The Impact of Voluntary Labeling*

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Abstract

Policy makers have mandated food labeling standards, for example through the Nutrition Labeling and Education Act. However, many claims made by firms are voluntary, such as when they label products as containing "low calories" and "no High Fructose Corn Syrup (HFCS)". This paper examines whether voluntary labels are used by firms in a way that is likely to be beneficial (e.g. providing information) or harmful to consumers (e.g. obfuscating negative information and highlighting favorable nutritional information). Examining the nutritional content of brands across various product categories where the use of the "no HFCS" label is prevalent, the findings indicate that products with the "no HFCS" label are less healthy, containing more sugars, than others. This result suggests consumers may be harmed by voluntary labels, especially if they are misled into thinking they are purchasing a healthier product. To further analyze consumer behavior in the presence of voluntary labels, we design an incentive aligned experiment. Our findings indicate that consumers obtain less information about product ingredients and are more likely to purchase nutritionally worse products in the presence of such voluntary labels. Finally, we discuss the policy implications of our results.

KEYWORDS: Voluntary labels; Nutrition; Marketing

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1 Introduction

The U.S. Food and Drug Administration (FDA) mandates, through acts such as the Nutrition Labeling and Education Act (signed into law in 1990), that firms report the nutritional content of their products, such as the calories, fat, cholesterol, sodium, fiber, total sugars and protein content. In addition, firms often use voluntary labels to selectively showcase certain attributes of their products to consumers, such as when they use "low calorie", "gluten-free", "low fat", or "no High Fructose Corn Syrup (HFCS)" labels. Such selective marketing can benefit consumers when products showcase claims that inform and are pertinent to a consumer, e.g., a "gluten-free" label is relevant for a consumer with celiac disease. At the same time, selective marketing strategies may showcase certain features at the expense of other relevant facts. For example, a "low fat" label may conceal the fact that the product is high in calories, potentially harming consumers by obfuscating relevant nutritional product facts.[1] Obfuscating labels are especially concerning because consumers not only believe the health claims but overgeneralize from specific claims to the overall healthiness of a product (e.g. Andrews et al. 1998).

This paper, focusing on the "no high fructose corn syrup (HFCS)" label, evaluates whether voluntary labels have an overall beneficial or harmful effect on consumer product choices.

The "no HFCS" label is of specific interest because of the evolution of its usage in food products and the changing consumer sentiment and scientific consensus around it. HFCS is a sweetener that was increasingly being used in most US food products due to its low cost relative to sugar. Following this widespread usage, an influential article in 2004 linked the increased usage of HFCS to the rising obesity rates in the US (Bray et al. 2004). This article sparked controversy about HFCS (Klurfeld et al. 2013), leading firms to begin labeling their products as containing "no HFCS".

However, more recently scientists have found that HFCS is no worse than sugar – in fact chemically the two are nearly identical[2] and are metabolized by the body in an identical way (Rippe and Angelopoulos 2013; Soenen and Westerterp-Plantenga 2013; White et al. 2010; Raatz et al. 2015). Moreover, as noted by the authors of the original article (Bray et al. 2004), the evidence was based on temporal links and did not present a causal effect. A subsequent editorial by Anderson (2007) pointed out that HFCS replaced sugar and was not used in addition to sugar. In other words, had sugar (and not HFCS) continued being used in US products, holding prices fixed, we would likely have seen the same increasing rate of

[1] In the context of this paper, these are not false claims.

[2] Table sugar is 50% fructose 50% glucose; the most commonly used HFCSs are HFCS-42 and HFCS-55 containing 42% and 55% fructose respectively with the remaining composed of glucose. HFCS and sugar are equal in terms of calories (4 calories per gram) and sweetness (Marcus 2013).

obesity. The current scientific consensus is that any form of caloric sweetener is harmful to a consumer's health.

The "no HFCS" label also provides a clean setting to study voluntary labels because it allows us to examine a simple nutritional construct - sugar content - across products. Examining calories and fat, for example can be ambiguous because not all calories are harmful. Calories that come from sources like whole grains or even certain types of fat can be beneficial. However empty calories that come from sugar and other caloric sweeteners are considered harmful to health. Moreover, as HFCS and sugar are equivalent and HFCS is intended to replace sugar, the "no HFCS" label makes for an ideal setting to study voluntary labels and the corresponding sugar content of products showcasing such labels.

To understand whether consumers benefit from the presence of voluntary firm labels, such as the "no HFCS" label, we turn to prior work to develop potential predictions. First, the theoretical literature on information disclosure predicts that, in equilibrium, high quality sellers will disclose signals of their quality, because otherwise consumers will interpret non-disclosure as a signal of low quality (Grossman 1981; Milgrom 1981; Jovanovic 1982). In our context, this theory would predict that all brands without HFCS should highlight the absence of this controversial ingredient in their products, thereby benefiting consumers by providing this information. Another way in which firms may use a voluntary label to inform and benefit consumers is if they wish to differentiate themselves from other nutritionally equivalent products in the market. For example, if two firms sell nutritionally equivalent products, but one contains no HFCS, while the other does, then the first firm would have an incentive to highlight this fact using a "no HFCS" label.

Second, in contrast to the literature on information disclosure, the obfuscation literature suggests that low quality brands would try to hide their low quality by providing other favorable information to consumers instead (Gabaix and Laibson 2006; Ellison and Wolitzky 2012). In our context, this theory would predict that nutritionally worse products would highlight the absence of HFCS through the "no HFCS" label in an effort to hide their otherwise unfavorable features. Such a practice would then harm consumers since they could end up purchasing and consuming nutritionally worse products.

Because of these opposing theoretical predictions, it is an empirical question to determine whether voluntary firm labels aid or harm consumers. Such a question is also policy relevant: if all sellers without HFCS engage in disclosure, it provides information with no harm done to consumers; however, if only low quality sellers engage in such disclosure it can potentially mislead consumers into buying what appears to be a healthier product (with the no HFCS label) but which is in fact nutritionally worse.

We use a two-pronged approach to answer this question. First, using firm-level labeling

data, we document which kind of firms use the label. Specifically, we ask whether all firms eligible to make the claim do so, or do only nutritionally worse products choose to display the label? Or, alternatively, do those products that are nutritionally equivalent to products that do use the ingredient choose to display the label? We then design an incentive aligned experiment to understand consumers' search and purchase behavior. This experiment helps understand consumers' substitution patterns in the presence of the label. Specifically, if consumers buy nutritionally equivalent or better products because of the label, then there is no harmful effect. However, if consumers buy nutritionally worse products because of the label, then such selective labeling can be harmful.

Using data from Nielsen IQ's Label Insight technology, that tracks package labels across a wide variety of products and categories, we provide three main pieces of evidence on the potential effect of voluntary labels. First, we show that, even though a majority of products do not contain HFCS (percentage ranges from 64%-100% across 24 categories we analyze), only a small fraction of products choose to advertise the absence of HFCS on their packaging (ranging from 2%-30% across 24 categories we analyze). This stark difference between the number of products without HFCS available in a category and the number highlighting the lack of HFCS per category is evidence inconsistent with predictions from the information disclosure literature. In other words, the majority of firms are not choosing to provide consumers information on the absence of HFCS from their products, even though such information may aid consumers.

Second, we focus on the subset of products that contain no HFCS and compare the sugar content of products displaying the "no HFCS" label with those that do not display such a label.[3] Our findings show that in 14 (out of 24) categories, products with the "no HFCS" label have more sugar than products without the label and that this effect is statistically and economically significant. The remaining ten categories have no significant association between the label and the product's sugar content. In no category is the effect significantly negative. These findings are consistent with the obfuscation literature: in the majority of categories, the products with more sugars (lower nutritional quality) are the ones highlighting the absence of HFCS. Thus, such a practice may harm consumers by misleading them into choosing products with a label that are nutritionally worse.

Third, we ask whether labeled products are better, worse, or nutritionally equivalent to their HFCS-containing counterparts. More precisely, we compare the sugar content of "no HFCS" labeled products to that of products containing HFCS (among all products in our data). Our findings indicate no statistically significant nutritional differences between the

[3]We need to focus on this subset of the data since products containing HFCS cannot use a "no HFCS" label.

products with the "no HFCS" label and the products containing HFCS. This finding suggests that firms with high sugar content and no HFCS could use the label to differentiate themselves from products with similar sugar content but that contain the controversial ingredient. Such a practice could aid consumers by providing them with relevant product information.

In sum, the firm level data supports both the possibility that voluntary labels aid (through differentiation) and harm consumers (through obfuscation). To directly study the effect of voluntary labels on consumer choices, we design a pre-registered incentive-aligned experiment. This experiment is intended to determine whether consumers' search and purchase behavior changes in the presence of voluntary labels. If consumers obtain additional relevant information about the nutritional content of a product in the presence of the label, then they will likely be benefited by it. If in contrast consumers ignore relevant nutrition information in the presence of the label, then they may be harmed by the label. For example if consumers substitute away from low sugar content products and choose those with high sugar in the presence of a label, then voluntary labels might be sub-optimal leading consumers to make inferior choices.

To test for these possible effects, we design a website mimicking a typical online grocery store where consumers can search and purchase products in a given category. In designing this website, we pick a category where sufficient products use the "no HFCS" label and where there is a significant correlation between the label and the sugar content of a product. The condiments category satisfies both of these criteria (see our evidence in section 3), and we focus on ketchup products to test the impact of the label.

The experiment was conducted with 1,486 participants, recruited through Prolific. Participants who entered our experiment saw 10 products displayed as a list on our website among which they could search. Each ketchup product was identified by an image, a brand name and price in dollars. From this list, participants could search a product by clicking on it, in which case they would navigate to a product page reserved for that ketchup where they could obtain additional information about the product. In particular, participants could see an enlarged image of the product, as well as click to read about its ingredients or nutritional facts. After searching a ketchup, participants could either return to the list page (by clicking a "Back" button) to search other products (including ones they had clicked on before), or terminate the search process and choose that ketchup for purchase or quit and choose not to buy anything.

The experiment contained three conditions - a Control condition, a "no HFCS" label Treatment condition, and a "gluten-free" label Treatment condition. Participants were randomized into each of these conditions with equal probability. Participants in the control group saw the 10 listed products described above. In the "no HFCS" label treatment group,

products that were eligible to display the label (i.e, contained no HFCS) advertised this fact in the image (through a "no HFCS" label), as well as in the text next to the brand name. Six of the 10 products displayed the label in the treatment group. In the "gluten-free" label treatment group, the same 6 products displayed a "gluten-free" label instead (products were eligible for both labels). This second treatment condition serves as a decoy, allowing us to test whether our results are due to the presence of a label in general or due to the specific "no HFCS" label used. The experiment also included a manipulation check to test whether consumers noticed the presence of each voluntary label.

The experiment was designed to be incentive-aligned, with participants having a 1 in 15 chance of receiving the ketchup product they purchased, in addition to a monetary bonus payment. If participants won the lottery, they would get the product for the price in the experiment plus the remainder as a cash bonus. If they chose not to purchase, they would receive the entire bonus as a cash payment. To study consumer search and purchase behavior, we recorded all clicks consumers made (which products they searched, whether they read about the product's ingredients or nutritional facts, how long they spent searching), as well as their final purchase decision. Once participants finished shopping on our website, they filled out a Qualtrics questionnaire consisting of questions about their gender, ketchup preferences, predisposition to check products' ingredient information, and knowledge of HFCS.

We find that voluntary labels do not impact the overall propensity to purchase – participants are no more likely to purchase in control relative to treatment. However, the presence of either voluntary label does impact the quality of products purchased: in the presence of the label, participants are more likely to purchase nutritionally worse products, i.e. ketchup with a higher sugar content. In the presence of the "no HFCS" label, participants are also less likely to click to see a product's detail page or to read about ingredient information. Therefore, participants spend less time searching in the presence of the "no HFCS" label.

In sum, we find that voluntary labels can lead participants to ignore relevant nutritional information, such as the presence of sugar and other sweeteners in a product, and to buy nutritionally worse products. This evidence allows us to conclude that the presence of voluntary labels has a harmful effect on consumers.

The next section describes the relevant literature. The following section showcases empirical evidence for or against various effects of voluntary labels using the firm-level labeling and nutrition data. This is followed by a section on consumer behavior in the presence of labels from our incentive-aligned experiment. The subsequent section discusses policy implications of our findings, while the last section concludes.

2 Literature Review

2.1 Firm Information Disclosure

This paper is broadly related to work on selective information disclosure. Hastak and Mazis (2011) document various types of truthful but misleading practices used by firms (e.g. "contains oat bran" might imply a substantial amount of oat bran; "no cholesterol" might imply competitors contain cholesterol). Moorman (1998) shows that some firms, when forced by a regulator to display their nutrient information, merely increase certain positive nutrients (e.g. vitamins) while not altering any of their negative nutrients (e.g. sodium). Rao (2022b) studies firm incentives to conduct selective research and/or report only favorable outcomes of scientific studies.

Within this work, several theories can be used to derive predictions on whether firm voluntary labels will have an overall beneficial or harmful effect on consumers. In what follows, we discuss these theories and their predictions in our context. We note however that our goal in this paper is not to uncover or test all possible theories on the effect of voluntary labels. Rather, our goal is to understand how harm or benefit to consumers can occur in the context of voluntary labels.

