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Pushed into a Crowd: Repositioning Costs, Resources, and Competition in the RTE Cereal Industry[1]

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Research summary:

This paper exploits a natural experiment involving self-regulation in the ready-to-eat (RTE) breakfast cereal industry to evaluate how firms respond to entry in light of changes in competition and to estimate the value of brand equity as products are repositioned. Self-regulation led to a crowding of the product space by forcing differentiated products to become more similar. Among other things we find that products constrained by regulation perform relatively worse than unconstrained products, brand equity specific to a product is tightly linked to existing product positions and does not transfer well to new positions, and that when competition increases, firms reposition to new segments and increase investments on product differentiation. The paper offers a performance based assessment of repositioning and to our knowledge offers the first empirical analysis in the strategy literature that measures in performance terms how repositioning changes the value of brand equity.

Managerial summary:

This paper 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 U.S. ready-to-eat 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 increased investments in differentiation.

Keywords: positioning, resources, brand equity, competitive dynamics, non-market strategy

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1. Introduction

How should a firm respond to the entry of a powerful competitor? Should the firm reposition, maintain its current position, or even exit? The choice turns on both the level of ensuing competition and the value of the firm's competitively-relevant resources. While the impacts of changes in competition intensity have received much empirical attention in the strategy literature, less attention has been given to changes in the value of resources.

In this paper we exploit a natural experiment resulting from the introduction of self-regulation in the U.S. ready-to-eat (RTE) breakfast cereal industry. The regulation circumscribed key product and marketing choices which, in turn, induced changes in positioning of some cereal products. The cereal setting has two features that make it especially useful to study. First, changes in position are easy to observe and measure because the regulatory shock that induces repositioning is narrowly tailored to the sugar levels of the cereal products. Second, the children's RTE cereal market is populated with numerous differentiated products for which positioning, pricing, sales and advertising are all observable. The granularity of this data allows us to generate a series of findings regarding (1) the impacts of the involuntary repositioning of high-sugar cereals on product and firm performance, (2) the nature and value of brand equity for products in this market and how that value is affected by product repositioning, and (3) the responses of firms to changes in the competitive environment.

Because the factors animating managerial choice at the product level are similar to those animating business unit choice, our work contributes to the strategy literature addressing firm responses to entry and other changes to the competitive environment. Within this literature scholars have examined firm responses involving repositioning (Wang & Shaver, 2014; Menon & Yao, 2017; Du, Li & Wu, 2018), diversification (Bowen & Wiersema, 2005), exit (Dobrev &

Kim, 2006), exit followed by new entry (de Figueiredo & Silverman, 2007), differentiation (Gimeno, Chen & Bae, 2006; Flammer, 2015), and investments (Ethiraj & Zhou, 2019). In linking product-level positioning, product-specific resources, and performance, we focus primarily on repositioning and differentiation.

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 with industry expenditures running about 13 percent of sales (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.[4] But excessive sugar in a child's diet has a big nutritional downside because it 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. As participants in this initiative, all of the dominant cereal firms agreed not to advertise to children cereal products containing more than 12 grams of sugar per serving. The agreement addressed advertising, the primary marketing lever for selling those products, and sugar, the most important ingredient generating sweetness. The advertising constraint was binding and significant. While not all children's cereals were directly affected, some cereals required a 25 percent or greater reduction of sugar to meet the standard. All of the directly affected products ("constrained products") lowered sugar rather than cease advertising to children. Because all CFBAI firms complied with the Initiative (Lee, Kolish & Enright, 2010;

[4] 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).

Enright, 2018), there was no difference between self-regulation and regulation in terms of impacts. Hence, going forward we refer to the restrictions as "regulations."

Our first set of findings assess the performance impact of regulation on products and firms. We find that the constrained products on average experienced 16 percent lower sales and a four percent lower price performance relative to unconstrained products, products not explicitly targeted by the regulations. We observe that unconstrained products were indirectly affected by changes in competition associated with changes to constrained products. Aggregating to the firm level, firms with more constrained products performed relatively less well than firms with less constrained products.

The next set of findings provides insight into 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. To start, we provide evidence that firms in this industry invest more heavily in product-specific brand equity relative to firm-specific brand equity. We then estimate that repositioning associated with a 7 to 10 percent reduction in sugar led to an average sales decline of 3.5 percent.

The third set of findings characterize how competition and brand equity deterioration considerations affected exit, repositioning, and investment in brand equity. The raw numbers show substantial exit after regulation: the number of advertised product and product variants per year decreased from 26 to 19 compared with an almost 30 percent increase of products in the adult segment. Unsurprisingly, exit of constrained products was more likely if the initial sugar level of the products was higher. Repositioning, operationalized as an increase in advertising addressed to adult versus children's segments, was 20 percent more likely with the addition of each additional close competitor. There is also weak evidence that repositioning is more strongly

influenced by cannibalization of own products than competition from rival products. Finally, we examine impacts on investment in brand equity. Repositioning of constrained products resulted in an increase in per product advertising from $5.5 million to $6.6 million in the children's segment, compared with a slight decrease in the adult segment. Using a measure of the intensity of competition, we also find that advertising expenditures increased by 17 percent 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.

