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How sales promotion influences consumers' physical exercise and purchase behaviors: Evidence from mobile exercise app data

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Abstract

Purpose – Firms can benefit from designing sales promotions based on the analysis of consumers' physical exercise and purchase data. This study aims to study mobile exercise app data to explore how purchasing a promoted or nonpromoted product affects exercisers' subsequent exercise and purchase behaviors.

Design/methodology/approach – Drawing from the theoretical framework of overjustification effect, this study empirically examines the effects of the purchase of promoted – monetary and nonmonetary – or nonpromoted products on relationships (1) between past and subsequent exercise behaviors and (2) between past exercise and subsequent purchase behaviors. Novel data of one million exercise activities and purchase transactions created by 7,517 mobile exercise app users were collected.

Findings – The results reveal that monetary and nonmonetary promotions have a negative effect on overall consumers' amount of physical exercise but increase heavy exercisers' exercise amount. In addition, nonmonetary (monetary) promotion has a positive (negative) effect on consumers' purchase expenditure but has no moderating effect on the exercise-expenditure relationship.

Originality/value – This study provides a theoretical framework explaining how to mitigate the dark side of sales promotions while targeting right exercise consumer segments with the right promotion campaigns.

Keywords – Mobile exercise app, Sales promotion, Overjustification effect, Postpurchase behavior

Paper type Research paper

1. Introduction

Although extant research has studied consumers' immediate response to sales promotion (e.g., brand choice, purchase), studies have paid little attention to consumers' postpurchase behaviors. Postpurchase behavior refers to the way consumers think, feel, and act after they have purchased a product. In this research, we focus on consumers' actions to use the purchased product or purchase new product(s) subsequently after the previous purchase. There are two streams of work on consumers' postpurchase behavior. The first stream of research suggests that promotional tactics (e.g., coupons, displays, and features) lead to outcomes positively in the short run (e.g., immediate purchases) but negatively in the long run, in terms of subsequent and aggregate purchases (e.g., Ailawadi et al., 2007; Dodson et al., 1978; Guadagni and Little, 1983). The second stream of research emphasizes that sales promotion is not effective if it offers little value or varies depending on the type of promotion (e.g., monetary vs. nonmonetary) (Nunes and Park 2003; Simonson et al., 1994). However, empirical evidence is lacking on how the purchase of promoted product affects consumers' subsequent nonpurchase behavior (e.g., product consumption or purchased product-related activities) that may also influence subsequent product purchases.

The emergence of mobile health and exercise apps enables sporting goods firms to track consumers' physical exercise and purchase behaviors longitudinally. Over 325,000 mobile health apps were available in Google Play store, which equates to an expected 3.7 billion app downloads (Research2Guidance, 2017). The number of US smartphone users using health and fitness apps is expected to increase by 27.2% in 2020, from 68.7 million in 2019 to 87.4 million (Phaneuf, 2020). Such booming popularity of exercise apps has motivated sports brands to use consumers' exercise data to strengthen customer relationship management. For example, the UA Shop, a mobile shopping app, launched by UnderArmour leverages exercise data generated by 170 million users of four fitness apps to provide in-app

product recommendations. Although recent studies have explored mobile exercise apps usage (Li and Chang, 2021; Whelan and Clohessy, 2021; Yin et al., 2022), no evidence has answered a question of whether sales promotion affects consumers' physical exercise and purchase behaviors positively or negatively.

Regarding consumers' postpurchase behavior, prior studies have focused primarily on the conflicting effects of sales promotion on the outcomes (more engaged vs. less engaged) of consuming the purchased products. Some scholars argue that price promotions can elevate consumers' moods, and positive moods influence subsequent related and unrelated evaluation judgments (Cohen et al., 2008) and allow consumers to enjoy consuming the purchased product more (Knutson et al., 2007). Other scholars argue that price promotions may reduce consumers' attention during consumption (Wathieu and Bertini, 2007), and the purchase of discounted products may motivate consumers less to pay attention to the details in an affective experience (Lee and Tsai, 2014). However, there is little evidence for the effects of sales promotion on other postpurchase behavior, specifically, exercise behavior in our study.

This study fills these gaps in the literature by empirically demonstrating (1) the direct effects of sales promotion on consumers' postpurchase physical exercise and purchase behaviors and (2) the moderating roles of past exercise behavior in two relationships: promotion-exercise and promotion-purchase. The theoretical basis for our work emanates from the findings from research in social psychology on the overjustification effect (Lepper et al., 1973); which establishes that extrinsic rewards undermine intrinsic motivation. The overjustification effect has been established in educational (e.g., Akin-Little and Little, 2004) and organizational (e.g., Hewett and Conway, 2016) settings and recently in the field of marketing (e.g., Dholakia, 2006; Kivetz, 2005). This theory suggests that consumers' act of purchasing promoted products may inadvertently undermine their intrinsic motivation for exercise or self-determination (i.e., perception of control over their actions) (Dholakia, 2006).

In this study, exercise behavior belongs to intrinsic motivation because it occurs in the absence of an extrinsic reward or benefit (Feingold and Mahoney, 1975). We hypothesize the differential effects of sales promotion on exercise and purchase actions of heterogeneous consumers in terms of past exercise amount (e.g., light vs. heavy exercisers).

Our research advances marketing and exercise app research in a number of ways. First, we provide empirical evidence of the dual effects of sales promotion on subsequent exercise behavior. Specifically, we find that while, overall, consumers' purchase actions of promoted products decrease their proclivity for subsequent exercise, heavy exercisers are more motivated to increase their subsequent exercise after purchasing promoted products. This finding extends the heterogeneity of the overjustification effect (Lepper et al., 1996) by empirically showing that intrinsic motivation (i.e., exercise) can be strengthened or weakened by extrinsic rewards and the surrounding situational factors. Second, we identify the differential effects of sales promotion on subsequent purchase behavior—a positive effect for consumers who engage in purchasing nonmonetarily promoted products but no effect for heavy exercisers. This finding shows that heavy exercisers, whose goals are exercise itself rather than purchasing exercise products, are likely to increase their spending on exercise products regardless of promotional benefits, which extends the literature on goal-directed behavior (Higgins et al., 2003; Mannetti et al., 2012). Finally, while previous exercise app research has largely focused on the usage of the exercise app itself (Li and Chang, 2021; Whelan and Clohessy, 2021), this study extends our knowledge on the value of exercise apps by showing the interrelationship among sales promotions, physical exercises, and product purchases.

2. Literature review

2.1 Sales promotion and postpurchase behavior

Marketers design short-term sales promotion incentives to stimulate consumers to purchase products or services within the duration of the promotions. Studies have mostly identified two types of incentives—monetary (e.g., discount) and nonmonetary (e.g., free gift)—that influence purchase behaviors (Ramanathan and Dhar, 2010), brand choice (Chandon et al., 2000), and brand loyalty (Papatla and Krishnamurthi, 1996). Some studies on monetary promotions have identified mixed effect of coupons on choice (i.e., positive in the short run but negative in the long run) (Dodson et al., 1978) or the positive effect of reframing discounts on purchase intentions (Guha et al., 2018). Other studies have demonstrated that while price promotions encourage purchase amount in a short-term or are more effective for utilitarian than hedonic products, non-price promotions (e.g., free sample coupons) increase the longer-term purchase propensity (Eisenbeiss et al., 2015; Park et al., 2018). However, these studies focus on the immediate response to sales promotion—monetary and nonmonetary—without investigating consumers' subsequent behaviors.

