

The Role of Repugnance in Markets: How the Jared Fogle Scandal Affected Patronage of Subway¹

Rosemary Avery, Cornell University
John Cawley, Cornell University
Scott Cunningham, Baylor University
Julia Eddelbuettel, Johns Hopkins University
Matthew Eisenberg, Johns Hopkins University
Alan Mathios, Cornell University

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Abstract

Economics has long studied how consumers respond to the disclosure of information about firms, such as product quality, accounting fraud, or environmental disasters. We study a case in which the disclosed information is unrelated to the product or firm leadership, but which could still potentially affect consumer patronage through the mechanism of repugnance. The information concerns the arrest of Jared Fogle, the well-known spokesman and advertising pitchman for the Subway sandwich franchise, who was arrested in 2015 on charges of sex with a minor and child pornography. We study how the disclosure of this information, which was widely covered in the media, affected patronage of Subway. We estimate synthetic control models using data from a large nationwide survey of consumers regarding the restaurants they patronize. Despite the close and long-standing association of Jared Fogle with Subway, and heavy publicity of his crimes, we estimate a relatively precise zero of the effect of the Jared Fogle scandal on patronage of Subway. This is in contrast to past studies of negative information disclosure, which tend to find negative impacts on sales, revenue, or stock price of the relevant companies. The absence of an effect in this case suggests that repugnance did not drive demand, and that consumers largely separated the offenses of a symbol of the firm from the products of the firm.

¹ Corresponding author: John Cawley, 2312 MVR Hall, Cornell University, Ithaca NY 14853.

1. Introduction

How agents respond to information is a classic topic in economics (e.g., Stigler, 1961; Arrow, 1963; Pauly, 1968; Akerlof, 1970; Spence, 1973; Dranove et al., 2003; Kolstad, 2013; Handel and Kolstad, 2015; Jin et al., 2021). A substantial literature has examined how consumers respond to negative information about a firm's products, employees, or management. For example, there have been studies of how consumers responded to new negative information about a firm's products, such as the disclosure that products (e.g. children's toys) were dangerous and had to be recalled (Freedman et al., 2012; Jarrell and Peltzman, 1985), the disclosure that baby formula had been adulterated with harmful chemicals and was causing children's deaths (Bai et al., 2021), or that Volkswagen's diesel vehicles had much greater emissions, and negative impact on the environment, than the firm claimed (Bachmann et al., 2021). Other research has examined responses to the disclosure of information about the actions of firm employees, such as sexual abuse by priests in the Catholic church (Hungerman, 2013) or capital market reactions to accounting fraud at Enron (Leuz and Schrand, 2009) and Arthur Andersen (Nelson et al., 2008). Other studies examine how consumers or investors responded to the disclosure of information about a firm's lack of safety precautions that resulted in major pollution, such as British Petroleum's Deepwater Horizon oil spill (Barrage et al., 2020). These studies generally find that consumers and investors react negatively to such information disclosures, and that the sales, revenue, and stock prices of the company fall.

In this paper, we contribute to this literature by examining consumers' response to the disclosure of information that does not concern the firm's products, services, or management, but instead crimes committed by someone closely identified with the firm. Specifically, we examine how

consumers responded to the disclosure that Jared Fogle, long-time advertising pitchman for the Subway franchise, had been arrested and pled guilty in 2015 to a series of crimes including sex with a minor and child pornography.

An unusual aspect of this disclosure is that while it is clearly associated with one specific firm, the scandal is unrelated to the firm's products, its management, safety precautions, or accounting integrity. Instead, the information concerns the very public face of the company: its advertising pitchman. Given that the information does not concern the qualities of the product or the firm, one might hypothesize that the disclosure of information would have no impact on consumer patronage. This null hypothesis is consistent with consumers keeping the information about Jared separate from their decisions about patronizing Subway. A competing hypothesis, which we will call the Repugnance Hypothesis, is that patronage of Subway would decrease due to this information disclosure. This hypothesis is based on Roth (2007), which argues that repugnance or distaste can affect markets just as much as prices and other incentives. He gives numerous examples of repugnance limiting or affecting economic transactions, including bans on human consumption of horse meat or the paying of live organ donors, and people's discomfort with viatical settlements (which is the buying of life insurance contracts of terminally ill patients), tradeable pollution permits, and paid sex work by others. Roth notes, however, that repugnance is hard to predict, because similar transactions may be judged quite differently. Thus, we do not interpret Roth (2007) as predicting that consumers would definitely decrease their patronage in response to the disclosures about Jared Fogle, but that it is a possibility. The examples and discussion in Roth (2007) are qualitative and narrative. An additional contribution of this paper

is that it conducts an empirical test of the importance of repugnance in markets. We make the case below that the details of the scandal were likely to invoke repugnance in consumers.

The repugnance hypothesis is also consistent with other economic theories. For example, Bernheim and Rangel (2004) model consumption as partly a function of environmental cues. In the absence of cues, consumers make decisions in a cold, rational state, but after exposure to a sufficient number of cues, consumers enter a hot state and make impulsive decisions that result in overconsumption. Bernheim and Rangel (2004) give the example that, for someone on a diet, the sight or smell of food could be a cue that generates a powerful impulse to overeat. They also posit that there may be counter-cues that discourage consumption through the mechanism of disgust or repugnance. They give the example that some countries mandate that graphic and repellant photos be printed on all cigarette packages in order to discourage smoking. They also note that billboards, advertising, and marketing can be cues (or counter-cues); thus, the association of Jared with Subway could cause a counter-cue; seeing a Subway sign or store could remind consumers of Jared's crimes, create feelings of disgust that decrease the perceived utility of consumption, and thus decrease patronage.

Jared Fogle as pitchman for Subway

As a college student in the late 1990s, Jared Fogle had weighed 425 pounds. By eating Subway twice a day (a 6-inch turkey sub for lunch and a full-length vegetable sub for dinner, with no cheese or condiments, with each meal including a bag of baked chips and a diet soda) and adhering to a walking regimen, Jared lost 245 pounds in one year. In 1999, his college

newspaper ran a story about his weight loss, which attracted further media coverage, bringing him to the attention of Subway.