Overall, these findings contribute to two literatures: the literature which examines the impacts of entry and, in particular, explains how differences among products and firms lead to differences in strategic responses and the literature linking the value of resources to changes in positioning. Like other studies in the literature exploring responses to entry, we identify circumstances leading to different types of responses. Empirical studies in strategy that address these topics typically take advantage of, as we do, one or more triggering events that reduce the number of confounding factors that affect observed outcomes. For example, Bowen & Wiersema (2005) find that foreign entry leads domestic incumbents to focus on their core businesses and Flammer (2015) observes that increases in competition created through tariff reductions lead firms to differentiate through investments in corporate social responsibility. Ethiraj & Zhou (2019) find full-service airlines, but not low-cost airlines, respond to entry threats with additional investments while Wang & Shaver (2014) find a negative relationship between higher brand equity and exit. There are, in addition, many papers that examine price changes in response to entry (e.g., Fleming *et al*., 1996; Simon, 2005; McCann & Vroom, 2010).

These studies delineate the types of strategic responses of incumbent firms to increased competition. But the settings studied typically do not allow the researchers to flesh out the

performance effects of such responses. By contrast, our product-level analysis makes it easier to observe differential performance outcomes resulting from differences in positioning and resource bases. Each product in our focal market has distinguishable positions and differs in terms of product-specific brand equity. In short, 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. We also consider cannibalization which would be a focus of a product-portfolio optimization.

In the literature linking the value of resources to changes in positioning, Grant (1991) and Amit & Schoemaker (1993) offer theories that link resources to the positioning of products while Aaker (2009) and Danneels (2011) do the same for brand equity resources. In terms of empirics, the literature that links the relative value of resources in light of demand-side changes in positioning has been relatively limited. That literature largely treats the values of resources determined by demand-side characteristics as exogenous to the resource-based view of firm advantage (Priem & Butler, 2001).

To our knowledge, our study offers the first empirical analysis in the strategy literature that measures in performance terms how repositioning changes the value of brand equity. We find that brand equity can be very local such that modest repositioning can be costly. With regard to brand equity and strategy, our study relates to three recent empirical papers, the first two (Wang & Shaver, 2014; Flammer, 2015) explore the value of brand equity in the context of intensifying competition and the third (Frake, 2017) measures the change in consumer perceptions resulting from an acquisition. Wang & Shaver (2014) focus on the response of incumbent television broadcasting firms to the entry of a single dominant firm, CCTV, in the Chinese television market and find that incumbents with more brand equity are less likely to

reposition away from CCTV. Our analysis complements the dominant firm analysis of Wang and Shaver by examining a relatively balanced oligopoly setting where competition from all firms must be considered. Flammer (2015) finds firms invest in brand equity in the form of CSR when competition increases because of a decline in tariffs. Both papers offer attractive analyses that establish the value of brand equity as a bulwark against competition, but neither evaluates the change in brand equity value with repositioning. The third paper, Frake (2017), shows that a craft beer's brand equity declines when the craft beer is acquired by a mainstream producer. Change in ownership is a common event that may trigger changes in consumer perceptions and may anticipate a possible repositioning of the acquired product. Frake (2017) finds the ownership change led to negative changes in consumer perceptions regarding the craft beer, though his analysis does not address the performance value changes that result with actual repositioning.

The remainder of the paper 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" (Ludwig 2005). 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 nine million young people in the U.S. were thought to be overweight (Kennedy, 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 towards 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. Industry self-regulation is also limited by antitrust law because of self-regulation's potential to facilitate collusion.

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 twelve. 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. After Post joined in October 2009 (Lee, Kolish & Enright, 2010) CFBAI member firms accounted for over 80 percent of industry sales.

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 grams of sugar per serving. Initially, Quaker Oats did not explicitly set a compliance level for sugar content (Kolish, 2008) and in 2010 set its sugar level at "≤ 25 percent of kcal added" (Kolish, 2008), consistent with its parent's snacks and beverage products targeted to children.[5] 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 31st 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 grams of sugar per serving with a 2013 start date (Kolish, 2011). This reduction took place outside our study period.[6]

2.2 The RTE Cereal Industry and Marketing to Children

In 2006 the top four manufacturers in the RTE cereal market controlled over 80 percent 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, 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 one percent (Price, 2000). The cost of launching a new product was significant in comparison to the

[5] PepsiCo's definition of its self-regulation sugar restriction was inconsistent with the other major manufacturers (i.e. PepsiCo distinguished between added sugar and naturally occurring sugar). However, all of the Quaker Oats children's cereals met the 12g threshold used by the other firms.

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

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 percent, much higher than the typical two to four percent in other food industries. Nevo (2001) argues that RTE cereal firms enjoyed a 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, Harris & Schwartz (2013) found that 91 percent of high-sugar cereal ads viewed by children caused the 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 getting them to eat cereal. The final decision, therefore, is partially driven by children who exert "pester power" (Lawlor & Prothero, 2011).