Along with the studies on the immediate response to sales promotions, some studies have examined that the effect of sales promotion on subsequent product purchase; this effect is found to be negative (Guadagni and Little, 1983) or positive (Ailawadi et al., 2007), or depends on the type of promotion; the effect is found to be negative with coupons but positive with display and feature promotions (Papatla and Krishnamurthi, 1996). Because these studies rely on scanner panel or experimental data, they can track purchase-related activities after sales promotion is offered but cannot observe consumers' product consumption or product-related activities over long periods. Although the existing literature demonstrates the positive or negative effect of sales promotion on repeat or subsequent purchases, there is little empirical evidence on how sales promotion affects buyers' consumption or usage behavior toward the purchased product.

When individuals purchase an exercise product using a mobile app, two subsequent

behaviors—exercise intensity and purchase of related exercise product(s)—can be observed through the app. The incorporation of two related but distinct behaviors differs from the incorporation of simply repeat purchases (Ailawadi et al., 2007). The main proposition in this study is that sales promotion influences two types of exercisers' postpurchase behavior (Lee and Tsai, 2014). Table 1 illustrates how this study differs from extant work in the literatures on sales promotion and postpurchase behavior.

[Insert Table 1 about here]

Given that the longer-term effects of sales promotions differ across consumer characteristics (Lim et al., 2005), we use the level of consumers' past exercise engagement (e.g., calories burned) as a moderator in the relationship between sales promotion and subsequent exercise and purchase behaviors. Managerially, we classify exercisers into two segments (heavy vs. light) in terms of past exercise engagement. Our conceptual framework considers two aspects: after purchasing a promoted or nonpromoted exercise product, (1) exercisers decide both postpurchase exercise amount and exercise product purchases, and (2) exercisers' postpurchase exercise and purchase behaviors vary across both the act of buying [non]promotional product and the level of past exercise amount. Figure 1 illustrates our conceptual model and the related hypotheses that are explained in the following sections.

[Insert Figure 1 about here]

2.2 Roles of sales promotion in exercise decision

People often progress through five distinct stages of exercise behavior: precontemplation, contemplation, preparation, action, and maintenance (Prochaska and DiClemente, 1983). For example, people who have never jogged (precontemplation stage) first intend to start jogging in the near future (contemplation stage), then may purchase running shoes and clothes (preparation stage), then may start jogging (action stage), and, finally, may even continue

jogging in the future (maintenance stage). Like Nike and Adidas, sports brands often promote their products, through monetary and nonmonetary incentives, to persuade consumers less interested in exercise to become more exercise-minded through the preparation and action stages. Then, the question is: can sales promotions drive consumers to purchase the promoted products and increase the exercise amount in the future? Notably, sales promotions often focus on short-term effectiveness, such as persuading potential customers to impulsively buy a specific brand or product (Chandon et al., 2000). Prior research has failed to consider how the purchase of promotional or nonpromotional products affects consumers' change in subsequent exercise behavior.

According to the overjustification effect (Lepper, 1983; Lepper et al., 1973), if an individual engages in an activity without extrinsic rewards, the introduction of rewards for engaging in that activity may make him or her less interested in the activity in the absence of these rewards. Prior research has demonstrated that rewards or benefits that are contingent on activity tend to lead to greater overjustification effects than noncontingent rewards or benefits (Ryan et al., 1983). This study focuses on the potential influence of promotional benefits on the benefit receiver's exercise behavior. The overjustification setting involves two actors (the benefit giver and the experienced benefit receiver) and two activities (the behavior a benefit encourages and the benefit itself). In the domain of exercise, when marketers (the benefit giver) offer a sales promotion for an exercise product (the benefit), some consumers will purchase the promoted product immediately (the benefit receiver), and others will purchase other nonpromoted products in another period (the nonbenefit receiver). After purchasing the promoted or nonpromoted product, some benefit receivers will increase exercise, and others will decrease it (the behavior). As such, we use exercise as an activity and the purchase of promotional product(s) as an extrinsic reward, likely to lead to an overjustification effect.

Conversely, the overjustification effect can be mitigated for intrinsically motivated

consumers (Fazio, 1981) or self-determined consumers (Dholakia, 2006) if rewards are designed to support consumers' intrinsic interests. Numerous studies have found that self-determination is linked to patients' regular attendance to weight-loss program (Williams et al., 1996), smoking cessation (Curry et al., 1991), and continuous pro-environmental behaviors (Pelletier et al., 1998). As self-determined choices (e.g., regular jogging) are accompanied by greater motivation, effort, and engagement over long periods (Ryan and Deci, 2002), we regard intrinsically motivated people as heavy exercisers who have a strong interest in the exercise itself and conduct exercise regularly for a long time.

As the overjustification effect suggests, consumers who purchase the promoted product will eventually come to interpret their exercise behavior in extrinsic terms, possibly by viewing the exercise as a means to an end rather than an end in itself (Kruglanski, 1975). Because promotional benefits often decrease the perceived price paid, we assume that promotional benefits may reduce consumer attention during consumption and, thus, decrease consumption enjoyment of the promoted product (Lee and Tsai, 2014; Wathieu and Marco, 2007). Conversely, exercisers who have purchased a nonpromoted product may increase their exercise amount because, as a means to exercise, the new product will facilitate the exercise environment (e.g., a new pair of shoes makes exercisers jog more frequently and farther). Hence, we suggest the following hypothesis:

***H1*:** (a) The purchase of promoted exercise product(s) will decrease postpurchase exercise while (b) the purchase of nonpromoted exercise product(s) will increase postpurchase exercise.

Although the overjustification effect is the central theory in the benefit–activity relationship, the assumption is that consumers' interest in doing an activity is not determined

solely by the activity itself but by situational factors surrounding the activity engagement (Higgins et al., 2010). It is possible that a decrease in intrinsic interest in the exercise activity will occur only insofar as the person's initial interest is not salient to him or her (Fazio, 1981). Similarly, if extrinsic rewards are designed to support individuals' intrinsic interests (e.g., by targeting coupons and discounts on an exercise product to heavy exercisers), they are likely to enhance intrinsically motivated people' motivation (Eisenberger and Cameron, 1996). That is, an increase in the salience of initial or intrinsic interests undermines the overjustification effect (Fazio, 1981). As heavy exercisers tend to have a greater interest in the exercise activity, the overjustification effect will be mitigated when they purchase a promoted product that supports the intrinsic interest.

Other studies have corroborated this conflicting prediction that extrinsic rewards will not diminish intrinsic motivation unless the receiver finds the rewards an unnecessary extrinsic reinforcement (Crano and Sivacek, 1984). That is, if the receiver does not have any information on the negative aspect of purchasing promoted products, his or her attitude toward intrinsic motivation to exercise will not change. Because heavy exercisers may regard the related exercise products as necessary goods, the act of purchasing the promoted product will reinforce their exercise activities. Therefore, we hypothesize the following:

***H2*:** The effect of purchasing promoted product(s) on postpurchase exercise will be moderated by the level of past exercise amount; heavy exercisers who purchase promoted product(s) will increase postpurchase exercise.

2.3 Roles of sales promotion in exercisers' purchase decision

The effectiveness of sales promotion is determined not only by the benefit of a sales promotion but also by the congruence of the benefit with consumers (Chandon et al., 2000;

Kivetz and Zheng, 2017). In the exercise context, consumers who have exercised in a specific area (e.g., bicycling, climbing) for long periods are likely to have rich knowledge about the exercise process, product technologies, and detailed attribute information on multiple products. Although promotional purchases, especially with little value, may decrease repeat purchases (Simonson et al., 1994), prior purchases made on sales promotions can increase consumption of the purchased products and subsequent purchases (Ailawadi et al., 2007; Papatla and Krishnamurthi, 1996). In exerciser settings, the act of buying an exercise product is regarded as a goal-directed behavior because the product purchase is influenced by a exerciser's intention to act (e.g., start or maintain exercise), which is predicted by a desire for the act (Bagozzi et al., 2003). As exercisers tend to maintain goal-directed progress toward a specific exercise (Kruglanski et al., 2000), they are likely to regard their buying promoted products as value-added due to monetary gains and exercise facilitators.

