expenditures in the study period[6] in those consumers who were

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Table 1
Expenditure patterns (in Croatian Kuna) by group, product category and period.

		Year	2017			2018		
		Period	1	2	3	1	2	3
Vegetables	**No Redemption**	**Mean**	61.44	60.58	60.58	66.30	68.20	61.84
		SD	106.95	86.89	72.75	106.35	87.93	77.87
		% zeros	14.03%	14.50%	11.92%	12.69%	8.24%	13.08%
		Max	22,753.43	8766.03	3111.92	15,550.88	7295.73	4721.31
	Redemption	**Mean**	77.96‡	78.84‡	78.85‡	89.42‡	106.14‡	89.68‡
		SD	147.34	120.24	100.64	160.35	140.36	112.82
		% zeros	11.62%	11.70%	9.40%	9.86%	4.01%	8.35%
		Max	13,777.71	7912.26	6414.99	11,524.88	9,529.55	6431.50
Fruit	**No Redemption**	**Mean**	99.48	83.44	84.29	97.05	80.43	68.59
		SD	133.43	103.75	97.79	132.50	93.30	82.03
		% zeros	9.36%	9.90%	9.34%	9.55%	4.13%	10.30%
		Max	12,901.46	5818.66	3669.96	13,169.86	7163.23	3030.61
	Redemption	**Mean**	124.65‡	105.54‡	103.69‡	125.97‡	120.86‡	92.61‡
		SD	154.88	124.96	113.98	159.15	124.60	101.50
		% zeros	6.81%	6.93%	7.08%	6.58%	1.56%	6.44%
		Max	8765.39	5590.67	3515.61	9345.09	6863.22	4463.50
Dried F&V	**No Redemption**	**Mean**	8.32	11.98	25.42	11.20	16.59	25.87
		SD	29.13	34.31	51.53	33.54	40.30	51.67
		% zeros	77.50%	70.54%	53.23%	71.29%	61.98%	53.05%
		Max	2960.82	2032.13	3149.97	2800.32	2268.90	2399.60
	Redemption	**Mean**	9.97‡	15.35‡	30.14‡	13.64‡	25.88‡	32.19‡
		SD	33.88	46.16	68.89	36.75	57.84	62.26
		% zeros	73.70%	64.80%	49.27%	66.15%	50.44%	47.58%
		Max	1926.53	4433.73	7601.27	1452.47	3920,00	2212.45
Other food	**No Redemption**	**Mean**	1085.54	1131.29	1312.50	1139.66	1149.45	1220.50
		SD	1038.46	984.73	1084.12	1050.19	960.00	1063.34
		% zeros	99.90%	99.95%	99.95%	99.93%	99.95%	99.92%
		Max	53,701.55	39,889.67	20,930.46	38,413.94	24,753.32	24,473.09
	Redemption	**Mean**	1580.65‡	1681.58‡	1910.86‡	1745.45‡	2,075.41‡	1980.38‡
		SD	1456.88	1394.31	1485.88	1509.49	1528.00	1536.06
		% zeros	99.96%	99.98%	99.98%	99.98%	100.00%	99.99%
		Max	65,601.16	81,873.83	84122.96	78,083.11	13,6421.70	105,329.60
All food	**No Redemption**	**Mean**	1254.79	1287.28	1482.78	1314.20	1314.67	1376.79
		SD	1189.56	1105.49	1200.32	1195.07	1070.05	1173.77
		% zeros	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Min	0.27	0.93	0.29	0.03	2.57	0.99
		Max	69,102.93	42,592.13	22,243.48	43,747.81	26,829.9	28,030.97
	Redemption	**Mean**	1793.23‡	1881.32‡	2123.54‡	1974.49‡	2328.29‡	2194.86‡
		SD	1649.38	1548.32	1628.67	1708.95	1678.49	1672.52
		% zeros	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Min	0.83	3.24	1.03	0.22	10.84	3.49
		Max	75,618.33	81,976.88	84,162.60	78,096.17	136,598.5	105,415.10

Note: Expenditures are expressed in Croatian Kuna (HRK). The minimum value for all categories except "All food" is zero. The symbol ‡ indicates that the two groups differ within a period with $p < 0.0001$, based on a t-test.

motivated by the reward: those in the "Redemption" group purchased considerably more F&V and other foods compared to those in the "No redemption" group. This increase is important because it counters the seasonal decline in sales observed in 2017. Table 1 also shows that consumers in the Redemption group spent more on other food products in 2018 compared to the No redemption group.

The dataset also contains purchase frequency, a variable commonly used as loyalty measure (Kopalle et al. 2012), which captures the total number of trips a loyalty card holder made in a year to any Konzum store using their loyalty card, in both 2017 and 2018; the lack of period-level data prevents more detailed analysis for this metric, which we only use in our descriptive analyses.

Focal independent variable: reward redemption

The dataset contains information on whether the consumer redeemed points for a reward (i.e., whether they bought at least one plush toy), and the number of rewards redeemed (range: 0 to 11 or more). This variable is key to the study of loyalty programs: the points pressure mechanism (during the promotional window) and the rewarded behavior mechanism (after the promotional window closed) only matter for consumers who are motivated by the reward (Kim, Steinhoff, and Palmatier 2021; Taylor and Neslin 2005). From a behavioral standpoint, these consumers will behave differently from the rest of the sample: consumers may collect points by buying point-awarding items because of an interest in the items rather than an interest in the reward; however, consumers

Table 2
Characteristics of the sample, in percentages – total and by group.

Variable	Category	Total sample	Points, No redemption	Points, Redemption	Pearson Chi2
Gender	**Male**	23.43	24.23	21.03	778.84***
	Female	73.29	72.09	76.91	
	Missing	3.28	3.68	2.06	
Age	**18-24**	0.99	0.97	1.05	17,021***
	25-34	8.41	6.59	13.89	
	35-44	17.47	13.43	29.60	
	45-54	20.40	20.56	19.92	
	55-64	22.59	23.60	19.54	
	65 +	27.30	31.61	14.34	
	N/A	2.84	3.24	1.65	
Family	**Babies >0**	47.74	39.89	71.32	19,903***
	Children >0	68.82	61.64	90.39	19,353***
Loyalty	**>44 visits in 2018**	49.51	44.29	65.19	8783***
	>44 visits in 2017	50.77	47.40	60.89	3657***
Books	**Bought ≥1 books**	4.28	1.39	12.99	16,498***
Observations		268,359	201,376	66,983	

Notes: Values in the cells are percentages. Significance is as follows: * = 10%; ** = 5%; *** = 1%.

motivated by the reward will accelerate their purchases (the points pressure mechanism) to earn the points they need to obtain the reward. As a result, the reward redemption variable allows identifying point pressure and rewarded behavior in the data.

Personal characteristics

The data includes information on the gender of the cardholder, age (in bands), and the county where the cardholder resides (21 NUTS-3 administrative units). The number of children in the household, relevant to understand the demand for the rewards (as these are plush toys), is not available in the dataset. We estimated the presence of babies in the household using a dummy equal to one (0 otherwise) if the household had non-zero expenditures in 2018 on products specifically designed for babies (e.g., baby bottles, milk formula, diapers, baby clothes, baby toys); similarly, estimated the presence of babies in the household using a dummy equal to one (0 otherwise) if the household had non-zero expenditures in 2018 on products specifically designed for children (e.g., children's clothes, toys, school materials). The data also contains information on the purchase of *Zdravoljupci* books[7] in each of the three 9-week periods of 2018, which we operationalize as a dummy variable equal to one if the cardholder purchased at least one book. Finally, loyalty to the supermarket brand was estimated as making more than the median shopping trips in Konzum stores; based on 2018 data, the cut-off point was determined as 44 store visits per year[8].

Table 2 presents the summary characteristics of the sample, presenting averages for the full sample, and by redemption behavior. This table shows that most of the loyalty card holders are women (75%) and over 45 years of age, typically spend-

ing on children's items (66%), and less frequently on baby items (45%). At the same time, customers who redeem the reward (the plush toy) are somewhat younger customers, generally women (77%), likely to buy children's (90%) or baby products (71%), and shopping in Konzum more frequently (65% of them have made more than 44 store visits in 2017). At the same time, 4.3% of consumers (11,491 cardholders) purchased at least one *Zdravoljupci* book, purchasing on average 1.17 books (max: 9); the percentage is much higher in the "Redemption" group, at 13%. A series of Pearson's chi-squared tests (Table 2) indicate that the two groups differ significantly in all personal characteristics.

Econometric model

In this section, we model the impact of the *Zdravoljupci* loyalty rewards program on consumer expenditures in the focal retailer. As indicated above, our dataset records expenditures for consumers who purchased at least once in three 9-week periods in both 2017 and 2018, with the campaign only running in 2018. In 2018, period 1 is the pre-promotion period; period 2 is the promotion period; and period 3 is the post-promotion period. The same periods in 2017 provide baseline information.

As explained above, all consumers in the dataset were exposed to the promotional campaign and collected points. However, only some consumers valued the reward, and redeemed it at least once – a "Redemption" group; while other consumers showed no interest in the reward, and never redeemed it – a "No redemption" group. This endogenous categorization is important: points pressure and the rewarded behavior mechanism only characterize consumers who are motivated by the reward, and through this classification we can identify the two effects.

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[7] These books do not feature in the expenditures on goods for children and babies discussed in the previous section.
[8] In 2017, the median number of trips was 45.