3. The Impact of Increased Competition and Repositioning: Theory

CFBAI's regulation induced high sugar children's cereals to reduce sugar levels, effectively shrinking the product characteristic space for children's cereals. This regulation is similar to minimum safety standards which may eliminate potentially lower-priced, lower-quality products that pose an unacceptable safety risk (Ronnen, 1991). More generally, the regulation is an example of an environmental shock that triggers repositioning of products to other segments of product space (Wang & Shaver, 2014).

Repositioning crowds other products, potentially creating increased competition for repositioned products and incumbent products alike (Crampes & Hollander, 1995). Changes to

the intensity of competition and resulting performance outcomes are influenced by changes in the number of competing products (Ronnen, 1991; Lutz, Lyon & Maxwell, 2000), how they are differentiated from one another, and changes in overall demand for these products.

One critical cost of repositioning, especially with regard to consumer products, is that repositioning may partially destroy differentiation advantages a product held at its original position, presumably because the advantages were optimized for that position. Consider, for example, product-specific brand equity. Aaker (1997) argues that a repositioned product may experience a deterioration in its brand equity because the change in the product's positioning creates a mismatch between consumer brand expectations and actual product performance.

3.1 Performance Impact of Increased Competition

The 12 grams 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 almost all high-sugar cereals, the "constrained" products, were either reformulated to meet the standard or discontinued. Given the central importance of sugar in children's cereals, this change in content represents a significant repositioning of those products leading to a crowding in the product characteristic space.

The impact of repositioning is somewhat subtle. Holding entry and exit fixed, repositioning increases the number of competitors in the lower-sugar part of product space. But the competition increasing effect of more competitors may be offset by an increase in demand for lower sugar cereals from customers who previously bought (now unavailable) higher-sugar offerings and some possible exit of more marginal cereal products. In addition, repositioning reduces the degree to which both the repositioned and the incumbent cereals are differentiated from each other, a force that intensifies competition. This latter effect is likely most acute for

cereal products with the maximum regulatorily-acceptable sugar level post regulation. Further, constrained cereals with original sugar content exceeding the standard were also likely to incur additional brand equity and reformulation costs. Given these opposing forces, a clear prediction on the changes in absolute performance for either group is difficult. We would, however, expect a relative reduction in profits for constrained cereals versus unconstrained cereals post-regulation. It also follows that firms with more constrained products will perform worse than firms with fewer constrained products.

3.2 Resource Transferability

We now turn to the role of resources in explaining performance differences among the products. Specifically, 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.

Brand equity is created over time through a firm's marketing investments and through the creation of a base of loyal consumers (Aaker, 2009) and it 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 do better with increased competition than products with less brand equity by creating more perceived differentiation in the minds of the consumer which, in turn, effectively reduces competition in a market.

The values of many resources, such as brand equity, are tied to the characteristics of the focal products or the characteristics of the focal firms (Montgomery & Wernerfelt, 1988; Aaker, 1997). In the case of products, it is useful to distinguish between product-specific and firm-specific brand equity. 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 in product-specific versus firm-specific brand equity? Product-specific brand equity would seem particularly valuable when products are more horizontally differentiated than vertically differentiated. In the vertical differentiation case, 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. 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 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 strong connection between product-specific brand equity and particular product characteristics has potentially 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 key determinant of a product's position is its sugar content. Hence, a change in sugar content potentially undermines the product-specific brand equity built at the original position. Furthermore, the value of a product's specific brand equity should decline more, the further the product is moved in product space (e.g., the more its sugar content changes). If the decline is rapid, then deterioration in product-specific brand equity would be a major consideration in repositioning. In addition, the rate of measured deterioration would be affected by whether repositioning is voluntary or involuntary where, for example, voluntary repositioning might be more benign as it might reflect changes in preferences of the primary target segment.

3.3 Strategic Responses to an Increase in Competition

The impacts of competition and the transferability of resources are critical factors affecting the strategic responses of firms to environmental shocks such as entry, exit, repositioning, and additional investment in resources. We consider these strategic responses next.

If product performance deteriorates or is expected to deteriorate because of increased competition, some exit or repositioning is likely and entry would be increasingly deterred (Seamans, 2012). We expect exit is most likely for products whose original performance was lower and whose repositioning costs are higher. In the case of children's cereals, there are technical costs of product reformulation and loss of product-specific brand equity associated with changes in product position. For marginal products, these costs could cause exit. This logic suggests, ceteris paribus, that constrained cereals are more likely to exit than unconstrained cereals.

In markets where a firm itself has competing products that compete with one another, cannibalization becomes relevant (Judd, 1985; Moorthy, 1992). In response to an external shock, such intra-firm competition may show up 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 and, if held at higher sugar levels, would need to rely on spillovers from the parent's advertising. Based on this argument, one also expects post-regulation exit or repositioning to be positively related to increases in within firm product competition.

For stronger products, these factors weigh in favor of maintaining position (Wang & Shaver 2014) or repositioning rather than exiting. For example, when resources that are closely tied to the product have substantial value, repositioning may be more attractive than exiting because repositioning allows some of the value of the resources to be continuously exploited (Sutton, 1991).

