Received: 2 August 2019 | Revised: 30 June 2021 | Accepted: 1 July 2021 | Published on: 5 October 2021

DOI: 10.1002/smj.3336

RESEARCH ARTICLE

STRATEGIC MANAGEMENT JOURNAL WILEY

Pushed into a crowd: Repositioning costs, resources, and competition in the RTE cereal industry

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Abstract

Research summary: This article exploits a natural experiment involving self-regulation in the ready-to-eat (RTE) breakfast cereal industry to evaluate the performance impact of product repositioning. It then examines how a product's brand equity value declines with repositioning distance and explores various nonprice responses of firms to increased own and rival competition. Self-regulation led to a crowding of the product space by forcing differentiated products to become more similar. We find that products constrained by regulation performed relatively worse than unconstrained products. Furthermore, brand equity specific to a product was tightly linked to existing product positions. Increased competition also led to increased brand equity investments and some products with strong brand equity repositioned more aggressively than those with weak brand equity.

Managerial summary: This article illustrates how firms respond to newly-imposed regulatory constraints and how product brand equity is tightly linked to underlying product positions. The analysis is an empirical examination of a self-regulatory initiative that placed advertising restrictions on high sugar RTE breakfast cereal products targeted toward children. We explore the impact of the regulation on performance and then use the setting to examine the connection between brand equity and changes in product

positions. Finally, we examine firm responses to rival entry that include exiting, repositioning, and increasing investments in differentiation.

KEYWORDS

brand equity, competitive dynamics, nonmarket strategy, positioning, resources

1 | INTRODUCTION

Why do firms reposition? Putting aside repositioning as a correction to mismatches between a firm's resources and its position, repositioning is typically triggered by changes in opportunities, threats, or environmental constraints that lead a firm to reevaluate its prospects in a new position relative to its previous position. In this article, we focus primarily on within-segment position changes by incumbents (Du, Li, & Wu, 2019; Menon & Yao, 2017; Wang & Shaver, 2014) rather than repositioning through exit or entry into new segments (Bigelow, Nickerson, & Park, 2019; de Figueiredo & Silverman, 2007; Dobrev & Kim, 2006). Recent theoretical analyses of within-market repositioning emphasize how repositioning costs may endogenously lead to increased product differentiation (Menon & Yao, 2017), how biases about repositioning costs impact entrant positioning (Du et al., 2019), and how comparative adjustment costs among rivals affect repositioning timing and location (Argyres, Mahoney, & Nickerson, 2019).

The range of sources of repositioning costs discussed in the theoretical analyses underscores the need for empirical work that provides understandings of specific repositioning cost mechanisms. Along these lines, Wang and Shaver (2014) demonstrated the importance of incumbent assets and market position for determining relative movement by Chinese satellite channel television incumbents in response to entry by CCTV into previously restricted programming categories. Incumbents with high audience share were shown to move less than those with lower share. To further understand repositioning, it is critical to see how changes in position and in specific assets affect cost and performance and how position changes interact.

To explore these questions, we exploit a natural experiment resulting from the introduction of self-regulation in the U.S. ready-to-eat (RTE) breakfast cereal industry. The RTE breakfast cereal industry ("cereal industry") is an oligopoly with four dominant firms, each selling products differentiated by characteristics such as taste, nutrition, and image. Differentiation is reinforced through substantial advertising (Nevo, 2001). In the children's segment of the market, taste and, in particular, sweetness, was so important, that sugar was once characterized as the "magic fairy dust" of the age.[1] But, excessive sugar in a child's diet contributes to childhood obesity. This downside and the attendant public pressures resulted in the launch of the cross-industry Children's Food and Beverage Advertising Initiative (CFBAI) in late 2006 to address childhood obesity by, for example, reducing sugar content. The implementation of CFBAI constitutes our natural experiment.

As participants in CFBAI, all of the dominant cereal firms agreed not to advertise to children cereal products containing more than 12 g of sugar per serving. The agreement

[1]Traig (2019). Many prominent cereals previously featured sugar in their brand names. These included Sugar Crisp (now Golden Crisp), Sugar Frosted Flakes (now Frosted Flakes), and Sugar Chex (now Honey Nut Chex).

addressed advertising, the primary marketing lever, and sugar, the most important ingredient. While not all children's cereals were directly affected, some cereals required a 25% or greater reduction of sugar to meet the standard. All CFBAI firms complied with the Initiative (Enright, 2018; Lee, Kolish, & Enright, 2010): the directly affected products ("constrained products") lowered sugar rather than ceased advertising to children. With no difference between self-regulation and regulation in terms of compliance, henceforth, we refer to the restrictions as "regulations."

The regulation circumscribed key product and marketing choices, which, in turn, induced changes in positioning of some cereal products. We focus on repositioning at the product level, which has the advantage of increasing the number of observations while holding industry constant, though the data do not allow us to assess overall firm-level repositioning. We observe individual product pricing, sales, and advertising and have a measure of repositioning because the regulatory shock that induced product movement was narrowly tailored to the sugar levels of the products. Hence, each product is similar to an individual business unit in terms of the factors that matter most in response to the regulatory shock and subsequent increased competition.

Our empirical exploration of repositioning focuses first on the costs of repositioning and second on the repositioning-related choices that firms make in response to increased competition. Regarding costs, to our knowledge, the literature only offers indirect evidence of the performance costs associated with repositioning. For example, Wang and Shaver (2014), in the context of a satellite television market, measures incumbent location changes in reference to the location of dominant firm CCTV. Frake (2017) assesses brand equity losses to a craft beer in terms of consumer perceptions when that beer company was acquired by a mainstream producer. One contribution of our article is to assess the performance cost of repositioning through lost sales. These performance costs are important because they allow us to better understand the underlying mechanisms driving repositioning.

Our first set of findings assesses the regulation-induced performance impact of repositioning. We find that the constrained products on average experienced 16% lower sales and 4% lower price performance relative to unconstrained products, which already complied with the regulations. Unconstrained products were indirectly affected by changes in competition resulting from changes to constrained products. Aggregating to the firm level, firms with more-constrained products performed worse than less-constrained firms. The next set of findings explores changes in the value of brand equity resources when products are repositioned. We distinguish between brand equity specific to the product and brand equity that applies to all of a firm's products and provide evidence that firms in this industry invested more heavily in product-specific brand equity relative to firm-specific brand equity. We then estimate that repositioning associated with a 7–10% reduction in sugar led to an average sales decline of 3.5%. We interpret these results to mean that brand equity can be very local so that modest repositioning can be costly.

We then explore nonprice choices that firms made given increased competition and the costs of repositioning. These responses included exit or possible repositioning and investment choices regarding resources. There are a number of studies (de Figueiredo & Silverman, 2007; Dobrev & Kim, 2006) that find as a product space becomes crowded, firms will desert their market segment and move to another, repeating the process when the new space again becomes crowded. We find similar results. Increased competition induced increased exit: the number of advertised product and product variants per year in the children's segment decreased from 26 to 19, where seven products were discontinued. This compares to an almost 30% increase in new products introduced in the adult segment. Exit of constrained products was more likely if the initial sugar level of the products was higher.

For firms that do not exit, some respond by emulating better-performing firms (Gimeno, Chen, and Bae, 2006) while others reposition (Wang & Shaver, 2014). Wang and Shaver find that stronger firms move less in response to a dominant-firm move because of the opportunity costs associated with moving which include attractiveness of position and existing audience share. Because Wang and Shaver only reference repositioning of incumbents relative to the position of the dominant firm, there is an open question as to how repositioning would occur when competition was less asymmetric. In particular, might a stronger incumbent choose to move when a weaker incumbent would not? Our setting with no dominant products or firms allows us to address such questions. We find that repositioning (operationalized as an increase in advertising addressed to adult versus children's segments) was 20% more likely with the addition of each additional close competitor, a result consistent with Wang and Shaver's findings. But we also found that products with more brand equity, conditional on staying in the market, were more likely to reposition than products with weak brand equity. That is, while strong brand-equity firms might be better at resisting competition in their current location, they also have a better passport to more distant locations. We also find weak evidence that repositioning is more strongly influenced by cannibalization of own products than competition from rival products.

Increased competition may also lead to investments in lieu of position changes or investments that complement position changes. Flammer (2015) finds that firms invest in brand equity in the form of CSR when competition increases because of a decline in tariffs while Ethiraj and Zhou (2019) find full-service airlines, but not low-cost airlines, respond to entry threats with additional investments in capacity. Increased competition may also lead firms to increase their focus on their core businesses (Bowen & Wiersema, 2005). These articles do not address repositioning, but raise alternative channels to repositioning that deserve attention. In our setting, we find increased competition results in an average increase in per product advertising from $5.5 million to $6.6 million in the children's segment. Using a measure of the intensity of competition, we also find that advertising expenditures increased by 17% on average per product with each additional close competitor. We interpret these responses as attempts to expand the customer-perceived product space by creating increased image differentiation.