Model specification

To estimate the impact of the *Zdravoljupci* loyalty rewards program, we model total consumer expenditure in a category using the fixed effect panel exponential model

$$Spend_{iwt} = exp\left[\alpha_{0i} + \pi_1 Redemption_i + \sum_{w=2}^{3} \pi_{2w} Period_w\right.$$
$$+ \pi_3 Year_t + \sum_{w=2}^{3} \alpha_{1w}(Redemption_i * Period_w)$$
$$+ \alpha_2(Redemption_i * Year_t) + \sum_{w=2}^{3} \delta_{0w}(Period_w * Year_t)$$
$$\left. + \sum_{w=2}^{3} \delta_{1w}(Period_w * Year_t * Redemption_i)\right] + v_{iwt} \quad (1)$$

where $Spend_{iwt}$ is the amount spent by individual i in period w of year t in a certain category. In Eq. 1, $Redemption_i$ is a dummy equal to 1 if the consumer redeems at least one reward during the *Zdravoljupci* campaign, zero otherwise; $Period_w$ are period-specific dummies (baseline: period 1), and $Year_t$ is a year-specific dummy, equal to 1 for 2018 (baseline: 2017). The term $(\alpha_{0i} + \pi_1 Redemption_i)$ are individual fixed effects[9], while v_{hiwt} are the residuals.

The interaction between period, year, and reward redemption group in Eq. (1) corresponds to a difference-in-difference-in-difference model (Imbens and Wooldridge 2009; Wing, Simon, and Bello-Gomez 2018), but with endogenous group allocation (Ye et al. 2023). Notably, the estimated parameters in Eq. (1) are half-elasticities: they indicate the % increase in expenditures when a dummy variable goes from zero to one.

Fig. 1 presents visually the different effects of the *Zdravoljupci* campaign captured in this study, and the respective coefficients in Eq. (1). Firstly, the parameter δ_0 estimates the simple exposure to the campaign through the interaction between period and year[10]. More precisely, the parameter δ_{02} captures the ***exposure effect*** (incidental points accumulation), capturing the impact of the information on healthy eating provided during the campaign, and the pure availability of *Zdravoljupci* points during the campaign; while δ_{03} estimates ***post-exposure effect***, measuring to what extent that mere exposure to the promotional campaign increases sales once the campaign finished. Our conceptual framework suggests that $\delta_{02} > 0$, and $\delta_{03} > 0$ for F&V, with less obvious expectations for other foods.

The parameter δ_{12} captures the ***points pressure mechanism***, with sales increasing to earn points for the reward. As indicated in the conceptual framework, we expect that $\delta_{12} > 0$ for the focal category (F&V), as well as for other categories. The parameter δ_{13} refers to the ***rewarded behavior mecha-***

nism: it measures the impact of reward redemption on sales after the promotion has completed (the set-up here is similar to the loyalty program in Taylor and Neslin 2005). Our conceptual framework suggests that $\delta_{12} > 0$ for the focal category (F&V), as well as for all other categories.

The coefficients α_1 capture average changes in consumption in the Redemption group in periods 2 and 3, relative to period 1; while α_2 captures changes in the consumption of the Redemption group from 2017 to 2018. Finally, π_1, π_2, π_3 are parameters estimating baseline differences in the Redemption vs No redemption groups (π_1); and average differences of the whole sample across period (π_2) and between years (π_3). See also Fig. 1.

Endogeneity of reward redemption

As mentioned above, all consumers in the dataset were exposed to the loyalty program, and some consumers manifested an interest in the reward. The decision to redeem points for a reward, $Redemption_i$, was not random, but rather endogenous in Eq. (1), depending on personal characteristics (e.g., presence of children in the household) and beliefs about the cause being promoted (e.g., interest in children's healthy eating). Eq. (1) in part addresses this endogeneity by removing unobservable time-invariant preferences as fixed effects (Lee, Lee, and Jeong 2023), but there may still be unobservable time-varying attributes influencing both expenditures and reward redemption. To address this endogeneity problem, we compare two identification strategy commonly found in the literature: a propensity score weighting (PSW) approach (Hirano and Imbens 2001; Lee, Lee, and Jeong 2023); and an instrumental variable (IV) approach (Gielens, Gijsbrechts, and Geyskens 2021; Lee, Lee, and Jeong 2023; Ye et al. 2023). The two approaches are described in detail in the following subsections.

PSM and IV methods differ in the underlying assumptions made to identify causal effects (Goldfarb, Tucker, and Wang 2022; Matthay et al. 2020). PSW assumes that observable pre-campaign characteristics explain the decision to redeem a reward. PSW then uses these characteristics to estimate the likelihood of reward redemption as a propensity score, which is used to weight each observation to obtain comparable control and treatment groups (Matthay et al. 2020). The estimated effect is causal if the decision to redeem a reward is random conditionally on the observable characteristics used to calculate the propensity scores, and not driven by unobservable characteristics – a condition called strong ignorability (Stuart et al. 2014). Conversely, IV methods use a random, exogenous variable, called "instrument", which explains the random assignment of an individual to the reward redemption group (Goldfarb, Tucker, and Wang 2022; Matthay et al. 2020; Ye et al. 2023). Identification relies primarily on exclusion restrictions: the instrument explains the redemption of the reward but is unrelated to the outcome (expenditures). While IV methods control for unobservable confounders, they require exogenous instruments that may be unavailable, or their

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[9] Because the *Redemption_i* dummy is a time-invariant fixed effect, the model cannot estimate its coefficient, unless interacted with a time-varying variable.

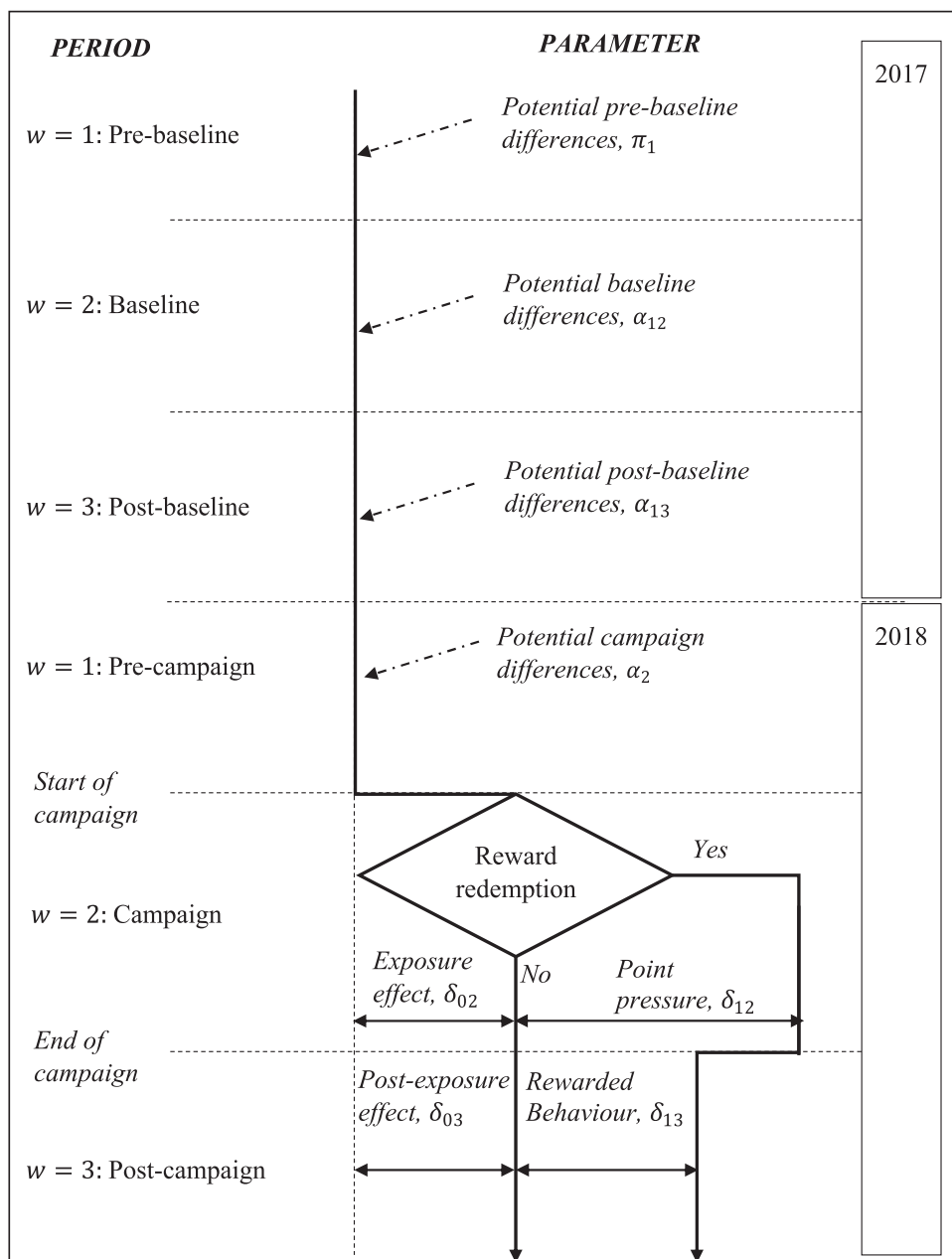[10] In a difference-in-difference setting, this parameter would correspond to the DID estimator.

Fig. 1. Structure of the natural experiment.

suitability may be hard to test (Goldfarb, Tucker, and Wang 2022; Laborde-Castérot, Agrinier, and Thilly 2015).