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 M. & 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.[7] 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 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 then 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 percent 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.

[7] 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 covers roughly 5 percent of all grocery stores in the U.S.

4.1 Defining Children's Cereal

Since the regulation at issue is directed towards 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 percent of the total impressions generated in the (2–11) age category for at least one year between 2004 and 2012 and categorize them as children's cereals.[8] For example, General Mills Cinnamon Toast Crunch is categorized as a children's cereal because it generated more than 36 percent 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 (4g) which was repositioned away from the children's segment well before CFBAI was implemented.[9] For the 73 identified children's products, firms generated between 85 to 100 percent (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.

'Insert Table 1 here,'

We begin with the IRI database which contains sales and prices for local city markets.

[8] 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 percent definition was the original General Mills definition and became the generally used definition (Lee, Kolish & Enright, 2010). The PepsiCo (Quaker Oats) definition was most different, but each product they classified as children's cereals was well above our 35% cut-off and products not considered children's cereals by either the PepsiCo definition or our definition, were at 10% or lower. Changing the definition around 35 percent does not make a substantial difference.

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

About 40 percent 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 percent of the total advertising spending on children's cereals, usually appear for one to two 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 to 2012. Summary statistics are provided in Table 1.

The heterogeneity of product-level positions and resources suggests that the impact of the CFBAI regulation will vary across products and firms. To give a sense of the differences in vulnerability to the regulation, consider Figure 1 which plots advertising versus sugar content of major children's cereal products in 2005 prior to the formation of CFBAI. The northeast quadrant (high sugar, high advertising) is occupied by both Kellogg's and General Mills. However, Kellogg's products tend to have higher sugar compared to that of General Mills. In the northwest quadrant (low sugar, high advertising), we find the best-selling General Mills Cinnamon Toast Crunch and Kellogg's Frosted Flakes. 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 regulation.

Figure 1 suggests that the regulation hit Kellogg's the hardest as it required the biggest changes to comply. The figure does not provide a clear basis for assessing which firm's products will encounter the largest increase in competition as a result of regulation. Nonetheless, based on compression of products along the sugar dimension, a comparison of the two figures provides evidence of increased crowding.

'Insert Figures 1 and 2 here,'

5. Empirical Models and Results

In this section we use data on the children's RTE cereals to investigate the ideas developed in Section 3. We follow the organization of Section 3 by first examining the impact of intensified competition on the performance of constrained and unconstrained products. We then assess the relative value of product-specific and firm-specific brand equity and the changes in the value of product-specific brand equity caused by repositioning. Finally, we discuss how firms strategically responded to the induced repositioning of the constrained cereals.

5.1 Impact on Product Performance (Constrained vs. 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. Hence, in this setting, changes in sales provide good proxies for changes in performance.

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.

'Insert Figure 3 here,'

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.[10] 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.[11]

The empirical specification is of the following form:

$$Y_{ijt} = \beta_0 + \beta_1 \times constrained_i + \beta_2 \times post_{it} + \beta_3 \times constrained_i \times post_{it} + X_{ijt}B + \phi_i + \gamma_j + \eta_t + \varepsilon_{ijt} \quad (1)$$

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 two years. This variable proxies for product-specific brand equity which is built in this industry through advertising spending (Aaker & Biel, 1993).[12] In addition, we create variable $Firm\ equity_{it}$ to capture firm-specific brand equity by aggregating annual advertising spending (again from a two-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,[13] γ_j is a fixed effect for city market *j*, and η_t is a year fixed effect. Inclusion of product and market fixed

[10] 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.

[11] 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, 2008).

[12] Variables $product\ equity_{it}$ and $firm\ equity_{it}$ extrapolate 2003 advertising spending using 2004 advertising spending adjusted by a factor based on the total advertising spending reported in the 10K.

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

effects control for fixed differences across products and markets, while the year fixed effect controls for common macroeconomic shocks.[14] Standard errors are clustered at the market level.

Table 2 summarizes our empirical results regarding product-level sales performance. Models (1) to (3) address relative sales changes with the variable $constrained_i \times post_{it}$. In all models, sales of constrained products decreased post-regulation more than sales of unconstrained products. For Model 3, with the most exhaustive set of controls, constrained products suffered a post-regulation decrease in sales of just over 4000 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 percent 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 four percent 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.

'Insert Table 2 here,'

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 constant both before and after regulation. We identify performance by replacing $constrained_i \times post_{it}$ in (1) with $standard_i \times post_{it}$, where $standard_i$ takes on the value of one for products with 12g of sugar and zero, otherwise. Mean sales decreased roughly 5,700 units more post regulation

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

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 percent of sales.[15] This result suggests that for 12g 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 short-run performance of firm *k*, we modify equation (1) to replace product interactions with firm interactions ($firm_k$ with $post_{it}$):

$$Y_{ijt} = \beta_0 + \beta_1 \times firm_k + \beta_2 \times post_{it} + \beta_3 \times firm_k \times post_{it} + X_{ijt}B + \gamma_j + \eta_t + \varepsilon_{ijt} \quad (2)$$

Table 3 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 post-regulation change is better. Given that Kellogg's had more, and Post and Quaker Oats had fewer, constrained products than General Mills.