First, in the following sub-section, we discuss theories that would predict voluntary labels have beneficial effects and in the sub-section after that, we go over theories that predict harmful effects of voluntary labels.

2.1.1 Beneficial Effects

The theoretical literature on information disclosure predicts that, in equilibrium, high quality sellers will engage in full disclosure, because anything short of a full disclosure will be interpreted as a signal of low quality by rational consumers (Grossman 1981; Milgrom 1981; Jovanovic 1982). In the setting of this paper, this theory would suggest that all brands with products that do not contain HFCS will highlight this information in an effort to convince consumers about the high quality of their products. Such practices would benefit consumers by providing them with information that aids them make better choices.

Empirical support for this theory has been found in Mathios (2000) and Jin and Leslie (2003), who show that when disclosure is voluntary, high quality firms largely disclose their quality. Empirical work on the demand side has shown that consumers respond to more information when regulatory changes forced products to disclose certain features; in several cases, consumers are shown to benefit from such mandatory regulatory changes through purchases of products with higher nutritional value (e.g., Ippolito and Mathios 1990, 1995;

Moorman 1996; Araya et al. 2022).[4]

However, it is worth noting that empirical evidence has not always found support for the full information disclosure theory (Jin 2005; Edelman 2009), citing reasons related to differentiation in a competitive marketplace. According to the differentiation account, firms, that are otherwise similar to their competitors, may seek an advantage by highlighting a feature that differentiates them in order to demonstrate some level of superiority. In our context, if two firms sell nutritionally equivalent products, but one contains no HFCS, while the other does, then the first firm would have an incentive to highlight this fact using a "no HFCS" label in order to differentiate from the other firm. In this case again, consumers may benefit from the fact that a firm uses a "no HFCS" label, since this label provides her with additional product information. Higher quality firms may not highlight this information either to signal that all information about them is positive (a prediction consistent with the countersignalling literature, see Feltovich et al. 2002; Luca and Smith 2015), or because they have other attributes to showcase.

2.1.2 Harmful Effects

The theoretical work on obfuscation suggests that firms with low quality have incentives to obfuscate information. Gabaix and Laibson (2006) highlight incentives for firms to advertise virtues but hide their vices. Examples include banks, credit cards and hotels that showcase their features but hide the fees associated with these features.

Ellison and Wolitzky (2012) posit that, because of search costs, consumers will not engage in complete search over all attributes. Firms will therefore have incentives to increase search costs and hide their negative attributes (e.g., obfuscate prices). Correspondingly, because search is costly, firms will have incentives to present favorable information about themselves to consumers in an easy-to-search manner, e.g., in the front-of-the-package rather than in the ingredient list visible only on the back of the product. If this is the case, consumers will be more likely to become informed about favorable product characteristics and ignore other attributes. Ellison and Wolitzky (2012) also state that if obfuscation is costly, firms with the most to gain (higher markups) will engage in obfuscation hiding unfavorable information.

In the context of this paper, the firms with the most incentives to highlight their favorable information would be the less healthy products that showcase such claims in an effort to lead consumers to think their products are more healthy. Thus, this theory would imply that brands with the worst nutritional profiles, i.e. more sugar, will wish to obfuscate this negative information by highlighting the virtuous aspects of their products, i.e., the absence

[4]More recently, empirical work has shown that consumers respond to misleading information as well (Rao and Wang 2017; Chiou and Tucker 2018; Rao 2022a; Kong and Rao 2021; Fong et al. 2023).

of HFCS. If this is the case, then consumers may be harmed by the presence of voluntary labels.

Table 1 below summarizes the potential effects of firm voluntary labels that we described in this section.

Table 1: Predictions from the Literature on Firm Information Disclosure

Policy implication	*Who displays a "no HFCS" label?*	*Theory*
Beneficial for consumers	All (or most) products without HFCS carry the label	Full information disclosure
	Products (nutritionally) similar to those with HFCS carry the label	Differentiation
Harmful to consumers	Nutritionally worse products carry the label	Obfuscation

These theories and their predictions help guide our supply-side analysis in Section 3. However, while analyzing firm conduct gives us a description of which type of firm engages in voluntary labeling, whether such conduct is beneficial or harmful can only be confirmed by understanding consumers' behavior in the presence of the label. In the next sub-section, we delineate various theories that help guide our demand-side analysis.

2.2 Consumer Information Search

We also relate to the rich literature on consumer information search. Starting with the seminal work of Stigler (1961), papers in both Economics and Marketing have tried to understand how consumers trade off the benefit of searching against the cost to form their final consideration set, from which they make a purchase. This work has modeled consumers as searching to either reveal information about their match value with a product (Dukes and Liu (2016); Ke and Villas-Boas (2019); Ursu (2018); Ursu et al. (2020)), to reveal information about the market distribution of a relevant attribute, such as price (Rothschild (1974); Koulayev (2014); Santos et al. (2017); Hu et al. (2019)), or to reveal information about specific product attributes (Branco et al. (2012, 2016); Ke et al. (2016); Gardete and Hunter (2020)).

Most closely related to our paper is the latter work that models consumers as searching over product attributes. In these models, consumers start with some basic product information and decide sequentially whether to obtain additional information on other product features. Each additional search to reveal information about an unknown attribute is costly. In our context, we can think of consumers as starting with some information about the product, available on its front-package. Consumers can subsequently also obtain additional information from the back of the package in the ingredient list or nutritional facts information panel. Voluntary labels placed on the front of the package can affect consumer search by affecting the probability that consumers search for additional information. The voluntary label can help or harm consumers based on how it impacts search. For example, if all the

label does is save consumers an additional search of inspecting the back of the package, with the final product purchased unchanged, it can benefit consumers by reducing search costs. However, if consumers ignore other attributes, such as the presence of other sugars or total sugar content in the presence of the label, then such labels can lead to sub-optimal choices and harm consumers.

Table 2 below summarizes relevant predictions in our context made based on prior work on consumer search.

Table 2: Predictions from the Literature on Consumer Information Search

Policy implication	*What do consumers buy in the presence of the label?*	*Theory*
Beneficial for consumers	Nutritionally equivalent/better product	Label saves consumers search costs
Harmful to consumers	Nutritionally worse product	Label steers consumers to worse products

In what follows, we first introduce our data from Label Insight, which we will use to determine the voluntary label practices that firms most often employ. Then, in the subsequent section, we supplement this analysis with consumer level data obtained by running an online grocery experiment to study the effect of voluntary labels on consumer behavior.

3 Firm Level Data and Evidence

3.1 Labeling and Nutrition Data

To answer the questions posed in the paper, front-of-package labeling information, nutritional content, date the labeling information was collected as well as in-store availability data are used. Package labeling, nutritional characteristics and date of the label, across products and categories, are acquired from Nielsen IQ's Label Insight.

The data from Label Insight is cross-sectional with packaging and nutritional information available *across* brands. Because packaging information might change year-to-year, the UPC-level information is specific to a given year and month combination, i.e., corresponding to the date collected by Label Insight. To ensure claims specific to a year-month are also in-stores at that time, this UPC-year-month level dataset is matched to the Nielsen RMS dataset. Using each product's unique UPC and the month the data were collected as the two identifiers, we matched the data (for example, if a UPC had a different claim the previous year, matching by UPC alone would inaccurately reflect the claim descriptions; a UPC and month match circumvents this issue.). Only matched UPCs are kept for the final analysis. UPCs that are present in the Label Insight data but not present in the RMS data (or vice versa) belong typically to store brands, or involve atypical sizes or seasonal offerings.

Categories relevant to the analysis were determined from the Label Insight data downloaded in 2020. The cutoff used is such that at least 100 products in a category have the "no HFCS" label. Categories that did not make the cutoff include Gels & Pectins, Chips & Snacks, Alcohol and Dog Food. There are 24 categories that made the cutoff and that will be the focus of our analysis.These data are then matched with the RMS data, leading to a smaller subset of products, and to fewer than 100 products with the label in some categories.

Table 3 lists the top categories in our data that showcase the "no HFCS" label, the percentage products with the "no HFCS" label, the median serving size and the sugar content. The table shows that across these categories, 2%-30% of products showcase the "no HFCS" label with Bread & Buns being the most popular category (based on magnitude alone) with 680 products showcasing the label. Figure 1 shows some examples of products in these categories and how they showcase the label.

Table 3: Categories with "no HFCS" labels

Category	N products	N products with "no HFCS" labels	% products	Median Sugar Per 100g	Median Serving Size	Serving Size Unit
Bars	2,263	160	7%	22.50	45	g
Bread&Buns	2,868	680	24%	4.65	45	g
Cakes&Snacks	2,078	84	4%	32.93	70	g
Candy	5,925	150	3%	58.54	34	g
CannedFruit	420	30	7%	12.86	124	g
Cereal	1,049	233	22%	29.03	36	g
Condiments	1,579	185	12%	20.00	29	g
Cookies&Biscuits	3,355	297	9%	33.33	30	g
Crackers	915	33	4%	3.57	28	g
Deli	2,327	80	3%	2.54	30	g
IceCream	3,386	237	7%	21.92	79	g
IcedTea	734	39	5%	5.29	240	ml
Jam&Jelly	873	61	7%	52.63	20	g
Juice	2,439	222	9%	9.72	240	ml
Milk	1,009	60	6%	5.08	240	ml
Nuts&Snacks	4,423	76	2%	7.14	30	g
Pastries	596	40	7%	27.06	56	g
Pasta&PizzaSauce	1,038	41	4%	4.00	124	g
Puddings&Custards	305	91	30%	17.00	92	g
SaladDressing	1,637	359	22%	6.67	30	g
Snacks	1,911	43	2%	3.57	28	g
Soda	1,897	76	4%	10.55	355	ml
WholesomeSnacks	1,404	73	5%	46.43	40	g
Yogurt	1,953	296	15%	10.00	150	g

Note: Table showcases descriptives for products present in both the Label Insight and Nielsen RMS data.

Category: Snacks

Category: Puddings

Category: Bread & Buns

Category: Cereal

Figure 1: Examples of Products with the no HFCS Label Across Various Categories

3.2 Empirical Results

3.2.1 How Frequently do Firms use the "No HFCS" Label?

To understand how frequently firms employ the "no HFCS" label in practice, we look at the percentage of products that do not contain HFCS in each category, as well as check what fraction of these products highlight the lack of the controversial ingredient using a label. Figure 2 plots the percentage of products within a category that do not contain HFCS (gray bars). This percentage ranges from 64%-100% across the 24 categories, suggesting a majority

of products do not use HFCS. The same figure also shows the percentage of products within a category that choose to display a "no HFCS" label (black bars). Surprisingly, only a small fraction of products choose to advertise the absence of HFCS on their packaging - ranging from 2% in Snacks to 30% in Puddings & Custards (also seen from Table 3). This stark difference between the number of products without HFCS available in a category and the number highlighting the lack of HFCS per category is evidence inconsistent with predictions from the information disclosure literature. This is the case because if brands used voluntary labels to inform consumers, then we would expect all (or most) brands without the ingredient to highlight it, i.e. display a "no HFCS" label, which is not what we find. In other words, the majority of firms are not choosing to provide consumers information on the absence of HFCS from their products, even though such information may aid consumers.

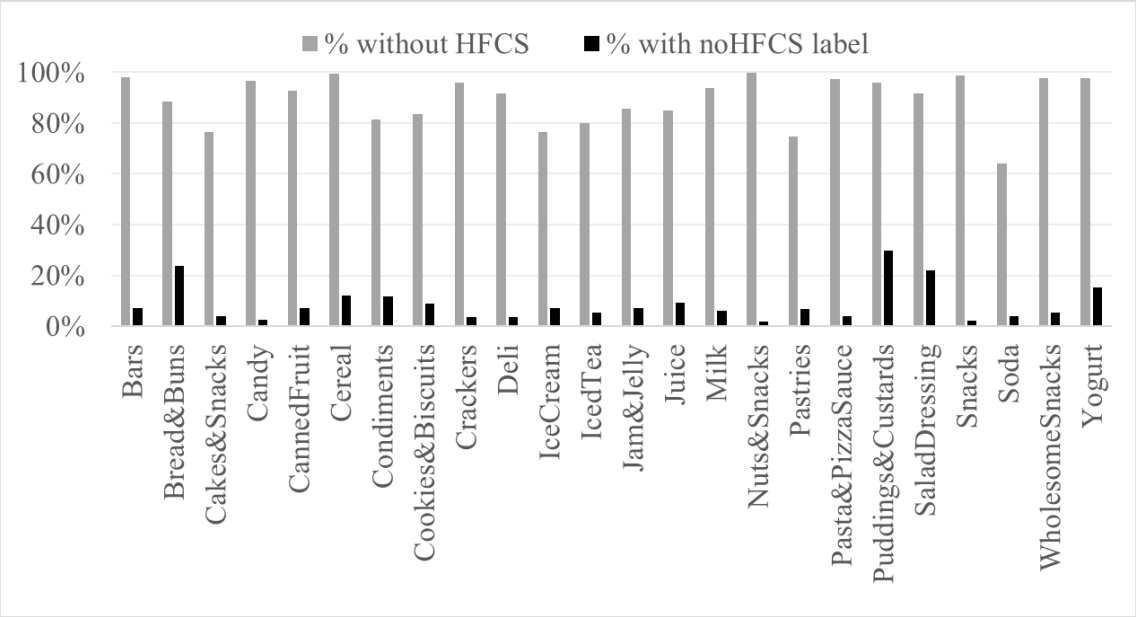


Figure 2: Percentage of Products without HFCS, and Percentage with the no HFCS label Across Categories

One reason why disclosure could be incomplete is if disclosure costs are high. However, in our context, disclosure amounts to printing an additional label on the package which is likely to be costless. Although printing this additional information might be costless, higher quality sellers might have other better attributes to showcase on their packaging. Because of limited package space they might choose to forego printing the no HFCS label so that they can highlight other relevant information to the consumer.