While the choice of methods is often driven by disciplinary preferences (Matthay et al. 2020), we present both estimators to allow a direct comparison of the different identifying assumptions. While Laborde-Castérot, Agrinier, and Thilly (2015) observe PSM and IV results can differ noticeably, in this study they provide estimates with the same sign and significance, although IV methods provide in general larger estimates in magnitude.

Propensity score weighting (PSM) approach

An approach to obtain consistent estimates is to weight all observations by a propensity score (Frölich 2004; Hi-

rano and Imbens 2001; Lee, Lessler, and Stuart 2010; Stuart et al. 2014). The endogeneity of reward redemption may be driven by a latent demand for the reward, which is manifested once consumers have enough points to purchase a reward. For a campaign promoting F&V consumption in children, reward redemption may be driven by the presence of children and babies in the household, as well as other observable characteristics that also influence expenditures. As a result, identification can be achieved by rebalancing the sample using observable characteristics that affect both reward redemption and expenditures[11].

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[11] Covariates that only affect participation but not expenditure cannot be used when adopting this approach, because they would increase the incon-

This approach assigns each participant a weight measuring the likelihood of redeeming a reward, making the "**Redemption**" group probabilistically comparable to the "**No redemption**" group. To this extent, if x_i are personal characteristics that explain group membership and consumer expenditures, we define the propensity score $0 < e(x_i) < 1$ as

$$e(x_i) = P(Redemption_i = 1|X_i = x_i)$$

The first step for obtaining propensity scores is the estimation of the (binary) regression:

$$Redemption_i = \Phi(\beta_0 + \beta_1 X_i) + \varepsilon_i \qquad (2)$$

where Φ is the normal c.d.f., i.e., a probit regression. In Eq. (2), X_i refers to characteristics influencing both the decision to redeem the reward and expenditures, such as:

- Age of the cardholder (in age bands);
- County of residence of the cardholder (NUTS-3 level);
- Gender of the cardholder (male, female, other);
- Number of visits to Konzum stores in 2017 (the pre-campaign year);
- Whether the consumer spent on goods for children in 2018, to capture the presence of children in the household; and
- Whether the consumer spent on goods for babies in 2018, to capture the presence of babies in the household.

The resulting propensity score weights ω correspond to (Stuart et al. 2014):

$$\omega(x) = \frac{Reward_i}{\hat{e}(x_i)} + \frac{1 - Reward_i}{1 - \hat{e}(x_i)} \qquad (3)$$

This approach requires somewhat less parametric assumptions than alternative methods (e.g., Instrumental Variable [IV] methods): assuming behavioral loyalty is independent of reward redemption after adjusting for X_i (the uncounfoundedness assumption), PSW identifies the direct effect of the campaign on expenditures by making samples comparable (Guo, Fraser, and Chen 2020; Hirano and Imbens 2001).

Instrumental Variable (IV) approach

In the case of loyalty programs targeting lifestyle choices, the endogeneity caused by the redemption might be driven not only by the demand for the reward, but by more general unobservable preferences for the behavior being promoted. As an example, parents interested in healthy eating may spend more on F&V, and target the reward as a means to motivate their children to eat more F&V, and teach the value of healthy eating to their children (e.g., Albani, Butler, Traill, and Kennedy 2017; Brecic, Gorton, and Cvencek 2022). These motivations are unobservable, and drive both the decision to redeem a reward and food expenditures. If this is the case, the PSW approach may be unable to correctly identify the effect of the intervention, because the presence of unobservable characteristics violates the uncounfoundedness

assumption (Goldfarb, Tucker, and Wang 2022; Guo, Fraser, and Chen 2020).

An alternative approach to handle the endogeneity of $Redemption_i$ in Eq. (1) is the use of IVs, which are used to estimate the endogenous variables, whilst imposing identifying restrictions. To deal with the endogeneity of reward redemption, we need an instrument Z_i that influence reward redemption (the group membership), but not category expenditures (Ye et al. 2023). In our analyses, Z_i includes one variable, a dummy variable that equals 1 if the consumer purchased at least 1 *Zdravoljupci* book[12] (0 otherwise); see the "Data and variable section" for more detail. The purchase of a *Zdravoljupci* book allows identifying parents with an underlying motivation in promoting F&V consumption to their children; we expect this variable to influence the probability of redeeming a reward without changing purchasing patterns, because the low price and the nature of the product makes books a poor substitute for food, and its content was to educate children rather than change parental behavior. Because in Eq. (1) $Redemption_i$ is interacted with $Period_w$, $Year_t$, and $Period_w*Year_t$, endogeneity affects the terms $(Redemption_i*Period_w)$, $(Redemption_i*Year_t)$, and $(Period_w*Year_t*Redemption_i)$; as a result, we interact Z_i with $Period_w$, $Year_t$, and the interaction $Period_w*Year_t$, and instruments are $(Z_i*Period_w)$, (Z_i*Year_t), and $(Period_w*Year_t*Z_i)$.

Estimation

We estimate Eq. (1) using a fixed-effect panel exponential estimator (Blundell, Griffith, and Windmeijer 2002; Wooldridge 1999), which removes consumer-specific time-invariant covariates, such as demographics and unobservable tastes. At the same time, this estimator is robust in situations with nonnegative outcomes (Wooldridge 1999), and suitable for dependent variables truncated at zero: in this dataset, fresh F&V expenditures are truncated at zero for 8–15% of participants (percentages vary by period), but percentages exceed 50% for dried F&V; conversely, other foods are characterized by very few zeros within a 9-week period (see Table A1 in Web Appendix 2). The model is estimated using a Generalised Method of Moment (GMM) estimator as detailed in Blundell, Griffith, and Windmeijer (2002).

Results

Expenditure and patronage trends

Fig. 2 displays the average weekly category expenditure, in Croatian Kuna, on F&V and other foods in the 27-week period under consideration, for both 2017 and 2018. These graphs allow for observing whether reward redeemers and non-redeemers had comparable trends prior to the start of the Zdravoljupci campaign (Ahlfeldt 2018; Angrist and Pischke 2009; Wing, Simon, and Bello-Gomez 2018). The figures

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sistency of the estimator (Wooldridge 2016). We thank the editor Katrijn Gielens for highlighting this point.

[12] Results do not change if we use the total number of books purchased by the household in 2018 instead of the dummy variable we define.
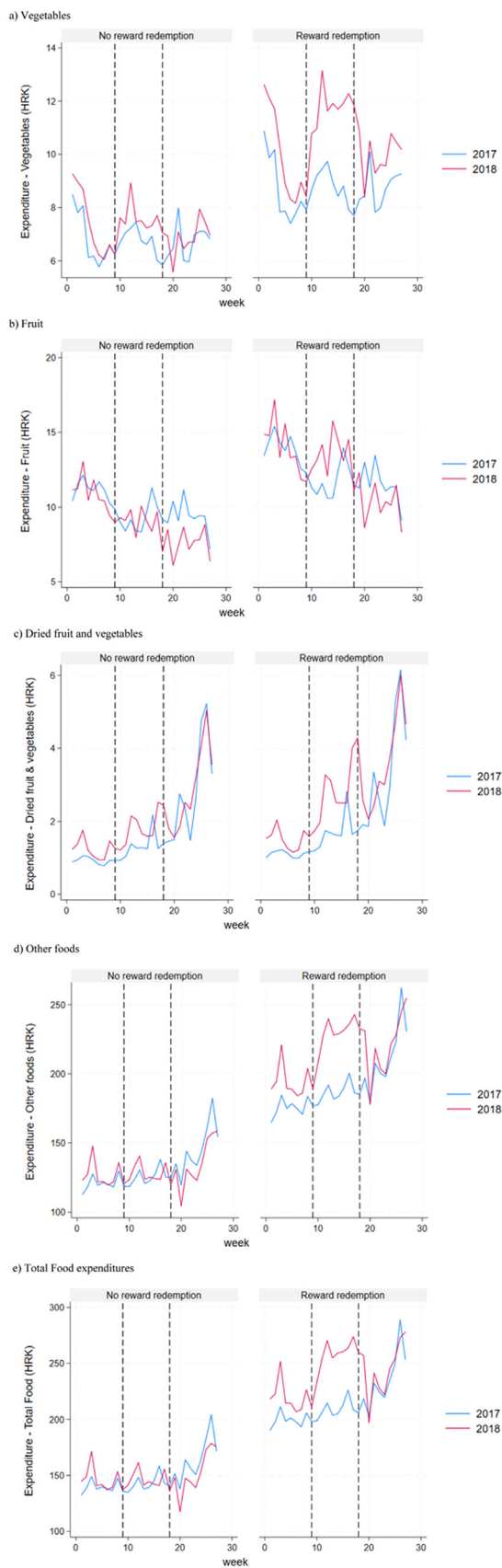
Fig. 2. Customer spending on food product categories, by reward redemption group.
Note: Dashed lines refer to week 9 in 2018 (the week before the start of the promotional campaign) and 18 (the last week of the campaign).
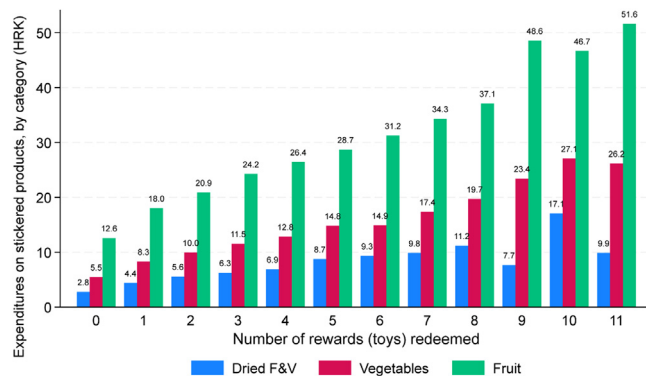

Fig. 3. Expenditures on point-awarding F&V, by number of rewards redeemed.
Note: figures are in Croatian Kuna (HRK). Note: the group with 0 rewards corresponds to the "No redemption" group, while all other consumers together correspond to the "Redemption" group.

show that the two groups of consumers had overall similar trends prior to the start of the promotional campaign, although with differences in average baseline consumption levels. The graphs also show that the Redemption group comprises consumers who purchased more F&V before the intervention, and spent more on F&V during the campaign. Fig. A4 in Web Appendix 2 also shows that the average share of food expenditure allocated to vegetables increased during the campaign, without a clear reduction in the budget allocated to all other categories.