'Insert Table 3 here,'

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 our focus from measuring general 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 $product\ travel\ distance_{it}$ and interact it with $product\ equity_{it}$.

[15] 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.

$Product\ travel\ distance_{it}$ 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.

$$Y_{ijt} = \beta_0 + \beta_1 \times product\ equity_{it} + \beta_2 \times product\ travel\ distance_{it} + \beta_3 \times product\ equity_{it} \times product\ travel\ distance_{it} + \beta_4 \times firm\ equity_{it} + X_{ijt}B + \phi_i + \gamma_j + \eta_t + \varepsilon_{ijt} \quad (3)$$

'Insert Table 4 here,'

Before interpreting the regression results, it is helpful to further explain our choice for the measure of firm-specific brand equity. 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, e.g. advertising for Fruit Loops only helps sales of Frosted Flakes via building Kellogg's firm brand equity, then same-firm spending on non-focal products can proxy for firm-specific brand equity spending on non-focal products.

With this construction in mind, the regression results in Table 4 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, of course, 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 non-focal 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 $product\ equity_{it}$ in Model 3 in Table 4 suggests a one million dollar increase in $product\ equity_{it}$ increases 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 X, the value of product brand equity is about 7 percent of sales.[16] 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 7-10% in sugar level) from its previous position, the incremental value of a one 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 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. On the other hand, the measured sales decline might also capture the impact of increased competition because most of the observed repositioning involved reductions of sugar. To check this possibility we controlled for the number of competitors at a given sugar level and found the Table 4 results robust to this addition. This check supports the view that the primary source of performance decline was the reduction in brand equity caused by repositioning.

5.3 Firm Strategic Responses to Regulation

Compliance with the sugar standard through induced product repositioning crowded the product

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

space and increased competition by forcing products to become more similar on the key taste dimension of sweetness. This crowding can lead to exit or repositioning away from a predominately children targeting.[17] In this subsection we explore these strategic responses.

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 one was a main brand product (Kellogg's Mini Swirlz). If the cost associated with greater repositioning (distance) is greater, then we expect it 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 12g sugar standard prior to regulation:

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

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 grams level, 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. Model 3 in Table 5 shows that the estimated coefficient for $sugar\ distance$ is 0.426 and is statistically different from zero, which posits the hazard rate of discontinuation for constrained products increases with the increase in sugar content. As discussed in Section 3.3, there are many possible factors leading to exit which may be captured by our sugar distance measure.

'Insert Table 5 here,'

We next examine whether an increase in competition caused by crowding increases

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

product repositioning to appeal to a broader or different segment of customers. 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. Figure 4 plots the distribution of television ads for children's cereals before and after regulation that are categorized by each advertisement's ratio of advertising "impressions" generated on adults to impressions on children, broken down by constrained and unconstrained products. The plots do not suggest a major differences on this dimension between the two product groups.[18] The plots also indicate that most children's cereals advertise heavily in children-only programming.

'Insert Figure 4 here,'

These plots suggest a good measure of repositioning is the change in the ratio of adult program advertising spending to children's program spending, $\frac{adult_{it}}{children_{it}}$. As suggested by Figure 4, for most of the advertised products in the children's segment of the market that ratio is relatively small. For example, Lucky Charms in 2006 had a ratio of 0.01 while Apple Jack's had a ratio of 0.18. We interpret an increase in the ratio as repositioning towards a different market subsegment, e.g. focusing more on teens than children.

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

[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.
[19] We decompose all products spanning the entire time frame (e.g., $product_i$) into three product characteristics (e.g., $sugar_{it}, sodium_{it}, protein_{it}$). 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)

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 ($number\ other\ competitors$).[21]

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

$$reposition_{it} = \beta_0 + \beta_1 \times competition_{it} + X_{it}B + \phi_i + \varepsilon_{it} \quad (5)$$

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 percent after regulation.

The product fixed-effect regression results reported in Table 6 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,

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that its three characteristics predicts the product to be $product_i$, denoting this estimate as $score_i$ for $product_i$, $score_j$ for $product_j$ etc.

[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. 0.2 was the smallest cutoff that still produced significant variability in the number of competitors. Varying the level from 0.2 to 0.5 did not significantly change the results.

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

the ratio of $\frac{adult_{it}}{children_{it}}$ advertising spending increases by 0.014, representing 20 percent of the mean $\frac{adult_{it}}{children_{it}}$ 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 strongly to adults by 2010. 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 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).

'Insert Table 6 here,'

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.

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

[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. $F = \frac{(SSE_0 - SSE_1)/(p1-p0)}{SSE_1/(n-p1)} = \frac{(10.337-9.803)/(18-16)}{9.803/(116-18)} = 2.67$, under H_0 follows $F_{2,98}$, p-value 0.0763.