3.2.2 Relation between the "No HFCS" Label and a Product's Sugar Content

This section compares the sugar content of products displaying the "no HFCS" label with those that do not display such a label. For this analysis, we focus on products that do not contain HFCS (because those that do contain HFCS cannot display a "no HFCS" label). Using the amount of sugar per 100 grams of the product j, sugars per $100g_{j,ms}$, as the dependent variable, the following regression is estimated:

$$\text{sugars per } 100g_{j,ms} = \beta_0 + \beta_1 \text{noHFCS\_Label}_{j,ms} + \alpha_m + \alpha_s + \varepsilon_{j,ms} \quad (1)$$

where s corresponds to the sub-category product j belongs to, and m is the year-month combination when the claims data were collected. $\text{noHFCS\_Label}_{j,ms}$ is an indicator variable that identifies whether the product contains the "no HFCS" label or not and β_1 is the coefficient of interest. If β_1 is zero, this implies that products with the label are no different than products without the label in terms of sugar content. If β_1 is negative it implies that such products have less sugar and if β_1 is positive it implies such products have more sugar.

The regression also controls for year-month fixed effects, α_m, so that any time-specific changes are accounted for (e.g., a trend towards lowering sugar content might make sugar content in later years lower than in earlier years, and comparing products across years might lead to spurious effects). For the same reason, for each year-month combination, only those products that are available in-stores and for which the claims data are available are compared. In other words, a product in 2009 that is not available in 2012 or for which there is no available claims data[5] will not be compared with products available in 2012. α_s is the sub-category level fixed effect, that allows comparison of products with and without the label *within* each sub-category.The product categories themselves are fairly broad. For example the category Bread & Buns consists of sub-categories such as White Bread, Dinner Rolls, Naan, Hawaiian Rolls etc. The sub-category fixed effect enables comparison of products with and without the label *within* each sub-category, e.g., within Hawaiian Rolls.

Table 4 presents estimates of the β_1 coefficient on the $\text{noHFCS\_Label}_{j,ms}$ indicator across various categories and with increasing numbers of controls. Here we find that in a majority of categories (14 of the total 24 categories), products with the "no HFCS" label have significantly more sugar than those without the label. In the remaining categories. the estimate is not significantly different from zero. In no category is the effect significantly negative.

[5]Claims can change year over year for the same UPC. Using the precise date when the packaging claim was recorded by Label Insight ensures accuracy in case such changes occurred in other years.

Table 4: Regression Estimates: Sugar content and no HFCS labels

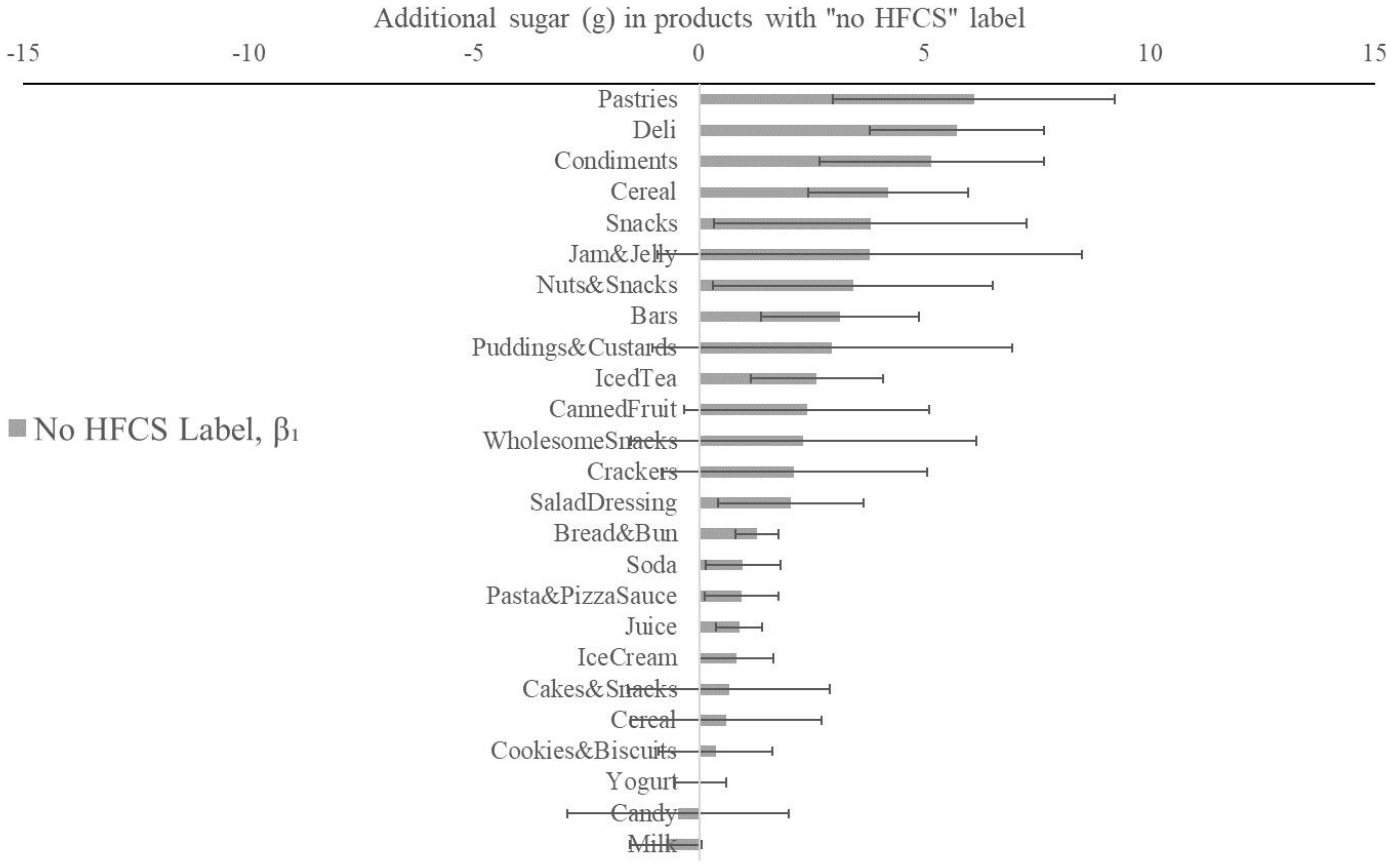
	(1)		(2)		(3)		(4)		
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	N Products
Bars	7.99***	0.96	8.82***	0.93	8.23***	0.95	3.12***	0.90	2,221
Bread&Bun	1.49***	0.27	1.56***	0.28	1.65***	0.29	1.28***	0.25	2,540
Cakes&Snacks	1.17	1.26	0.55	1.25	0.53	1.32	0.66	1.14	1,586
Candy	-4.35**	1.42	-4.22**	1.43	-4.96***	1.47	-0.47	1.25	5,720
CannedFruit	-1.15	1.40	-0.74	1.48	2.19	1.49	2.39+	1.39	390
Cereal	1.26	0.91	1.75	0.96	0.53	1.08	0.6	1.08	1,038
Cereal	8.45***	0.92	9.5***	0.95	7.54***	1.01	4.2***	0.90	1,741
Condiments	9.78***	1.27	10.47***	1.29	10.89***	1.36	5.16***	1.28	1,287
Cookies&Biscuits	-1.57*	0.71	-1.23+	0.73	-0.72	0.76	0.36	0.64	2,807
Crackers	4.54**	1.39	4.43**	1.38	5.43***	1.52	2.11	1.51	879
Deli	6.01***	1.16	6.02***	1.18	6.01***	1.22	5.72***	0.98	2,131
IceCream	-0.45	0.42	0.11	0.42	-0.42	0.42	0.83*	0.42	2,594
IcedTea	2.45***	0.69	2.61***	0.68	2.77***	0.74	2.61***	0.75	586
Jam&Jelly	-2.23	2.22	-1.04	2.25	2.85	2.39	3.79	2.40	749
Juice	1.34***	0.26	1.4***	0.26	1.23***	0.28	0.89***	0.26	2,068
Milk	1.63	1.29	1.15	1.31	1.16	1.33	-0.74+	0.41	945
Nuts&Snacks	8.16***	2.33	8.94***	2.32	8.98***	2.33	3.41*	1.58	4,408
Pastries	6.55***	1.58	7.57***	1.59	7.88***	1.65	6.1***	1.60	446
Pasta&PizzaSauce	2.37***	0.37	2.41***	0.39	2.09***	0.42	0.94*	0.42	1,010
Puddings&Custards	0.68	3.21	1.82	3.35	8.93*	3.71	2.95	2.04	292
SaladDressing	2.57***	0.75	2.5**	0.76	1.18	0.87	2.03*	0.82	1,502
Snacks	3.76*	1.74	4.82**	1.75	3.95*	1.84	3.8*	1.77	1,888
Soda	2.72***	0.58	2.52***	0.58	2.37***	0.58	0.97*	0.42	1,215
WholesomeSnacks	-26.34***	2.99	-25***	3.03	-18.72***	3.26	2.31	1.95	1,369
Yogurt	0.45+	0.24	0.73**	0.24	1.07***	0.27	0.03	0.29	1,911
Year FE			Yes						
Year-Month FE					Yes		Yes		
Sub-category FE							Yes		

Note: Table showcases estimates of the noHFCS label indicator variable. The dependent variable is the sugar content per 100g. Each row corresponds to estimates from regressions in that category. Column 1 presents estimates with no controls, Column 2 incorporates year fixed effects, Column 3 incorporates year-month fixed effects, and Column 4 incorporates both year-month and sub-category fixed effects. Categories in bold indicate cases where the effect is positive and statistically significant in the regression in column 4 with the most inclusive list of fixed effects. Data are restricted to those products that do not contain HFCS. + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

We can illustrate this result in a different way as well. Figure 3 plots the additional sugars in products with the "no HFCS" label relative to those without the "no HFCS" label across various categories using the β_1 estimates from the full specification with the most inclusive set of fixed effects (Table 4 , column 4). The categories in this figure are sorted in decreasing order of β_1. Once again we see that across most categories, products with the "no HFCS" label contain more sugars. We notice the largest effect in categories such as "Pastries", "Deli", and "Condiments".

These findings are consistent with the obfuscation literature: in the majority of categories, the products with more sugars (lower nutritional quality) are the ones highlighting

the absence of HFCS. Such a practice may harm consumers by misleading them into choosing products with a label that are nutritionally worse.



Note: Figure plots the estimated additional sugars in products with the "no HFCS" label, β_1 , across various categories. These estimates are obtained from the regression analysis specified in Equation 1 that controls for store availability, month and product sub-category fixed effects. Only products that do not contain HFCS are included in the analysis.

Figure 3: Additional sugars (g) in products with the "no HFCS" label

As a robustness check, we also control for the fact that categories differ in the number and the type of other labels that are displayed on products. For example, in the Cereal category these labels are fiber content, whole grains, free of artificial flavors and contains vitamins and minerals. Table 8 in Appendix A lists these top labels per category. To account for the additional labels present on products, we estimate a version of the regression in equation 1, but where we additionally control for the top four labels in each category (see equation 3 in Appendix A). Our main results from this section on the relation between the "no HFCS" label and the sugar content of a product continue to hold (see Appendix A).