The 2017 trends show that the promotion occurred during a period – end of the summer to the end of the year – when fresh F&V consumption declines, due to the seasonality of production. The decline in expenditure is steep for fresh F&V, while sales of dried F&V, other foods, and all food tend to increase as the end of the year festivities (Christmas and new year) approach. The promotion successfully lifted sales of the target categories amongst consumers who redeemed a reward, with a particularly large impact on vegetables and other foods. Post-promotion expenditures on vegetables remained higher than the levels recorded for the same period in 2017, while sales of all other categories returned to the levels of the previous year.

Importantly, while consumers could obtain points from a very small number of products outside the F&V category, Fig. 3 shows that the ability to earn a reward is linked to the purchase of point-awarding F&V: the number of rewards obtained (almost monotonically) increased with the amount spent on points earning F&V, with those who redeemed no reward showing the lowest levels of expenditures on points-awarding F&V.

Finally, Fig. 4 presents the total number of times the cardholder used their loyalty card in a Konzum store within a year, by reward redemption group. The graph indicates that in 2018 consumers in the "Redemption" group made 3 more visits to the retailer compared to 2017; while consumers in the "No redemption" group reduced their patronage by 3 trips. A repeated measure ANOVA ($R^2 = 0.0280$) finds no main effect

Table 3
Drivers of reward redemption, probit regression.

	Coefficient	S.E.	MFX	Coefficient	S.E.	MFX
Intercept	-2.2868***	0.0401	-	-2.2850***	0.0405	
ln(nr of visits)	0.1975***	0.0038	0.0535	0.2012***	0.0039	0.0529
Buys books	-		-	1.0801***	0.0136	0.2838
Babies in household	0.4871***	0.0060	0.1319	0.4598***	0.0061	0.1208
Children in household	0.6627***	0.0076	0.1795	0.6049***	0.0077	0.1590
Gender: Male	Baseline			Baseline		
Gender: Female	0.0899***	0.0069	0.0244	0.0909***	0.0069	0.0239
Gender: Others	0.0139	0.0328	0.0038	0.0041	0.0331	0.0011
Age: 18-24	Baseline			Baseline		
Age: 25-34	0.3379***	0.0286	0.0915	0.3006***	0.0288	0.0790
Age: 35-44	0.3507***	0.0279	0.0950	0.2943***	0.0281	0.0773
Age: 45-54	-0.06013**	0.0280	-0.0163	-0.0639**	0.0282	-0.0168
Age: 55-64	-0.0815***	0.0280	-0.0221	-0.0912***	0.0282	-0.0240
Age: 65 or over	-0.3137***	0.0281	-0.0850	-0.3208***	0.0283	-0.0843
Age: not reported	-0.1383***	0.0435	-0.0375	-0.1556***	0.0439	-0.0409
County dummies	Yes			Yes		
Observations	268,359			268,359		
Pseudo R2	0.1447			0.1677		
Log-likelihood	-128,976.30			-125,509.71		
χ2	43,628.10***			50,561.18***		

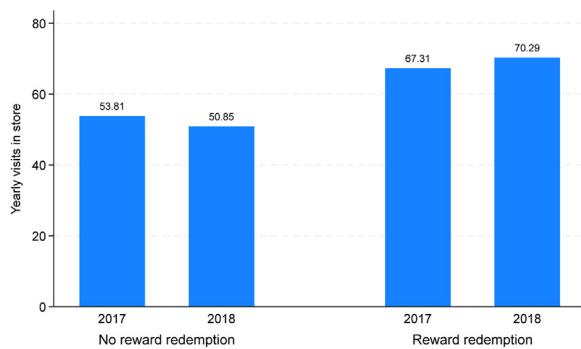Note: Significance is as follows: * = 10%; ** = 5%; *** = 1%.

Fig. 4. Yearly visits in the retail chain, by reward redemption and year.
Note: Yearly visits refers to the total number of times the cardholder total number of times the cardholder used their loyalty card in a Konzum store in a given year. Values on top of the bars refer to the average. A repeated measure ANOVA (R2 = 0.0280) finds no main effect for year ($p = 0.95$), a significant main effect for group membership ($p < 0.0001$), and a significant year-reward interaction ($p < 0.0001$).

for year (F = 0.00, $p = 0.95$), a significant main effect for group membership ($F = 14,802.47$, $p < 0.0001$), and a significant year-redemption interaction ($F = 480.74$, $p < 0.0001$). These results indicate that consumers who redeemed a reward (the "Redemption" group) shopped more frequently in the focal retailer at baseline, and their frequency of shopping increased in 2018, the year of the campaign (Fig. 4).

Who redeems a reward?

Table 3 presents the estimates of Eq. (2), which indicates the socio-demographic characteristics associated to the redemption of at least one reward. The first set of results (columns 2–4) refers to the probit regression used to estimate the propensity score weights; while the second set of

results (columns 5–7) estimates the same probit regression, adding the dummy variable capturing whether the consumer purchased at least one *Zdravoljupci* book (the instrument of the IV approach). Results indicate that loyalty cardholders who were more likely to redeem a reward were women (+2% in the probability of redeeming a reward) aged 25–44 (+8–9%), who also spent on goods for babies (+12–13%) and children (+16–18%) during the 27-week window in 2018. Similarly, the probability of redeeming a reward is higher for consumers who visited Konzum more frequently in 2017. These results indicate that reward redemption is particularly relevant for relatively young mothers with babies or children, particularly those who are more loyal to the store brand. Finally, consumers purchasing *Zdravoljupci* books were 28% more likely to redeem at least one reward.

Measuring the impact of the loyalty program on expenditures

This section presents the estimates of Eq. (1). Table 4 presents the results of a fixed effects panel exponential regression with PSW, while Table 5 presents the same model with endogeneity correction (IV) and no PSW weights. The same regressions without PSM nor endogeneity corrections can be found in Table A2 in the Web Appendix. In all regressions, residuals are clustered at the level of the consumer to reduce the impact of serial autocorrelation and heteroscedasticity (Bertrand, Duflo, and Mullainathan 2004; Cameron and Miller 2015; Wooldridge 2003). Table A3 in Web Appendix 3 presents the diagnostic tests for the IV estimator[13], where a cluster-robust score test (Wooldridge, 1995) detects endo-

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[13] Results of the full set of equations in Table A3 are available from the authors upon request.

Table 4
Estimation results – Fixed effects panel exponential regression with propensity score weights.

	Parameter	Vegetables	Fruit	Dried F&V	Other food	All food
Period 2 vs 1	π_{22}	-0.0110***	-0.1726***	0.3666***	0.0450***	0.0295***
S.E.		0.0028	0.0023	0.0073	0.0014	0.0014
Period 3 vs 1	π_{23}	-0.0111***	-0.1692***	1.0971***	0.1874***	0.1648***
S.E.		0.0037	0.0027	0.0080	0.0017	0.0017
2018 vs 2017	π_3	0.0793***	-0.0257***	0.2924***	0.0515***	0.0488***
S.E.		0.0035	0.0027	0.0090	0.0016	0.0016
Period 2 vs 1 - Redemption group	α_{12}	0.0143**	0.0050	0.0557***	0.0079**	0.0092***
S.E.		0.0066	0.0053	0.0187	0.0032	0.0032
Period 3 vs 1 - Redemption group	α_{13}	0.0070	-0.0020	0.0473**	0.0062	0.0074*
S.E.		0.0085	0.0061	0.0198	0.0039	0.0039
2018 vs 2017 - Redemption group	α_2	0.0509***	0.0472***	0.0214	0.0397***	0.0408***
S.E.		0.0070	0.0058	0.0204	0.0037	0.0036
Exposure	δ_{02}	0.0377***	-0.0162***	0.0294***	-0.0341***	-0.0271***
S.E.		0.0033	0.0028	0.0094	0.0017	0.0017
Post-exposure	δ_{03}	-0.0558***	-0.1804***	-0.2772***	-0.1202***	-0.1193***
S.E.		0.0040	0.0032	0.0098	0.0019	0.0019
Point pressure	δ_{12}	0.1472***	0.1491***	0.1921***	0.1584***	0.1575***
S.E.		0.0075	0.0065	0.0221	0.0039	0.0038
Rewarded behavior	δ_{13}	0.0584***	0.0508***	0.0354	0.0590***	0.0579***
S.E.		0.0100	0.0075	0.0230	0.0043	0.0042
Observations – total		1,610,154	1,610,154	1,610,154	1,610,154	1,610,154
Observations with sales > 0		1,423,313	1,480,474	593,856	1,609,190	1,610,058
Consumers		268,359	268,359	268,359	268,359	268,359
GMM criterion function Q		9.052e-32	2.713e-32	1.546e-32	2.428e-31	8.084e-32

Note: Significance is as follows: * = 10%; ** = 5%; *** = 1%. S.E. refers to the standard errors clustered at the level of the individual consumer.

geneity of the "Redemption" group variable; and instruments are strong (Stock, Wright, and Yogo 2002).