In support of this argument, in exercise and shopping situations, market mavens who buy more promoted products than nonmavens tend to engage in smart buying (Slama et al., 1992) because they keep track of contemporary sales promotions, due to their need for smart decision making. Thus, we posit that market mavens are likely to seek out various sales promotions and their benefits (i.e., monetary and nonmonetary) to a point that they purchase promoted exercise products rather than nonpromoted products. Hence, we hypothesize the following:

***H3*:** Exercisers' purchase of promoted product(s) will increase subsequent purchase expenditure for exercise products.

Although heavy exercisers view the purchase of promoted products as positive rather than negative (Crano and Sivacek, 1984), they are likely to focus more on the exercise itself

than the promotional benefit (Higgins et al., 2003; Mannetti et al., 2012). As light exercisers are more extrinsically motivated to exercise, they will initially purchase the promoted product on impulse, which can lead to greater subsequent purchases (Chandran and Morwitz, 2005; Dhar et al., 2007). Therefore, we assume that light exercisers tend to engage in impulse buying induced by monetary and nonmonetary promotions, which will further drive the subsequent purchases. Conversely, as heavy exercisers are more intrinsically motivated to exercise, their purchase decisions on promoted exercise products can be regarded as a type of goal-directed behavior because they may think these products as necessary goods. Because heavy exercisers are likely to have a high self-control (Gillebaart et al., 2016), they may purchase promoted or nonpromoted products when they need them. Therefore, sales promotion may not encourage heavy exercisers to continue purchasing additional products. Thus, we predict:

***H4*:** The effect of purchasing promoted product(s) on postpurchase exercise will be moderated by the level of past exercise engagement; light exercisers who purchase promoted product(s) will increase subsequent purchase expenditure while heavy exercisers who purchase promoted product(s) will not increase subsequent purchase expenditure.

In our study, we incorporate three control variables (i.e., demographics and seasonality) that may affect exercise and purchase behavior. Specifically, age is included as a critical demographic factor because younger consumers are likely to prefer the usefulness of the exercise app-tracking technology (Venkatesh et al., 2003) and physical activity may decrease with age (Hallal et al., 2012). In addition, as people tend to exercise more in particular seasons such as summer and fall (Kim et al., 2018), we capture such seasonality effects of specific month and year in the study.

3. Data

3.1 Data collection

To test our hypotheses, we collected rich data for exercise and purchase behavior with support from a leading mobile exercise app operator in South Korea. The exercise app tracks and records the details of users' exercise activity, such as type (e.g., jogging, bicycling), time, location, distance, burned calories, exercise duration, speed, and altitude. This exercise app ran in-app (now defunct) marketplace in which manufacturers sold exercise products to app users. Such in-app commerce functionality enabled us to track app users' purchase transactions in addition to exercise activities. We found that manufacturers decided the type of a sales promotion for a specific product, and the specific promotion was offered to all app users. To analyze the consumers' exercise and purchase journey, we extracted a complete set of exercise and purchase data of 7,517 app users who purchased exercise products at least once within three years (January 2013-December 2015) in the marketplace.

3.2 Data description

The final dataset consists of two subsets. The first contains five types of exercise activities such as hiking, walking, bicycling, jogging, and rollerblading. The most popular exercise is hiking and the second is walking, followed by bicycling. In this sample, 98% of exercise app users (7,363 of 7,517) engaged in hiking and burned approximately 4,000 calories, on average, by hiking roughly 19 kilometers per month. In addition, 70% of app users participated in walking and burned 444 calories, on average, by walking 8.8 kilometers per month. Finally, 52% of the app users engaged in bicycling and burned 514 calories by biking 23 kilometers per month. Jogging and rollerblading activities were not popular in this sample.

The second subset contains the historical data of sales promotions and purchases.

Regarding the aggregate-level purchase frequency, 7,305 app users (97.18%) made purchases 1 to 10 times during the three-year period, 189 users (2.51%) 11 to 20 times, 19 users (0.25%) 21 to 30 times, and 4 users more than 30 times. We classified the type of sales promotion by first identifying the detailed promotional tag information attached to each promoted product name (e.g., [free shipping] AAA T-shirts).

To measure the type of sales promotion, we first grouped the purchased products into six categories—free shipping, discount, limited offering, merchandiser recommendation, special product introduction, and no promotion. Next, we classified six categories into three categories: (1) MONETARY (free shipping, discount), (2) NONMONETARY (limited offering, merchandiser recommendation, special product introduction) and (3) NONE. In the sample, exercise app users purchased promoted (43.8%)—monetary (9.9%) and nonmonetary (33.9%)—and nonpromoted (56.2%) products. The endogeneity of promotional campaigns may be a concern, such as when a firm plans and implements its promotional campaigns using endogenous customer information (Manchanda et al., 2004).

Finally, we found that the prices of purchased products ranged from $1 to $1,433, with a mean value of $78, median value of $54, and standard deviation of $84. The distribution of product prices was positively skewed (skewness: 4.83); purchased products with prices over $400, $300, and $200 represented 1.15%, 2.07%, and 5.62%, respectively. Most products were outdoor apparel and accessories useful for different types of exercise. For example, exercise app users might use outdoor shoes for hiking or walking and t-shirts for bicycling or jogging.

3.3 Model-free analysis

Before estimating main models, we conduct a preliminary tabulation analysis to provide initial evidence of multiple relationships among sales promotions, exercise activities, and

purchases. Specifically, we divide consumers in the sample into three equal groups based on 33% and 66% quantiles of the number of exercise hours: light, medium, and heavy. Then, we compare the purchase patterns of each group given the type of purchased product (i.e., nonpromoted vs. promoted). As Table 2 shows, the number of consumers who purchased nonpromoted products was bigger than promoted products regardless of the level of exercise activities, but light exercisers (71%) purchased promoted products more frequently than heavy exercisers (16%). These results imply the different effectiveness of sales promotion across exerciser segments; sales promotions tend to be more influential to light exercisers' purchase decisions than heavy exercisers. That is, marketers can implement promotion campaigns differently depending on consumers' exercise behavior. Furthermore, the results indicate the necessity of building an integrated model that consists of consumers' exercise and purchase behaviors.

[Insert Table 2 about here]

4. Estimation method

4.1 Operationalization of variables

We begin with a definition of the variables for exercise and purchase models. As the proxy measure for the level of consumer exercise amount, we use burned calories ($\mathrm{CALORIE_{it}}$), which refers to the number of calories that consumer *i* burns by exercising in month *t*. To treat the skewedness of three variables, we use logarithmic transformation of the variables. Furthermore, to measure the level of consumers' exercise engagement in the past, we define the variable of cumulative exercise amount as follows:

$$\mathrm{CALORIE_CUM_{it}} = (1-\rho_1) \times \mathrm{CALORIE_{it}} + \rho_1 \times \mathrm{CALORIE_CUM_{it-1}} \quad (1)$$

where $0 < \rho < 1$.

In this specification, ρ refers to the carryover effect of past exercise efforts, which is similar to a loyalty variable (Guadagni and Little, 1983) or a goodwill variable of advertising (Fershtman, 1984) because it may represent a stock of exercise amount cumulated over time. If ρ is small, a consumer puts more weight on the exercises he or she has done more recently than in the past. Because the estimation of ρ requires all observations of consumers' exercise activities regardless of their purchase of exercise products, ρ should not be estimated solely from the purchase model. Therefore, we estimate ρ from the integrated model of both exercise and purchase models, i.e., the exercise model and purchase model were estimated jointly.