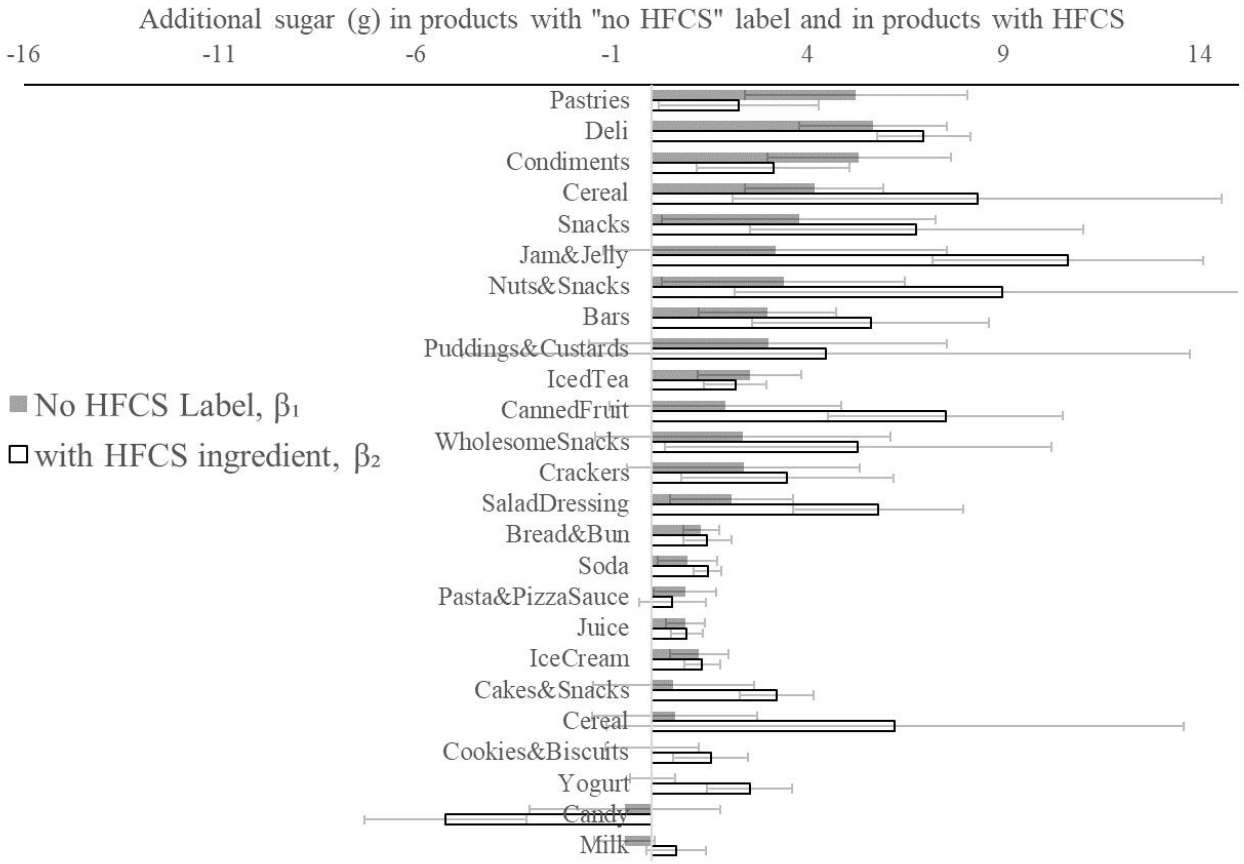
3.2.3 Are "No HFCS" Labeled Products Nutritionally Equivalent to Products Containing HFCS?

Our findings so far show that among all products that do not contain HFCS, products with the label are nutritionally worse than products without the label. However, it remains unclear whether among all products in our data, the labeled products are better, worse, or nutritionally equivalent to their HFCS-containing counterparts. The regression specified in equation 2 below helps answer this question.

$$\text{sugars per } 100\text{g}_{j,ms} = \beta_0 + \beta_1 \text{noHFCS\_Label}_{j,ms} + \beta_2 \text{hasHFCS}_{j,ms} + \alpha_m + \alpha_s + \varepsilon_{j,ms} \quad (2)$$

Here, β_1 corresponds to the additional sugars in products with the "noHFCS" label, and β_2 corresponds to the additional sugars in products that contain the ingredient HFCS. If $\beta_2 > \beta_1$, it implies that products containing the ingredient are nutritionally worse than products without the ingredient (and with the label); if $\beta_2 = \beta_1$ it would imply the two are nutritionally equivalent.

Figure 4 plots the two coefficients for each category controlling for year-month, α_m, and sub-category, α_s, fixed effects. The gray bars correspond to products with the label and the white bars correspond to the products with the ingredient. In most categories these bars overlap, suggesting the two kinds of products are nutritionally equivalent, i.e. show no statistically significant difference in their sugar content. This overlap is especially true for the 14 categories where a positive and significant association between the label and the product's sugar content was found earlier in this section (e.g. "Pastries", "Deli", or "Condiments"). In other words, there is no evidence that the "no HFCS" labeled products are nutritionally better than the products that contain HFCS. This finding suggests that firms with high sugar content and no HFCS could use the label to differentiate themselves from products with similar sugar content but that contain the controversial ingredient. Such a practice could aid consumers by providing them with relevant product information.



Note: Figure plots the estimated additional sugars in products with the "no HFCS" label, β_1, and thes estimated additional sugars in products containing HFCS, 2 , across various categories. These estimates are obtained from the regression analysis specified in Equation 2 that controls for store availability, month and product sub-category fixed effects. All products are included in the analysis.

Figure 4: Additional sugars (g) in products with the label and products with the ingredient

In sum, our evidence using firm level data supports both the possibility that voluntary labels aid (through differentiation) and harm consumers (through obfuscation). To directly study the effect of voluntary labels on consumer choices, in the next section, we design a pre-registered incentive-aligned experiment and measure consumers' response to firms' use of labels.

4 Consumer Behavior in the Presence of Voluntary Labels

In this section, we study how labels affect consumer behavior. Studying consumer demand in response to labels using observational data is challenging because exogenous variation in when a firm introduced a label is rare. Firms might introduce a label in anticipation

of demand, and a before-after analysis suffers from the usual endogeneity concerns. We therefore design an experiment designed to mimic a typical online grocery store. We now describe the details of the experimental design and our results, preceeded by an explanation of the category we chose to feature in the experiment.

4.1 Choice of Product Category

Of the 24 product categories studied in the previous section, we pick a category where a considerable percentage of products display the "no HFCS" label and where a significant correlation between the label and the product's sugar content was found.

Categories with more than 10% of products with the label include Bread & Buns, Cereal, Condiments, Puddings & Custards, Salad Dressing and Yogurt (see Table 3). Of these categories, as can be seen in Figure 3, Condiments, Cereal, Salad Dressing, Bread & Buns (in decreasing order of the magnitude of correlation) have a significant correlation with the label and sugar content. We therefore focus our experiment on Condiments as our broad category, with a further focus on the ketchup subcategory to ensure a consistent consideration set.

4.2 Experimental Design

In the experiment, participants are told they are shopping for ketchup on our online grocery store and can purchase at most one product among a list of 10 available options. Also, participants had the option not to purchase any of the ketchup products.

The experiment is designed to be incentive aligned: all respondents are entered into a lottery at the end of the study, with a 1-in-15 chance of receiving an award worth $10. More precisely, if a respondent wins the lottery, she will receive the product she chose in the experiment at the listed price and the remaining balance as a cash bonus. If the respondent does not pick a product in the experiment (i.e. she chooses the outside option of not buying any ketchup), then she receives the entire award as a cash bonus. All the instructions we provided participants are also illustrated in Figures 11-13 in Appendix B.

After reading these instructions and before navigating to our website to shop for ketchup, participants are randomized into one of three conditions - Control condition, a Treatment condition with the "no HFCS" label, and a Treatment condition with the "gluten-free" label. In each treatment condition, 6 of the 10 available products contained a label. The difference between the two treatment conditions relative to the control condition is the presence of the label displayed both in the image and in the title of a product. The only difference between the two treatment conditions is which label is used - no HFCS or gluten-free, i.e.

the products these labels are showcased on are identical across the two conditions (and are verified to be eligible for either label). The treatment condition with the "gluten-free" label will serve as a decoy, to test whether our results are due to the presence of a label in general or due to the specific "no HFCS" label used. Figures 5 and 6 below illustrate the list of available options for the Control and Treatment - no HFCS conditions.

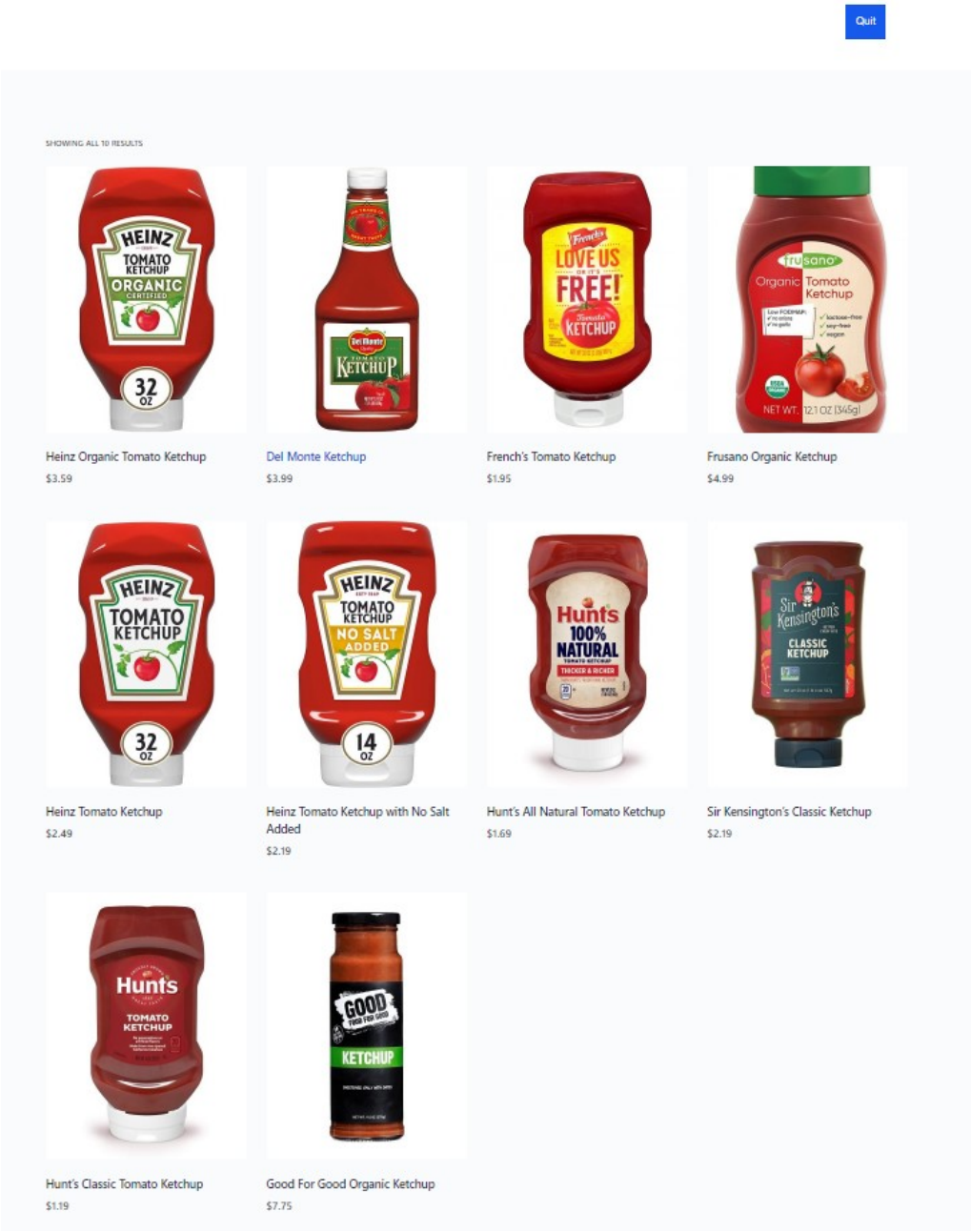


Figure 5: Control Condition List Page

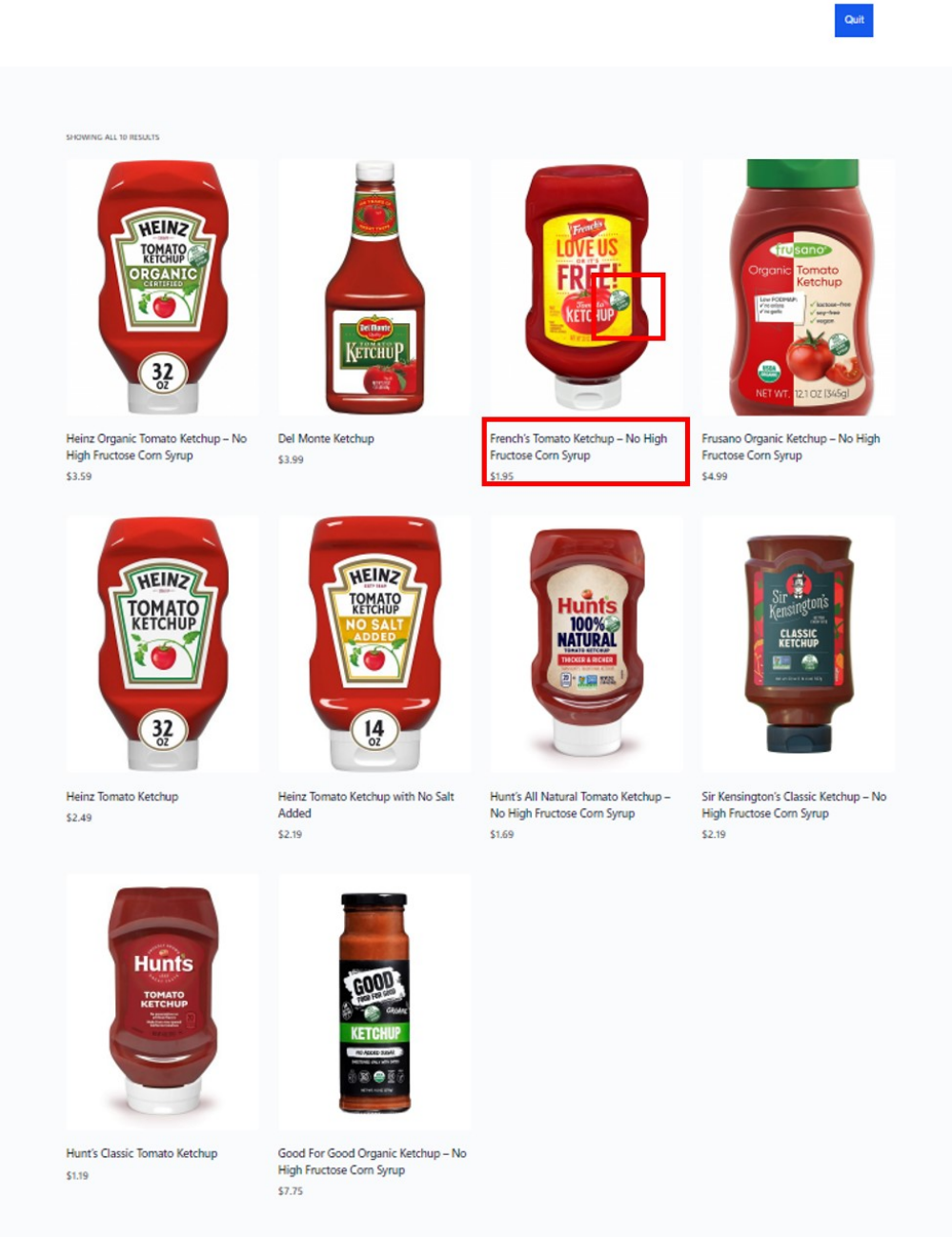


Figure 6: Treatment Condition List Page: Six products contain the label both in the image and in the product name below the image. See highlighted product French's for an example.