The remainder of the article is organized as follows. Section 2 describes the self-regulatory initiative and then provides background about the RTE cereal market. Section 3 discusses relevant theories of competition-driven responses and resource transferability and applies those theories to the children's RTE cereal market. Section 4 describes the data and Section 5 provides an empirical analysis of performance impacts, changes in the value of brand equity, and strategic responses to regulation by the firms. Section 6 concludes.

2 | THE CHILDHOOD OBESITY PROBLEM AND THE RTE CEREAL MARKET

Childhood obesity, as a major public health threat, has been characterized as "a massive tsunami headed for the United States" (Lesley, 2008). Since 1980, the rate of obesity in the United States has more than doubled in preschool children and tripled in adolescents and by 2005 about 9 million young people in the U.S. were thought to be overweight (Prevention of Childhood Obesity Act, 2005). One cause of childhood obesity is the poor nutritional content of the food children are eating.

In the years immediately preceding the creation of CFBAI, legislation was introduced to increase funding and coordination of programs addressing childhood obesity, and the FTC and HHS held an influential public workshop to examine what the private sector might do to combat this crisis (Majoras et al., 2006). Industry, for the most part, questioned the potential effectiveness of governmental regulation, raised free speech concerns (Majoras et al., 2006), and lobbied to defend the food industry's right to advertise to children (Ellison, 2005). Such efforts played a major role in forestalling governmental regulation. But firms also worked toward their own solutions either individually or collectively through industry self-regulation.

2.1 | The children's food and beverage advertising initiative (CFBAI)

In contrast to governmental regulation, industry self-regulation is typically less invasive. Such collective action serves as a middle way between governmental regulation and the free market. But a key difference—and a key weakness—is that self-regulation is typically voluntary and lacks effective sanctions.

The Council of Better Business Bureaus (CBBB) was well-positioned to facilitate industry efforts to address childhood obesity because of its long history of self-regulation involving marketing to children. In 2005, CBBB formed a working group, which ultimately led to the launch of CFBAI in late 2006. Under CFBAI, the participating firms set nutrition criteria to govern the foods they advertise to children under the age of 12. Three of the ten founding firms were major cereal manufacturers: General Mills, Kellogg's, and PepsiCo (parent of Quaker Oats, henceforth referred to as Quaker Oats). Others included Coca-Cola, Hershey, and McDonalds. Post joined in October 2009 (Lee et al., 2010).

The nutrition guidelines for RTE cereal were focused predominantly on sugar content. General Mills, Kellogg's, and Post committed not to advertise children's cereal products that exceeded 12 g of sugar per serving. Initially, Quaker Oats did not explicitly set a compliance level for sugar content (Kolish & Peeler, 2008) and in 2010 set its sugar level at "≤25% of kcal added" (Peeler, Kolish, Enright, & Burke, 2010), consistent with its parent's snacks and beverage products targeted to children. General Mills initially set the most aggressive self-regulation policy (e.g., initiated compliance for some products up to a year or more before Kellogg's implementation date of December 31, 2008). Through the period of this study, the branded RTE manufacturers were in near-perfect compliance with their self-regulatory commitments, in part, because the commitments were easily observable and children's nutrition was a sensitive topic (Ellison, 2005). In 2011, CFBAI announced a lowering of the standard to 10 g of sugar per serving with a 2013 start date (Kolish, 2011). This reduction took place outside our study period.[2]

2.2 | The RTE cereal industry and marketing to children

In 2006, the top four manufacturers in the RTE cereal market controlled over 80% of the market with the remaining sales coming from private labels and smaller manufacturers who either do not advertise or do minimal advertising. To fend off competition from new entrants and private-label products, manufacturers employ strategies involving continual differentiation,

[2]The food policy and medical literature (e.g., Berning, Huang, and Rabinowitz (2013) and LoDolce, Harris, and Schwartz (2013)) examined the effectiveness of the RTE cereal portion of CFBAI and found mixed results.

product proliferation, and heavy advertising. Hundreds of different cereal products were produced in a given year, each with only a very small share of the market, typically under 1 % (Price, 2000). The cost of launching a new product was significant in comparison to the expected revenue and most new products failed quickly (Hitsch, 2006). Advertising plays a huge role in differentiation. In 2001, the advertising-to-sales ratio for the RTE cereal industry was around 13%, much higher than the typical 2–4% in other food industries. Nevo (2001) argues that RTE cereal firms enjoyed high price–cost margins mainly due to their ability to differentiate their products and influence perceived product quality.

Cereals targeted to consumers under 12 years of age account for about one-third of sales and about one-quarter of advertising expenditures. These cereals are advertised directly to children who, unsurprisingly, respond to taste and cues other than nutrition. For example, LoDolce et al. (2013) found that 91% of high-sugar cereal ads viewed by children caused many children to ascribe extraordinary powers to these products. Furthermore, even if parent purchasers have an accurate understanding of a nutritious diet and information on a cereal's nutritional content, they heavily weigh the benefits of keeping children happy and are greatly affected by a child's "pester power" (Lawlor & Prothero, 2011).

3 | THE IMPACT OF INCREASED COMPETITION AND REPOSITIONING

In this section, we motivate our empirical analysis of repositioning costs and how these costs impact the responses of firms to changes in the character of competition. We begin by using the theory of differentiated product competition to better understand how CFBAI altered competition in the children's segment of the RTE cereal market. Next, we focus on the value of brand equity and discuss how that value may decline with repositioning. Finally, we explore the implications of brand equity and product repositioning costs for firm responses to changes in competition.

3.1 | Performance impact of increased competition

The 12-g standard imposed through CFBAI self-regulation induced involuntary repositioning of high-sugar products. While nominally less rigid than a product ban, the restriction on advertising was so binding that all high-sugar cereals, the "constrained" products, were either reformulated to meet the standard or discontinued. Induced repositioning of those products led to a crowding in the product characteristic space, potentially creating increased competition for repositioned products and incumbent products alike (Crampes & Hollander, 1995). Changes in competition intensity and resulting performance outcomes are influenced by changes in the number of competing products (Lutz, Lyon, & Maxwell, 2000; Ronnen, 1991), how products are differentiated from one another (Deephouse, 1999), and changes in overall demand (Adner & Zemsky, 2006). Holding entry and exit fixed, repositioning increases the number of competitors in the lower-sugar part of product space and reduces the degree to which the repositioned and the incumbent cereals are differentiated from each other. Repositioning may partially destroy differentiation advantages which had been built at a product's original position through a combination of brand investment linked to product characteristics. For example, a repositioned product's brand equity may deteriorate because the change in the product's positioning creates

a mismatch between consumer brand expectations and actual product performance (Aaker, 1997). The impact of these competition-increasing effects, however, also depends on how CFBAI altered overall demand in the children's segment of the market. If demand was constant or declined, then reduced differentiation alone increased the intensity of competition. However, if, for example, reduced-sugar versions of cereals increased demand, then the impact on competition would be ambiguous.

It is important, then, to confirm empirically whether overall demand increased in response to the regulatory shock. In any case, theory also strongly suggests that the performance impact of the regulation falls more heavily on constrained (versus unconstrained) products because the constrained products (a) may experience a loss of brand equity from repositioning and (b) will primarily move to a relatively more crowded part of product space at the top of the regulatorily-acceptable range for the sugar content. We discuss our findings regarding these empirical regularities in Section 5.

3.2 | Resource transferability

In this subsection we explore how brand equity, a particularly important resource for consumer goods firms, moderates the impact of competition in the RTE cereal market by increasing product differentiation. Then, after making a distinction between product-specific and firm-specific brand equity, we discuss how the value of product-specific brand equity is affected by product repositioning.

Brand equity, created through a firm's marketing investments, and the creation of consumer loyalty (Aaker, 2009), allows the firm to make future sales even absent further investments (Mizik & Jacobson, 2008; Vomberg, Homburg, & Bornemann, 2015). The "added utility" of brands (Farquhar, 1989) creates value above that of the direct product features, suggesting products with greater brand equity will outperform products with less brand equity by creating more differentiation in the consumer mind, which effectively reduces competition.