For measuring sales promotion variables, we categorize each product consumers purchased into a specific type of sales promotion offered to the product (Table 3). Specifically, we define dummy variables for monetary promotion ($\mathrm{MONETARY_{it}} = 1$ if consumer *i* purchases a product with monetary promotion in month *t*), nonmonetary promotion ($\mathrm{NONMONETARY_{it}} = 1$ if consumer *i* purchases a product with nonmonetary promotion in month *t*), and no promotion ($\mathrm{NONE_{it}}$ = 1 when consumer *i* purchases a nonpromoted product. Finally, we measure three control variables. Age ($\mathrm{AGE_{it}}$) is consumer *i*'s age in month *t*, month ($\mathrm{MONTH_t}$) is a set of dummy variables to represent each month from January to December, and year ($\mathrm{YEAR_t}$) refers to 2 dummy variables to represent a specific year (2014 and 2015). Table 3 presents the type and definition of dependent, independent, and control invariables employed in the models.

[Insert Table 3 about here]

4.2 Exercise model

For the exercise model, we analyze how consumers' purchase of promoted product(s)

influences their postpurchase exercise behavior and also how the relationship is moderated by the past exercise amount. We find that exercise amount ($\mathrm{CALORIE_{it}}$) is either 0 (a consumer did not exercise in month *t*) or positive (a consumer exercised in month *t*). To treat this bimodal property of the exercise variable, we develop a Type I Tobit model (Tobin, 1958). For $\mathrm{CALORIE_{it}}$, we define a latent variable, $\mathrm{U_{it}}$ as follows:

$$\mathrm{CALORIE_{it}} = 0 \text{ if } \mathrm{U_{it}} < 0, \text{ and } \mathrm{CALORIE_{it}} = \mathrm{U_{it}} \text{ if } \mathrm{U_{it}} > 0. \tag{2}$$

We hypothesize that consumer *i*'s exercise amount in month *t* will be affected by (1) the purchase of promoted or nonpromoted exercise product(s) in month *t – 1* (i.e., $\mathrm{MONETARY_{it-1}}$, $\mathrm{NONMONETARY_{it-1}}$, and $\mathrm{NONE_{it-1}}$) and (2) its interactions with a situational factor of consumer *i*'s past exercise amount, $\mathrm{CALORIE_CUM_{it-1}}$. Accordingly, we specify the latent variable, $\mathrm{U_{it}^{CALORIE}}$, as follows:

$$\begin{aligned}\mathrm{U_{it}} = {} & \beta_0 + \beta_1\mathrm{CALORIE_CUM_{it-1}} + \beta_2\mathrm{MONETARY_{it-1}} \\ & + \beta_3\mathrm{NONMONETARY_{it-1}} + \beta_4\mathrm{NONE_{it-1}} \\ & + \beta_5\mathrm{MONETARY_{it-1}} \times \mathrm{CALORIE_CUM_{it-1}} \\ & + \beta_6\mathrm{NONMONETARY_{it-1}} \times \mathrm{CALORIE_CUM_{it-1}} \\ & + \beta_7\mathrm{NONE_{it-1}} \times \mathrm{CALORIE_CUM_{it-1}} \\ & + \beta_8\mathrm{AGE_{it}} + \beta_9\mathrm{MONTH_{it}} + \beta_{10}\mathrm{YEAR_{it}} + \xi_i + \eta_{\mathrm{it}} \\ & + \delta_1\mathrm{IMR_1} + \delta_2\mathrm{IMR_2} + \delta_3\mathrm{IMR_3},\end{aligned} \tag{3}$$

where $\xi_i \sim \mathrm{N}(0,\ \sigma_\xi^2)$ and $\eta_{\mathrm{it}} \sim \mathrm{N}(0,\ \sigma_\eta^2)$.

Although we include the control variables such as age ($\mathrm{AGE_{it}}$), month ($\mathrm{MONTH_{it}}$), and year ($\mathrm{YEAR_{it}}$) in the model, some events or occasions might be happening in local communities that affect consumers' exercise and purchase decisions. IMR refers to inverse

Mills ratio (IMR) that mitigates selection bias (Heckman, 1979), which will be discussed in the next section. In addition, our model captures observed individual heterogeneity by introducing a random effect term that varies across consumers (ξ_i).

4.3. Selection bias

Noting the possible endogeneity of consumers' choices of promoted products is important. For example, some consumers may tend to purchase products with promotions, while others may not care about promotions. In such cases, whether their purchases of (non)promoted products affect their exercise behaviors may not be attributable to the overjustification effect, as our hypothesis describes, but because of their purchase tendencies or occasions. Also, on a particular day when more promoted products are available, some consumers may likely choose promoted products when others choose promoted products—others influence consumer choices.

In this regard, the promotion-related variables, $\mathrm{MONETARY}_{\mathrm{it}-1}$, $\mathrm{NONMONETARY}_{\mathrm{it}-1}$, and $\mathrm{NONE}_{\mathrm{it}-1}$ in Equation (3) may suffer from a self-selection-based endogeneity bias. To control for any potential bias from endogeneity due to the self-selection, we introduce IMR, widely used in the management literature (Hamilton and Nickerson, 2003). For instance, for the variable of purchasing monetarily promoted product, $\mathrm{MONETARY}_{\mathrm{it}-1}$, we define IMR_1 in Equation (4) as follows:

$$\mathrm{IMR}_1 = \mathrm{I}(\mathrm{MONETARY}_{\mathrm{it}-1} > 0)\left(\frac{\phi\left(\mathrm{Z}_{\mathrm{it}-1}\alpha_1^{\mathrm{S}} + \omega_i\right)}{1 - \Phi\left(\mathrm{Z}_{\mathrm{it}-1}\alpha_1^{\mathrm{S}} + \omega_i\right)}\right) + \mathrm{I}(\mathrm{MONETARY}_{\mathrm{it}-1} = 0)\left(\frac{-\phi\left(\mathrm{Z}_{\mathrm{it}-1}\alpha_1^{\mathrm{S}} + \omega_i\right)}{\Phi\left(\mathrm{Z}_{\mathrm{it}-1}\alpha_1^{\mathrm{S}} + \omega_i\right)}\right) \quad (4)$$

where ϕ and Φ are the density and cumulative probability functions, respectively,

and $\mathrm{I}(\cdot)$ is an indicator function.

We incorporate $\mathrm{Z}_{\mathrm{it}-1} = [1,\ \mathrm{NUM_MONETARY}_{\mathrm{t}-1}.\mathrm{AGE}_{\mathrm{it}-1}]$ in the IMR functions, where $\mathrm{NUM_MONETARY}_{\mathrm{t}-1}$ indicates the number of other consumers who have made purchases with monetary promotion. The rationale for this incorporation is that as more consumers purchased promoted products, consumer *i* is also likely to buy promoted products, possibly due to the social effect ($\mathrm{NUM_MONETARY}_{\mathrm{t}-1}$.)[1]. Specifically, peer influence may happen through learning from other users who have purchased monetarily promoted products (Iyengar et al., 2015; Toker-Yildiz et al., 2017; Trusov et al., 2010)[2]. In addition, if more promoted products are offered by retailers in a given day, consumers would be likely to have more opportunities to purchase the promoted products. Finally, the IMR functions incorporate individual-specific effects, such as age ($\mathrm{AGE}_{\mathrm{it}}$) and unobserved heterogeneity ($\omega_i \sim \mathrm{N}(0, \sigma_\omega^2)$), which may control for individual differences in the tendency of purchasing (non)promoted products. Similarly, we create IMR_2 and IMR_3 for the purchase of nonmonetarily promoted product ($\mathrm{NONMONETARY}_{\mathrm{it}-1}$) and the purchase of nonpromoted product ($\mathrm{NONE}_{\mathrm{it}-1}$), respectively. Thus, IMR ($\mathrm{IMR}_1, \mathrm{IMR}_2, \mathrm{IMR}_3$) plays a role in correcting any selection bias[3].