The ***point pressure mechanism*** (parameter δ_{12}), which occurs to consumers redeeming a reward during the promotional period, has a positive impact on F&V sales. Specifically, during the campaign consumers who redeemed the reward increased significantly their expenditures on fresh vegetables (+14.7% using PSW; +24.6% using an IV approach), fresh fruit (+14.9%; +33.7%), dried F&V (+19.2%; +30.5%), and other foods (+15.8%; +32.7%), resulting in a sizable increase in total food sales (+15.8%; +32.3%). Overall, IV estimates are higher than PSW estimates. Nonetheless, these results are indicative of a substantial points pressure mechanism during the 9-week period of the campaign. The positive effect on the sales of other food products and total food is an indication that consumers in the "Redemption" group spent more time and money in stores during the period of the campaign.

Importantly, the results indicate the presence of a positive ***rewarded behavior mechanism***: the effect observed during the loyalty program persisted in all categories in the period after the end of the campaign (period 3 in 2018), although reducing in magnitude over time. Specifically, after the campaign consumers who redeemed the reward recorded an increase in their expenditures on fresh vegetables (+5.8% using PSW; 5.4% using an IV approach), fresh fruit (+5.1%; +8.9%), dried F&V (+3.5%; +0.05%, not significant), and other foods (+5.9%; +10.1%), with an overall increase in total food expenditures (+5.8%; +9.9%). As before, IV estimates are higher than PSW estimates, except for vegetables

and dried F&V. These results provide evidence of a significant rewarded behavior effect in almost all the categories in analysis, which is however smaller in magnitude compared to points pressure.

In contrast, estimates of the ***exposure mechanism*** δ_{02} (the year-period interaction variables: Period 2 × 2018; and Period 3 × 2018) present a less straightforward picture. Results using PSW indicate that during the promotional campaign, mere exposure increased expenditures on vegetables and dried F&V increased (+3.7% and +2.9% respectively); however, IV estimates indicate no significant impact on both these categories. Conversely, both methods estimate a reduction in expenditures on fruit (−1.6% using PSW; −8.1% using an IV approach) and sales of other foods decreased (−3.4%; −10.5%), resulting in a drop in total food expenditures (−2.7%; −9.6%). These results suggest that consumers may have substituted part of their budget away from other goods to buy vegetables, but more generally did not respond to the campaign solely on the basis of the information that was provided. The ***post-exposure mechanism*** δ_{03} indicates that the effect of information did not persist, as consumers spent less in all categories once the campaign stopped: expenditures on vegetables (−5.5% using PSW; −5.95% using IV), fruit (−18.0%; −19.1%), dried F&V (−27.7%; −26.8%), and other foods (−12.0%; −13.7%) all decreased, with an overall drop in total food expenditures (−11.9%; −13.5%).

Regarding the remaining coefficients, π_{22} and π_{23} indicate that fresh F&V consumption falls towards the end of the year due to the seasonality of production, except for dried F&V and other foods, which increase in preparation for Christmas

Table 5
Estimation results – Fixed effects panel exponential regression with endogeneity correction.

	Parameter	Vegetables	Fruit	Dried F&V	Other food	All food
Period 2 vs 1	π_{22}	-0.0282***	-0.1829***	0.3264***	0.0339***	0.0172***
S.E.		0.0065	0.0050	0.0164	0.0035	0.0034
Period 3 vs 1	π_{23}	-0.0307***	-0.1690***	1.1345***	0.1832***	0.1598***
S.E.		0.0084	0.0059	0.0158	0.0039	0.003855
2018 vs 2017	π_3	0.0633***	-0.0254***	0.2645***	0.0381***	0.0361***
S.E.		0.0085	0.0055	0.0183	0.0039	0.0038
Period 2 vs 1 - Redemption group	α_{12}	0.0755***	0.0342**	0.1995***	0.0449***	0.0504***
S.E.		0.0212	0.0163	0.0535	0.0106	0.01035
Period 3 vs 1 - Redemption group	α_{13}	0.0842***	-0.0074	-0.0806	0.0212*	0.0254**
S.E.		0.0270	0.0193	0.0536	0.0117	0.01168
2018 vs 2017 - Redemption group	α_2	0.1084***	0.0388**	0.1312**	0.0855***	0.0843***
S.E.		0.0284	0.0174	0.0602	0.0116	0.01148
Exposure	δ_{02}	-0.0050	-0.0814***	-0.0312	-0.1048***	-0.0957***
S.E.		0.0087	0.0068	0.0229	0.0047	0.0045
Post-exposure	δ_{03}	-0.0595***	-0.1906***	-0.2679***	-0.1366***	-0.1350***
S.E.		0.0099	0.0068	0.0201	0.0047	0.0046
Point pressure	δ_{12}	0.2458***	0.3368***	0.3045***	0.3271***	0.3229***
S.E.		0.0278	0.0203	0.0697	0.0130	0.0128
Rewarded behavior	δ_{13}	0.0537*	0.0893***	0.0005	0.1010***	0.0985***
S.E.		0.0321	0.0213	0.0668	0.0137	0.0135
Observations – total		1,610,154	1,610,154	1,610,154	1,610,154	1,610,154
Observations with sales > 0		1,423,313	1,480,474	593,856	1,609,190	1,610,058
Consumers		268,359	268,359	268,359	268,359	268359
GMM criterion function Q		8.797e-33	4.405e-33	1.524e-33	1.495e-32	4.012e-32

Note: Significance is as follows: * = 10%; ** = 5%; *** = 1%. S.E. refers to the standard errors clustered at the level of the individual consumer.

and new year festivities, and sustain the growth of the total food category. These trends do not fully characterize the consumers in the "Redemption" group: α_{12} indicate that for this group expenditures in all categories increase in the second period; however, α_{13} suggests this group spend more on food overall in period 3, with the PSW approach suggesting only through an increase in dried F&V, while the IV approach suggests growth in expenditures on vegetables and other food. Finally, π_3 indicates that compared to 2017, in 2018 consumers on average spent more on everything except fruit, with a particularly large increase in dried F&V expenditures; while α_2 indicates that the "Redemption" group recorded an additional increase in expenditures across all the categories (except dried F&V in Table 4). As a result, the promotional campaign succeeded to some extent in slowing down the downward-facing trend within the F&V category over winter; while for the "Redemption" group, the campaign reinforced an existing positive trend.

Discussion

This article estimates the within and cross-category effects of a retailer's loyalty program, both during and after the promotional period. Unlike previous research, which considers generic (multi-category) loyalty programs, this study analyses a nationwide program run by a large Croatian grocery retailer that specifically promoted the sales of F&V, a key element of a healthy lifestyle (Albani et al. 2018; Bollinger et al. 2020; List, Samek, and Zhu 2015). Loyalty programs where the focal category is a healthy category can differ from programs

targeting generic in-store expenditures because they provide information about the personal or social benefits of the promoted behavior (Bollinger et al. 2020; Polacsek et al. 2018; Schwartz et al. 2014). At the same time, the promotion of healthy products like F&V (and fresh produce more generally) requires retailers to pay for the campaign without procurement income, limiting the appeal of such an activity. Overall, the results support the view that retailers can play a primary role in the pursuit of public health and sustainability goals, and marketing campaigns promoting more sustainable consumption patterns can lead to win-win scenarios where retailers increase their revenues. This section discusses these results, focusing on the learning of this campaign for retailers.

Are loyalty programs promoting F&V consumption effective?

Loyalty programs seek to provide benefits to consumers who engage more frequently with the retailer, through a spending goal that rewards consumers, as well as retailer, through an increase in revenues and profits (Ballings, McCullough, and Bharadwaj 2018; Blattberg, Kim, and Neslin 2008; Henderson, Beck, and Palmatier 2011; Stourm et al. 2020; Taylor and Neslin 2005). A key objective of loyalty programs is to increase sales and induce cross-category selling to existing customers, strengthening behavioral loyalty to the retailer (Belli et al. 2022; Blattberg, Kim, and Neslin 2008; Leenheer, van Heerde, Bijmolt, and Smidts 2007). The main finding of this research is the expansionary nature of the Zdravljupci campaign: the promotion of a healthy category (F&V) is accompanied by an overall increase in expenditures

in the focal category, as well as total food expenditures, an indication of campaign effectiveness.

The analysis of cross-category purchases is particularly important when promoting products in a single category: in a category like F&V, where retailers have to pay for the costs of the promotional campaign, the increase in consumer spending across all categories allows retailers to subsidize (in monetary or non-monetary form, e.g., through redeemable points in Wei and Xiao 2015) the sales of healthy options with the increase in revenue from other goods. As a result, an effective loyalty program promoting healthy products requires an increase in the share of wallet consumers spend in the focal retailer (Meyer-Waarden 2007), as profitability is inherently linked to an increase in consumer spending across non-focal categories (Gabel and Guhl 2022; Liu and Yang 2009; Wei and Xiao 2015). Crucially, our results suggest that loyalty programs can be used within a portfolio of actions retailers can use designed to deliver societal benefits (see also Panzone, Auch, and Zizzo 2021; Panzone et al. 2021a; Panzone et al. 2021b), and increase behavioral loyalty to the retailer.