Each ketchup product was identified on the list page by an image, a brand name and a price in dollars. From this list, participants could search a product by clicking on it, in which case they would navigate to a product page reserved for that ketchup where they could obtain additional information about the product. On such a product page, consumers can see an enlarged image of the product, accompanied by the product's name and price, as well as clickable links to the Ingredients and Nutrition Facts of a product. Examples of product

pages are shown in Figures 7a and 7b in the control and treatment conditions, respectively. Product images are taken directly from manufacturer's websites with no alterations (except in the treatment conditions where the label images are added) to ensure a realistic shopping experience.[6] Prices are taken from Amazon (as of February 2023) and discounted by 50% so that participants have incentives to purchase the products and not just click out of the study. After searching a ketchup, participants could either return to the list page (by clicking the "Back" button) to search other products (including ones they had clicked on before), or indicate that they would like to terminate the search process and choose that ketchup for purchase (by clicking the "Buy Now" button). They could also, at any point, choose to not purchase anything (by clicking the "Quit" button). Once again, participants were made aware of these instructions before entering the website. Also, our design of the website mimicks a standard navigation pattern on most online retailer websites.

After finishing the shopping part of the study, respondents fill out a Qualtrics questionaire where they are asked questions about their ketchup consumption characteristics (frequency of consumption, favorite brand), importance of reading labels as well as ingredients list when they shop and their knowledge about HFCS. We record basic demographic information on all respondents (age, gender, and race). For details on all the questions we asked participants (in the order in which they were asked), see Figures 14-15 in Appendix B. We also included a manipulation check at the end of the experiment to test whether participants noticed and recalled the presence/absence of each voluntary label in their respective conditions (for the wording used in this manupulation check, see the last two questions displayed in the left panel of Figure 15 in Appendix B). Table 9 in Appendix C confirms that participants were more likely to notice the correct label when it was present.

4.3 Outcomes of Interest

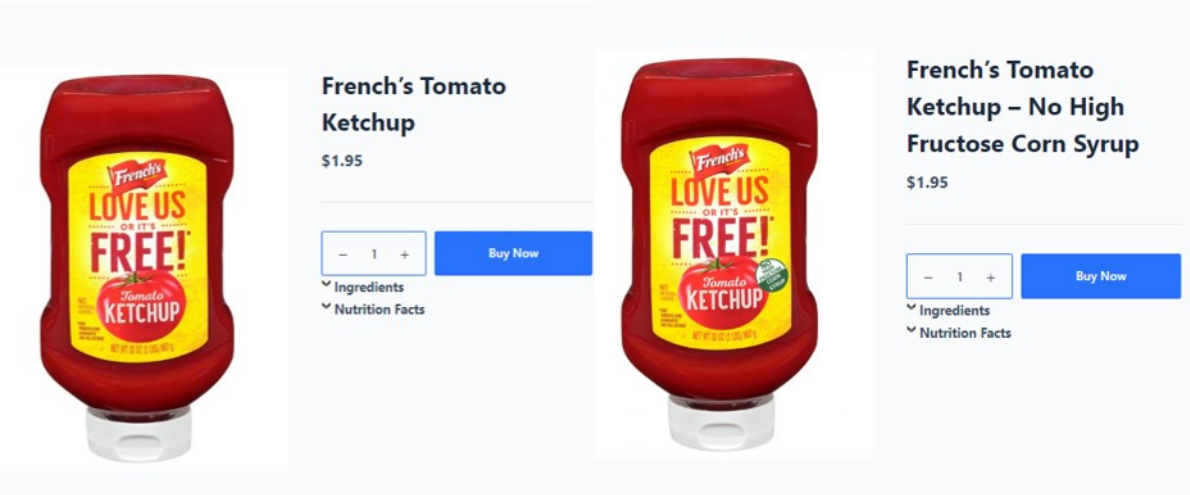
There are two outcomes of interest the experiment is designed to capture - consumer purchase and search decisions.

Purchase behavior

The key purchase outcomes we consider are whether respondents buy a product, whether they buy a labeled product, and the average sugar content of the products purchased.

By examining whether labeled products are more likely to be purchased in the treatment condition relative to the control condition, we can measure if the "no HFCS" label has a

[6]Fabricated products would not only be unrealistic, but we would also not be able to satisfy the incentive-aligned component of the experiment where we would not be able to ship non-existent products to respondents.



(a) Control Condition (b) Treatment Condition

Figure 7: Product Page

positive impact on demand.

By examining the average sugar content of the product purchased across conditions, we can measure if consumers substitute from low-sugar option or from equivalent or high sugar options. This substitution pattern is informative and helps address whether labels can be harmful or beneficial. If consumers substitute away from low sugar options, this can lead to worse health outcomes and it implies that firms can benefit from using voluntary labels as an obfuscation mechanism. If they substitute from equivalent sugar options to a labeled product, it implies that firms can benefit by using the label as a differentiator; consumers also benefit by avoiding products that contain the controversial ingredient. Finally, if they substitute away from high sugar options it also can also lead to better health outcomes because consumers choose healthier products in the presence of the label.

Search behavior

We capture the extent of search in response to the presence of voluntary labels using the total number of products clicked (clicks into a product page), the amount of information obtained on each product through inspection of the ingredients and nutritional facts panels, the time spent searching a product, as well as the time spent on the list page before clicking any products. By examining if the number of clicks (either into the product page or the ingredients and the nutrition facts drop-down menus) decrease when products with the label are present (treatment), we can measure if search behavior is modified in the presence of the "no HFCS" label.

4.4 Results

The study was pre-registered at AsPredicted (#124605) and was launched on the Prolific platform on March 14, 2023. The sample size was pre-determined to be 500 per condition. Data collection was complete in one day, with a total of 1,486 participants recruited. Participants spent approximately 5-7 minutes to complete the experiment and follow-up questions and were compensated $1.20. Table 10 in Appendix C performs a randomization check and confirms that participants randomized into each condition were similar across demographic and behavioral variables we gathered in our study.

Purchase behavior

Table 5 (column 1) presents the purchase propensity in all three conditions. In the control group, 83% of respondents purchase a product, in the no HFCS condition 2.8% fewer people purchase, i.e. 80%, and in the Gluten Free condition 0.5% more people purchase. However, these differences are not significant across conditions – respondents are no more likely to purchase in control relative to treatment.

However, the fact that overall purchases are not different across conditions does not tell us what kinds of products are purchased in control relative to treatment. To look at this question, we first check whether consumers have an increased propensity to buy the labeled products in either treatment condition. Table 5 (column 2) presents our results: 48.1% of participants buy a no HFCS product in the control condition (without the label), and while this number is 2.3% higher in the presence of a label, it is not statistically significant. Note that products with a label in the "no HFCS" condition are identical to those with a label in the "gluten-free" condition; only the label is different. Therefore, our results also indicate that participants are not more likely to buy labeled products in treatment versus control conditions.

Finally, we examine the average sugar content of purchased products. In Table 5 (column 3), we find that the average sugar content of products purchased in both treatment conditions is higher, by 0.14g, than in the control condition when no voluntary labels are available. Note that for this analysis we assume consumers who do not make a purchase in our experiment will purchase a ketchup with an average amount of sugar (4g) elsewhere. This finding indicates that the presence of the voluntary label leads to suboptimal purchase behavior, with respondents buying more sugary products. In other words, our results suggest that participants may be harmed by the presence of labels, since they switch to purchasing nutritionally worse products when these labels are showcased.

Table 5: Estimates of Consumer Purchase Behavior in the Presence of a Voluntary Label

	(1) Purchased a product	(2) Purchased a "no HFCS" product	(3) Average sugar purchased
No HFCS Condition	-0.028	0.023	0.146*
	(0.025)	(0.032)	(0.062)
Gluten Free Condition	0.005	-0.016	0.144*
	(0.024)	(0.032)	(0.062)
Constant	0.830***	0.481***	3.465***
	(0.017)	(0.023)	(0.047)
Number of Observations	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.176	0.215	0.967

Note: + p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001. Standard errors in paranthesis. The last row presents the p-value of a test between the two treatment conditions, No HFCS and Gluten-free.

Our results in this section are robust to futher controlling for participant demographics, favorite brand indicators, knowledge about sugar/HFCS harm and indicated level of importance attributed to reading product labels. For these additional results, see Tables 11- 13 in Appendix D.

Search behavior

Table 6 presents our results on how participants' search behavior is affected by voluntary labels. We find that participants are marginally less likely to click into a product page in the "no HFCS" condition compared to the Control condition (column 1). Also, participants are less likely to click on the ingredient list in the "no HFCS" treatment: 54% click into the ingredient list in the Control condition, and 7.6% fewer people, i.e., only 46.4%, click to learn about ingredients in the "no HFCS" condition (column 2). We do not find any difference in clicks to the nutrition facts. An explanation for such behavior is that the "no HFCS" treatment provides some ingredient information upfront to the participant (i.e. the product does not contain HFCS) so there is lesser need to click into the product page or the ingredient list page. In contrast, the label does not directly provide information that is available in the nutrition facts portion of the product page, so clicks to the nutrition facts menu are unaffected.

We see this pattern also reflected in the total time spent on a product page, which is lesser by 3.61 seconds in the "no HFCS" treatment (column 5). Finally, we also check whether

consumers spend a different amount of time on the list page before making the first click, but do not find any significant differences (column 4).

Table 6: Estimates of Consumer Search Behavior in the Presence of a Voluntary Label

	(1)	(2)	(3)	(4)	(5)
	Information search - Clicked into			Time spent searching (seconds)	
	A product page	Ingredient list	Nutrition facts	On the list page	On a product page
No HFCS Condition	-0.212+	-0.076*	-0.015	7.319	-3.611+
	(0.115)	(0.032)	(0.032)	(6.259)	(2.095)
Gluten Free Condition	-0.089	-0.047	-0.036	2.346	-2.486
	(0.119)	(0.032)	(0.032)	(1.745)	(2.758)
Constant	2.085***	0.540***	0.469***	23.868***	15.287***
	(0.086)	(0.022)	(0.022)	(1.231)	(2.017)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.272	0.360	0.496	0.427	0.567

Note: + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors in paranthesis. The last row presents the p-value of a test between the two treatment conditions, no HFCS and Gluten-free.

We note that these results occur in the Treatment - "no HFCS" condition, but not in the Treatment - "gluten free" condition. This finding suggests that the presence of any voluntary label is not sufficient for an effect on participant search behavior. Rather, labels that involve ingredients participants can substitute between (e.g. HFCS versus sugar) show this effect.

In sum, we find that participants are less likely to acquire information about other ingredients, such as the sugar content of a product, in the presence of a "no HFCS" label. As a result, they buy nutritionally worse products in the presence of the label, suggesting potential harm.The results presented in this section are robust to futher controlling for participant demographics, favorite brand indicators, knowledge about sugar/HFCS harm and indicated level of importance attributed to reading product labels. For these additional results, see Tables 14- 18 in Appendix D.

Behavior conditional on a purchase

Of special managerial importance are participants who make a purchase in our experiment. However, studying these participants introduces a selection issue. More precisely, if the "no HFCS" label attracts participants who like sugary products, then a finding indicating that the average sugar consumed is larger in treatment is not due to the label but rather due to the selection of participants in our sample. Nonetheless, we proceed to examine this subset of participants to understand whether at least directionally the same patterns we found earlier in this section hold for participants who make a purchase.

First, we find that the "no HFCS" label impacts which product is purchased (Figure 8). Conditional on a purchase, the "no HFCS" treatment condition sees a significantly higher percentage of purchases of products labeled "no HFCS" relative to the "gluten free" treatment condition, even though these products are identical in all aspects such as nutrition facts, ingredients and product image. The only difference is the label displayed.