4.4 Purchase model

For the purchase model, we develop a model of purchase (Neslin et al., 1985; Ramanathan and Dhar, 2010) by analyzing whether the purchase of [non]promoted product(s) affects subsequent purchase expenditure for exercise product(s) and how the relationship is

[1] Our dataset does not support how many products were offered with monetary and nonmonetary promotions or without any promotions. We can observe only purchases made by consumers, not products available to them. In this regard, our dataset does not allow us to disentangle the effect of promoted product availability and the network effect.

[2] The exercise and shopping apps run an online review board where users can leave comments on their shopping and exercise experiences.

[3] In general, the interpretation of the IMR coefficients, $[\delta_1, \delta_2, \delta_3]$ in Equation (3) is described as follows: When an IMR coefficient is positive, "positive selection" occurs (without the correction, the estimate of $[\beta_2, \ldots, \beta_7]$ would be upward-biased); when it is negative, "negative selection" occurs (without the correction, the estimate of $[\beta_2, \ldots, \beta_7]$ would be downward-biased). If the IMR coefficient is not significant, there may not be a strong selection bias for the $\mathrm{NONMONETARY_CUM}_{\mathrm{it}-2}$ and $\mathrm{NUM_MONETARY}_{\mathrm{t}-2}$ variables.

moderated by the level of exercise engagement. Here, $\mathrm{EXPENDITURE_{it}}$ represents how much money ($) consumer *i* spent in month *t* given a conversion. Similar to Equation (3), we develop a linear regression model for $\ln(\mathrm{EXPENDITURE_{it}})$. We incorporate sales promotion (whether consumer *i* has purchased promoted products in month *t*), cumulative exercise amount in the past, and the interaction between them. In addition, the model includes the control variables of age ($\mathrm{AGE_{it}}$), month fixed effects ($\mathrm{MONTH_t}$), and year fixed effects ($\mathrm{YEAR_{it}}$), as follows:

$$\begin{aligned}\ln(\mathrm{EXPENDITURE_{it}}) = {} & \gamma_0 + \gamma_1 \mathrm{CALORIE_CUM_{it-1}} \\ & + \gamma_2 \mathrm{MONETARY_{it-1}} + \gamma_3 \mathrm{NONMONETARY_{it-1}} \\ & + \gamma_4 \mathrm{MONETARY_{it-1}} \times \mathrm{CALORIE_CUM_{it-1}} \\ & + \gamma_5 \mathrm{NONMONETARY_{it-1}} \times \mathrm{CALORIE_CUM_{it-1}} \\ & + \gamma_6 \mathrm{AGE_{it}} + \gamma_7 \mathrm{MONTH_t} + \gamma_8 \mathrm{YEAR_t} + \psi_i + \varepsilon_{it} \\ & + \theta_1 \mathrm{IMR_1} + \theta_2 \mathrm{IMR_2}\end{aligned} \tag{5}$$

where $\psi_i \sim \mathrm{N}(0, \sigma_\psi^2)$ and $\varepsilon_{it} \sim \mathrm{N}(0, \sigma_\varepsilon^2)$. Finally, we include $\mathrm{IMR_1}$ and $\mathrm{IMR_2}$ to treat the endogenous selection bias as the same manner as described in Section 4.3.

4.5. Endogeneity due to the random effects

Recall that our models in Sections 4.2. and 4.4. incorporate random effects to capture unobserved heterogeneity across consumers. The assumption of such a random effect model is that the unobserved heterogeneity should not correlate with observed covariates. In Equations (3) and (5), unobserved heterogeneity is captured by $\xi_i \sim \mathrm{N}(0, \sigma_\xi^2)$ and $\psi_i \sim \mathrm{N}(0, \sigma_\psi^2)$, respectively. If these terms correlate with covariates for purchases ($\mathrm{MONETARY_{it-1}}$, $\mathrm{NONMONETARY_{it-1}}$, and $\mathrm{NONE_{it-1}}$ in Equation (3)) and ($\mathrm{MONETARY_{it-1}}$ and $\mathrm{NONMONETARY_{it-1}}$ in Equation (5)), endogeneity may arise, known

in econometrics as the random effects assumption (Wooldridge, 2013).

To test such potential endogeneity, we perform the Hausman (1978) test to compare an estimator assumed to be consistent (e.g., fixed effect) with an efficient estimator (e.g., random effect). Specifically, β_{Random} is a set of estimates with the random effect, and β_{Fixed} is a set of estimates with the fixed effect. A statistical test H is as follows:

$$\mathrm{H} = (\beta_{\text{Random}} - \beta_{\text{Fixed}})^{1}[\mathrm{V}(\beta_{\text{Random}}) - \mathrm{V}(\beta_{\text{Fixed}})]^{-1}(\beta_{\text{Random}} - \beta_{\text{Fixed}}). \quad (6)$$

The test statistics asymptotically follow the chi-squared distribution with the number of degrees of freedom equal to the rank of matrix $\mathrm{V}(\beta_{\text{Random}}) - \mathrm{V}(\beta_{\text{Fixed}})$. Our Hausman test results show that the null hypothesis cannot be rejected; H for the exercise model = 9.20 < 11.07, and H for the purchase model = 1.848 < 12.59. These results imply that estimates β_{Random} and β_{Fixed} are both consistent, and therefore, the random effect is unrelated to covariates and dependent variables.

5. Results

5.1 Analysis of exercise models

The results of Model 1 show that the effect of purchasing monetarily or nonmonetarily promoted products on postpurchase exercise amount in terms of burned calories is negative and significant (Model 1: $\beta_2 = -1.475$, $\beta_3 = -1.631$; $p < .05$). The negative effect of sales promotion, either monetary or nonmonetary, on exercise may explain that the overjustification effect occurs for exercisers who are encountered by utilitarian benefits offered by monetary or nonmonetary benefits. This result can be explained by the benefit congruency framework of sales promotions (Chandon et al., 2000). On the contrary, the effect of purchasing nonpromoted products is positive and significant (NONE: $\beta_4 = 0.902$; $p < .05$).

Thus, while consumers' actions of purchasing promoted products tend to decrease their subsequent exercise (i.e., burned calories), their actions of purchasing nonpromoted products increase their exercise. These results provide support for both H1a and H1b.

[Insert Table 4 about here]

Furthermore, H2 predicts that heavy exercisers who purchase promoted products will increase their postpurchase exercise amount. Consistent with this prediction, the interaction terms of promoted product purchases (MONETARY or NONMONETARY) × cumulative exercise amount (EXERCISE_CUM) are positive and statistically significant in the exercise model (Model 1: $\beta_5 = 0.092$, $\beta_6 = 0.136$; $p < .05$). These results support H2.

To accurately investigate the interaction effects, Figure 2 visually illustrates interaction effects between type of purchased products (monetary, nonmonetary, nonpromoted) and consumers' past exercise behavior. In our sample, the weighted average from the logarithm of cumulative exercise amount in terms of burned calories lies between 0 and 13 (maximum 12.21). Given this range, we compute the effects of type of purchased products combined with the moderation of cumulative exercise amount: monetary ($\beta_2 + \beta_5 \text{CALORIE_CUM}_{it-1}$), nonmonetary ($\beta_3 + \beta_6 \text{CALORIE_CUM}_{it-1}$), and nonpromoted ($\beta_4 + \beta_7 \text{CALORIE_CUM}_{it-1}$). Interestingly, Figure 2 shows consistent patterns between monetary and nonmonetary promotions. After purchasing monetarily or nonmonetarily promoted products, heavy exercisers will exercise more than light exercisers. These results imply the importance of targeting consumers based on past exercise behavior and types of promotion campaigns.