Subway ran their first advertisement featuring Jared Fogle on January 1, 2000, describing the centrality of Subway sandwiches in his successful weight loss regimen. The ad campaign was immediately successful; it was estimated that Subway sales rose 20% shortly after the ad aired (Masunaga, 2015). By 2013, Jared had filmed more than 300 commercials for Subway, and the company's chief marketing officer attributed one-third to one-half of their sales growth to Jared (revenue had tripled between 1998 and 2011). Jared had become the face of the company; its chief marketing officer said that Jared was "woven into the fabric of the brand" (Murray, 2013). The industry periodical *Nation's Restaurant News* described the Jared campaign as "a key cog in Subway's immense success" and "one of the most successful restaurant ad campaigns in history" (Maze, 2015b). The Jared ad campaign was so effective that it was profiled at length as a positive example in the 2007 book *Made to Stick: Why Some Ideas Survive and Others Die* (Heath and Heath, 2007).

It's hard to overstate the shock of the later scandal, as Jared was so well-known to the American public. A 2013 study restaurant brands found that Subway was rated number one in consumer perceptions, in part due to the relatable Jared Fogle ad campaign (Maze, 2015a). Jared was still the face of the company at the time of the information disclosure; ads featuring Jared were airing on television the day he was arrested (Associated Press, 2015).

Another factor that makes the Repugnance Hypothesis more likely is that Jared was famous *only* for being the face of Subway; he was not, for example, a famous actor already well-known to the public for other reasons, who then became a celebrity endorser. He was known *only* for being associated with Subway, which makes it more likely that the two were linked in consumers' minds after the disclosure.

Disclosure of Jared Fogle's Crimes

The following information is derived from newspaper stories of Jared Fogle's arrest, e.g. Larimer (2015) and Harwell and Phillip (2015).

On July 7, 2015, the FBI raided Jared's home and arrested him on child pornography charges. That same day, Subway announced that it had severed ties with Jared. Roughly six weeks later, on August 19, 2015, Jared agreed to plead guilty to distribution and receipt of child pornography and to traveling across state lines to engage in sex with an underage girl.

Given that Jared was the face of a 15-year-long advertising campaign, and Jared was widely known to the public, the news of his arrest made the evening news and front-page headlines. Thus, the disclosure of the scandal was abrupt (there had been no prior stories of this behavior) and immediately widespread, which makes it easier to examine how consumers responded to it.

In order to explain why the disclosure of Jared Fogle's crimes could potentially have affected patronage of Subway, it is necessary to provide details of the crimes. We caution that this section contains upsetting material, and advise that readers may want to skip to the next section. It is

included only to explain why this information may have invoked feelings of repugnance as described by Roth (2007).

In 2004, Jared started the Jared Foundation, a nonprofit organization with the stated goal of raising awareness about childhood obesity. Jared hired to direct this nonprofit a man named Russell Taylor. Taylor installed hidden cameras in his house's bedrooms and bathrooms and secretly filmed his own children and their friends changing clothes, showering, and bathing. Taylor sent hundreds of these videos to Jared, who would discuss them with Taylor and request more. Later it was discovered that the foundation had not engaged in activities related to its stated purpose; instead, most funds that were spent were simply paid to the director, Taylor. Thus, Jared effectively used donations to his nonprofit to produce and distribute child pornography. It was also disclosed that Jared had traveled to New York City to have sex with an underage girl. Jared had also asked numerous individuals to facilitate him having sex with underage girls. For example, he asked prostitutes to find him girls to have sex with, "the younger the girl, the better." (Evans and Alesia, 2015).

A restaurant industry consulting firm which quantifies firms' reputations estimated that the Jared Fogle scandal had a significant impact on Subway's reputation, lowering its score from 77 (nearly excellent) to 71 (slightly above average); the consulting firm claimed that when a company's reputation falls, consumers' willingness to spend with the company falls with it (Maze, 2015c).

Industry experts at the time predicted that this information would hurt patronage of Subway. A brand consultant said at the time of Jared's arrest, "For a while, when you see a Subway ad, you're going to think about that child pornography charge" (Associated Press, 2015). An analyst of franchise restaurants said, indelicately: "You think of Subway, and you think of Jared chasing around little girls. It's going to mitigate people's decision to go there," (Associated Press, 2015). These predictions are consistent with the Repugnance Hypothesis (Roth, 2007) and with this knowledge being a counter-cue to patronage of Subway (Bernheim and Rangel, 2004).

Data and Methods

Common approaches for estimating the effect of information on customer patronage are to examine how the news affected company sales, revenue, or profit (e.g. Bachmann et al., 2021; Barrage et al., 2020; Freedman et al., 2012) or the prices of the company's publicly-traded stock (e.g. Karpoff et al., 2005; Chaney and Philipich, 2002; Jarrell and Peltzman, 1985). Neither is possible in this case because Subway is a privately-held company and thus does not release revenue or profit statements nor does it have a publicly-traded stock.

Instead, to examine the impact of this information disclosure about Jared Fogle on customer patronage of Subway, one must rely on some other type of data. We use data from the Simmons National Consumer Survey (NCS), which contains data on customer patronage of specific restaurant chains, including Subway. We use this data to estimate synthetic control models, which compare how the patronage of Subway changed around the time of the Jared Fogle scandal, compared to a synthetic Subway that is a weighted average of a number of other restaurant chains, with the weights chosen to most closely resemble Subway prior to the

information disclosure. In the following subsections, we provide more details on the Simmons NCS and our synthetic control methods.

Data: Simmons National Consumer Survey (NCS)

We examine data from the Simmons National Consumer Survey (NCS), which is uniquely well-suited for our purpose because it is a nationwide survey of a large number of respondents (over 250,000), contains information about their visits to specific chains of fast food restaurants (including Subway), and was conducted before and after the disclosures about Jared Fogle.

The Simmons National Consumer Survey (NCS) is a proprietary nationally representative repeated cross-sectional survey. For each survey wave, the survey is administered to an independently-drawn multi-stage stratified probability sample of individuals. The response rate for the NCS during our study years (2014-2016) averaged 19%. NCS data include an intentional over-representation of higher-income households because the survey is intended to be useful for informing marketing decisions. Overall, the weighted NCS sample is comparable to U.S. Census data in terms of age, gender, race, ethnicity, marital status, income, and health care insurance coverage (See Appendix Table 1).