[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.

dependent variable in the empirical specifications described in Table 6 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 7 (Model 1), the coefficient on $number\ all\ competitors$ (0.167) 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 percent 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 as children are likely to be more responsive to non-functional product attributes than adults, but we cannot determine the relative sizes of the effects.

'Insert Table 7 here,'

6. Discussion and Conclusions

This paper exploits a natural experiment involving self-regulation to evaluate how firms respond to entry in light of changes in competition and to estimate the value of their product-specific resources. Regulation led to a crowding of the product space by forcing differentiated products to become more similar. In our CFBAI setting the intervention regarding reduced sugar was very narrow—yet very important—and occurred in a market with a large number of differentiated products for key market variables are observable. These features make possible a granular assessment of repositioning with own and rival competition and brand equity resources.

These features give our study some advantages over previous studies regarding either repositioning in response to entry (Wang & Shaver, 2014; Flammer, 2015), 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 percent 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 percent 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 (Skidmore, 2009; Jargon, 2011). 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 two grams in a single year, whereas Kellogg's reduced sugar by three grams in a single year for two of its most popular products.[24] 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., (Banbury & Mitchell, 1995; Levinthal & Wu, 2010)). Our empirical analysis

[24] 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.

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 dominant firm entry-induced repositioning analysis with an analysis of repositioning that is induced by factors that simultaneously affect many near-equal competitors responding to, for example, regulation, technological change, or a shift in consumer preferences. 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 four 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.[25] Such uneven effects suggest that both self-regulation and regulation may be utilized strategically.[26] Examining the strategic use of regulation is beyond the scope of this paper, 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 post-regulation 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.

[25] 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., Hahn & Hird, 1991; Armstrong & Sappington, 2007).
[26] 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 grams standard.

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Figures and tables

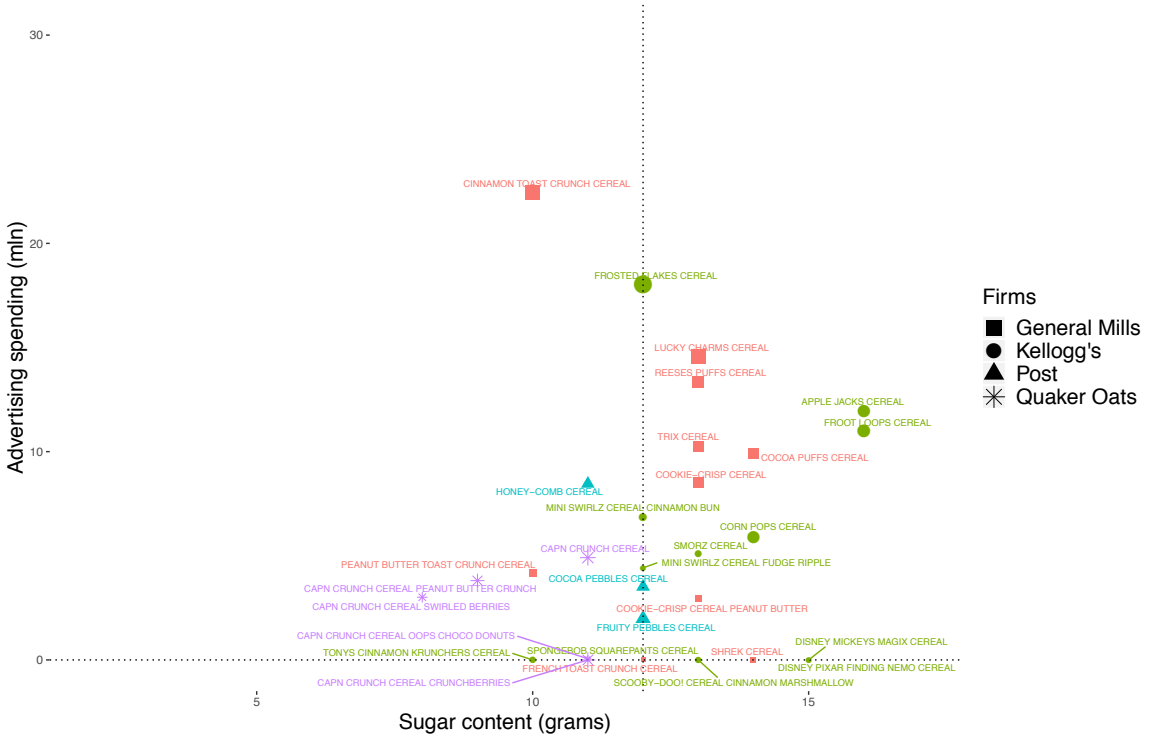

Figure 1: Product positioning of children's cereal: 2005.