[Insert Figure 2 about here]

5.2 Analysis of purchase models

The hypothesized effects of purchase actions of promoted or nonpromoted exercise products

and past exercise amount on subsequent purchase expenditure were assessed. Table 4 (Model 2) reports the parameter estimates of the purchase model that has the independent variables of burned calories. We find that while the purchase of monetarily promoted products has a negative relationship with the consumer spending on exercise products in the subsequent period (γ_2 = -0.099; $p < .1$), the purchase of nonmonetary promoted products increases consumer spending (γ_3 = 0.238; $p < .1$), partially supporting H3. This result implies that nonmonetary promotions work better in eliciting consumers' favorable attitude toward subsequent shopping than monetary promotions (Yi and Yoo, 2011), possibly because nonmonetary promotions are perceived separately from price information and regarded as gains (Sinha and Smith, 2000). However, in contrast with the results of the exercise models, the interaction term between sales promotion and cumulative exercise amount has no significant effect on purchase expenditure, not in support of H4.

6. Discussion

Although effectiveness of sales promotion is critical for increasing product sales and firm value, firms can have the opportunity to improve human life by promoting better health and well-being outcomes (Moorman, 2018). In this research, we attempt to contribute to the stream of research on the role of marketing practice in improving both firm profit and consumer health, in general, and the effect of sales promotion on consumers' physical exercise and purchase behaviors, in particular. Our findings shed light on suitable exercise behavior–based promotion strategies for sports brands and mobile exercise apps that use consumers' exercise data. In this study, we attempt to better understand how sales promotion affects consumers' postpurchase behaviors—particularly from the understudied perspective of subsequent exercise and purchase decisions which may vary across consumer segments. Using rich data of exercise and purchase activities generated by mobile exercise and

559 shopping app users, we identify the double-edged effects of sales promotion in the exercise
560 and purchase models.

561 We find that the effects of sales promotion on consumers' exercise and purchase
562 decisions differ across the type of purchased products (promoted vs. nonpromoted) and the
563 level of exercise engagement (light vs. heavy). From the exercise perspective, our empirical
564 findings identify that while the purchase of monetarily promoted (nonpromoted) products
565 decrease (increase) postpurchase exercise amount ("overjustification effect"), heavy
566 exercisers who purchase promoted products rather increase postpurchase exercise amount
567 ("mitigated overjustification effect"). From the purchase perspective, we find that consumers
568 who engage in purchasing nonmonetarily promoted products increase their spending on
569 exercise products, whereas heavy exercisers' purchase actions of promoted or nonpromoted
570 products do not predict their spending on exercise products. These findings translate into
571 several contributions for marketing and exercise app research and practice.
572

573 *6.1 Theoretical implications*

574 The present research represents the first effort to empirically demonstrate how the
575 overjustification effect occurs in the combined setting of sales promotion and exercise
576 behaviors. Prior studies have shown that people who are rewarded are less likely to engage in
577 the task again without a reward (Crano and Sivacek, 1984; Lepper et al., 1973). We extend
578 this notion of the overjustification effect on exerciser settings by exploring the impact of
579 purchasing promoted and nonpromoted products on subsequent exercise activities. In support
580 of the literatures on customer self-determination and overjustification effect, we find that in
581 the exercise context, the purchase of monetarily or nonmonetarily promoted products
582 attenuates consumers' motivation to increase their exercise amount. By contrast, we show
583 that consumers who purchase nonpromoted products continue to increase the postpurchase

584 exercise. This finding is in line with the argument that self-determined choices (e.g., the
585 purchase of nonpromoted products as a result of consumers' own initiative) support intrinsic
586 interests (e.g., ongoing exercise) more than firm-determined choices (e.g., the purchase of
587 exercise products as a result of a firm's introductory promotion) (Dholakia, 2006;
588 Eisenberger and Cameron, 1996).

589 Next, we extend the overjustification framework by showing the moderating role of
590 past exercise engagement in the relationship between a consumer's action of purchasing
591 promoted or nonpromoted products and postpurchase exercise behaviors. Our findings
592 demonstrated that a promoted product buying behavior does not always result in an
593 attenuation of exercise attitude if the buyer is already highly engaged in exercise. That is, the
594 more salient the initial interest is in a particular activity (e.g., exercise), the less likely the
595 overjustification effect will occur (Fazio, 1981). This conflicting finding can be explained by
596 prior research that shows that extrinsic rewards do not diminish intrinsic motivation if the
597 rewards are necessary reinforcement (Crano and Sivacek, 1984) or support people's intrinsic
598 interests (Eisenberger and Cameron, 1996). We surmise that heavy exercisers consider the
599 promoted product a necessary extrinsic incentive, which further encourages ongoing exercise
600 behaviors (Forehand, 2000; Kelley, 1973). The finding of relative effectiveness of sales
601 promotion is critical for sports brands because it suggests optimal promotion strategies to
602 target valuable segments.

603 Finally, we identify that while monetary sales promotions decrease subsequent
604 purchases, nonmonetary sales promotions increase purchases, which extends prior research
605 on sales promotion (e.g., Ailawadi et al., 2007; Guadagni and Little, 1984; Jones and
606 Zufryden, 1980; Lim et al., 2005; Papatla and Krishnamurthi, 1996; Sinha and Smith, 2000;
607 Yi and Yoo, 2011). We also find that although both nonmonetary sales promotion and
608 cumulative exercise amount are positively related to purchase expenditure separately, the

609 combination of two components does not lead to its increase or decrease. That is, heavy
610 exercisers are not influenced by sales promotion and may purchase exercise products, either
611 promoted or nonpromoted, whenever they need them. This finding implies that heavy
612 exercisers, who tend to have a high self-control to inhibit their impulses (Gillebaart et al.,
613 2016), are more focused on fulfilling the goal (i.e., exercise itself) than the means (i.e., sales
614 promotion). In another sense, the results also extends the notion of regulatory mode to the
615 area of health and exercise context by showing that goal-directed people are more successful
616 at achieving their health-related goals (e.g., food and nutrition) by overcoming the impulse to
617 engage in purchasing promoted products (Gillebaart et al., 2016; Higgins et al., 2003;
618 Mannetti et al., 2012).
619
620 *6.2 Managerial implications*
621 Our findings provide meaningful directions for sports brands (e.g., Nike and Adidas) and
622 mobile exercise apps (e.g., Strava and Fitbit) when they implement and plan promotional
623 campaigns for selling exercise products. From an implementation perspective, our findings
624 clearly show that firms should be cognizant of the importance of the exerciser segment they
625 are targeting when using exercise data. Compared with the absence of sales promotion,
626 monetary and nonmonetary promotions may increase the postpurchase exercise motivation of
627 heavy exercisers but discourage overall consumers from exercising in the future. Hence,
628 mobile exercise apps can maximize their revenue—monetized from both banner ads and
629 retail margin—by implementing optimal promotion strategies through exercise behavior-
630 based segmentation. Specifically, exercise apps should target heavy exercisers with sales
631 promotions because the revenue from retail margin might be higher for heavy exercisers than
632 light exercisers.
633 Although exercisers who purchase nonpromoted products tend to increase

postpurchase exercise (Forehand, 2000; Rosenfield et al., 1980), sporting goods marketers often offer various types of sales promotion—monetary or nonmonetary—to potential and existing customers but need to keep in mind that exercisers' postpurchase behavior could vary depending on the type of sales promotion. Our finding suggests that nonmonetary promotions, including limited offering and merchandiser recommendations, are more effective for increasing consumers' postpurchase exercise and purchases. This finding can be explained by a congruency between physical exercise and nonmonetary (hedonic) benefits, which can elicit exercisers' favorable attitude toward subsequent exercise and shopping behaviors (Chandon et al., 2000; Sinha and Smith, 2000).