The value of a resource such as brand equity is tied to the characteristics of the focal products or the characteristics of the focal firms (Aaker, 1997; Montgomery & Wernerfelt, 1988). In the case of products, it is useful to distinguish between product-specific and firm-specific brand equity (Ferjani, Jedidi, & Sharan, 2009). Product-specific brand equity (e.g., Tony the Tiger image with Frosted Flakes) complements the specific attributes that define a particular product and is designed to appeal to its target customers (e.g., children wanting great taste), while firm-specific brand equity might build a general appeal about all of the products offered by a firm (e.g., the quality of Kellogg's products). Why might a firm prefer to invest more heavily in product-specific versus firm-specific brand equity? Product-specific brand equity seems particularly valuable when products are more horizontally differentiated than vertically differentiated (Randall, Ulrich, & Reibstein, 1998). In the vertical differentiation case, for example, the resource sometimes derives its value from common resources that can be shared across all products, commonly based on supply-side investments which are relatively invisible to buyers (Wu, 2013). Such settings lend themselves to firm-specific brand equity investments. In contrast, when resources address specific buyer preferences, resources commonly are built on observable product characteristics and can be thought of being built on the demand side.

Firms offering multiple products in the same market account for both rival products and own products when deciding on positions (Hui, 2004). The logic of cannibalization has a potential implication for brand equity investments. We conjecture that the relative value of a

product-specific versus a firm-specific resource increases when a focal firm's products cannibalize one another because product-specific brand equity increases perceived differentiation among the focal firm's own products whereas firm-specific brand equity does not. Investments in firm-specific brand equity might even lead buyers to perceive a given firm's products as being more similar. As applied to children's cereal where many sub-segments are populated by products from the same firm, this logic predicts that the value of product-specific brand equity is likely greater than the value of firm-specific brand equity. We expect firms in these markets to invest more heavily in product-specific equity than firm-specific equity.

The connection between product-specific brand equity and product characteristics has important implications for product repositioning. The more a product's characteristics change—the more the product moves away from its original positioning—the more the value of the product-specific resource declines (Danneels, 2011). In the case of RTE children's cereal, a change in sugar content potentially undermines the product-specific brand equity built at the original position–the more its sugar content changes, the more the value of a product's specific brand equity declines. If the decline is rapid, then deterioration in product-specific brand equity would be a major consideration in repositioning decisions.

Qualitatively, the deterioration of brand equity with repositioning seems highly plausible. But the importance of that relationship has not been systematically explored. Such an exploration is difficult empirically because repositioning changes and attendant performance changes can be influenced by a multitude of factors. The children's segment of the RTE cereal market is a good context for such an exploration: product-specific brand equity is of first-order importance and varies by product and year, and changes in sugar content induced by the CFBAI regulation were critical for consumer choice and changed for each product by varying degrees. Hence, it becomes possible to assess the performance impact of repositioning for products with varying levels of brand equity. While the empirical measurement of this cost of repositioning is limited by being context specific, the size of the effect provides evidence regarding the transferability of the value of brand equity to modest changes in product characteristics.

3.3 | Strategic responses to an increase in competition and the cost of repositioning

In the previous subsections we focused on mechanisms affecting outcomes given firm choice. We now turn to the implications of these mechanisms for individual product choices facing the firm. These choices include product-level exit (Bigelow et al., 2019; de Figueiredo & Silverman, 2007; Dobrev & Kim, 2006), establishing entry barriers (Seamans, 2012), repositioning (Wang & Shaver, 2014), changes in investment in relevant resources such as in corporate social responsibility engagement (Flammer, 2015), and changes in price (e.g., McCann & Vroom, 2010; Simon, 2005; Fleming, Rumelt, Schendel, & Teece, 1996). We focus on the nonprice responses because such responses are actions that reduce the level of effective competition, whereas price changes can be thought of as a direct response to a given level of competition.

Exit takes into account rival positions (Wang & Shaver, 2014) and repositioning costs associated with supply-side changes (Argyres, Bigelow, & Nickerson, 2015). It is most likely for products whose original performance was lower, whose repositioning costs (brand equity and product reformulation costs) are higher, and which might be exposed to more intense local

competition. We test this hypothesis by examining whether constrained cereals are more likely to exit than unconstrained cereals.

In markets where a firm owns competing products that compete with one another, exit might also be influenced by a firm's product portfolio because of cannibalization concerns (Moorthy, 1992; Judd, 1985). In response to an external shock, such intra-firm competition would emerge empirically as a rebalancing of a firm's product portfolio via selective exit or repositioning. In the children's cereal segment, for example, one expects exit of high sugar variants (e.g., Kellogg's Froot Loops Starberry) of lower sugar cereals (e.g., Kellogg's Froot Loops) whose primary differentiating characteristic from their "parent" is sweetness. Such variants, if forced to drop sugar, would cannibalize the parent product. Hence, postregulation exit should also be positively related to increases in within-firm product competition.

When resources closely tied to the product have substantial value, repositioning may be more attractive than exit because repositioning allows some of the value of the resources to continue to be exploited (Sutton, 1991). Products with considerable brand equity may even maintain their position rather than reposition when faced with threatening entry (Wang & Shaver, 2014). In the case of children's cereal products, our primary focus is on repositioning within the children's segment by changing ingredient content. But, while brand equity may deteriorate through repositioning in product ingredient space, it is possible that brand equity may ease some forms of repositioning on a different dimension. For example, rather than attracting new customers in a specific age-demographic segment a firm might increase focus on retention of its aging existing customers.[3]

Finally, because product-specific brand equity can be thought of as a partial antidote to competition, another response to increased numbers of competitors is to increase advertising, build brand equity, and increase product differentiation (Boulding, Lee, & Staelin, 1994; Nils-Henrik & Stevik, 1998). That is, firms combat increased crowding by expanding the product space in a consumer's mind. This strategy appears more effective in cases where consumers are influenced both by product characteristics and image, for example, in children's cereal markets where consumers might love sugar but also attribute "superpowers" to eating particular cereals. To be sure, advertising competition is still competition, but it has the positive feature that it builds brand equity which increases differentiation and moderates competition. Hence, we expect an increase in the number of competitors in a given consumer market to increase per product advertising expenditures.

4 | DATA

We utilize three main sources of data: advertisement information from Nielsen, nutrition information from Mintel, and sales information from IRI.[4] Nielsen provides monthly national television advertisement data from 2004 at the product level, including advertisement units, expenditures, impressions generated for each age group, and characteristics such as program

[3]Alternatively, a firm might choose to maintain a high-sugar position while sacrificing its ability to build brand equity through advertising to children. None of the top cereal manufacturers took this strategy in response to the 12-g standard.

[4]All estimates and analysis in this paper based on Information Resources Inc. data are by the author and not by Information Resources Inc. Weekly data for UPC-coded products are drawn from a sample which represents the universe of supermarkets with annual sales of more than $2 million dollars in the U.S. Our analysis shows that this data cover roughly 5% of all grocery stores in the U.S.

type and program name (Nielsen, 2015). Mintel provides cereal nutrition information as reported on the box label (e.g., sugar content, calories) over the period 2001 to 2012 (Mintel, 2015). Changes in this information (or in product availability) are identified by "shoppers" hired by Mintel who send these changed products to Mintel. Since Mintel only makes a report when there are changes to a product or when a new product is introduced, we assume that the cereal characteristics are unchanged absent a new Mintel entry. Mintel information is consistent with nutrition data provided by the manufacturers to the U.S. Department of Agriculture.

IRI Infoscan provides sales, price, and rebate information obtained from checkout scans at a representative sample of individual stores across 50 U.S. cities from 2001 to 2012 (Bronnenberg, Kruger, & Mela, 2008). We aggregate this data by product, market, and year. Cereals are offered in many different packages but about 94% of all sales are packaged in a box and most of those sales are in 15-oz boxes. We limit our sample to box cereals and standardize the weight per box which averaged just over 15 oz.

4.1 | Defining children's cereal

Since the regulation at issue is directed toward children, our first step is to define what constitutes a children's cereal. We adopt the CFBAI definition: a cereal whose advertising is directed to an audience in which "35 percent or more...is composed of children under 12." To identify children's cereals, we first aggregate by product-year total impressions generated in each age category. Next, for each product-year, we calculate the percent of impressions generated on children (ages 2–11) relative to impressions on all audiences. We identify 73 products that had at least 35% of the total impressions generated in the (2–11) age category for at least 1 year between 2004 and 2012 and categorize them as children's cereals.[5] For example, General Mills Cinnamon Toast Crunch is categorized as a children's cereal because it generated more than 36% of all their ad impressions in the (2–11) age range from 2004 to 2008 even though that percentage dropped after 2009. We removed Kellogg's Rice Krispies from the sample because it was a very low sugar cereal (4 g) which was repositioned away from the children's segment well before CFBAI was implemented.[6] For the 73 identified children's products, firms generated between 85 and 100% (mean of 97) of all children's impressions from programs directed toward children. That is, for our defined children's products, the manufacturers gain impressions from programs primarily watched by children (e.g., cartoons and not news) and there is a relatively strong distinction between adult and children's segments as there is a sharp drop off in the amount of children impressions generated by advertising on what we classify as programs directed to children versus advertising on programs directed to adults.[7]

[5]Although the initial definitions of child-directed advertising and children's cereal across the participant firms differed somewhat, the differences are not material to our analysis. The 35% definition was the original General Mills definition and became the generally used definition (Lee et al., 2010). PepsiCo's (Quaker Oats) definition was slightly different, but robustness tests show no substantial differences in empirical results when varying the definitions.