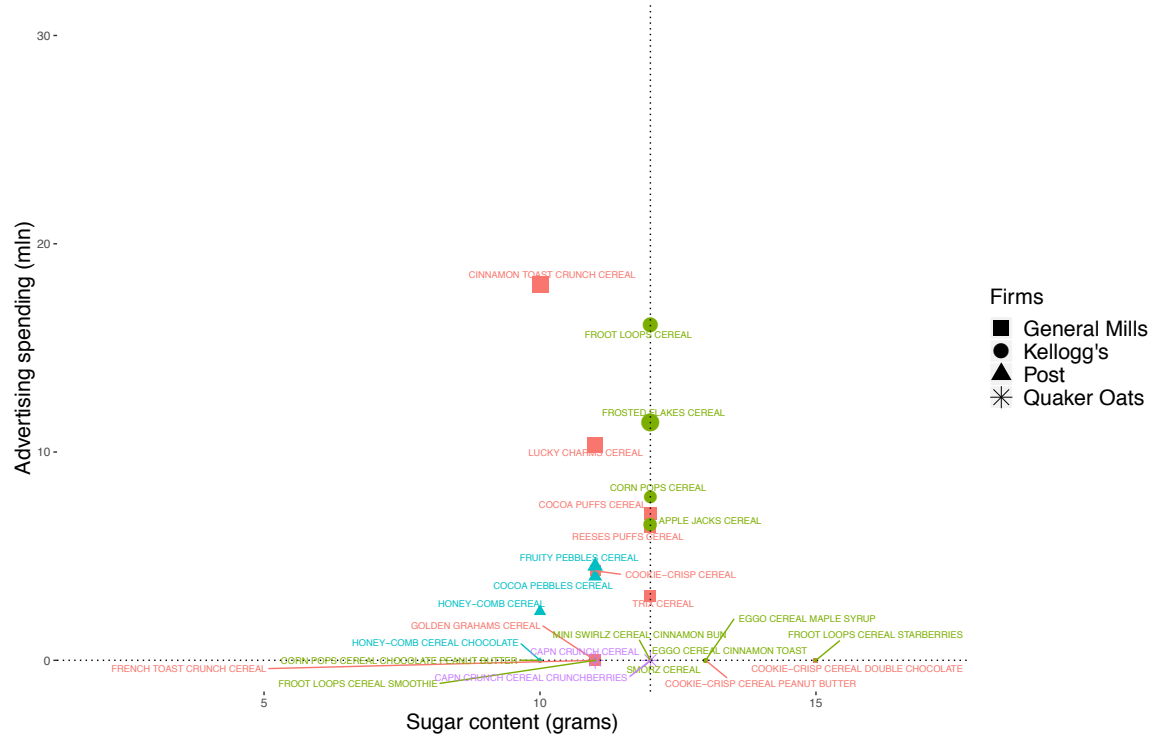

Figure 2: Product positioning of children's cereal: 2009.

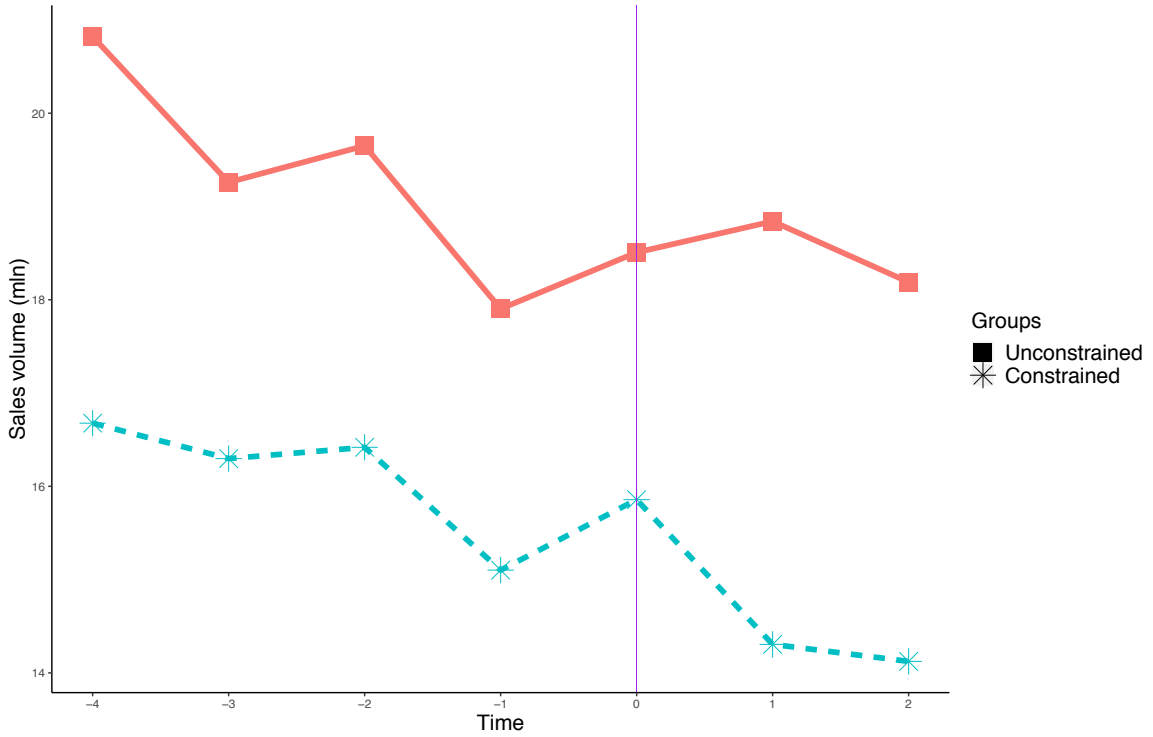

Figure 3: Sales volume comparison for constrained versus unconstrained products.