From a planning perspective, marketers should understand that when most of the light exercisers purchase promoted exercise products, an overjustification effect occurs when they decide the postpurchase exercise behavior. To alleviate any overjustification concerns of the light exerciser segment, we provide two specific recommendations. First, marketers should communicate that the promoted product is focused on the benefit rather than the incentive offered in the promotion. If consumers believe that the promoted brand is promotion focused, they will respond less positively to the product (Forehand, 2000). Second, to encourage consumers' higher intrinsic motivation to exercise, mobile exercise apps could collaborate on providing exercise-based rewards, rather than promotion-focused benefits, and turning them into points that consumers can monetize to purchase exercise products (e.g., Adidas Runtastic). This task-related reward reflects the level of exercise amount, which can induce a greater intrinsic motivation to continue exercising (Rosenfield et al., 1980).

6.3 Limitations and future research directions

This research has several limitations that provide opportunities for further research. First, we used monthly aggregated data and thus could not conduct dynamic analyses on the interplay

among exercise, sales promotion, and purchases. Further research could incorporate real-time exercise, promotion, and purchase data into an integrated model to uncover the dynamic relationships relevant to mobile marketing.

Second, we conducted the Hausman test to verify that the unobserved heterogeneity (i.e., random effect) should not correlate with observed covariates (e.g., age). While our result reveals the consistency of both random-effect and fixed-effect models, this approach may require other variables to test the heterogeneity including other demographic information (e.g., gender and disposable income). In addition, designing and implementing field experiments may allow for manipulating variables of interest in controlled settings (Johnson et al., 2017).

Third, because we focused on the mobility of mobile exercise app users rather than the locations of the app uses, we did not consider location-based mobile targeting (e.g., Fong et al., 2015), which can help marketers promote the right products to the right consumers at the right locations. Further research could incorporate additional exercise data, such as how much and where an exercise app user exercises at a certain time.

Fourth, due to the data limitation, this study could not examine whether purchases of a specific type of exercise product (e.g., treadmill for indoor exercise) may crowd out the time of other exercise activities (e.g., running outside), leading to reduction of the total exercise amount. For example, after someone buys a promoted treadmill, s/he stays at home walking and does not go to a gym for running or a mountain for hiking. This calls for further research on validating an overjustification effect in the exercise setting. Hence, researchers must examine whether the purchase of promoted products reduces the exercise amount due to the psychological reactance or simply the behavioral change among different exercises.

Finally, although exercise is an important topic in public health management, research could collect more comprehensive data on people's health-related activities, such as fitness,

nutrition, and sleep, in addition to exercise. Tracking users' activities throughout the entire day will provide information about their general health status, which may have an effect on firms' promotion activities and consumers' purchase behavior. These limitations offer new insights to explore exercise behavior–based marketing practices.

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Table 1. Overview of relevant sales promotion literature

Source	Research setting	Type of data	Response to sales promotion	Postpurchase behavior	Key findings
Ailawadi et al. (2007)	Promotion-induced stockpiling	Scanner panel	Brand choices and incidences	Repeat purchases	Promotion-induced stockpiling increases consumption and repeat purchases.
Chandon et al. (2000)	Offering monetary and nonmonetary promotions	Experiment	Product choice		The effect of monetary promotions varies depending on benefit congruency, but the effect of nonmonetary promotions is positive.
Dodson et al. (1978)	Offering and retracting a deal	Scanner panel	Choice		The effect of a deal on brand choice is positive in the short run but negative in the long run when the deal is retracted.
Eisenbeiss et al. (2015)	Deal-of-the-day (DoD) promotions	Lab and field experiment	Deal attractiveness, sales		The discount level of DoDs increases promotional effectiveness for utilitarian more than for hedonic products.
Guadagni and Little (1983)	Offering store promotion and price cut	Scanner panel	Brand choice	Subsequent purchase	Promotional purchases decrease the likelihood of a subsequent purchase of that brand.
Guha et al. (2018)	Comparing the discount depth against the sale price	Field and lab experiment	Perceived discount depth, purchase intentions		Framing the price promotion by comparing it with the sale price increases consumers' discount depth perceptions and purchase intentions.
Lim et al. (2005)	Short- and longer-term effects of price promotions	Scanner panel	Product quantity		The longer-term effects of price promotions differ across consumer segments (heavy vs. light, loyal vs. non-loyal vs. switcher)
Neslin et al. (1985)	Offering coupons, advertising, and discounts	Scanner panel	Interpurchase time, purchase quantity		Coupon and discount have a positive effect on quantity but no relationship to interpurchase time. Advertising is relatively ineffective.
Nunes and Park (2003)	Offering monetary and nonmonetary promotions	Experiment	Choice		People attend to absolute benefit (i.e., monetary) rather than relative (i.e., nonmonetary) differences.
Papatla and Krishnamurthi (1996)	Offering coupons, displays and features	Scanner panel	Brand loyalty, price sensitivity	Subsequent purchase	Coupons erode brand loyalty and increase price sensitivity, while prior purchases made on display and feature promotions have a positive effect on subsequent purchases.
Park et al. (2018)	Short- and longer-term effects of mobile price and non-price promotions	Transactions	Purchase incidence and purchase amount		While price discount coupons strengthen the short-term impact on purchase amount, non-price free sample coupons increase purchase propensity over a longer period.
Ramanathan and Dhar (2010)	Offering monetary promotions	Lab and field experiment	Purchase quantity, expenditure		Sales promotion cues affect the size and composition of a consumer's shopping basket.
Simonson et al. (1994)	Offering unneeded promotions	Experiment	Brand choice		Discounts and product features with little value do not increase purchase probability.
This study	Purchasing promoted and nonpromoted products	Exercise and transactions	Purchase expenditure	Subsequent exercise and purchase	The purchase of (nonmonetarily) promoted products decreases (increases) consumers' subsequent exercise (expenditure) but increases heavy exercisers' subsequent exercise.

Table 2. Purchase behavioral changes by exercise activities

Exerciser group	Type of purchased product	Consumers		Purchase incidence per consumer	
		Total number	Difference (nonpromoted - promoted)	Average number	% increase (promoted / nonpromoted)
Light	Nonpromoted	2,776	1,879	0.73	71%
	Promoted	897		1.25	
Medium	Nonpromoted	2,722	1,628	0.95	43%
	Promoted	1,094		1.36	
Heavy	Nonpromoted	2,792	1,487	1.42	16%
	Promoted	1,305		1.65	

Table 3. Operationalization of variables

Variable	Type	Description
$\mathrm{CALORIE_{it}}$	DV	How many calories consumer *i* burns in month *t*.
$\mathrm{EXPENDITURE_{it}}$	DV	How much consumer *i* spends given that he or she purchases in month *t*
$\mathrm{CALORIE_CUM_{it-1}}$	IV	Cumulative (weighted average) calories that consumer *i* has burned until month *t – 1*.
$\mathrm{MONETARY_{it}}$	IV	1 if consumer *i* purchases a product with monetary promotion in month *t*, 0 otherwise.
$\mathrm{NONMONETARY_{it}}$	IV	1 if consumer *i* purchases a product with nonmonetary promotion in month *t*, 0 otherwise.
$\mathrm{NONE_{it}}$	IV	1 if consumer *i* purchases a product without sales promotion in month *t*, 0 otherwise.
$\mathrm{AGE_{it}}$	CV	Age of consumer *i* in month *t*
$\mathrm{MONTH_{t}}$	CV	A set of 11 dummy variables that represent a specific month in month *t*
$\mathrm{YEAR_{t}}$	CV	A set of 2 dummy variables that represent a specific year (2014, 2015) in *t*

Note: DV, IV, and CV denote dependent variable, independent variable, and control variable, respectively.