[6]We test our findings both with and without Rice Krispies, finding no major differences.

[7]Of all cereal products that are sold and advertised in our time frame, we rank the products based on the percentage of impressions generated on children. The lowest-ranked product we defined as a children's product gained more than 40% of its advertising impressions from children. The next-ranked product, classified as adult, gained 28%, and this percentage drops precipitously thereafter.

We begin with the IRI database which contains sales and prices for local city markets. About 40% of the children's products are missing from this database, but they are of relatively limited consequence because the products combine for less than 6% of the total advertising spending on children's cereals, usually appear for 1–2 years, and are mostly variants of a primary product brand. Next, we merge Nielsen advertising information and Mintel nutrition information into the IRI data. The merged data cover 50 city markets and span 2004–2012. Summary statistics are provided in Table 1. Table 2 provides a correlation matrix of these variables.

The heterogeneity of product-level positions and resources suggests that the impact of the CFBAI regulation varied across products and firms. Consider Figure 1 which plots the ratio of adult to children advertising spending versus sugar content of major children's cereal products in 2005 before CFBAI. The right half of the figure (higher sugar) is occupied by both Kellogg's and General Mills. However, Kellogg's products tend to have higher sugar compared to those of General Mills. In the left half (lower sugar), we find the best-selling General Mills Cinnamon Toast Crunch and Kellogg's Frosted Flakes whose advertising positioning also suggests some targeting toward older children. Cinnamon Toast Crunch occupies a relatively more regulation favorable resource position with a lower sugar content. Post and Quaker Oats are better positioned than General Mills and Kellogg's in terms of direct regulatory vulnerability. Figure 2 shows a similar plot for 2009, after CFBAI. Figure 1 suggests that the regulation hit Kellogg's

TABLE 1 Summary statistics on children's cereals

Statistic	Mean	*SD*	Min	Max
Sales (million units)	1.59	1.40	0.02	7.16
Revenue (million dollars)	4.49	3.53	0.05	15.04
Product equity (million dollars)	6.34	6.92	0	42.10
Firm equity (million dollars)	37.27	23.82	0	90.44
Unit price (dollar)	2.78	0.24	2.24	3.33
Ounce price (dollar)	0.20	0.03	0.14	0.28
In store display (thousand)	10.21	7.13	0	37
Discount (thousand)	0.51	0.73	0	3

Note: Summary statistics are for children's products. Sales are the number of cereal boxes sold standardized at 15.16 oz per box. Revenue is in millions of dollars. Product and firm equity are the average 2 year rolling total advertising spending at the product and firm levels in millions, unit and ounce prices are in dollars. In-store display is the number of in-store advertisement displays, discount is the number of coupons or rebates used. Mean represents simple averages and are not weighted by sales. Advertising data from Nielsen and capture ads nationally. Sales data aggregated from IRI sample stores. Data aggregated at product-year-national level from 2004 to 2012.

TABLE 2 Correlation table of key covariates

	Price	Product equity	Firm equity	In-store display	Discount
Price	1	−.192	.399	−.238	−.113
Product equity		1	.188	.345	.070
Firm equity			1	.091	−.097
In-store display				1	.377
Discount					1

FIGURE 1 Product positioning of children's cereal: 2005

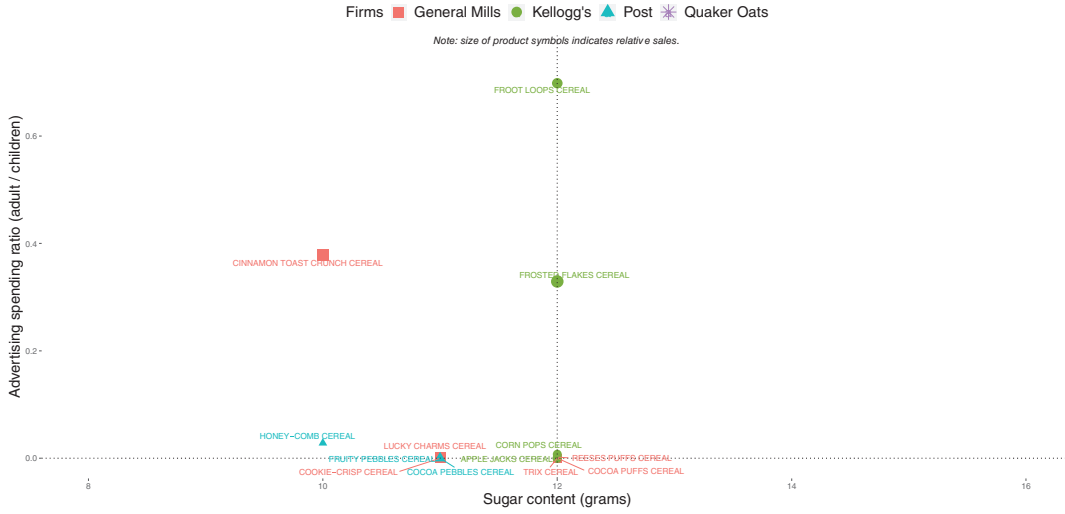

FIGURE 2 Product positioning of children's cereal: 2009

the hardest as it required the biggest changes to comply, while a comparison of the figures provides evidence of increased crowding in sugar content.

5 | EMPIRICAL MODELS AND RESULTS

In this section we empirically investigate the ideas developed in Section 3. We follow the organization of Section 3 by first examining the impact of intensified competition on the

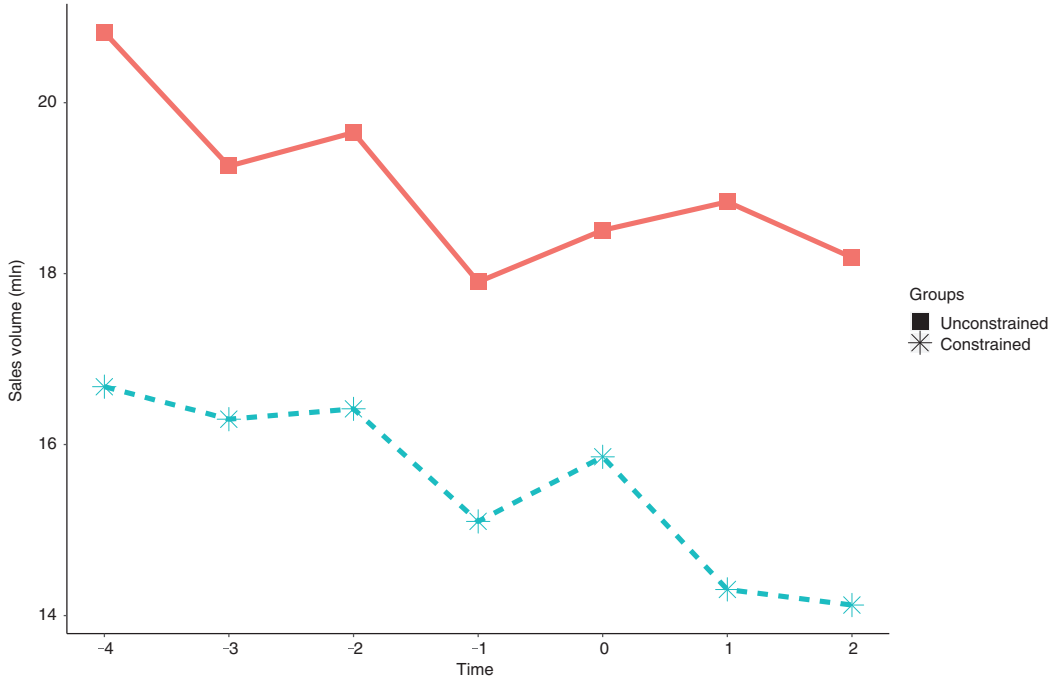

FIGURE 3 Sales volume comparison for constrained versus unconstrained products

performance of constrained and unconstrained products, then assessing the changes in the value of product-specific brand equity caused by repositioning, and finally, discussing how firms strategically responded to the induced repositioning of the constrained cereals.

5.1 | Impact on product performance (constrained versus unconstrained)

Ideally, we would measure the profit change directly, but because cost information is unavailable to us, we focus on changes in sales. A relative decrease in sales of constrained products translates to a relative decrease in profitability if the relative change in costs of producing and marketing the constrained cereals weakly increases, while prices of constrained products do not increase relative to the prices of unconstrained products. The cost condition seems likely given the added costs of repositioning incurred by the constrained products, while the relative price condition is consistent with the empirical evidence.