The NCS questionnaires ask consumers the number of times they visited fast food restaurant chains in the past 30 days.² Our outcome is the extensive margin of visits: whether the consumer reported visiting that chain in the past 30 days. We do not examine the intensive margin of patronage, because the number of visits is reported categorically and those categories

² Specifically, respondents are first asked whether they go to fast food and drive-in restaurants. If they respond yes, then they are asked to mark the number of times, in the last 30 days, they visited each of a list of 38 chain fast food restaurants, which includes Subway.

change over time.³ During the period we examine, the NCS consistently asked about patronage of 59 restaurant chains. The NCS also includes information on each respondent's demographic characteristics, such as age, race, ethnicity, gender, education, and household income.

We have data from January 2014 through December 2016. The disclosure of information occurred in July, 2015, so we have data from 18 months before, to 18 months after, the disclosure. Four NCS surveys are conducted in each of those calendar years.

The key date for classifying waves as either untreated or treated by the information disclosure is July 7, 2015 – the date the police raided the home of Jared Fogle, which was prominently covered in the media. Waves completed prior to that date are assumed to be untreated by the information, while those that began after that date are assumed to be treated by the information. A special case is Simmons NCS wave 82, which was in the field at the time of the information disclosure (it was conducted between May 14 and August 29, 2015). For that wave, the variable for treatment is assigned a value of 0.5, given that roughly half of the respondents were interviewed prior to the revelation and half after.

Our final sample consists of 78,903 unique adults.⁴ Each of those individuals appears twice in the data – once regarding their visits to Subway and once regarding their visits to the synthetic control for Subway - so our total sample size is 157,806. A strength of using the NCS is that it provides a large sample size and thus substantial statistical power to detect even modest effects.

³ The categories concerning number of times visited in the last 30 days are not consistent across wave; for example, in some waves the categories include 3-5 and 6-9, in other waves it is 6-13, in still other waves it is 6 or more.

⁴ The NCS surveys each person in the household. We study adults (aged 18 years and older), but not youths because we do not have data for youths after 2013. Our adult data do not include information about whether there are children in the household.

Methods: Synthetic Control

One simple approach to estimating the impact of the Jared Fogle scandal on patronage of Subway would be to estimate a difference-in-differences (DiD) model, comparing the change in patronage over time for Subway to that of a comparison firm. The DiD model relies on the identifying assumption of parallel trends: that, in the absence of the scandal, that patronage of Subway would have followed the same trend over time as that of the comparison firm. We estimated DiD models in which the comparison firm was each of the other sandwich restaurant chains contained in the Simmons NCS data (Blimpie, Panera/Au Bon Pain, Miami Subs, Quiznos, Schlotzsky's), but in each case the assumption of parallel trends prior to treatment was violated.

For this reason, we turn instead to estimating synthetic control models (Abadie, 2021). Synthetic control models are based on the idea that, when the units of observation are a small number of entities (such as states, or in this case, restaurant chains), then a combination of untreated units may be a more appropriate comparison than a single untreated unit (Abadie, 2021). Rather than the researcher choosing a comparison unit that seems logical (such as a nearby state or a restaurant chain selling similar food), the synthetic control methodology uses a data-driven procedure for applying an optimal set of weights to the untreated units to form a synthetic control unit. Synthetic control models have been applied to estimate the effects of a wide range of treatments, including tobacco control programs (Abadie et al., 2010), right-to-carry gun laws (Donohue et al., 2019) and legalized indoor prostitution (Cunningham and Shah, 2018).

Unlike many applications of synthetic control models, in which the treated unit is a unit of geography (such as state, as in the seminal article by Abadie et al., 2010), in this paper the treated unit is a restaurant chain (Subway), and thus the donor pool to create the synthetic Subway is made up of other restaurant chains.

The logic of the synthetic control method is to choose a set of comparison units from the “donor pool” of all untreated units, and assign to them a set of weights, such that the synthetic control is as similar as possible to the treated unit prior to the treatment. Some untreated units may be assigned a weight of zero, and thus the synthetic control unit may effectively be a weighted average of only a subset of the donor pool. One decision to be made is what is the set of variables that one wants to be as similar as possible between the treated and synthetic control. In other words, if the weights are being chosen to construct a synthetic control unit that is as similar as possible to the treated unit, it is important to consider: as similar as possible in terms of what? It is common to include in this set of variables the value of the dependent variable in each of the pre-treatment time periods. We follow this convention and include the value of the dependent variable (percentage of respondents who report patronizing that restaurant chain in the past 30 days) for each of the six survey waves conducted prior to the Jared Fogle scandal. An advantage of consistently using all available lags of the dependent variable is the assurance that there has been no p-hacking; i.e. the subset of lagged dependent variables has not been selected to generate a certain result. In addition to the lagged dependent variables, we also include three socio-demographic variables for the synthetic model to match on at the firm-time level: the proportion of the patrons in that time period that are female, the proportion in that time period that are white, and the proportion in that time period with a high school degree.

Our measure of the effect size is the root mean square prediction error (RMSPE) after the treatment. This measures how much the treated unit deviated from the counterfactual of the synthetic control after the treatment. However, that can be large simply if the synthetic control is a poor match for the treated unit. To scale the estimated effect, we estimate the ratio of the RMSPE after, versus before, the scandal.

To test for statistical significance, we estimate synthetic control models for each of the 58 untreated fast food chains in the donor pool, and compare the RMSPE ratio for Subway to those of the untreated chains. If the scandal had a meaningful effect on Subway patronage, then the RMSPE ratio estimated for Subway should be, if not the largest, among the largest estimated in the placebo tests for the 58 untreated firms. If Subway's RMSPE ratio is in the top 5% of those estimated for all of the firms we observe, then it will be considered to be statistically significant at the 5% level and we will reject the null hypothesis of no effect. This result would be consistent with the Repugnance Hypothesis. If, on the other hand, the RMSPE ratio for Subway is smaller than at least 5% of those for untreated firms, then we will fail to reject the null hypothesis of no effect of the scandal on consumer patronage of Subway.