The results provide evidence that the promotion generated a significant ***points pressure mechanism*** (Blattberg, Kim, and Neslin 2008; Dorotic et al. 2014; Taylor and Neslin 2005). This mechanism leads to the largest change in consumer expenditure across all categories. However, this mechanism affected only those consumers interested in the reward – approximately one third of our sample. These consumers have a stronger motivational attachment to the campaign (that is, an interest in the reward), and possibly stronger preferences for the brand of the retailer, as they appeared to have stronger baseline behavioral loyalty. The initial collection of points may have motivated this group of consumers to engage with the promotion by collecting more points (Kivetz, Urminsky, and Zheng 2006); while the presence of a non-linear pricing schedule for rewards may have further motivated the collection of points to reduce the monetary cost of the reward. At the same time, the presence of points may have also motivated some individuals to redeem a reward to avoid losing points i.e. "points loss aversion"; or avoid wasting the effort placed in collecting points (sunk costs).

Results also provide evidence of a ***rewarded behavior mechanism*** (Bijmolt, Dorotic, and Verhoef 2011; Dorotic et al. 2014; Kim, Steinhoff, and Palmatier 2021; Taylor and Neslin 2005), which affected consumers who redeemed the reward. In the case studied, the rewarded behavior mechanism leads to a smaller increase in sales compared to the points pressure mechanism amongst those who redeemed points for a reward, but sales in F&V remained above the baseline level even after the end of the promotional campaign. This mechanism increased expenditures across all categories, except dried F&V, due to the seasonal and storable nature of this category. From the perspective of retailers, these results are important: the campaign increased consumer loyalty, with expenditures that remained higher than the baseline once the reward was removed. This increased loyalty may be driven by more favorable attitudes towards the retailer, an increase in the

self-esteem of the consumer, or learning about the quality of the products sold in the retailer (Belli et al. 2022; Kim, Steinhoff, and Palmatier 2021); while the data does not allow disentangling these effects, the results support the view that the intervention was effective in increasing sales in the focal retailer.

Finally, the results indicate that ***pure exposure*** to the campaign did not have a clear effect, with small positive or non-significant effects on the sales of vegetables and dried F&V, and a drop in expenditure in all other classes. As a result, exposing consumers to information promoting F&V consumption online or offline (e.g., on billboards) did not have a clear, positive effect on F&V consumption, an indication that this information did not prime consumers (Papies 2016; Tate, Stewart, and Daly 2014). Importantly, the ***post-exposure mechanism*** saw a drop in expenditure in all categories. The negative effect on vegetables and dried F&V suggests that information may have prevented a decline in consumption in those categories, but the protective effect only lasted when available *during* the shopping trip (as seen for nutrition labels in Bollinger et al. 2020; Dubois et al. 2020). The overall drop in expenditure might reflect a more general drop in patronage due to unobservable factors (e.g., increasing market share of discount retailers) that drove consumers away from the focal retailer. Future research is needed to understand the reasons for this drop.

Targeting and the design of loyalty programs promoting societal goals

This study shows that the provision of a health goal that targets expenditures in a specific category can increase the total amount consumers spend in the stores of the focal retailer. A key insight for retailers is that a societal goal can align with business goals: while the goal is category-specific, it can increase the interactions between consumers and retailers, with an increase in consumer expenditures in all revenue-generating categories. In fact, the design of promotions that incorporate health goals can increase sales, with growth coming from an increase in sales within the focal category, as well as from a spillover effect to other categories in the shopping basket (Manchanda, Ansari, and Gupta 1999; Richards, Hamilton, and Yonezawa 2018). Notably, the effectiveness of a loyalty program depends crucially on its design (Bijmolt, Dorotic, and Verhoef 2011; Bombaij and Dekimpe 2019; Bombaij, Gelper, and Dekimpe 2022), and this study provides some important insights.

A first consideration is the need to understand the customer segment targeted by the promotion. The increase in revenue observed in our study comes from consumers who had a strong interest in healthy eating for their children and valued the reward – mothers with children. In line with previous research (Gabel and Guhl 2022; Liu 2007), engagement was particularly relevant for consumers who had a high level of loyalty at the outset. Crucially, consumers who redeemed rewards spent more also after the promotion finished (although at a diminishing rate), consistent with the notion that cus-

tomers need to experience the benefits of a reward from a loyalty program before changing their behavior (Gabel and Guhl, 2022). From a consumer dynamics perspective, this study shows that at the expansion stage, where consumers consider ways to increase their interactions with the retailer, the presence of a lifestyle goal value by the target segment is a way to strengthen relationships.

A second consideration is the design of the reward (Bombaij, Gelper, and Dekimpe 2022). Previous research warns that messages promoting lifestyle choices can backfire, causing reactance (Zemack-Rugar, Moore, and Fitzsimons 2017), or reduce the motivation to engage with the retailer in other related categories (Dubé, Luo, and Fang 2017). The "Zdravoljupci" campaign presented consumers with a reward that was hard (redeemable points, which give a discount on the final reward), and directly linked to the activity of the store; but it also contained a soft, intangible element, as it rewarded consumers who care for the health of their children (see e.g., Belli et al. 2022 for the classification of rewards). The characteristics of this promotion made it very appealing to the targeted customer segment (primarily mothers aged 45 or less, loyal to the store brand). The alignment of the incentives of the retailer and the target segment is likely to have contributed to the increase in total expenditure.

A final consideration is the choice of the category, fresh produce, which is characterized by perishable products, and is therefore typically unsuitable for stockpiling. This feature may explain the absence of anticipatory delays from consumers expecting the promotion (Raghubir, Inman, and Grande 2004); as well as the absence of post-promotion dips in sales (Ballings, McCullough, and Bharadwaj 2018). Consequently, fresh produce is particularly appropriate for such a rewards program, and results might differ for non-perishable product categories.

Limitations and future research

While providing important insights for retailers, a key limitation of this study is the limited availability of behavioral variables in the dataset. Behavioral loyalty entails consumers developing more positive attitudes towards the retailer, leading to higher spending in store (in terms of total expenditure or share of wallet), as well as more visits in store (Henderson, Beck, and Palmatier 2011; Kim, Steinhoff, and Palmatier 2021). At the same time, the redemption of a reward associated with a virtuous goal is expected to increase the self-esteem of redeemers (Fishbach and Dhar, 2007; Fishbach et al., 2010); while points accumulation is expected to motivate consumers in the pursuit of the goal, therefore increasing their consumption rate (Kivetz, Urminsky, and Zheng 2006). This study only observes expenditures, and (yearly) data on visits in store, but has no data on consumer attitudes, patronage of competitors, and other behavioral metrics over time that may explain our results in more detail (Belli et al. 2022; Kim et al. 2021). Future research could investigate whether redeeming points for differing products has varying effects on self-esteem, and if associated feelings

of gratitude explain the positive spillover effect on sales after the end of the campaign.

Similarly, loyalty card data collects information on household purchasing patterns, but not actual consumption (which may vary due to gifting and food waste), or the intrahousehold allocation of consumption. Consequently, the results provide evidence of secondary demand effects (Neslin et al. 2014; Verhoef, Kannan, and Inman 2015), whereby the campaign shifted sales from rivals to the focal retailer. However, the data cannot precisely estimate primary demand effects, whereby households increase their total expenditures on, and consumption of, F&V, and overcoming this limitation requires data from consumer panels, which records expenditure data in all retailers (e.g., Meyer-Waarden 2007). Finally, while the dataset allows for exploring expansion dynamics in consumer shopping, it cannot provide insights regarding customer acquisition (the decision to join the loyalty card program), or customer onboarding (value delivery after enrolment). These are two important metrics affected by loyalty programs (Henderson, Beck, and Palmatier 2011; Kim, Steinhoff, and Palmatier 2021), which may respond to programs promoting lifestyle choices. This is again left for future research.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jretai.2023.12.002.

References

Ahlfeldt, G.M. (2018), "Weights to Address Non-Parallel Trends in Panel Difference-in-Differences Models," *CESifo Economic Studies*, 64 (2), 216–40.

Albani, V., Butler L.T., Traill W.B. & Kennedy O.B. (2017), "Fruit and Vegetable Intake: Change with Age across Childhood and Adolescence," *British Journal of Nutrition*, 117 (5), 759–65.

Albani, V., Butler L.T., Traill W.B. & Kennedy O.B. (2018), "Understanding Fruit and Vegetable Consumption in Children and Adolescents. The Contributions of Affect, Self-Concept and Habit Strength," *Appetite*, 120, 398–408.

Angrist, J.D. & Pischke J.-S. (2009). *Mostly Harmless Econometrics*. Princeton University Press.

Baca-Motes, K., Brown A., Gneezy A., Keenan E.A. & Nelson L.D. (2013), "Commitment and Behavior Change: Evidence from the Field," *Journal of Consumer Research*, 39 (5), 1070–84.

Ballings, M., McCullough H. & Bharadwaj N. (2018), "Cause Marketing and Customer Profitability," *Journal of the Academy of Marketing Science*, 46 (2), 234–51.

Belli, A., O'Rourke A.-M., Carrillat F.A., Pupovac L., Melnyk V. & Napolova E. (2022), "40 years of Loyalty Programs: How Effective Are They? Generalizations from a Meta-Analysis," *Journal of the Academy of Marketing Science*, 50 (1), 147–73.

Bertrand, M., Duflo E. & Mullainathan S. (2004), "How Much Should We Trust Differences-in-Differences Estimates?," *The Quarterly Journal of Economics*, 119 (1), 249–75.

Bijmolt, T.H.A., Dorotic M. & Verhoef P.C. (2011), "Loyalty Programs: Generalizations on Their Adoption, Effectiveness and Design," *Foundations and Trends® in Marketing*, 5 (4), 197–258.