The impact of product crowding can be seen in Figure 3 which plots over time the aggregate sales volume across our 50-city sample for the categories of unconstrained and constrained products. The y-axis and x-axis measure the number of cereal boxes sold and time from self-regulation implementation (e.g., where 0 indicates the first year of implementation), respectively. Sales of each group followed roughly parallel tracks before diverging after the implementation of CFBAI.

To examine market outcomes more rigorously, we use an approach similar in spirit to a difference-in-differences approach to compare the sales impact of regulation on constrained

versus unconstrained products.[8] Repositioned cereals that subsequently meet the sugar standard are not reclassified. The implementation date is defined as the regulation implementation year, which differs slightly across firms.[9]

The empirical specification is of the following form:

$$Y_{ijt} = \beta_0 + \beta_1 \times \text{constrained}_i + \beta_2 \times \text{post}_{it} + \beta_3 \times \text{constrained}_i \times \text{post}_{it} + X_{ijt}B + \phi_i + \gamma_j + \eta_t + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} is the standardized sales volume for product i in market j at time t. Variable $constrained_i$ is a dummy variable that takes on the value of one if the product is constrained and zero otherwise. $Post_{it}$ is a dummy variable that takes on the value of one after the relevant firm's regulation implementation date. Variable X_{ijt} is a vector of control variables (e.g., product equity, price). We create variable $product\ equity_{it}$ as the average annual advertising spending over the last 2 years. This variable proxies for product-specific brand equity which is built in this industry through advertising spending (Aaker & Biel, 1993).[10] In addition, we create variable $firm\ equity_{it}$ to capture firm-specific brand equity by aggregating annual advertising spending (again from a 2-year average) for all children's brands of firm k at time t minus $product\ equity_{it}$. We discuss this choice below. Variable ϕ_i is a product fixed effect,[11] γ_j is a fixed effect for city market j, and η_t is a year fixed effect. Inclusion of product and market fixed effects control for fixed differences across products and markets, while the year fixed effect controls for common macroeconomic shocks.[12] Standard errors are clustered at the market level.

Table 3 summarizes our empirical results regarding product-level sales performance. Models (1)–(3) address relative sales changes with the variable $\text{constrained}_i \times \text{post}_{it}$. In all models, sales of constrained products decreased postregulation more than sales of unconstrained products. For Model 3, with the most exhaustive set of controls, constrained products suffered a postregulation decrease in sales of just over 4,000 units per product-market-year compared to unconstrained products. With mean sales per product-market-year for constrained products prior to regulation at about 25,000 units, the relative decrease is about 16% of sales. An analysis of relative prices finds that on average price decreased for constrained products relative to unconstrained products by $0.128 per box, a 4 % reduction. Hence, making the reasonable assumption that relative costs have weakly increased for constrained versus unconstrained products, the relative price and sales declines imply that profitability has also relatively decreased for constrained versus unconstrained products.

These results support the prediction from Section 3 that constrained products perform relatively worse than unconstrained products. What about absolute performance? In Model 4, we focus attention on the set of *unconstrained* products with the highest allowed level of sugar because competition at that level of sugar should be the most intense and costs are likely

[8]We use children's cereal products that are unconstrained as a comparison to measure the impact of regulation. Because consumers substituted between constrained and unconstrained products, the impact we measure should be thought of as the joint effect of self-regulation on both constrained and unconstrained cereal products as opposed to the effect on the constrained group only as would result from an ideal difference-in-differences approach. Our approach has the advantage of avoiding potential concerns where a control group constructed through methods such as matching may be dissimilar on important but unobservable dimensions from the treatment group.

[9]Since our data is aggregated by year, we identify constrained years as those years for each firm at which most of the sales were first affected by the regulation: GM 2008, KL 2009, PepsiCo 2008, Post 2010 (Kolish & Peeler, 2008).

[10]Variables $\text{product equity}_{it}$ and firm equity_{it} extrapolate 2003 advertising spending using 2004 advertising spending adjusted by a factor based on the total advertising spending reported in each firm's 10K report.

[11]We also ran our specification with firm fixed effects. Results do not differ for our coefficient of interest.

[12]Given potential endogeneity concerns regarding the price variable, we use price for other geographical markets as instruments.

TABLE 3 Effect of regulation on sales for constrained and unconstrained products

	(1)	(2)	(3)	(4)
Constrained × post	−1.501	−1.875	−4.079	
	(0.817)	(0.873)	(1.637)	
Standard × post				−5.674
				(3.356)
Post	2.317	2.454	4.029	9.129
	(0.736)	(0.767)	(1.224)	(1.459)
Product equity	0.174	0.180	0.168	0.703
	(0.101)	(0.104)	(0.100)	(0.135)
Firm equity	0.039	0.056	0.052	0.062
	(0.026)	(0.033)	(0.032)	(0.028)
In-store display	0.106	0.105	0.106	0.166
	(0.013)	(0.013)	(0.013)	(0.015)
Price	0.038	0.021	−0.267	−2.773
	(0.256)	(0.256)	(0.184)	(0.345)
Discount		0.046	0.041	0.024
		(0.014)	(0.014)	(0.014)
Sugar			−0.317	
			(0.311)	
Constant	28.597	27.644	35.010	39.980
	(10.901)	(11.197)	(8.567)	(6.148)
Observations	9,850	9,850	9,250	4,200
R^2	.789	.791	.794	.817

Note: Dependent variable is in number of cereal boxes sold in thousands standardized at 15.16 oz per box. Constrained indicates products that contained more than 12 g of sugar per serving prior to regulation. Model (4) is subset to only include unconstrained products, standard is a dummy variable that further subsets the unconstrained products, where 1 indicates unconstrained products that contained 12 g of sugar per serving the year prior to regulation and 0 indicates unconstrained products that contained less than 12 g of sugar. Product and firm equity are the average 2 year rolling total advertising spending at the product and firm levels in millions (firm equity represents total advertising spending at the firm level on all products by the respective firm less the spending for the focal product), in-store display is the number of in-store advertisement displays, price is in cents per oz, discount is the number of coupons or rebates used. Nutrition content is per serving, sugar in grams. Models (1–3) include product, year and market fixed effects. Model (4) include year and market fixed effects. Standard error clustered at the market level.

constant both before and after regulation. We identify performance by replacing $\text{constrained}_i \times \text{post}_{it}$ in (1) with $\text{standard}_i \times \text{post}_{it}$, where $standard_i$ takes on the value of one for products with 12 g of sugar and zero, otherwise. Mean sales decreased roughly 5,700 units more postregulation for products at the standard versus products with sugar levels less than the standard. Based on a mean sales of about 66 thousand units for unconstrained products at the standard prior to the regulation, this decrease represents 10% of sales.[13] This result suggests that for

[13]An additional analysis was undertaken to assess whether constrained and unconstrained cereals exhibited different trends prior to regulation being implemented. No evidence of different time trends was found.

12 g-sugar incumbent products crowding led to sales losses relative to the even lower-sugar incumbents, perhaps because losses to the newly repositioned products were not sufficiently offset by increased overall demand.

Finally, to empirically assess CFBAI's effects on the short-run performance of firm k, we modify Equation (1) to replace product interactions with firm interactions (firm_k with post_{it}):

$$Y_{ijt} = \beta_0 + \beta_1 \times \text{firm}_k + \beta_2 \times \text{post}_{it} + \beta_3 \times \text{firm}_k \times \text{post}_{it} + X_{ijt}B + \gamma_j + \eta_t + \varepsilon_{ijt} \quad (2)$$

Table 4 displays the results for this analysis with General Mills as the reference firm. All three models estimate Kellogg's change in sales after regulation to be worse than that of General Mills, while Post and Quaker Oat's postregulation change is better. This result is expected given that Kellogg's had more, and Post and Quaker Oats had fewer, constrained products than General Mills.