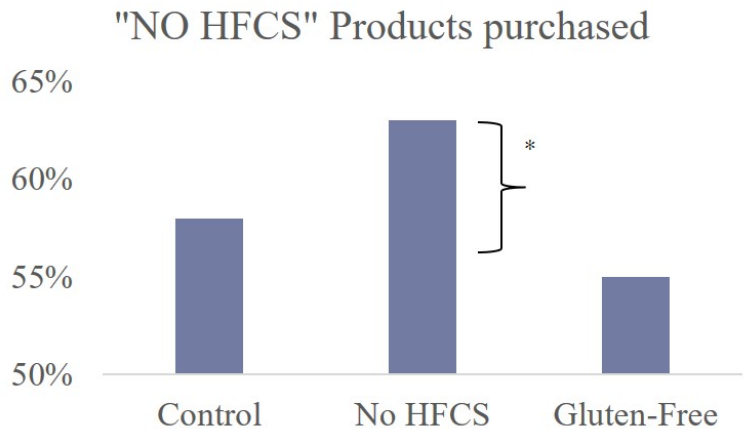


Figure 8: No HFCS label impacts which product is purchased

As discussed above, participants are less likely to search (click into a product page or ingredient list) in the treatment condition with the "no HFCS" label. If this behavior translates into participants purchasing sub-optimal (worse nutritional content) products in the presence of a label, we would once again show evidence consistent with the obfuscation literature. To study this question, we therefore examine the sugar content of products that are purchased in all conditions. Figure 9 shows that, in the presence of any label, among participants who purchase a product, they buy more sugary products on average. This finding implies that voluntary labels can lead to sub-optimal purchases, further supporting the obfuscation account.

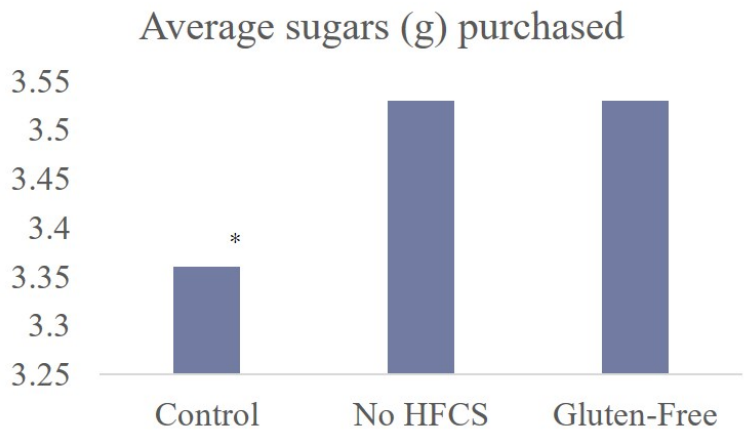


Figure 9: More sugary products purchased in presence of label

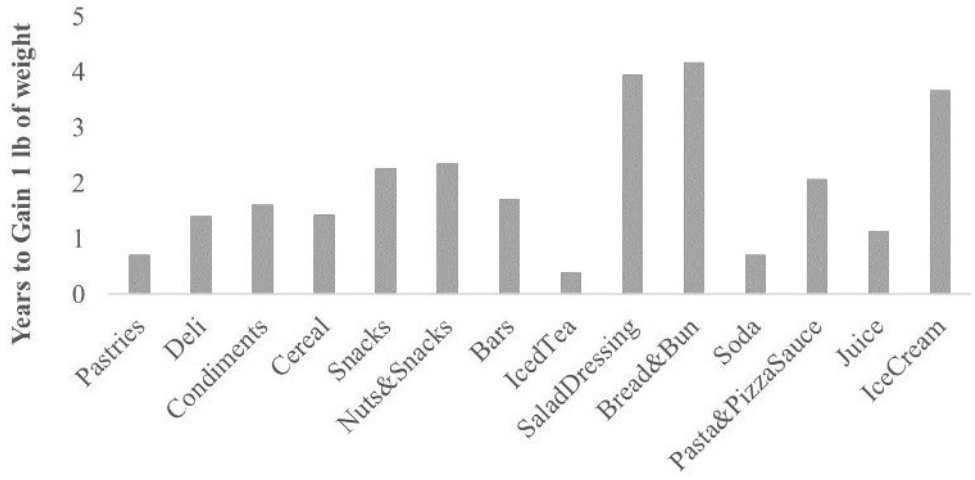
5 Economic Significance and Policy Implications

Based on our findings from the previous section, labels have the potential to mislead consumers into buying nutritionally worse products. To quantify the economic impact of such an impact and to understand the significance of these estimates, the additional sugars (estimated in equation 1 and presented in Table 4) are translated into calories and into the amount of time it would take to gain an additional pound of body weight. Taking the "Bars" category as an example, products with the "no HFCS" label have 3.12g additional sugars per 100g of the product (column 4, Table 4). For a median serving size of 45g (column 5, Table 3) this translates to 1.41g additional sugars or 5.62 additional calories[7] per serving. These additional 5.62 calories per day would accrue to 3500 calories in 1.71 years. Ignoring consumption of other products and other health repercussions of consuming excess sweeteners, one serving per day of a "Bars" product with the "no HFCS" label alone could contribute to an additional pound of body weight (assuming one pound of body weight is equivalent to 3500 calories) in 1.7 years.

Figure 10 plots this estimate across all categories where a positive significant association between the "no HFCS" label and a product's sugar content was found. In eight of the 14 categories, it would take less than 2 years to gain an additional pound of weight by consuming just 1 serving of any one product per day. At the extreme, these numbers for soda and iced tea are 8 months and 4.5 months respectively. The estimated number of years to gain an additional pound would further decrease if consumers consume more than one product across these categories per day (e.g., one product in the "Bread & Buns" category and one product

[7] 1g sugar = 4 calories

in the iced tea category) or consume more than one serving of a product per day. Overall, this exercise shows that the estimates reported in Table 4 are sizable.



Note: Figure displays, for categories where a positive significant association between the label and sugar content was found in Table 4, the number of years it would take to gain an additional pound of weight if one serving of a product with the "no HFCS" label was consumed (relative to consuming a product without the label)

Figure 10: "no HFCS" label products and Years to gain one pound of weight per category

From a policy maker's perspective, if consumers demand products with no HFCS, then showcasing the no HFCS label provides relevant information to the consumer. However, in our experiment we do not find evidence for such a demand (purchases of products with and without the label are not significantly different). Even if there exists no demand for the label, showcasing the label is not harmful by itself.

Moreover, if there is demand for sugary products, then the fact that the labeled products are sweeter is not necessarily problematic. However, the experiment shows that in the absence of the label, participants purchase lower-sugar options, indicating that, at least in the category we use, even though there is no strong preference for sweet products consumers might substitute to higher sugar options in the presence of the label.

Taken together, the firm-side analysis which shows that labeled products are typically nutritionally worse combined with the demand-side analysis which shows that labels influence the quality of products purchased, provides evidence that voluntary labeling can lead to consumer harm.

6 Discussion

High Fructose Corn Syrup is a controversial ingredient that has sparked consumer interest and scientific debate. Many firms highlight the fact that their products do not contain HFCS using the "no HFCS" label. However, if products that contain the "no HFCS" label are nutritionally worse than products without the label, such claims can mislead consumers into thinking they are purchasing a healthier product. It is therefore relevant to know the nutritional profile of such products. If the products with the "no HFCS" label are nutritionally equivalent or feature a better nutritional profile, then the presence of the label is not only informative but also beneficial. However, if the products are nutritionally worse such labels can be misleading.

This paper finds that products that highlight the "no HFCS" label on their product packages are often nutritionally worse, containing more sugars, than products not making such a claim. Unlike a consumer who studies the FDA-mandated nutritional label, a consumer basing her decisions on voluntary labels might be misled into buying a less healthy product. Thus, if consumers want to avoid sugary products and demand products with the "no HFCS" label, firms' current strategy might mislead consumers leading to over-consumption of sugary products. To the extent there exists a subset of consumers in the market that falls under the latter category, firms' policy could be obfuscating.

While this paper does not assert that firms are consciously obfuscating such nutritional information, if consumers are unaware of the above documented correlation between the no HFCS label and the sugar content of the product, they might make an inferior choice. Our results using the incentive aligned study shows that consumers are likely to make such suboptimal choices in the presence of a label.

We acknowledge our experiment focuses on one specific sub-category and that future work could explore whether the findings hold in other categories as well. Differences that might exist across indulgent versus staple categories might be interesting to document.

Our findings have implications for the debate surrounding whether voluntary labeling by manufacturers should be allowed (O'Neil 2014). A potential solution is to standardize voluntary labels so that all products that do not have HFCS always contain the label minimizing the potential for consumer confusion. Such standardization and mandatory labeling practices have been found to be effective in enhancing consumer outcomes in other settings (Ippolito and Mathios 1995; Hobin et al. 2017; Bollinger et al. 2011). At the same time, mandatory labeling can have unintended consequences. Moorman (1998) shows that some firms, when forced to display their nutrient information via a regulator, merely increase certain positive nutrients (e.g. vitamins) while not altering any of their negative nutrients (e.g.

sodium). Moorman et al. (2012) show that nutritional quality reduced after the enactment of the Nutrition Labeling and Education Act. Zhang (2016) posits that mandatory disclosure can be harmful if consumers wrongly infer the policy maker's motivation behind mandating disclosure. She shows that a mandated genetically modified organism (GMO) labeling policy can lead consumers to infer that GMOs are much more harmful than they actually are.

A middle ground to resolve the problems that emanate from voluntary labeling, suggested in Ippolito and Mathios (1990), could be achieved by a third-party certification of labels. Precisely because there are multiple dimensions of health attributes, an agency should evaluate all attributes while certifying a label. As shown in this paper the "no HFCS" labels and sugar content are positively correlated, both of which should be evaluated by a certifying agency to present a more complete picture to consumers.

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A Estimates Controlling for Top 4 Labels Per Category

In this section, we present results from a version of the regression in equation 1, but were we additionally control for the top four labels in each category. More precisely, in equation 3 below we include controls X_j, a vector of indicator variables reflecting whether product j has any of these top four labels available in a category. Our main results on the relation between the "no HFCS" label and the sugar content of a product continue to hold.

$$\text{sugars per } 100\text{g}_{j,ms} = \beta_0 + \beta_1 \text{noHFCS\_Label}_{j,ms} + \gamma X_j + \alpha_m + \alpha_s + \varepsilon_{j,ms} \tag{3}$$

Table 7: Regression Estimates: Sugar content and no HFCS labels

	(1)		(2)		(3)		(4)		
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	N Products
Bars	3.52***	0.89	4.36***	0.87	4.19***	0.89	2.51**	0.88	2,221
Bread&Bun	1.77***	0.32	1.9***	0.33	2.01***	0.34	1.4***	0.28	2,540
Cakes&Snacks	0.39	1.21	-0.07	1.21	-0.06	1.27	-0.18	1.13	1,586
Candy	-4.07**	1.44	-3.96**	1.45	-4.81**	1.49	-0.54	1.26	5,720
CannedFruit	0.12	1.34	-0.19	1.39	2.26	1.39	2.21+	1.27	390
Cereal	6.77***	0.85	7.38***	0.89	6.42***	0.93	4.05***	0.85	1,741
Condiments	9.49***	1.31	10.17***	1.33	10.55***	1.40	5.47***	1.30	1,287
Cookies&Biscuits	-0.59	0.78	-0.55	0.79	0.32	0.82	1.13	0.70	2,807
Crackers	5.03***	1.43	4.83***	1.42	5.81***	1.55	2.55+	1.55	8,79
Deli	6.36***	1.25	6.35***	1.26	5.85***	1.31	6.22***	1.04	2,131
IceCream	-0.11	0.40	0.36	0.40	-0.05	0.41	0.48	0.40	2,594
IcedTea	2.09**	0.68	2.31***	0.66	2.66***	0.74	2.46**	0.75	586
Jam&Jelly	-1.1	2.42	-0.03	2.47	0.75	2.62	1.6	2.66	749
Juice	1.5***	0.26	1.52***	0.26	1.36***	0.28	1.06***	0.26	2,068
Milk	2.33*	1.13	2.14+	1.14	2.02+	1.17	-0.78+	0.41	945
Nuts&Snacks	8.49***	2.26	9.14***	2.25	9.23***	2.25	4.38**	1.57	4,408
Pastries	6.06***	1.63	7.08***	1.64	6.88***	1.73	5.16**	1.66	446
Pasta&PizzaSauce	2.44***	0.38	2.45***	0.39	2.12***	0.42	0.92*	0.42	1,010
Puddings&Custards	12.71	3.07	14.23***	3.36	13.59***	3.66	3.92+	2.20	292
SaladDressing	3.25***	0.78	3.22***	0.80	2.04*	0.92	2.62**	0.87	1,502
Snacks	3.82*	1.69	4.72**	1.70	4.11*	1.79	3.43+	1.75	1,888
Soda	2.18***	0.49	1.98***	0.49	1.89***	0.49	1.07**	0.41	1,215
WholesomeSnacks	-23.68***	2.97	-23.34***	2.98	-16.73***	3.21	2.26	1.97	1,369
Yogurt	0.21	0.25	0.46+	0.25	0.84**	0.27	-0.06	0.29	1,911
Year FE			Yes						
Year-Month FE					Yes		Yes		
Sub-category FE							Yes		
Controls	Top 4 Labels Per Category								