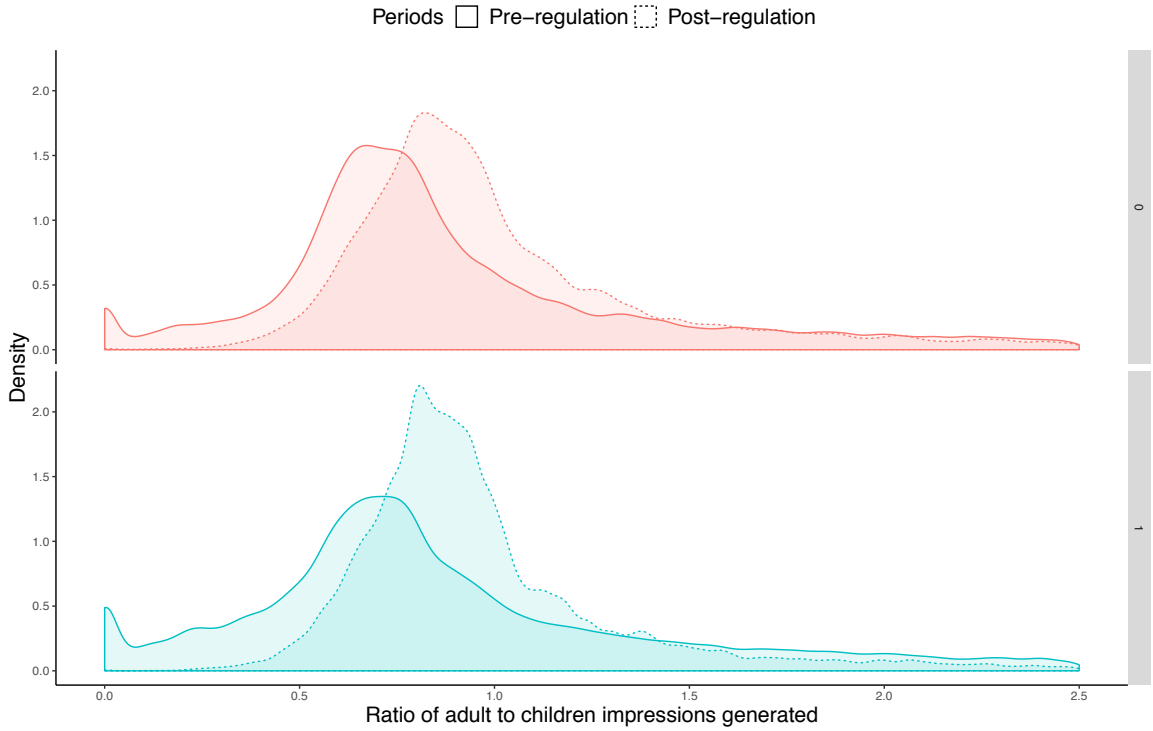

Figure 4: Distribution of television ads by audience ratio.

Table 1: Summary statistics on children's cereals.

Statistic	Mean	St. Dev.	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

Summary statistics are for children's products. Sales is 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 two 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 captures ads nationally. Sales data aggregated from IRI sample stores. Data aggregated at product-year-national level from 2004 - 2012.

Table 2: 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	0.789	0.791	0.794	0.817

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 grams of sugar per serving prior to regulation. Model (4) is subset to only unconstrained products, standard is a dummy variable that further subsets the unconstrained products, where 1 indicates unconstrained products that contained 12 grams of sugar per serving the year prior to regulation and 0 indicates unconstrained products that contained less than 12 grams of sugar. Product and firm equity are the average two 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 are 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.

Table 3: 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	0.737	0.739	0.744

Dependent variable is in number of cereal boxes sold in thousands standardized at 15.16 oz per box. Product equity is the average two 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 are 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.

Table 4: 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	0.792	0.793	0.794

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 two 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.

Table 5: 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	0.624	0.655	0.671

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 grams per serving. Product equity is based on cumulative advertising spending. Model (3) includes additional company fixed effects.

Table 6: Effect of product competition on repositioning.

	(1)	(2)	(3)	(4)
Number all competitors	0.014			
	(0.006)			
Number own competitors		0.045		0.021
		(0.022)		(0.032)
Number other competitors			0.018	0.012
			(0.008)	(0.012)
Product equity	0.049	0.049	0.048	0.049
	(0.015)	(0.015)	(0.015)	(0.015)
Constant	−0.654	−0.677	−0.619	−0.666
	(0.323)	(0.330)	(0.321)	(0.330)
Observations	116	116	116	116
R^2	0.406	0.400	0.404	0.406

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 based on cumulative advertising spending. Data ranges from 2004 to 2012 aggregated at the product-year level.

Table 7: 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	0.094	0.101	0.086	0.103

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 0.68. Data ranges from 2004 to 2012 and is at the product-year level.