5.2 | Impact on product performance (resource transferability)

In Section 3.2 we argued that (1) product-specific brand equity may be more valuable than firm-specific brand equity in differentiated-product settings with substantial cannibalization and (2) repositioning leads to declines in the value of product-specific brand equity. To explore these possibilities, we shift from measuring regulatory impact using a difference-in-differences-like approach to examining changes in the value of brand equity using a granular estimation based around repositioning of individual products over the entire study period. We construct the variable $\text{product travel distance}_{it}$ and interact it with $\text{product equity}_{it}$. $\text{Product travel distance}_{it}$ is proxied using the year-to-year change in sugar distance, so this interaction helps us examine the value of product-specific brand equity as a product is repositioned in terms of its sugar level. *Product equity*$_{it}$ is proxied for by the average 2 year rolling total advertising spending at the product level.

$$\begin{aligned} Y_{ijt} = \beta_0 + \beta_1 \times \text{product equity}_{it} + \beta_2 \times \text{product travel distance}_{it} + \beta_3 \times \text{product equity}_{it} \\ \times \text{product travel distance}_{it} + \beta_4 \times \text{firm equity}_{it} + X_{ijt}B + \phi_i + \gamma_j + \eta_t + \varepsilon_{ijt} \end{aligned} \quad (3)$$

Directly separating advertising that is product specific from advertising that is firm specific is impossible given our data and the context. But, if brand advertising for other brands does not create product-specific brand equity for the focal product, for example, advertising for Fruit Loops only helps sales of Frosted Flakes via building Kellogg's firm brand equity, then same-firm spending on nonfocal products can proxy for firm-specific brand equity spending on nonfocal products.

With this construction in mind, the regression results in Table 5 provide weak supporting evidence that product-specific brand equity is more valuable than firm-specific brand equity as the coefficient on firm equity_{it} is insignificant throughout all four specifications. This outcome could be the result of the weak power of the test. Furthermore, the construction of the brand-specific brand equity measure makes a relative comparison of coefficient estimates for product and firm-specific brand equities of limited interest because the firm-specific measure includes product-specific brand equity spending for nonfocal products.

We now turn to the product-specific brand equity costs of repositioning. Using the constrained-product sample and controlling for various observables, the coefficient on $\text{product equity}_{it}$ in Model

TABLE 4 Effect of regulation on sales at the firm level

	(1)	(2)	(3)
Kellogg's × post	−2.311	−2.675	−2.990
	(0.266)	(0.273)	(0.137)
Post cereals × post	12.052	12.420	14.129
	(1.263)	(1.033)	(2.695)
Quaker × post	0.484	1.165	9.959
	(0.283)	(0.404)	(3.151)
Post	−0.214	−0.525	−1.653
	(0.929)	(0.679)	(1.453)
Product equity	1.587	1.584	1.560
	(0.071)	(0.072)	(0.049)
In-store display	0.112	0.109	0.113
	(0.006)	(0.005)	(0.005)
Price	−2.016	−1.991	−1.833
	(0.335)	(0.338)	(0.455)
Discount		0.054	0.049
		(0.016)	(0.016)
Sugar			−1.931
			(1.045)
Constant	30.032	29.840	49.673
	(8.303)	(8.304)	(20.660)
Observations	9,850	9,850	9,250
R^2	.737	.739	.744

Note: Dependent variable is in number of cereal boxes sold in thousands standardized at 15.16 oz per box. Product equity is the average 2 year rolling advertising spending at the product level in millions, in-store display is the number of in-store displays, price is in cents per oz, discount is the number of coupons or rebates used. Nutrition content is per serving, sugar in grams. All models include company, year, and market fixed effects. Standard error clustered at the market level. Reference company is General Mills.

3 in Table 5 suggests a 1 million dollar increase in *product equity*$_{it}$ increases local market sample sales by about 214 units when the product does not move its position. At the sample average product equity$_{it}$ of about $6 million dollars and the sample average sales of 1.6 million units nationally, the value of product brand equity is about 7% of sales.[14] Given product fixed effects and the variable's construction, this is a narrow and very conservative measure of product-specific brand equity which is probably best interpreted as the value of adding a million dollars to product-specific brand equity. When *product travel distance*$_{it}$ changes by 1 unit (between 7 and 10% in sugar level) from its previous position, the incremental value of a 1 million dollar increase in product equity$_{it}$ decreases by 119 units, which is substantial when compared to the average value of increasing investment in brand equity. For high and medium brand-equity products this decrease was roughly 3.5% of sales. The repositioning-cost results support the

[14]This is compared to the average sales of 18,535 within group controlling for product, market, and year fixed effects.

TABLE 5 Effect of product equity on sales

	(1)	(2)	(3)
Product equity × product travel distance	−0.121	−0.116	−0.119
	(0.059)	(0.057)	(0.058)
Product equity	0.206	0.207	0.214
	(0.093)	(0.093)	(0.096)
Product travel distance	0.682	0.624	0.557
	(0.489)	(0.469)	(0.458)
Firm equity	0.030	0.031	0.046
	(0.028)	(0.028)	(0.034)
In-store display	0.108	0.107	0.105
	(0.013)	(0.013)	(0.013)
Price		−0.377	−0.405
		(0.236)	(0.241)
Discount			0.042
			(0.014)
Constant	28.928	35.707	35.203
	(6.998)	(9.525)	(9.609)
Observations	9,250	9,250	9,250
R^2	.792	.793	.794

Note: Dependent variable is in number of cereal boxes sold in thousands standardized at 15.16 oz per box. Product and firm equity are the average 2 year rolling total advertising spending at the product and firm levels in millions (firm equity represents total advertising spending at the firm level on all products by the respective firm less the spending for the focal product), product travel distance is the change in sugar content from year to year. In-store, display is the number of in-store advertisement displays, price is in cents per oz, discount is the number of coupons or rebates used, sugar in grams. All models include product, year, and market fixed effects. Standard error clustered at the market level.

theory that predicts the value of product-specific brand equity is tightly linked to the product's previous position and that the further the product is moved in product space, the more the value of a product's specific brand equity declines. The 3.5% sales loss may underestimate the cost of an isolated move because the estimation includes many cases where more than one product is repositioned simultaneously. In those cases, any given repositioned product will capture a portion of the brand-equity related sales losses of the other repositioned products. It is possible, however, that the measured sales decline might also capture the impact of increased competition as constrained products reduced sugar. To check this possibility, we controlled for the number of competitors at a given sugar level and found the Table 5 results robust to this addition. This check supports the view that reduction in brand equity caused by repositioning is a significant source of performance decline regardless of competition level.

5.3 | Firm strategic responses to regulation

Compliance with the sugar standard crowded the product space and increased competition by inducing products to become more similar on the dimension of sweetness. This crowding can

lead to exit or repositioning away from a predominately children targeting.[15] In this subsection, we explore these strategic responses. In interpreting the results in this section, it is important to recognize that we empirically examine the choices individually rather than analyzing them through a more complex model such as a structural model that would explicitly account for the interactions among the choices.

The average number of (advertised) product and product variants offered in a given year in the children's segment of the RTE cereal industry decreased from 26 before regulation to 19 after regulation. Six of the exiting products were variants of a main brand or were variants associated with cartoon characters. Only Kellogg's Mini Swirlz was a main brand product. As discussed in Section 3.3, there are many reasons to expect that if costs increase with greater repositioning, then it is more likely that higher sugar cereals will exit. Using a Cox proportional hazards model, we estimate the likelihood of exit based on how much a constrained product exceeded the 12 g-sugar standard prior to regulation:

$$h(t)=h_0(t)\exp(\beta_0+\beta_1\times\text{sugar distance}_{it}+X_{it}B+\pi_k+\varepsilon_{it}) \quad (4)$$

where $h(t)$ is the hazard function for product i at time t given covariate vector X_{it},sugar distance$_{it}$ is the number of grams of sugar above the 12-g standard, X_{it} is a vector of control variables, and π_k is a firm fixed effect. We define survival length as the number of years survived after regulation.[16] Model 3 in Table 6 shows that the estimated coefficient for sugar distance is 0.426 and is statistically different from zero, so, the hazard rate of discontinuation for constrained products increases with the amount of repositioning.

We next examine whether an increase in competition caused by crowding increases the likelihood of repositioning. To do this we need a measure of repositioning and then a measure of competition. Regarding repositioning, we focus on changes in consumer segment targeting and operationalize these changes as changes in the ratio of adult program advertising spending to children's program spending, $\frac{\text{adult}_{it}}{\text{children}_{it}}$.[17] To provide some context for this measure, consider Figure 4, which are plots for constrained and unconstrained children's cereals of the distribution of television ads by each advertisement's ratio of advertising "impressions" generated on adults to impressions on children. The plots indicate that most children's cereals advertise heavily in children-dominated programming but do not suggest major differences on this dimension between constrained and unconstrained products taken as groups.[18] As suggested by Figure 4, for most of the advertised products in the children's segment of the market that ratio is relatively small, where the mode is around 0.6, indicating that an ad generates 1.7 times more impressions on children than adults. We interpret an increase in the ratio as repositioning toward a different market subsegment, for example, focusing more on older children or teenagers.

[15]We observed no meaningful entry in our study period until 2012 when Kellogg's introduced Krave Cereal.

[16]Because we are estimating survival at the product level, we aggregate our observations at this level.

[17]Advertising spending is categorized as "adult" or "children" based on whether the ad is aired in a children's program type. Program types are defined by Nielsen. We rank all program types based on cost per children's impression. We then identify a "children" program type as program types that rank in the top half.