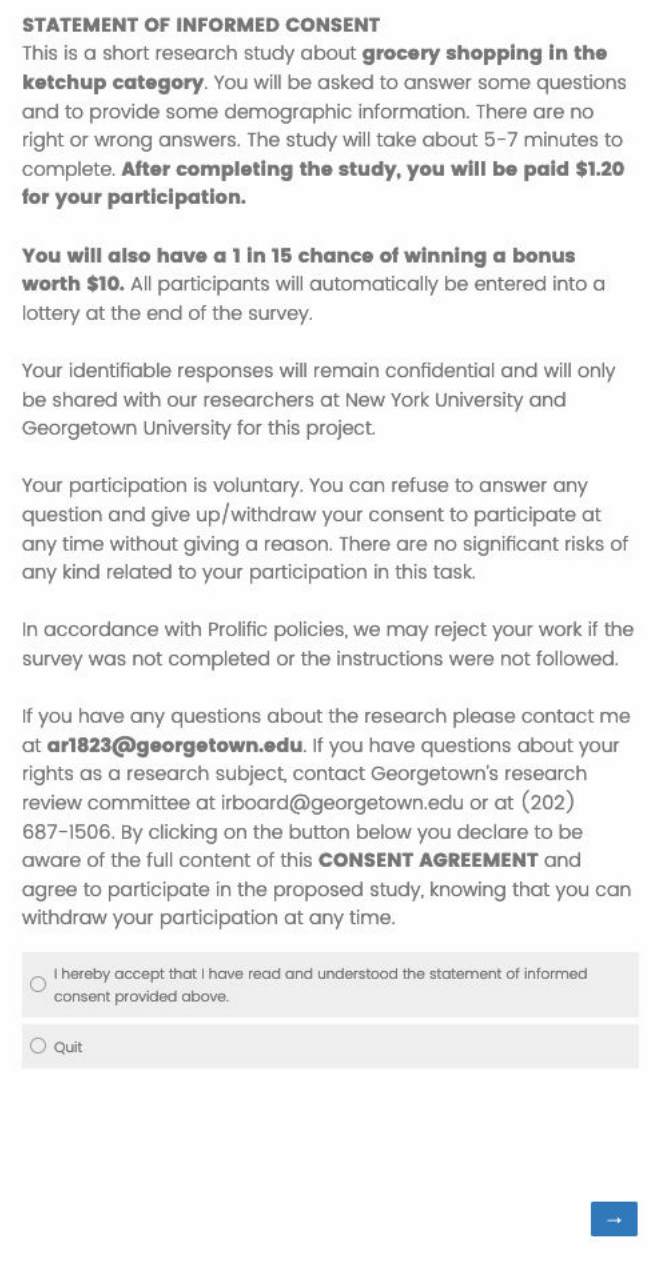
Note: Table showcases estimates of the noHFCS label indicator variable. The dependent variable is the sugar content per 100g. All regressions control for whether the product contains any of the top 4 labels in that category. Each row corresponds to estimates from regressions in that category. Column 1 presents estimates with no controls, Column 2 incorporates year fixed effects, Column 3 incorporates year-month fixed effects, and Column 4 incorporates both year-month and sub-category fixed effects. Categories in bold indicate cases where the effect is positive and statistically significant in the regression in column 4 with the most inclusive list of fixed effects. Data are restricted to those products that do not contain HFCS. + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 8: Top Labels per Category

	Label 1		Label 2		Label 3		Label 4		
Category	Label	%	Label	%	Label	%	Label	%	N
Bars	Gluten	57%	Protein	58%	GMO	41%	Natural	26%	2,263
Bread&Buns	WholeGrain	23%	Calorie	21%	TransFat	25%	Artificial	18%	2,868
Cakes&Snacks	Nautral	18%	Calorie	10%	Peanut	11%	Gluten	6%	2,078
Candy	Natural	26%	Calorie	27%	Gluten	26%	Fat	13%	5,925
CannedFruit	BPA	34%	Calorie	19%	HeavySyrup	13%	Gluten	27%	420
Cereal	WholeGrain	47%	Fiber	37%	Natural	30%	Sweetened	19%	1,752
Condiments	Gluten	40%	Calorie	15%	Natural	24%	Organic	4%	1,579
Cookies&Biscuits	Calorie	12%	Sugar	10%	Artificial	17%	Gluten	16%	3,355
Crackers	Artficial	22%	Calorie	19%	Wholegrain	23%	TransFat	21%	915
Deli	Gluten	18%	Calorie	12%	Kosher	7%	Artificial	8%	2,327
IceCream	Calorie	26%	Gluten	23%	Natural	25%	RBST	21%	3,386
IcedTea	Calorie	63%	Natural	54%	Gluten	20%	Organic	24%	734
Jam&Jelly	Calorie	26%	Gluten	26%	Natural	26%	Artificial	17%	873
Juice	Pasteurized	52%	Ingredient	54%	Calorie	50%	Vitamin	44%	2,439
Milk	Pasteurized	79%	Vitamin	77%	RBST	57%	Fat	61%	1,009
Nuts&Snacks	Gluten	24%	Calorie	14%	Salted	12%	Protein	13%	4,423
Pastries	Natural	22%	Calorie	11%	TransFat	14%	Cinnamon	6%	596
Pasta&PizzaSauce	Gluten	38%	Natural	39%	Organic	10%	Presevative	20%	1,038
Puddings&Custards	Gluten	34%	Natural	19%	Preservative	21%	Calorie	17%	305
SaladDressing	Gluten	51%	Calorie	24%	Artificial	20%	Organic	10%	1,637
Snacks	Gluten	39%	Protein	30%	Calorie	17%	Ingredient	33%	1,911
Soda	Calorie	49%	Natural	45%	Caffeine	46%	Phenylketonurics	6%	1,897
WholesomeSnacks	Gluten	40%	Organic	24%	Calorie	29%	GMO	24%	1,404
Yogurt	Natural	43%	Gluten	38%	Protein	41%	Vitamin	33%	1,953

Note: Table showcases top 4 labels in each category. % refers to the percentage of products with that label.

B Experiment Instructions and Qualtrics Survey



STATEMENT OF INFORMED CONSENT

This is a short research study about **grocery shopping in the ketchup category**. You will be asked to answer some questions and to provide some demographic information. There are no right or wrong answers. The study will take about 5-7 minutes to complete. **After completing the study, you will be paid $1.20 for your participation.**

You will also have a 1 in 15 chance of winning a bonus worth $10. All participants will automatically be entered into a lottery at the end of the survey.

Your identifiable responses will remain confidential and will only be shared with our researchers at New York University and Georgetown University for this project.

Your participation is voluntary. You can refuse to answer any question and give up/withdraw your consent to participate at any time without giving a reason. There are no significant risks of any kind related to your participation in this task.

In accordance with Prolific policies, we may reject your work if the survey was not completed or the instructions were not followed.

If you have any questions about the research please contact me at **ar1823@georgetown.edu**. If you have questions about your rights as a research subject, contact Georgetown's research review committee at irboard@georgetown.edu or at (202) 687-1506. By clicking on the button below you declare to be aware of the full content of this **CONSENT AGREEMENT** and agree to participate in the proposed study, knowing that you can withdraw your participation at any time.