In order to demonstrate that the information about the Jared scandal was widespread, we rely on two sources. First, we utilize the TV Archives database⁵ and plot the number of news stories related to the search term "Jared Fogle" over the study period. Second, we examine Google

⁵ The TV Archive database is part of the nonprofit Internet Archive that includes the Wayback Machine. For more information, see Internet Archive (2023).

trends data to see how searches for the term “Jared Fogle” varied around the time of his arrest and guilty plea.

Empirical Results

Dissemination of information about the Jared Fogle Scandal

One way to measure the dissemination of information about the scandal is coverage on television news. Figure 1 graphs data from TV Archives; specifically, the number of TV news stories pertaining to “Jared Fogle” by month from January 2014 to December 2016 – the same period covered by our Simmons NCS data. Prior to July 2015, there were 0 stories about Jared Fogle. However, when news of the scandal broke in July, there were 234 stories, and when he pled guilty in August there were 271 stories.

A second way to measure the dissemination of information about the scandal is peoples’ searches for information about it online. Figure 2 shows a graph of Google Trends data. It plots the relative intensity of searches for the term “Jared Fogle” by week during the period January 1, 2014 to December 31, 2016 – again, the same period covered by our Simmons NCS data. The graph shows that the peak of search intensity occurred in the week of August 16-22, 2015, when he pled guilty to child sex and child pornography charges. The second highest peak occurred the week of July 5-11, 2015, when he was arrested.

The brief time between Jared Fogle’s arrest (July 7, 2015) and his guilty plea (August 19, 2015) means that in a short period of time consumers went from having no knowledge of Jared’s

crimes to the information being both widespread and known to be true. This makes it relatively straightforward to test for an effect of this disclosure on patronage of the Subway chain. Both of these data sources are consistent with there being a sudden disclosure of information at the time of his arrest, which makes it easier to detect any consumer response to that information than if the disclosure had been gradual over an extended period of time.

Synthetic Control Procedure

The synthetic control procedure selected, from the donor pool of 58 fast food restaurants, a set of three chains to receive positive weights: Whataburger (weight of 0.556), McDonalds (weight of 0.402) and Jack in the Box (weight of 0.042) – see Table 1.

By construction, the synthetic Subway is very similar to Subway in terms of the variables designated for the match; see Table 2. Likewise, the patronage of synthetic Subway is very similar to that of actual Subway before the disclosure.

However, an important thing to note is that Subway patronage, both in isolation and relative to synthetic Subway, remains very similar from before to after disclosure – see Table 3 and Figure 2. The fact that Subway has a very similar trend to the synthetic control, after the Jared scandal, is consistent with consumer patronage not changing in response to the information disclosure.

In order to determine whether the estimated effect of the Jared scandal on patronage of Subway is meaningfully large and statistically significant, we repeat the synthetic control approach for each of the 58 untreated fast food chains in the donor pool. Given that none of them were truly

treated by the Jared Fogle scandal, any change in their patronage post-disclosure is just random noise. By repeating the synthetic control for each candidate firm in the donor pool, we have a distribution of that noise. We can then examine how the estimated effect on Subway (which was truly treated) compares to the distribution of noise (the placebo results for the untreated firms). The results are presented in Table 4. The estimated treatment effect is in the second column, which lists the root mean squared prediction error after the scandal (RMSPE – post); this indicates how much patronage of Subway deviated from that of synthetic Subway after disclosure. However, each of the synthetic control models for the different restaurant chains may differ in their level of baseline error (shown in column 1, RMSPE-Pre). Thus, it is helpful to scale the treatment effect by the baseline error, which is shown in column 3 (RMSPE Ratio); this is the measure of how much worse the match of the “treated” and their synthetic control firms are after, relative to before, the treatment. The tests of statistical significance are shown in the final two columns. The second-to-last column indicates where that firm ranks among the 59 firms (Subway and the 58 untreated fast food chains) based on the ratio of the fit of the model after versus before the information disclosure. The final column, percentile rank, expresses that rank in terms of its percentile in this set of firms; this represents the p value. If the truly treated firm, Subway (shown in bold) had a percentile rank below a critical threshold (e.g. 0.05), that would be consistent with Subway truly having experienced a substantial treatment effect; i.e. much greater than the noise resulting from the placebo tests using each of the untreated firms. In contrast, if the percentile rank is above a critical threshold (e.g. 0.05), that suggests that the estimated effect for the truly treated firm isn’t an outlier among the estimated noise for the untreated firms.

The results in Table 4 are consistent with an inability to reject the null hypothesis that the Jared Fogle scandal had no effect on consumer patronage of Subway. The percentile rank for Subway is 0.282, indicating that the estimated effect of the Jared Fogle scandal on patronage of Subway is not statistically significant even at the 10% level. There were 10 untreated firms whose estimated effect in the placebo test were greater than that for the truly treated firm, Subway. Figure 3 plots a histogram of the RMSPE ratios of the 59 firms, and a vertical line marks the result for Subway. Clearly, the estimated effect size for Subway is not an outlier among the untreated firms.

Figures 4a and 4b plot the RMSPE gaps by survey wave, where the vertical dotted line indicates the timing of the treatment (the Jared Fogle scandal). McDonald's, as the largest fast food chain, has a very high percentage of respondents who have patronized it in the past month, which makes it very hard to construct an accurate synthetic control for it using firms that all have smaller patronage. For that reason, in Figure 4a, McDonald's consistently has the greatest error in its model in every wave. To make the graph of all other firms more visible, we exclude McDonald's from the lower graph (Figure 4b). If the Jared Fogle scandal had negatively impacted customer patronage of Subway, we would expect to see the error increase considerably after the information disclosure indicated by the vertical dotted line. In particular, we would expect the increase in error for Subway dwarf that of other firms. Instead, the error for Subway (shown by the bold line) is very similar to that of the untreated firms in the three waves after the scandal. In the final wave, the error for Subway decreases considerably, but overall there is not evidence that, from the time of the information disclosure, Subway's patronage changed dramatically relative to that of the synthetic Subway in the post-treatment period.

We conducted a series of robustness checks to examine the sensitivity of the results. Omitting the sociodemographic variables and instead basing the weighting procedure purely on the lagged dependent variables does not change the fact that McDonald's and Whataburger are the two chains receiving by far the greatest weight in the construction of a synthetic Subway.