[18]Of the three products that were repositioned the most based on our measure, two (General Mills Cinnamon Toast Crunch and Kellogg's Frosted Flakes) were unconstrained, while one (Kellogg's Froot Loops) was constrained. Figure 4 captures all ads with adult to children's ratio ranging between 0 and 2.5.

TABLE 6 Cox proportional hazards model for children's cereal

	(1)	(2)	(3)
Sugar distance	0.097	0.379	0.426
	(0.146)	(0.217)	(0.215)
Price	−6.069	−23.828	−25.536
	(12.055)	(16.270)	(16.571)
In-store display	−0.076	−0.102	−0.109
	(0.026)	(0.030)	(0.033)
Product equity		0.449	0.443
		(0.263)	(0.278)
Observations	37	37	37
R^2	.624	.655	.671

Note: The hazard is the probability that if a product survives to year *t*, it will experience exit in the next year. Survival event is defined as product exit between 2004 and 2012. Survival length is measured as the number of years the product variant survived after the implementation date until 2012. Sugar distance is the sugar content of the product in its last year prior to regulation implementation less the regulation constraint level of 12 g per serving. Product equity is based on cumulative advertising spending. Model (3) includes additional company fixed effects.

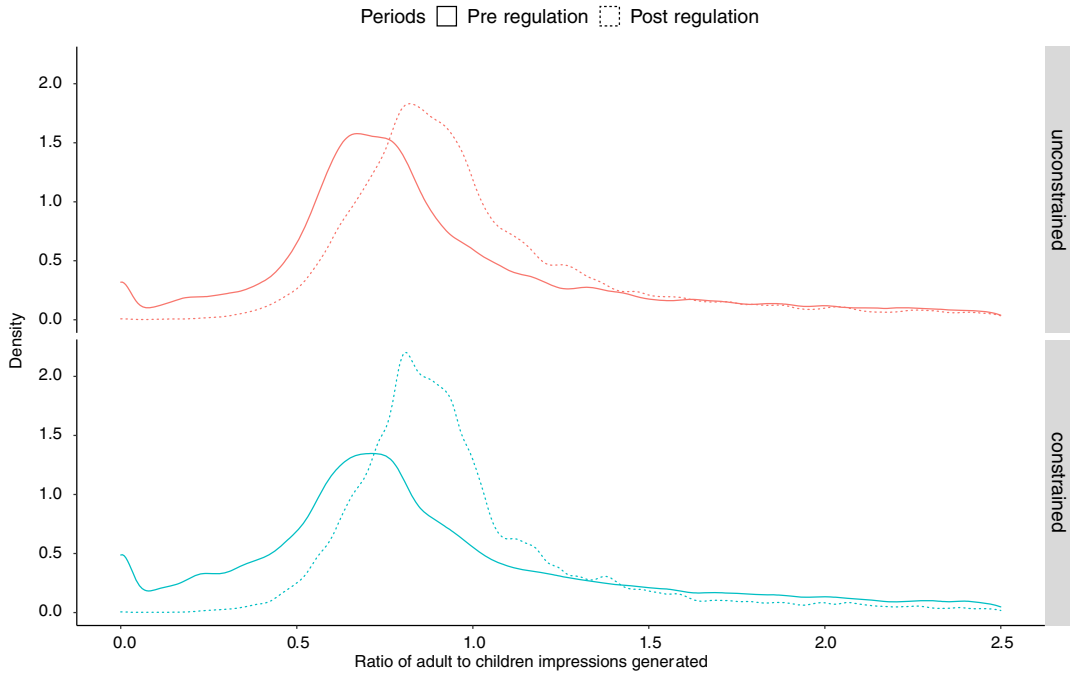

FIGURE 4 Distribution of television advertisements by audience ratio

Next, to construct a measure of competition, we characterize cereals through three principal ingredients, then for each cereal we determine how many other cereals have relatively similar ingredients. Competition is greater for product *i* when there are more cereal competitors which have similar ingredients. Specifically, first, for each product, we reduced its characteristics into

a single dimension using the propensity score method to create a product score.[19] Then, for each pair of products *i* and *j*, we calculate their similarity (similarity distance$_{i,j}$) using the difference in their scores. The distance is scaled from zero to one, with one indicating the largest distance between two products. Second, we develop a proxy for the overall level of competition (number all competitors) faced by each product by counting the number of products within a given similarity distance of the focal product.[20] This count is further divided into the number of own-firm competitors (number own competitors) and the number of rival competitors (*n*umber other competitors).[21]

Our empirical examination of the relationship between product competition and product repositioning uses the following specification:

$$\text{reposition}_{it} = \beta_0 + \beta_1 \times \text{competition}_{it} + X_{it}B + \phi_i + \varepsilon_{it} \quad (5)$$

where reposition$_{it}$ and competition$_{it}$ measure the repositioning efforts and the competition level of product *i* at time *t*, respectively. Using our similarity measure, the overall level of competition increased by 14% after regulation.

The product fixed-effect regression results reported in Table 7 suggest that products that face increased competition are more likely to be repositioned. In Model 1, the coefficient on number all competitors indicates that when the number of close competitors increases by one, the ratio of $\frac{\text{adult}_{it}}{\text{children}_{it}}$ advertising spending increases by 0.013, representing about 20% of the mean $\frac{\text{adult}_{it}}{\text{children}_{it}}$ ratio in our data. This measure captures a few major repositioning moves such as with Frosted Flakes which changed from advertising predominately to children in 2004 to advertising predominately to older children and young adults by 2010. These repositioning moves can be seen in a comparison of the changes to the advertising ratio as shown in Figures 1 and 2. In Model 4, we attempt to distinguish the impacts of own and rival competition, but the results are not significant, likely due to the relatively small number of observations.[22] Models 2 and 3 focus just on own or just on rival competition, respectively. These regressions are not ideally specified, but provide weak evidence that cannibalization may be more important than rival

[19]We decompose all products spanning the entire time frame (e.g., product$_i$) into three product characteristics (e.g., sugar$_{it}$,*sodium*$_{\text{it}}$,*protein*$_{\text{it}}$). To measure how close each of the other products (e.g., product$_j$) is from product$_i$, we create a dummy variable that equals 1 for product$_i$ and 0 otherwise. Using the three decomposed product characteristics for each year, we calculate for each product an estimated probability (e.g., propensity score) that its three characteristics predicts the product to be product$_i$, denoting this estimate as *score*$_i$ for product$_i$, score$_j$ for product$_j$, and so on.

[20]We choose a cutoff distance of 0.2 for our analysis because it produces a reasonable variability in levels of competition, though our results are not particularly sensitive to the cutoff choice. The smaller the cutoff the more similar the included competitors are to the focal firm. Then, 0.2 was the smallest cutoff that still produced significant variability in the number of competitors. Varying the level from .2 to .5 did not significantly change the results.

[21]As an example, consider Reese's Puffs cereal which contained 13 g of sugar, 195 mg of sodium, and 1.9 g of protein per serving and, based on our measures, had no close competitors in 2007. Reese's Puff was reformulated in 2008 to contain 12 g of sugar, 180 mg of sodium, and 2 g of protein per serving. It subsequently faced three competitors: Post Honeycomb (sugar 10 g, sodium 170 mg, and protein 2 g), General Mills Trix (sugar 13 g, sodium 180 mg, and protein 2 g), and General Mills Lucky Charms (sugar 11 g, sodium 190 mg, and protein 2 g).

[22]However, likelihood ratio testing between Model 4 and a model which removes the two competition variables indicates that the combined effect of the two variables is different from zero.
$F = \frac{(SSE_0 - SSE_1)/(p1-p0)}{SSE_1/(n-p1)} = \frac{(6.148-5.669)/(18-16)}{5.669/(116-18)} = 4.14$, under H_0 follows $F_{2,98}$, *p*-value .019.