Blattberg, R.C., Kim B.-D. & Neslin S.A. (2008). "Chapter 22: Frequency Reward Programs". In Blattberg Robert C., Kim Byung-Do, and Neslin Scott A. (Eds.), *Database Marketing: Analyzing and Managing Customers* (pp. 549–578). New York, NY: Springer New York.

Blundell, R., Griffith R. & Windmeijer F. (2002), "Individual Effects and Dynamics in Count Data Models," *Journal of Econometrics*, 108 (1), 113–31.

Bolderdijk, J.W., Steg L., Geller E.S., Lehman P.K. & Postmes T. (2013), "Comparing the Effectiveness of Monetary Versus Moral Motives in Environmental Campaigning," *Nature Clim. Change*, 3 (4), 413–16.

Bollinger, B., Liebman E., Hammond D., Hobin E. & Sacco J. (2020), "Educational Campaigns for Product Labels: Evidence from on-Shelf Nutritional Labeling," *Journal of Marketing Research*, 59 (1), 153–72.

Bombaij, N.J.F. & Dekimpe M.G. (2019), "When Do Loyalty Programs Work? The Moderating Role of Design, Retailer-Strategy, and Country Characteristics," *International Journal of Research in Marketing*.

Bombaij, N.J.F., Gelper S. & Dekimpe M.G. (2022), "Designing Successful Temporary Loyalty Programs: An Exploratory Study on Retailer and Country Differences," *International Journal of Research in Marketing*, 39 (4), 1275–95.

Brecic, R., Gorton M. & Cvencek D. (2022), "Development of Children's Implicit and Explicit Attitudes toward Healthy Food: Personal and Environmental Factors," *Appetite*, 176, 106094.

Breck, A., Mijanovich T., Weitzman B.C. & Elbel B. (2017), "The Current Limits of Calorie Labeling and the Potential for Population Health Impact," *Journal of Public Policy & Marketing*, 36 (2), 227–35.

Cameron, C.A. & Miller D.L. (2015), "A Practitioner's Guide to Cluster-Robust Inference," *Journal of Human Resources*, 50 (2), 317–72.

Craveiro, D., Marques S., Zvěřinová I., Máca V., Ščasný M., Chiabai A., Suarez C., Martinez-Juarez P., García de Jalón S., Quiroga S. & Taylor T. (2021), "Explaining Inequalities in Fruit and Vegetable Intake in Europe: The Role of Capabilities, Opportunities and Motivations," *Appetite*, 165, 105283.

Dimbleby H., National Food Strategy: an independent review for government, 2021.

Dorotic, M., Verhoef P.C., Fok D. & Bijmolt T.H.A. (2014), "Reward Redemption Effects in a Loyalty Program When Customers Choose How Much and When to Redeem," *International Journal of Research in Marketing*, 31 (4), 339–55.

Du, S., Bhattacharya C.B. & Sen S. (2007), "Reaping Relational Rewards from Corporate Social Responsibility: The Role of Competitive Positioning," *International Journal of Research in Marketing*, 24 (3), 224–241.

Dubé, J.-P., Luo X. & Fang Z. (2017), "Self-Signaling and Prosocial Behavior: A Cause Marketing Experiment," *Marketing Science*, 36 (2), 161–86.

Dubois, P., Albuquerque P., Allais O., Bonnet C., Bertail P., Combris P., Lahlou S., Rigal N., Ruffieux B. & Chandon P. (2020), "Effects of Front-of-Pack Labels on the Nutritional Quality of Supermarket Food Purchases: Evidence from a Large-Scale Randomized Controlled Trial," *Journal of the Academy of Marketing Science*.

Espinosa, R. & Treich N. (2021), "Moderate Versus Radical Ngos†," *American Journal of Agricultural Economics*, 103 (4), 1478–501.

Eurostat. (2022). *How Much Fruit and Vegetables Do You Eat Daily?* https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220104-1.

Fishbach A., Dhar R., Dynamics of Goal-Based Choice, In *Handbook of Consumer Psychology*, ed. Curtis P.‖ Haugtvedt, Paul M.‖ Herr and Frank R. Kardes, (2007) New York Routledge, 611-37.

Fishbach, A., Eyal T. & Finkelstein S.R. (2010), "How Positive and Negative Feedback Motivate Goal Pursuit, *Social and Personality*," *Psychology Compass*, 4 (8), 517–30.

Frölich, M. (2004), "Finite-Sample Properties of Propensity-Score Matching and Weighting Estimators," *The Review of Economics and Statistics*, 86 (1), 77–90.

Gabel, S. & Guhl D. (2022), "Comparing the Effectiveness of Rewards and Individually Targeted Coupons in Loyalty Programs," *Journal of Retailing*, 98 (3), 395–411.

Garai, T. (2022). *Go Green, Get Green with a Sustainable, Green Loyalty Program* https://antavo.com/blog/green-loyalty-programs/.

Gielens, K., Gijsbrechts E. & Geyskens I. (2021), "Navigating the Last Mile: The Demand Effects of Click-and-Collect Order Fulfillment," *Journal of Marketing*, 85 (4), 158–78.

Gneezy, A., Gneezy U., Riener G. & Nelson L.D. (2012a), "Pay-What-You-Want, Identity, and Self-Signaling in Markets," *Proceedings of the National Academy of Sciences*, 109 (19), 7236–40.

Gneezy, A., Imas A., Brown A., Nelson L.D. & Norton M.I. (2012b), "Paying to Be Nice: Consistency and Costly Prosocial Behavior," *Management Science*, 58 (1), 179–87.

Goldfarb, A., Tucker C. & Wang Y. (2022), "Conducting Research in Marketing with Quasi-Experiments," *Journal of Marketing*, 86 (3), 1–20.

Guo, S., Fraser M. & Chen Q. (2020), "Propensity Score Analysis: Recent Debate and Discussion," *Journal of the Society for Social Work and Research*, 11 (3), 463–82.

Henderson, C.M., Beck J.T. & Palmatier R.W. (2011), "Review of the Theoretical Underpinnings of Loyalty Programs," *Journal of Consumer Psychology*, 21 (3), 256–76.

Hirano, K. & Imbens G.W. (2001), "Estimation of Causal Effects Using Propensity Score Weighting: An Application to Data on Right Heart Catheterization," *Health Services and Outcomes Research Methodology*, 2 (3), 259–78.

Imbens, G.W. & Wooldridge J.M. (2009), "Recent Developments in the Econometrics of Program Evaluation," *Journal of Economic Literature*, 47 (1), 5–86.

Kamenica, E. (2012), "Behavioral Economics and Psychology of Incentives," *Annual Review of Economics*, 4 (1), 427–52.

Kanay, A., Hilton D., Charalambides L., Corrégé J.-B., Inaudi E., Waroquier L. & Cézéra S. (2021), "Making the Carbon Basket Count: Goal Setting Promotes Sustainable Consumption in a Simulated Online Supermarket," *Journal of Economic Psychology*, 83, 102348.

Kekes-Szabo, B. (2021). *10 Lifestyle Loyalty Programs That Reward Customers for Being Themselves* https://antavo.com/blog/lifestyle-loyalty-programs/.

Kim, J.J., Steinhoff L. & Palmatier R.W. (2021), "An Emerging Theory of Loyalty Program Dynamics," *Journal of the Academy of Marketing Science*, 49 (1), 71–95.

Kivetz, R., Urminsky O. & Zheng Y. (2006), "The Goal-Gradient Hypothesis Resurrected: Purchase Acceleration, Illusionary Goal Progress, and Customer Retention," *Journal of Marketing Research*, 43 (1), 39–58.

Kopalle, P.K., Sun Y., Neslin S.A., Sun B. & Swaminathan V. (2012), "The Joint Sales Impact of Frequency Reward and Customer Tier Components of Loyalty Programs," *Marketing Science*, 31 (2), 216–35.

Laborde-Castérot, H., Agrinier N. & Thilly N. (2015), "Performing Both Propensity Score and Instrumental Variable Analyses in Observational Studies Often Leads to Discrepant Results: A Systematic Review," *Journal of Clinical Epidemiology*, 68 (10), 1232–40.

Lal, R. & Bell D.E. (2003), "The Impact of Frequent Shopper Programs in Grocery Retailing," *Quantitative Marketing and Economics*, 1 (2), 179–202.

Larcom, S., Rauch F. & Willems T. (2017), "The Benefits of Forced Experi-

mentation: Striking Evidence from the London Underground Network*,” *The Quarterly Journal of Economics*, 132 (4), 2019–55.

Lee, B.K., Lessler J. & Stuart E.A. (2010), “Improving Propensity Score Weighting Using Machine Learning,” *Statistics in Medicine*, 29 (3), 337–46.

Lee, S., Lee J.-H. & Jeong Y. (2023), “The Effects of Digital Textbooks on Students' Academic Performance, Academic Interest, and Learning Skills,” *Journal of Marketing Research*, 60 (4), 792–811.

Leenheer, J., van Heerde H.J., Bijmolt T.H.A. & Smidts A. (2007), “Do Loyalty Programs Really Enhance Behavioral Loyalty? An Empirical Analysis Accounting for Self-Selecting Members,” *International Journal of Research in Marketing*, 24 (1), 31–47.

Lewis, M. (2004), “The Influence of Loyalty Programs and Short-Term Promotions on Customer Retention,” *Journal of Marketing Research*, 41 (3), 281–92.

List, J.A. (2022). *The Voltage Effect*. Penguin UK.