Discussion

This paper makes several contributions to the literature. First, we examine how consumers responded to information that is associated with a specific firm, but which is not informative about the qualities of the product or the firm management. Second, this paper conducts an empirical test of whether repugnance affects markets (as hypothesized by Roth, 2007) and whether such information could represent a counter-cue to consumption (as theorized by Bernheim and Rangel, 2004). Third, we estimate synthetic control models in which the units are firms rather than states.

The results of our synthetic control model indicate that we cannot reject the null hypothesis that the disclosure of information about the Jared Fogle scandal had no effect on consumer patronage of Subway. The estimated effect of the scandal on patronage of Subway is no greater than the effects estimated from placebo tests of many untreated firms, and thus is not statistically significant. More generally, we do not find evidence that repugnance affected consumption in this market (Roth, 2007) or that the strong association of Jared with Subway represented a counter-cue to consumption (Bernheim and Rangel, 2004).

One natural comparison for our results is how consumers responded to other firms' scandals. Barrage et al. (2020) find that gasoline sales by British Petroleum in the U.S. declined 4.2% in the five months after its Deepwater Horizon oil spill in 2010. Several studies find evidence of that consumers not only react negatively to the company which is the subject of the information disclosure, but also to other, similar, companies. For example, Bachmann et al. (2021) find that the Volkswagen emissions scandal caused a 23.5% reduction in the sales of other German auto manufacturers. Bai et al. (2022) examine how the child deaths resulting from industrially-adulterated baby formula from China affected all exports from the Chinese dairy industry. They estimate that dairy exports fell by 68% as a result of the disclosure and did not recover for at least five years. Chaney and Philipich (2002) found that, in the three days after disclosure of information that Arthur Andersen had engaged in accounting fraud on behalf of Enron, other public companies also audited by Arthur Andersen suffered substantial stock declines, with companies audited by Andersen's Houston office (which had worked with Enron) suffering the largest drops (Chaney and Philipich, 2002).

Another natural comparison is how individuals respond to disclosure of information about sexual abuse. Hungerman (2013) estimates that a landmark story in the Boston Globe in January, 2002 about widespread sexual abuse by Catholic priests reduced membership in the Catholic church by 3% (or two million members), with those who left the Catholic church switching to Protestant denominations that were relatively different from the Catholic tradition, e.g. the Baptist church. Shortly after the airing of the "Leaving Neverland" documentary which presented evidence that Michael Jackson sexually abused children, there was a 39% decrease in his album sales, a 5%

decline in online streaming of his songs, and a 13% decline in radio airplay of his music catalog (Caulfield, 2019).

Another natural comparison is how people have been found to respond to other types of information about restaurants. This has been an active area in recent years, with researchers studying how consumers respond to calorie labels on menus (e.g. Avery et al., 2023; Cawley et al., 2020; Bollinger et al., 2011; Wisdom et al., 2010), nutrition information and suggested item substitutions (Bedard and Kuhn, 2015), and restaurant hygiene report cards (Jin and Leslie, 2003). This literature generally finds that restaurant consumers are responsive to information, but not in every case and responses can be small. Two of these studies are relevant comparisons to the present one, because they provide information regarding consumer patronage. Jin and Leslie (2003) conclude that the mandatory disclosure of restaurant hygiene report cards (based on health department inspections) in Los Angeles led restaurant revenue to become responsive to the restaurant's hygiene grade, implying that customer patronage was elastic to the information. They find that an A grade causes restaurant revenue to be 5% higher than a B-grade. Avery et al. (2023) study the voluntary disclosure of calorie information by Starbucks, and find no detectable impact of that disclosure on the probability of consumer patronage. However, Bollinger et al. (2011) find that, among those who did patronize Starbucks, the disclosure of calorie information led to a reduction in calories ordered of 6%.

Other research of how consumers respond to information disclosure about restaurants has conducted randomized controlled field trials. Cawley et al. (2020) find in an RCT of calorie labels on the menus of full-service restaurants that the information disclosure reduces the number

of calories ordered for dinner by 3%. Wisdom et al. (2010) conduct an RCT of calorie labels (and other treatments) for fast food sandwich restaurants and estimate that providing calorie information reduces the number of calories ordered at lunch by 60.

Disclosure of information about calories and nutrients, along with suggestions for healthful item substitutions, in a fast food hamburger chain resulted in no significant change in calories ordered but a 2% reduction in cholesterol ordered and suggestive evidence that consumers may have followed the substitution recommendations (Bedard and Kuhn, 2015). Difference-in-differences models based on street intercept data of consumers before and after New York City's mandatory calorie labeling law yield no evidence that consumers ordered fewer calories after the information disclosure, either shortly after the law or 5 years later (Elbel et al., 2009; Cantor et al., 2015).

Our inability to reject the null hypothesis that the disclosure of information about Jared Fogle's crimes had no impact on the probability consumers patronize Subway, is more consistent with the studies that also fail to reject the null of no consumer response to information about restaurants (e.g. Avery et al., 2023; Cantor et al., 2015; Elbel et al., 2009). The reason for the lack of a consumer response could be due in part to consumers recognizing that the information disclosed had nothing to do with the quality of the food or service at Subway, nor with the character or integrity of the employees or firm leadership. The result is inconsistent with the Repugnance Hypothesis based on Roth (2007), which posits that people can have visceral reactions to information that make them unwilling to consume certain items or engage in certain transactions. Our inability to reject the null is also inconsistent with the disclosure of Jared's

crimes representing a counter-cue in the spirit of Bernheim and Rangel (2004); in that theory, counter-cues put a consumer into a hot state that deters them from consuming. The lack of a detectable response of consumers to this information disclosure is more consistent with consumers processing the information in a cold rational state rather than in a hot state or state of repugnance.

In terms of methods, this paper demonstrates that consumer surveys can be used to estimate the effect of the disclosure of bad news on consumer behavior. Many past studies of such questions rely on data from publicly-released revenue or profit statements by the firm, or changes in the prices of its publicly-traded stocks. In the case of a privately-held company such as Subway, neither of those data sources are available, and this paper demonstrates that consumer surveys can be used to estimate the consequences.