Figure 11: Consent Form

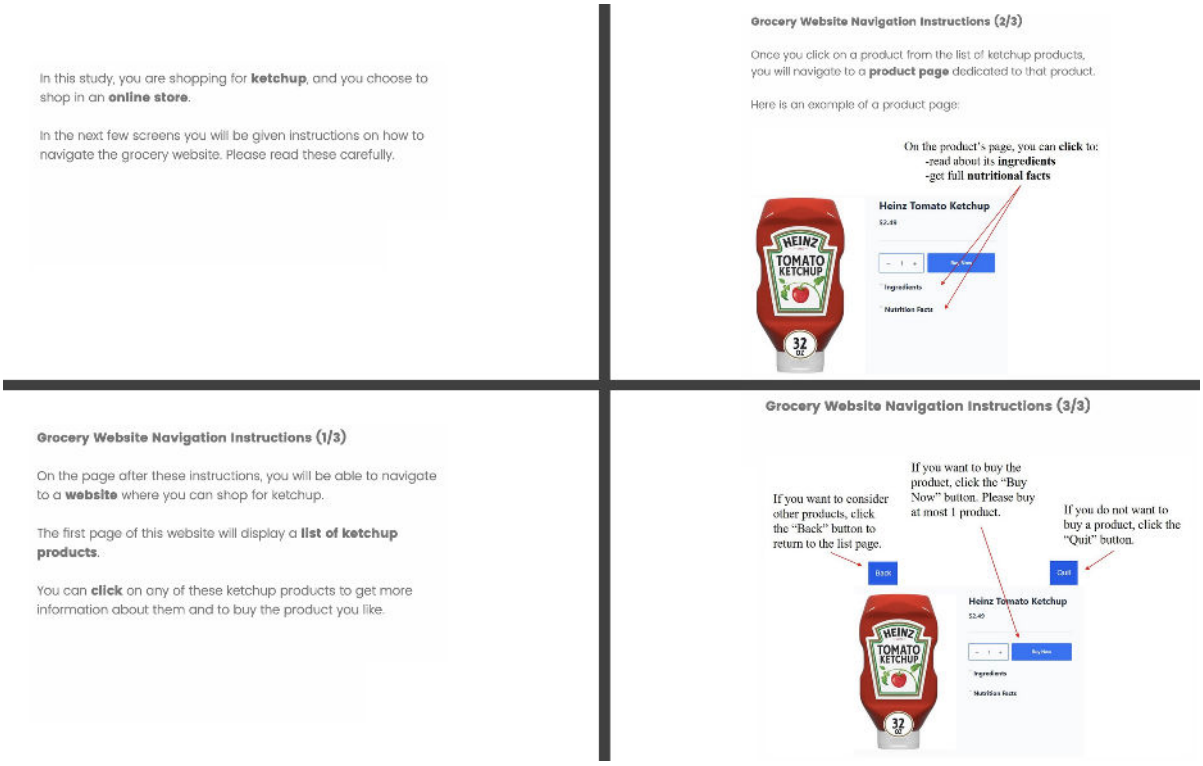


Figure 12: Shopping Website Instructions

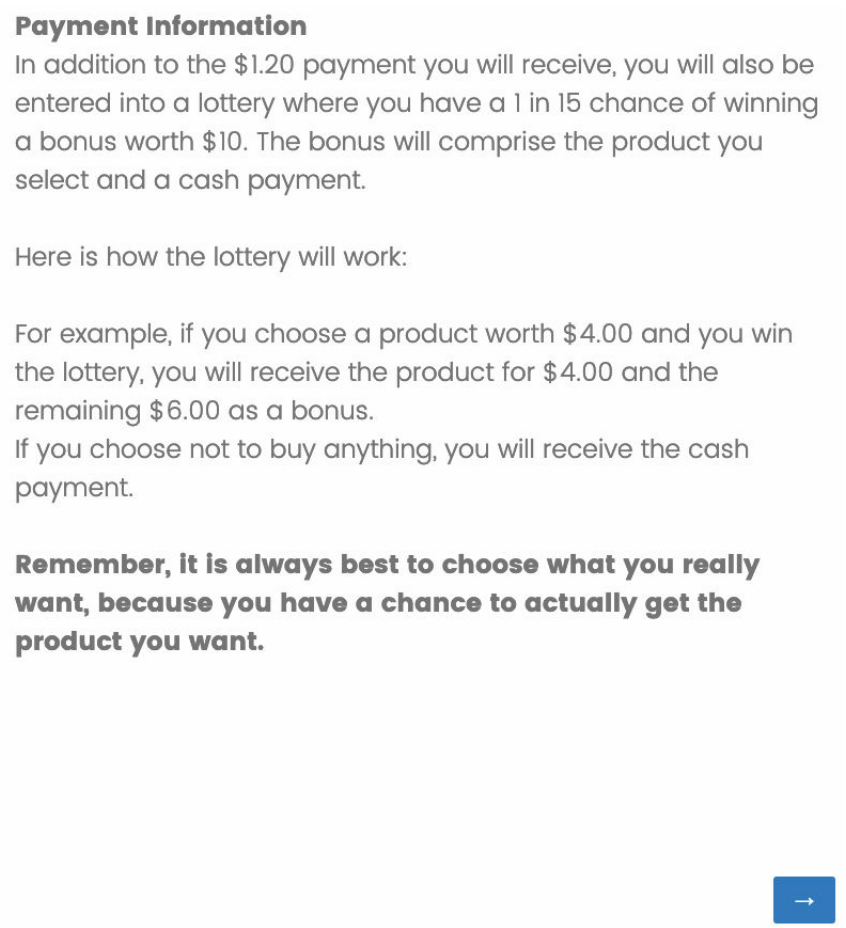


Figure 13: Payment Information

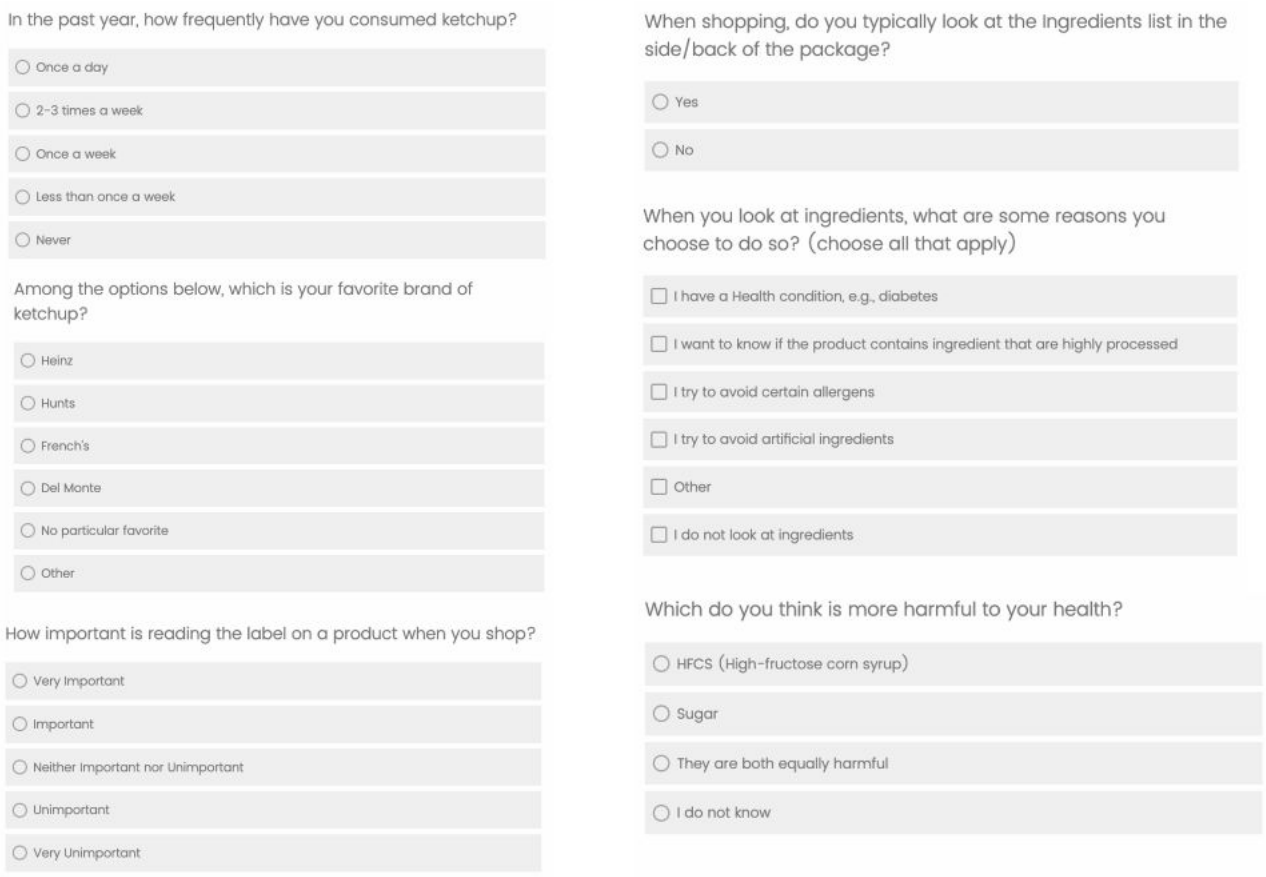


Figure 14: Qualtrics Survey Questions (1/2)

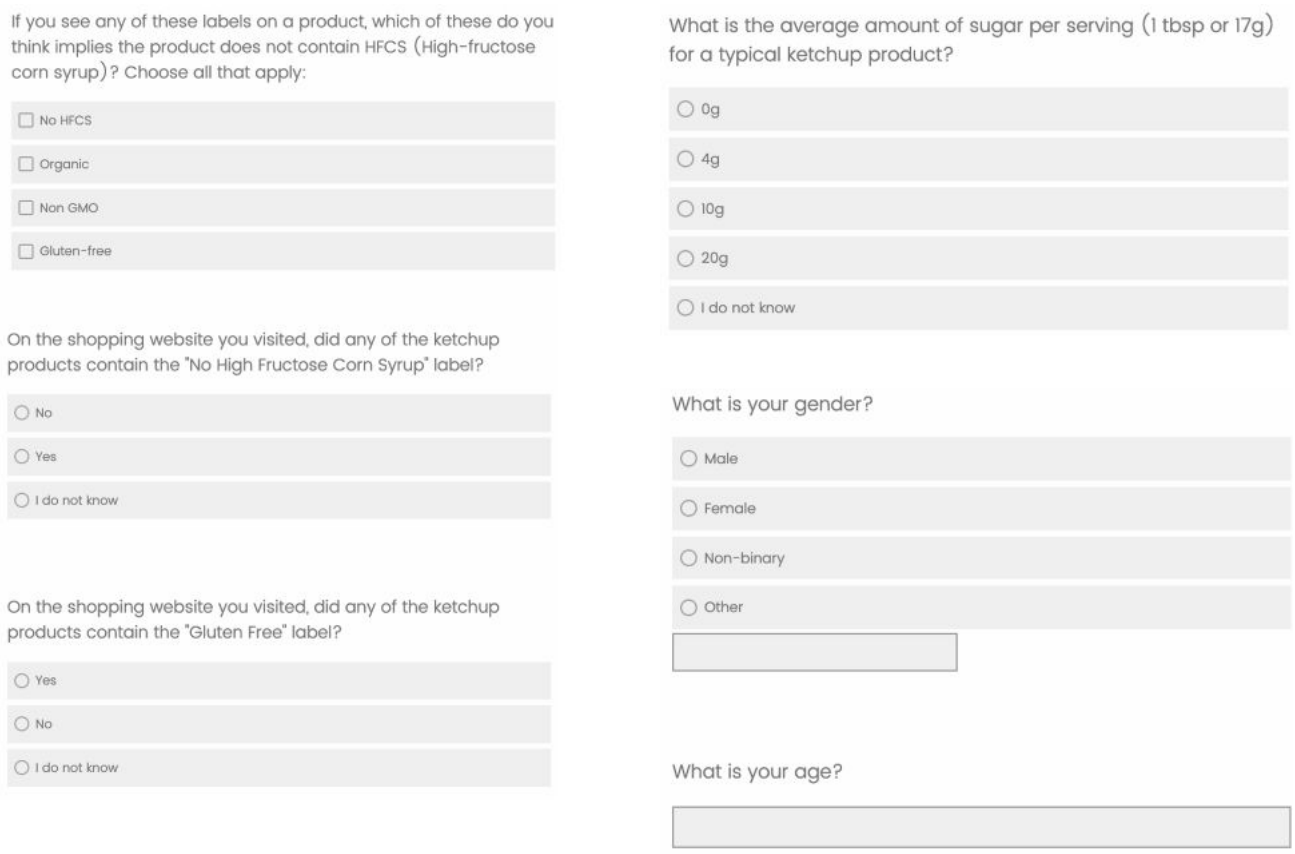


Figure 15: Qualtrics Survey Questions (2/2)

C Randomization and Manipulation Checks

Table 9: Manipulation Check

		Condition		
	No HFCS	Control	Gluten Free	p-value
Did any ketchup products contain a "no HFCS" label?				
Yes	64%	23%	21%	p<0.001
No or I don't know	36%	77%	79%	p<0.001
Did any ketchup products contain a "gluten free" label?				
Yes	32%	33%	69%	p<0.001
No or I don't know	68%	67%	31%	p<0.001
Number of Observations	498	493	495	

Table 10: Randomization Check

		Condition		
	No HFCS	Control	Gluten Free	p-value
Demographics				
Female	48%	47%	50%	0.671
White	78%	80%	80%	0.573
Black	7%	7%	7%	0.890
Average age	41.793	42.004	42.101	0.930
Behavioral				
Avoid products with HFCS	46%	43%	45%	0.774
Avoid products with gluten	8%	10%	10%	0.491
Avoid products with GMO	22%	20%	24%	0.402
State reading label is important	75%	77%	76%	0.587
Look at ingredients panel	71%	75%	74%	0.248
Think sugar is more harmful than HFCS	6%	7%	6%	0.636
Think sugar and HFCS equally harmful	45%	47%	49%	0.610
Consume ketchup once a day	3%	2%	3%	0.262
Consume ketchup 2-3 times a week	33%	32%	35%	0.630
Consume ketchup once a week	28%	30%	26%	0.343
Consume ketchup less than once a week	34%	33%	34%	0.955
Never consume ketchup	2%	3%	2%	0.569
Favorite brand is Heinz	59%	60%	60%	0.908
No favorite brand	29%	28%	28%	0.855
Number of Observations	498	493	495	

D Robustness Checks

Table 11: Purchased a product

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	-0.028	-0.026	-0.026	-0.021	-0.023
	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)
Gluten Free Condition	0.005	0.005	0.005	0.006	0.005
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Constant	0.830***	0.956***	0.872***	0.837***	0.750***
	(0.017)	(0.051)	(0.065)	(0.067)	(0.075)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.176	0.196	0.204	0.256	0.254
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS harm			Yes	Yes	Yes
Favorite brand FE				Yes	Yes
Demographic controls					Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 12: Purchased a "no HFCS" product

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	0.023	0.033	0.033	0.031	0.030
	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Gluten Free Condition	-0.016	-0.012	-0.012	-0.011	-0.011
	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Constant	0.481***	0.359**	0.186	0.245*	0.219+
	(0.023)	(0.113)	(0.124)	(0.121)	(0.129)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.215	0.148	0.145	0.177	0.181
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes
Demographics					Yes

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 13: Average sugar purchased

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	0.146*	0.133*	0.136*	0.140*	0.140*
	(0.062)	(0.060)	(0.060)	(0.058)	(0.058)
Gluten Free Condition	0.144*	0.132*	0.135*	0.145*	0.146*
	(0.062)	(0.061)	(0.061)	(0.059)	(0.059)
Constant	3.465***	3.548***	3.691***	3.529***	3.617***
	(0.047)	(0.174)	(0.181)	(0.146)	(0.160)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.967	0.984	0.995	0.931	0.910
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes
Demographics					Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 14: Information search - Clicked into a product page

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	-0.212+	-0.184	-0.189+	-0.186	-0.192+
	(0.115)	(0.113)	(0.113)	(0.114)	(0.114)
Gluten Free Condition	-0.089	-0.070	-0.072	-0.072	-0.077
	(0.119)	(0.117)	(0.117)	(0.117)	(0.117)
Constant	2.085***	1.665***	1.655***	1.720***	1.369**
	(0.086)	(0.465)	(0.477)	(0.474)	(0.469)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.272	0.294	0.285	0.302	0.298
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 15: Information search - Clicked into ingredient list

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	-0.076*	-0.069*	-0.070*	-0.073*	-0.073*
	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Gluten Free Condition	-0.047	-0.043	-0.043	-0.045	-0.044
	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Constant	0.540***	0.247**	0.327**	0.358***	0.342**
	(0.022)	(0.095)	(0.106)	(0.106)	(0.113)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.360	0.408	0.384	0.372	0.355
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 16: Information search - Clicked into nutrition facts

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	-0.015	-0.009	-0.009	-0.011	-0.011
	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
Gluten Free Condition	-0.036	-0.033	-0.033	-0.035	-0.034
	(0.032)	(0.031)	(0.032)	(0.032)	(0.032)
Constant	0.469***	0.275**	0.334**	0.346**	0.370**
	(0.022)	(0.103)	(0.112)	(0.114)	(0.121)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.496	0.439	0.446	0.432	0.466
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 17: Time spent searching (seconds) on the list page

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	7.319	7.425	7.408	6.549	6.481
	(6.259)	(6.269)	(6.317)	(5.584)	(5.566)
Gluten Free Condition	2.346	2.408	2.482	2.027	1.940
	(1.745)	(1.735)	(1.796)	(1.958)	(1.996)
Constant	23.868***	22.789***	48.742+	46.781*	33.394+
	(1.231)	(5.751)	(25.642)	(22.127)	(16.035)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.427	0.429	0.429	0.457	0.460
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.

Table 18: Time spent searching (seconds) on a product page

	(1)	(2)	(3)	(4)	(5)
No HFCS Condition	-3.611+	-3.460+	-3.487+	-3.498	-3.480
	(2.095)	(2.093)	(2.105)	(2.128)	(2.127)
Gluten Free Condition	-2.486	-2.467	-2.515	-2.600	-2.602
	(2.758)	(2.761)	(2.741)	(2.753)	(2.792)
Constant	15.287***	9.641***	13.057**	13.750*	13.791
	(2.017)	(2.179)	(4.832)	(5.604)	(6.215)
Number of Observations	1,486	1,486	1,486	1,486	1,486
No HFCS = Gluten Free (p-value)	0.567	0.610	0.611	0.639	0.644
Importance of reading label		Yes	Yes	Yes	Yes
Sugar/HFCS are harmful			Yes	Yes	Yes
Favorite brand FE				Yes	Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
Note: "Importance of reading label" adds controls for answers to the following question "How important is reading the label on a product when you shop?" "Very important", "Important", "Neither important nor unimportant", and "Unimportant", relative to the omitted "Very Unimportant" answer. "Sugar/HFCS harm" adds controls for answers to the following question "Which do you think is more harmful to your health?": "HFCS", "Sugar", and "They are both equally harmful", relative to the omitted "I do not know" answer. The "Favorite brand FE" includes fixed effects for each brand indicated in response to the question "Among the options below, which is your favorite brand of ketchup?", relative to the omitted "No particular favorite" answer. Finally, we include controls for participant demographics: female indicator, white indicator and age of the participant.