TABLE 7 Effect of product competition on repositioning

	(1)	(2)	(3)	(4)
Number all competitors	0.013			
	(0.005)			
Number own competitors		0.041		0.019
		(0.016)		(0.024)
Number other competitors			0.016	0.011
			(0.006)	(0.009)
Product equity	0.045	0.044	0.044	0.045
	(0.005)	(0.005)	(0.005)	(0.005)
Constant	−0.539	−0.566	−0.523	−0.545
	(0.125)	(0.127)	(0.124)	(0.128)
Observations	116	116	116	116
R^2	.657	.651	.655	.657

Note: Dependent variable is the ratio of advertising spending on adult programs over children's programs. Number all competitors, number own competitors, and number other competitors measure the number of cereal products within a propensity score of 0.2 from $product_i$ that is a children's cereal, a children's cereal from the same firm as $product_i$, and a children's cereal from a different firm than $product_i$. Correlation coefficient between number own competitors and number other competitors is 0.68. Product equity is the average 2 year rolling total advertising spending at the product level in millions. Data ranges from 2004 to 2012 aggregated at the product-year level.

competition.[23] The disparity may reflect business stealing benefits that exist against rival products but not against a firm's own products (Banbury & Mitchell, 1995).[24]

Section 3.3 argued that increased competition may lead firms to invest in advertising to build a product's brand equity. To examine this possibility, we replace the repositioning dependent variable in the empirical specifications described in Table 7 with the year-to-year change in advertising spending for each product and remove the product-specific brand equity variable. Consistent with our theoretical predictions, we find that an increase in the number of competitors in a given consumer market increased per product advertising expenditures. Specifically, as reported in Table 8 (Model 1), the coefficient on number all competitors (.167) suggests that when the number of close competitors to the focal product increases by one, there is a $167,000 increase in advertising spending, representing a 17% increase at the mean spending level. This increase may reflect the value of increased differentiation with increased competition but could also reflect current-period advertising competition. We think both factors are in play, especially

[23]Because of large standard errors in Model 4, we cannot statistically distinguish the other competition and cannibalization effects from zero. But in Models 2 and 3 (where the variables are entered separately, we see that the cannibalization effect is larger than the other competition effect, albeit for regressions that are not directly comparable. These results are robust to sales-weighted competition over products that spanned our time frame as well as competition counts that included products that appeared for only a portion of the time frame.

[24]We also considered an alternative interpretation that firms may reposition their advertising toward adults as a means to indirectly target children. But an analysis of the Nielsen Consumer Panel Data provides evidence against this interpretation: while sales of repositioned products to households with children experienced a sales decline post regulation, sales to households without children experienced a modest increase.

TABLE 8 Effect of product competition on advertising spending

	(1)	(2)	(3)	(4)
Number all competitors	0.167			
	(0.079)			
Number own competitors		0.692		0.580
		(0.298)		(0.410)
Number other competitors			0.185	0.054
			(0.099)	(0.135)
Constant	−0.200	−0.725	−0.033	−0.613
	(1.597)	(1.617)	(1.602)	(1.647)
Observations	127	127	127	127
R^2	.094	.101	.086	.103

Note: Dependent variable is year-to-year change in advertising spending in millions. Number all competitors, number own competitors, and number other competitors measure the number of cereal products within a propensity score of 0.2 from $product_i$ that is a children's cereal, a children's cereal from the same firm as $product_i$, and a children's cereal from a different firm than $product_i$. Correlation coefficient between number own competitors and number other competitors is .68. Data ranges from 2004 to 2012 and is at the product-year level.

as children are likely to be more responsive to nonfunctional product attributes than adults, but we cannot determine the relative sizes of the effects.

6 | DISCUSSION AND CONCLUSIONS

This article exploits a natural experiment to evaluate how firms respond to increased competition and estimates the value of their product-specific resources. A highly-targeted regulatory intervention induced a crowding of the product space involving many substantially differentiated products for which key market variables are observable. These features give our study some advantages over previous studies regarding either repositioning in response to entry (Flammer, 2015; Wang & Shaver, 2014), brand equity responses to increased competition (Flammer, 2015), or acquisition (Frake, 2017). We assess, for example, the magnitude of the effects using performance measures. Hence, we estimate the unequal regulatory impact across the firms, the localness of product-specific brand equity, and the amount by which firms reinvest in product-specific brand equity in response to increases in competition. We find repositioning resulted in a decrease of 3.5% of sales for a single gram reduction in sugar, which is substantial, particularly given that many cereals needed to reduce sugar by two or more grams. Further, investment in product-specific brand equity increased by 17% on average per product with each additional close competitor.

Our finding that product-specific brand equity deteriorates rapidly with changes in position raises an interesting question about repositioning strategies over time. How quickly should a firm change the position of its products? While we do not explore this question, there is evidence that General Mills, where possible, favored a gradual reduction in sugar to allow the consumers to adjust to lower sweetness (Jargon, 2011; Skidmore, 2009). This transitional strategy is consistent with our sample evidence which shows that General Mills did not change sugar content for any product by more than 2 g in a single year, whereas Kellogg's reduced sugar by 3 g

in a single year for two of its most popular products.[25] A more gradual change in position might mitigate the repositioning penalty on product brand equity.

In Section 3.2 we argued that firms will have a greater incentive to invest in product-specific rather than firm-specific brand equity when they have multiple products competing in the same market. The reasoning was that both investments help versus rival products, but product-specific brand equity investments also reduce competition among own products. This theory connects the corporate strategy literature focused on conflicts raised by different, but related, businesses (or products) in a firm's portfolio as opposed to literature focused on shared resources (e.g., Levinthal & Wu, 2010; Banbury & Mitchell, 1995). Our empirical analysis provided only a weak suggestion that product-specific investment was of greater value in this market than firm-specific investment. Because we lacked direct measures of firm-specific advertising investments, we relied a measure constructed from overall firm advertising (minus that of the focal product). Unfortunately, this indirect measure is not ideal for making a comparative value statement. This question remains largely open.

While our assessments are for a particular market, the children's RTE breakfast cereal market seems typical of multi-product, consumer goods markets. We complement Wang and Shaver's (2014) dominant firm entry-induced repositioning analysis with an analysis of repositioning that is induced by a regulatory factor that simultaneously affects many near-equal competitors. Like Wang and Shaver, we do not focus on repositioning based on opportunities (Greve, 1995). In the context of children's cereals, however, we speculate that repositioning induced by competition will sometimes be shaped by the opportunity to target older customers, perhaps by harvesting a product's (older) brand-loyal customers while not further investing in attracting new (younger) customers. Such a transitional repositioning relates to a cross-product loyalty strategy through which companies build firm loyalty with entry level products in hopes that those same consumers (as they become older and more wealthy) will purchase the company's higher-level products (Li, Sun, & Montgomery, 2011).

By focusing on a particular industry, we are better able to explore nuances associated with product-level decisions, but a single industry study has the disadvantage of limiting the amount of data. This data limitation weakens the power of our tests and limits our ability to distinguish among alternative hypothesis. We attempt to control for unobserved product and firm heterogeneity, but are unable to fully discount the potential for time-varying changes in characteristics. Thus, although we control for time fixed effects, we do not fully account for trends associated with the financial crisis or for a general consumer demand shift away from high-sugar products. With respect to the latter, a more rigorous examination of high-sugar and lower-sugar product sales trends in the 4 years prior to the regulation does not find such a trend, nor did we find evidence over this time period of a demand shift away from cookies, a similar children-oriented high-sugar product category.

When firms differ in terms of their resources and their market positions prior to regulation, they are likely to experience different impacts from a given regulation.[26] Such uneven effects suggest that both self-regulation and regulation may be utilized strategically.[27] Examining the

[25]Two of General Mills' products appeared to begin reformulation earlier than the regulation implementation date. Such early anticipation would slightly reduce the regulatory impact that we measure.

[26]By showing that a firm's prospective vulnerability is not tied solely to products directly affected by the regulation, we add to the social impact of regulation literature (e.g., Armstrong & Sappington, 2007; Hahn & Hird, 1991).

[27]Firms sometimes exploit regulatory loopholes by complying with the letter, but not necessarily the spirit of the regulation. For example, in other analysis we find evidence that firms sometimes decreased serving size to make it easier to meet the 12 g standard.

strategic use of regulation is beyond the scope of this article, in part, because a full examination of this subject calls for a model of the political economy of regulation. Furthermore, given the potentially strategic use of regulation, whether the regulation in question is on net beneficial or harmful to the industry or society is an open question. Our data prevent a full investigation of this question, but we note that the children's segment experienced a postregulation sales decline while average prices increased. These outcomes are consistent with a decrease in competitiveness for structural reasons (e.g., exit) or possibly the market participants found themselves in a less-competitive equilibrium.

ACKNOWLEDGEMENT

The authors thank David Baron, Paul Boyer, Maureen Enright, Hillary Greene, Felix Oberholzer-Gee, Brian Richter, John Beshears, Brian Wu, participants in the Strategy and the Business Environment Conference at Stanford, the HBS strategy workshop and two anonymous reviewers for helpful comments. We also thank Puneet Brar for research support. An early version of this article was titled "The Impact of Regulation on Strategic Positioning in the RTE Cereal Industry."

DATA AVAILABILITY STATEMENT

Data subject to third party restrictions.

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How to cite this article: Hou, Y., & Yao, D. (2021). Pushed into a crowd: Repositioning costs, resources, and competition in the RTE cereal industry. *Strategic Management Journal*, *43*(1), 3–29. https://doi.org/10.1002/smj.3336