One limitation of this analysis is that, because the untreated firms in the donor pools were firms competing with the treated firm, there may have been spillover effects of the scandal to the patronage of other firms. For example, instead of eating at Subway, patrons may have switched to eating at another restaurant chain. This is unlikely to explain our null result, however, as such effects would cause upward bias in estimates of the effect of the scandal on Subway (because at the time that Subway patronage would be falling, that of its competitors would be rising). We suspect that any such bias is minimal, because the three firms receiving positive weight are not the most direct competitors to Subway (none are sandwich shops, and all three are hamburger chains) and there are so many alternatives to eating at Subway (e.g. eating at any of the 58 fast food chains on our list, eating at any sit-down restaurant chain, or eating at home), that any

spillover impact on any individual rival chain is likely minimal. Another limitation is that we are not able to examine the intensive margin of patronage, due to that being reported in only a few categories. However, it may be the extensive margin - whether someone goes at all – that is more likely to be affected by repugnance. Despite these limitations, this paper contributes to the literature on how consumers respond to information, and the role of repugnance and counter-cues in consumer demand.

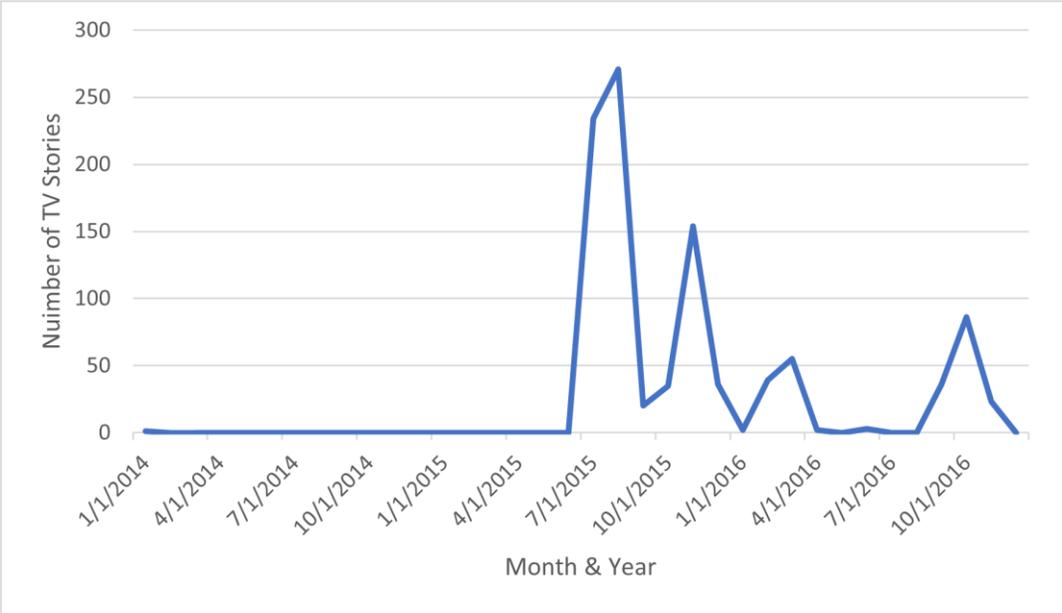
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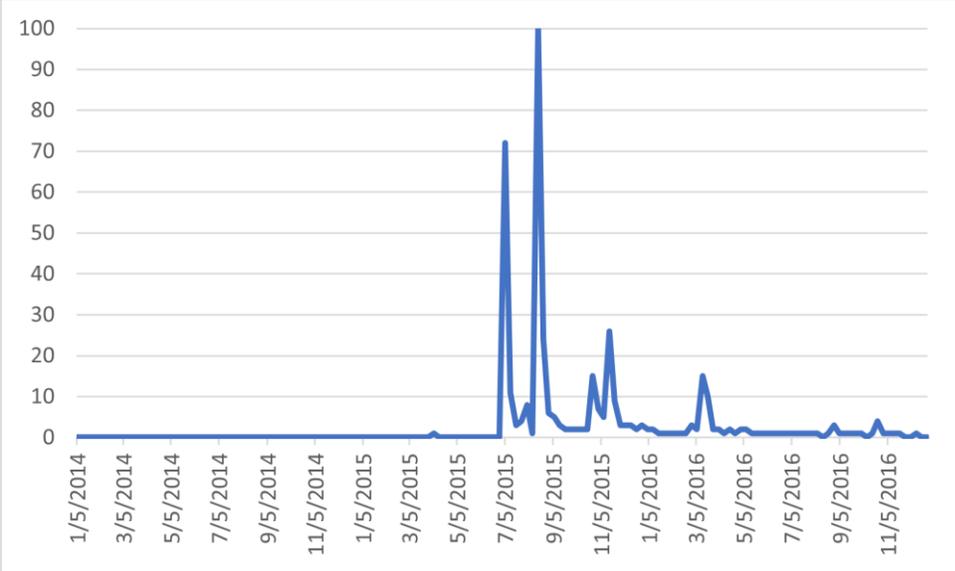
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Figure 1. Number of TV News Stories about “Jared Fogel”



Note: Source: TV Archive database. Number of TV news stories matching search term “Jared Fogel” by month from January 2014 through December, 2016.

Figure 2: Google Trends Searches of “Jared Fogle”



Notes: Source: Google Trends. Number of Google searches for “Jared Fogle” by week from January 2014 through December, 2016.

Table 1. Synthetic Control Restaurant Chains and Weights

| Restaurant Chain | Synthetic Control Weight |
|------------------|--------------------------|
| Jack in the Box | 0.042 |
| McDonalds | 0.402 |
| Whataburger | 0.556 |

Note: The donor pool consisted of 38 fast food restaurants, which are listed in the rows of Table 4.

Table 2. Predictor Balance for Synthetic Subway

| | Subway (Treated) | Synthetic Subway |
|-----------------------------|------------------|------------------|
| Patronage - Wave 76 | .2635736 | .260049 |
| Patronage - Wave 77 | .2648814 | .2554396 |
| Patronage - Wave 78 | .2696125 | .2693999 |
| Patronage - Wave 79 | .2606826 | .2601096 |
| Patronage - Wave 80 | .2455202 | .2539334 |
| Patronage - Wave 81 | .2366458 | .2417404 |
| Proportion Female | .5649226 | .5502003 |
| Proportion White | .7548339 | .7243751 |
| Proportion with a HS Degree | .279375 | .2926198 |

Note: Patronage is defined as visiting the restaurant at least 1 time in the last 30 days.