List, J.A., Samek A. & Zhu T. (2015). “Incentives to Eat Healthy: Evidence from a Grocery Store Field Experiment”. CESR-Schaeffer Working Paper *ed. SSRN*.

Liu, Y. (2007), “The Long-Term Impact of Loyalty Programs on Consumer Purchase Behavior and Loyalty,” *Journal of Marketing*, 71 (4), 19–35.

Liu, Y. & Yang R. (2009), “Competing Loyalty Programs: Impact of Market Saturation, Market Share, and Category Expandability,” *Journal of Marketing*, 73 (1), 93–108.

Manchanda, P., Ansari A. & Gupta S. (1999), “The “Shopping Basket”: A Model for Multicategory Purchase Incidence Decisions,” *Marketing Science*, 18 (2), 95–114.

Matthay, E.C., Hagan E., Gottlieb L.M., Tan M.L., Vlahov D., Adler N.E. & Glymour M.M. (2020), “Alternative Causal Inference Methods in Population Health Research: Evaluating Tradeoffs and Triangulating Evidence,” *SSM - Population Health*, 10, 100526.

Mauri, C. (2003), “Card Loyalty. A New Emerging Issue in Grocery Retailing,” *Journal of Retailing and Consumer Services*, 10 (1), 13–25.

Meyer-Waarden, L. (2007), “The Effects of Loyalty Programs on Customer Lifetime Duration and Share of Wallet,” *Journal of Retailing*, 83 (2), 223–36.

Montoya, R. & Flores C. (2019), “Buying Free Rewards: The Impact of a Points-Plus-Cash Promotion on Purchase and Reward Redemption,” *Marketing Letters*, 30 (1), 107–18.

Neslin, S.A., Jerath K., Bodapati A., Bradlow E.T., Deighton J., Gensler S., Lee L., Montaguti E., Telang R., Venkatesan R., Verhoef P.C. & Zhang Z.J. (2014), “The Interrelationships between Brand and Channel Choice,” *Marketing Letters*, 25 (3), 319–30.

Panzone, L., Auch N. & Zizzo D. (2021). *Voluntary Vs Forced Commitment to Reduce the Carbon Footprint of Food Shopping*. Newcastle University Working Paper.

Panzone, L.A., Larcom S. & She P.-W. (2021), “Estimating the Impact of the First Covid-19 Lockdown on UK Food Retailers and the Restaurant Sector,” *Global Food Security*, 28, 100495.

Panzone, L.A., Ulph A., Hilton D., Gortemaker I. & Tajudeen I.A. (2021a), “Sustainable by Design: Choice Architecture and the Carbon Footprint of Grocery Shopping,” *Journal of Public Policy & Marketing*, 40 (4), 463–86.

Panzone, L.A., Ulph A., Zizzo D.J., Hilton D. & Clear A. (2021b), “The Impact of Environmental Recall and Carbon Taxation on the Carbon Footprint of Supermarket Shopping,” *Journal of Environmental Economics and Management*, 109, 102137.

Papies, E.K. (2016), “Goal Priming as a Situated Intervention Tool,” *Current Opinion in Psychology*, 12, 12–16.

Perino, G. & Schwickert H. (2023), “Animal Welfare Is a Stronger Determinant of Public Support for Meat Taxation Than Climate Change Mitigation in Germany,” *Nature Food*, 4 (2), 160–9.

Polacsek, M., Moran A., Thorndike A.N., Boulos R., Franckle R.L., Greene J.C., Blue D.J., Block J.P. & Rimm E.B. (2018), “A Supermarket Double-Dollar Incentive Program Increases Purchases of Fresh Fruits and Vegetables among Low-Income Families with Children: The Healthy Double Study,” *Journal of Nutrition Education and Behavior*, 50 (3) 217-28.e1.

Raghubir, P., Inman J.J. & Grande H. (2004), “The Three Faces of Consumer Promotions,” *California Management Review*, 46 (4), 23–42.

Richards, T.J., Hamilton S.F. & Yonezawa K. (2018), “Retail Market Power in a Shopping Basket Model of Supermarket Competition,” *Journal of Retailing*, 94 (3), 328–42.

Schwartz, J., Mochon D., Wyper L., Maroba J., Patel D. & Ariely D. (2014), “Healthier by Precommitment,” *Psychological Science*, 25 (2), 538–46.

Sharp, B. & Sharp A. (1997), “Loyalty Programs and Their Impact on Repeat-Purchase Loyalty Patterns,” *International Journal of Research in Marketing*, 14 (5), 473–86.

Shreedhar, G. & Galizzi M.M. (2021), “Personal or Planetary Health? Direct, Spillover and Carryover Effects of Non-Monetary Benefits of Vegetarian Behaviour,” *Journal of Environmental Psychology*, 78, 101710.

Stock, J.H., Wright J.H. & Yogo M. (2002), “A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments,” *Journal of Business & Economic Statistics*, 20 (4), 518–29.

Stourm, V., Bradlow E.T. & Fader P.S. (2015), “Stockpiling Points in Linear Loyalty Programs,” *Journal of Marketing Research*, 52 (2), 253–67.

Stourm, V., Neslin S.A., Bradlow E.T., Breugelmans E., Chun S.Y., Gardete P., Kannan P.K., Kopalle P., Park Y.-H., Amariles D.R., Thomadsen R., Liu-Thompkins Y. & Venkatesan R. (2020), “Refocusing Loyalty Programs in the Era of Big Data: A Societal Lens Paradigm,” *Marketing Letters*, 31 (4), 405–18.

Stuart, E.A., Huskamp H.A., Duckworth K., Simmons J., Song Z., Chernew M.E. & Barry C.L. (2014), “Using Propensity Scores in Difference-in-Differences Models to Estimate the Effects of a Policy Change,” *Health Services and Outcomes Research Methodology*, 14 (4), 166–82.

Sunstein, C.R. (2017), “Nudges That Fail,” *Behavioural Public Policy*, 1 (1), 4–25.

Tate, K., Stewart A.J. & Daly M. (2014), “Influencing Green Behaviour through Environmental Goal Priming: The Mediating Role of Automatic Evaluation,” *Journal of Environmental Psychology*, 38, 225–32.

Taylor, G.A. & Neslin S.A. (2005), “The Current and Future Sales Impact of a Retail Frequency Reward Program,” *Journal of Retailing*, 81 (4), 293–305.

Trewern, J., Chenoweth J., Christie I., Keller E. & Halevy S. (2021), “Are Uk Retailers Well Placed to Deliver ‘Less and Better’ Meat and Dairy to Consumers?,” *Sustainable Production and Consumption*, 28, 154–163.

Trivedi, M., Sridhar K. & Kumar A. (2016), “Impact of Healthy Alternatives on Consumer Choice: A Balancing Act,” *Journal of Retailing*, 92 (1), 65–82.

van Doorn, J., Onrust M., Verhoef P.C. & Bügel M.S. (2017), “The Impact of Corporate Social Responsibility on Customer Attitudes and Retention—the Moderating Role of Brand Success Indicators,” *Marketing Letters*, 28 (4), 607–19.

Verhoef, P.C., Kannan P.K. & Inman J.J. (2015), “From Multi-Channel Retailing to Omni-Channel Retailing: Introduction to the Special Issue on Multi-Channel Retailing,” *Journal of Retailing*, 91 (2), 174–81.

Wei, L. & Xiao J. (2015), “Are Points Like Money? An Empirical Investigation of Reward Promotion Effectiveness for Multicategory Retailers,” *Marketing Letters*, 26 (1), 99–114.

White, K., Habib R. & Hardisty D.J. (2019), “How to Shift Consumer Behaviors to Be More Sustainable: A Literature Review and Guiding Framework,” *Journal of Marketing*, 83 (3), 22–49.

Wing, C., Simon K. & Bello-Gomez R.A. (2018), “Designing Difference in Difference Studies: Best Practices for Public Health Policy Research,” *Annual Review of Public Health*, 39 (1), 453–69.

Wise Marketeer (2022). *Consumers Think Loyalty Programmes Need to Do More in Sustainability* https://thewisemarketer.com/loyalty-strategy/consumers-think-loyalty-programmes-need-to-do-more-in-sustainability/.

Wooldridge, J.M. (1995). “Score Diagnostics for Linear Models Estimated by Two Stage Least Squares”. In Maddala G.S., Phillips P.C.B., and Srinivasan T.N. (Eds.), *Advances in Econometrics and Quantitative Economics: Essays in Honor of Professor C. R. Rao* (pp. 66–87). Oxford: Blackwell.

Wooldridge, J.M. (1999), “Distribution-Free Estimation of Some Nonlinear Panel Data Models,” *Journal of Econometrics*, 90 (1), 77–97.

Wooldridge, J.M. (2003), "Cluster-Sample Methods in Applied Economet-rics," *The American Economic Review*, 93 (2), 133–8.

Wooldridge, J.M. (2016), "Should Instrumental Variables Be Used as Match-ing Variables?," *Research in Economics*, 70 (2), 232–7.

Ye, T., Ertefaie A., Flory J., Hennessy S. & Small D.S. (2023), "Instrumented Difference-in-Differences," *Biometrics*, 79 (2), 569–81.

Zeithaml, V.A. (1988), "Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence," *Journal of Marketing*, 52 (3), 2–22.

Zemack-Rugar, Y., Moore S.G. & Fitzsimons G.J. (2017), "Just Do It! Why Committed Consumers React Negatively to Assertive Ads," *Journal of Consumer Psychology*, 27 (3), 287–301.