Table 4. Parameter estimation of exercise and purchase models

Variable	Model 1 (DV: burned calories)		Model 2 (DV: purchase expenditure)	
	Mean	SD	Mean	SD
Intercept	-2.499**	0.126	10.480**	0.078
EXERCISE_CUM $_{t-1}$	0.958**	0.005	0.006**	0.002
MONETARY$_{t-1}$	-1.475**	0.285	-0.099*	0.056
NONMONETARY$_{t-1}$	-1.631**	0.227	0.238*	0.144
NONE$_{t-1}$	0.902**	0.167		
MONETARY$_{t-1}$ × EXERCISE_CUM $_{t-1}$	0.092**	0.034	0.015	0.007
NONMONETARY$_{t-1}$ × EXERCISE_CUM $_{t-1}$	0.136**	0.027	-0.024	0.018
NONE$_{t-1}$ × EXERCISE_CUM $_{t-1}$	-0.257**	0.014		
AGE	0.581**	0.019	0.003	0.013
MONTH (January-November)	Controlled		Controlled	
YEAR (2014-2015)	Controlled		Controlled	
Variance of regression error	4.055	0.009	0.845	0.007
Variance of heterogeneity	2.345	0.028	0.284	0.014
IMR for MONETARY$_{t-1}$	2.729**	0.502	0.015**	0.007
IMR for NONMONETARY$_{t-1}$	2.349**	0.406	0.155**	0.012
IMR for NONE$_{t-1}$	6.087**	0.468		
Carryover effect of past exercise efforts	0.719	0.004		

** 95% credible interval does not contain zero.
* 90% credible interval does not contain zero.
Note: DV and SD denote dependent variable and standard deviation, respectively. EXERCISE_CUM is CALORIE_CUM. As we estimated Model 1 and Model 2 jointly, the coefficient of carryover effect of past exercise efforts was estimated from the integrated model of Model 1 and Model 2.

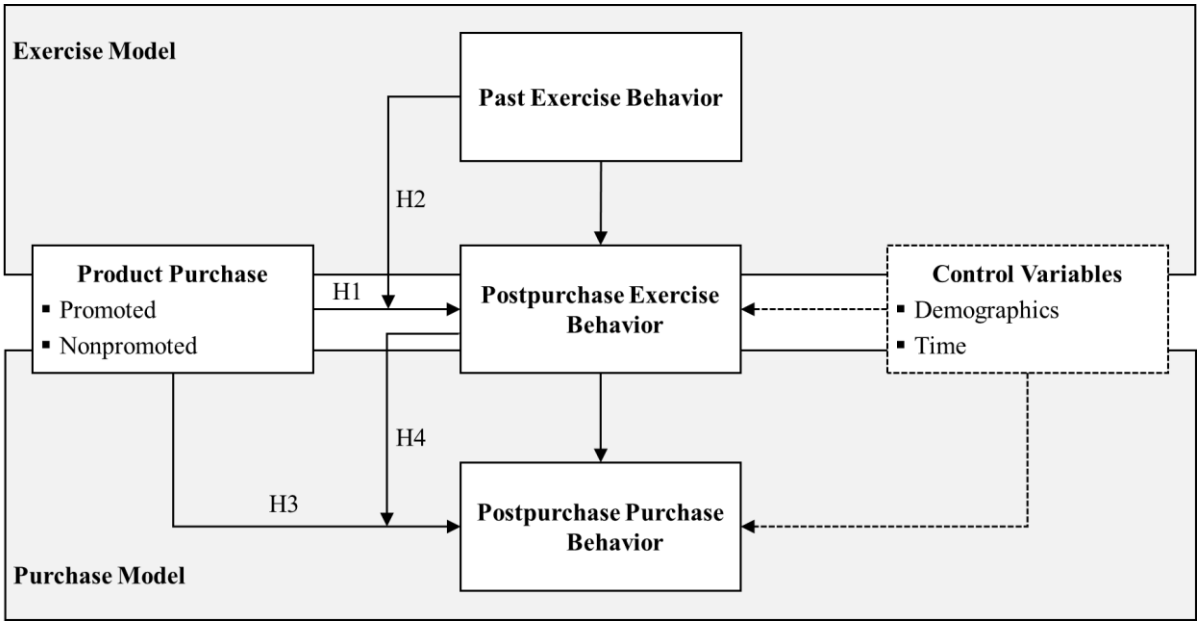
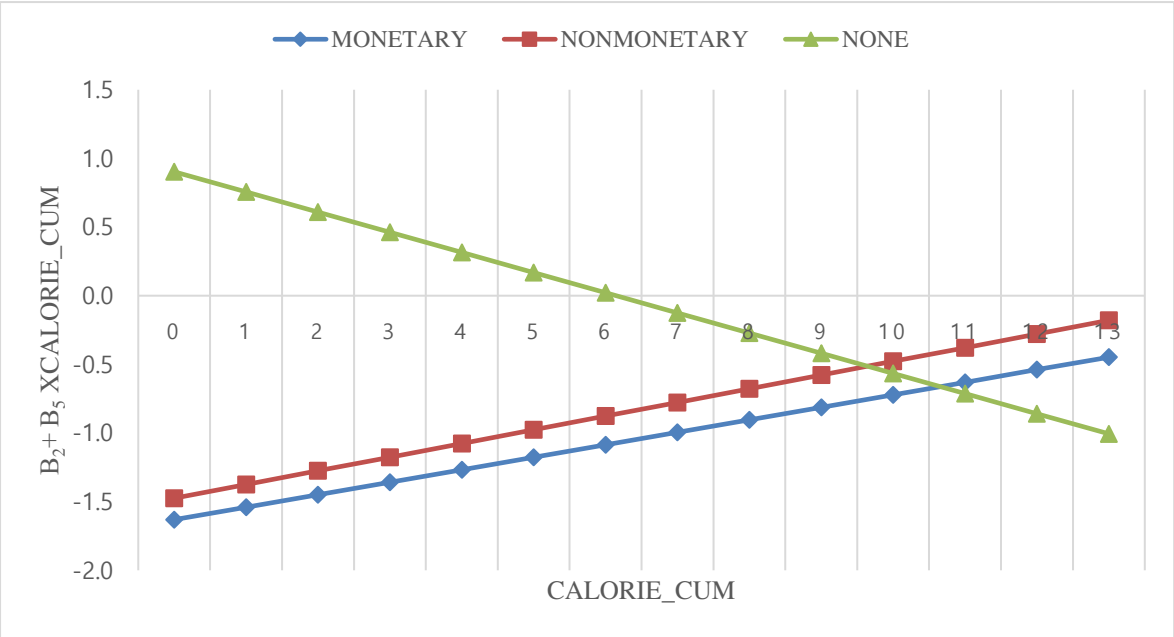


Figure 1. Proposed conceptual framework.



Note: X-axis denotes exercise level (calories), and Y-axis denotes combination of (1) main effect of type of purchased product (monetary, nonmonetary, nonpromoted) and (2) its interaction effect with exercise level.

Figure 2. Interactions between type of purchased products and cumulative exercise amount.