Table 3. Subway v. Synthetic Subway Patronage

| Wave | Subway | Synthetic Subway |
|------|----------|---------------------|
| 76 | .2635736 | .260049 |
| 77 | .2648814 | .2554396 |
| 78 | .2696125 | .2693999 |
| 79 | .2606826 | .2601096 |
| 80 | .2455202 | .2539334 |
| 81 | .2366458 | .2417404 |
| 82 | .2470002 | .2493627 |
| 83 | .252218 | .2476096 |
| 84 | .2463816 | .2513901 |
| 85 | .2489316 | .239797 |
| 86 | .2429785 | .2460637 |
| 87 | .2366931 | .2604944 |

Note: Intervention occurred in wave 83.

Table 4. RMSPE Table

| Firm | RMSPE - Pre | RMSPE - Post | RMSPE Ratio | Rank | Percentile Rank |
|------------------|--------------|--------------|--------------|---------------|-----------------|
| Papa Johns | 0.001 | 0.005 | 7.568 | 1.000 | 0.026 |
| KFC | 0.001 | 0.008 | 6.298 | 2.000 | 0.051 |
| Chick-fil-A | 0.006 | 0.027 | 4.269 | 3.000 | 0.077 |
| Whataburger | 0.003 | 0.011 | 3.972 | 4.000 | 0.103 |
| Krispy Kreme | 0.002 | 0.007 | 3.824 | 5.000 | 0.128 |
| Jack in the Box | 0.004 | 0.013 | 3.144 | 6.000 | 0.154 |
| Popeyes | 0.002 | 0.006 | 3.041 | 7.000 | 0.179 |
| Little Caesars | 0.002 | 0.006 | 2.842 | 8.000 | 0.205 |
| Boston Market | 0.002 | 0.006 | 2.752 | 9.000 | 0.231 |
| Hardees | 0.002 | 0.006 | 2.639 | 10.000 | 0.256 |
| Subway | 0.005 | 0.013 | 2.464 | 11.000 | 0.282 |
| Pizza Hut | 0.005 | 0.012 | 2.457 | 12.000 | 0.308 |
| Long John Silver | 0.003 | 0.007 | 2.308 | 13.000 | 0.333 |
| Del Taco | 0.002 | 0.005 | 2.007 | 14.000 | 0.359 |
| Taco Bell | 0.004 | 0.008 | 1.919 | 15.000 | 0.385 |
| Bojangles | 0.002 | 0.004 | 1.870 | 16.000 | 0.410 |
| Church's | 0.005 | 0.008 | 1.832 | 17.000 | 0.436 |
| Captain D's | 0.001 | 0.002 | 1.802 | 18.000 | 0.462 |
| Domino's | 0.004 | 0.005 | 1.481 | 19.000 | 0.487 |
| Quizno's | 0.003 | 0.004 | 1.453 | 20.000 | 0.513 |
| Steak n Shake | 0.002 | 0.003 | 1.427 | 21.000 | 0.538 |
| Krystal | 0.001 | 0.002 | 1.399 | 22.000 | 0.564 |
| Sonic | 0.006 | 0.008 | 1.367 | 23.000 | 0.590 |
| Burger King | 0.006 | 0.008 | 1.262 | 24.000 | 0.615 |
| Dunkin Donuts | 0.006 | 0.007 | 1.219 | 25.000 | 0.641 |
| Sbarro | 0.001 | 0.002 | 1.193 | 26.000 | 0.667 |
| Panera | 0.006 | 0.007 | 1.143 | 27.000 | 0.692 |
| White Castle | 0.002 | 0.002 | 1.041 | 28.000 | 0.718 |
| McDonalds | 0.242 | 0.235 | 0.974 | 29.000 | 0.744 |
| A&W | 0.003 | 0.003 | 0.929 | 30.000 | 0.769 |
| Checkers | 0.002 | 0.002 | 0.891 | 31.000 | 0.795 |
| Carl Jr | 0.004 | 0.003 | 0.881 | 32.000 | 0.821 |
| Dairy Queen | 0.015 | 0.013 | 0.865 | 33.000 | 0.846 |
| Starbucks | 0.008 | 0.006 | 0.804 | 34.000 | 0.872 |
| Mazzio's | 0.001 | 0.001 | 0.665 | 35.000 | 0.897 |
| Wendy's | 0.008 | 0.005 | 0.658 | 36.000 | 0.923 |
| Arby's | 0.008 | 0.005 | 0.617 | 37.000 | 0.949 |
| Rally's | 0.001 | 0.001 | 0.597 | 38.000 | 0.974 |
| Blimpie's | 0.001 | 0.001 | 0.581 | 39.000 | 1.000 |

Figure 2a and 2b. Subway vs. Synthetic Subway Patronage

Figure 2a: with Y axis (Percent of Respondents Patronizing in the Past 30 Days) ranging from 0 to 0.3

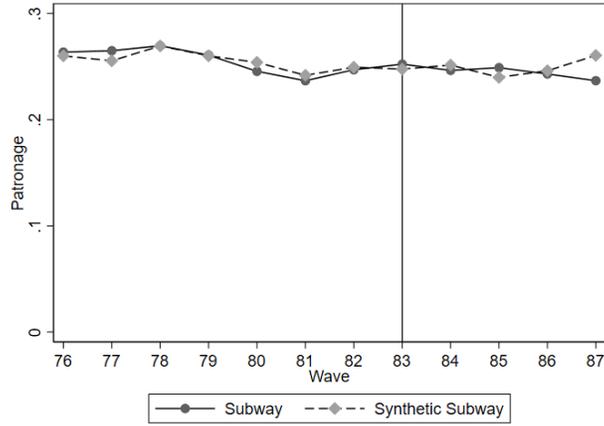


Figure 2b: with Y axis (Percent of Respondents Patronizing in the Past 30 Days) ranging from 0.2 to 0.3

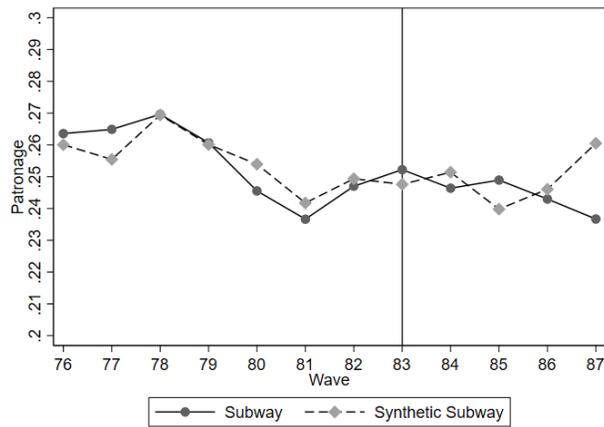
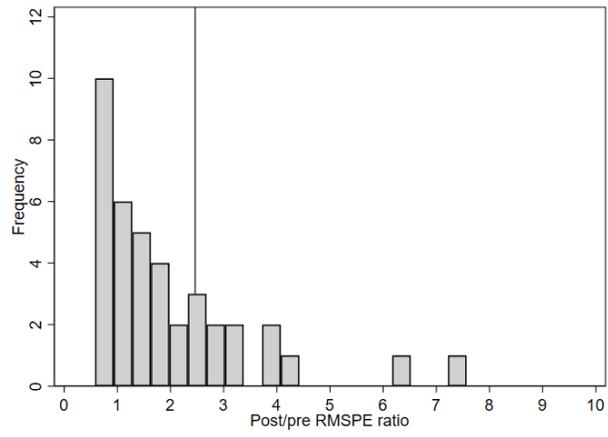


Figure 3. Plotted RMSPE Ratio Histogram



Note: The vertical line indicates RMSPE for Subway, the treated firm.

Figures 4a and 4b. Plotted RMSPE Gaps by Wave

Figure 4a: RMSPE Gaps by Wave, Including McDonald's (Top Line)

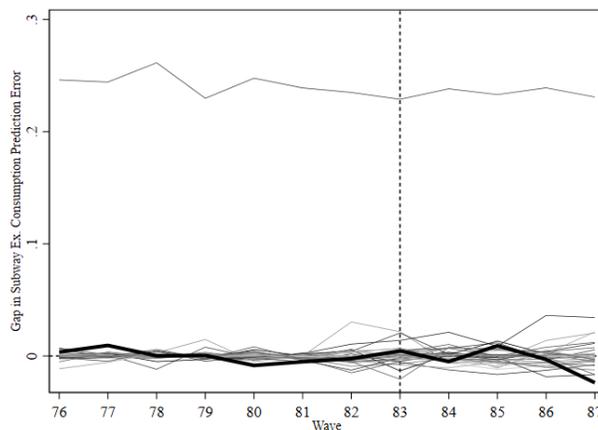
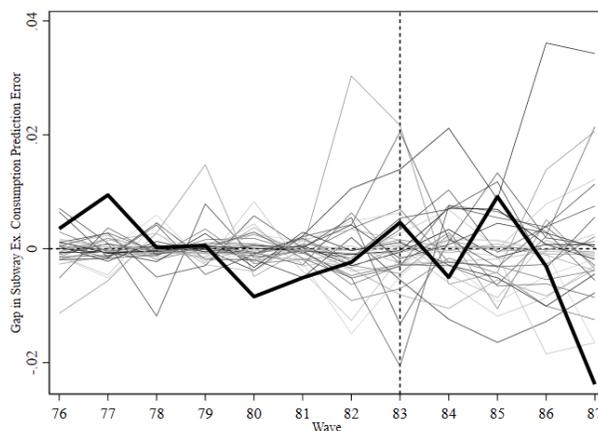


Figure 4b: RMSPE Gaps by Wave, Excluding McDonald's



Notes: The bold line corresponds to Subway, and the lighter lines correspond to the other 38 fast food chains. McDonald's consistently has the highest error in every wave because it has by far the highest percentage of respondents who report patronizing it in the past 30 days, so it is difficult to construct an accurate synthetic McDonald's by weighting the other (smaller) firms.

**Appendix Table 1:
United States Demographic Distribution v. Regression Sample Distribution**

| Demographic Characteristic | United States 2010 Census | Regression Sample, 2014-2016 |
|-----------------------------------|--------------------------------------|---|
| % Male | 48.5% | 43.5% |
| % Female | 51.5% | 56.5% |
| % White | 81.0% | 74.4% |
| % Black | 11.9% | 9.3% |
| % Asian | 4.7% | 3.5% |
| % Other Race | 2.4% | 12.8% |
| % Hispanic | 13.9% | 29.5% |
| % Non Hispanic | 86.1% | 70.5% |
| % Age 18-30 | 24.1% | 15.0% |
| % Age 30-40 | 17.2% | 14.3% |
| % Age 40-50 | 18.8% | 16.3% |
| % Age 50-60 | 17.9% | 20.6% |
| % Age 60-70 | 12.3% | 18.7% |
| % Age 70 Plus | 11.6% | 15.0% |
| % Less than HS Grad | 13.7% | 13.2% |
| % HS Grad | 31.0% | 27.2% |
| % College Graduate | 18.0% | 17.4% |
| % Graduate School Degree | 9.3% | 11.2% |
| % Married | 54.1% | 58.2% |
| % Single | 26.9% | 22.4% |
| % Divorced, Separated, or Widowed | 19.0% | 19.4% |
| % HH Income: \$0-\$29,999 | 31.5% | 17.8% |
| % HH Income: \$30,000-\$49,999 | 19.1% | 17.1% |
| % HH Income: \$50,000-\$74,999 | 17.7% | 17.7% |
| % HH Income: \$75,000-\$149,999 | 23.4% | 29.7% |
| % HH Income: \$150,000+ | 8.3% | 17.8% |
| % in Northeast Region | 18.4% | 18.7% |
| % in Midwest Region | 21.8% | 21.8% |
| % in South Region | 36.7% | 39.7% |
| % in West Region | 23.1% | 19.9% |

Note: All Percentages are for Simmons or Census respondents aged 18 years or older unless otherwise noted.

Asterisk (*) indicates that, due to Census Data availability, the U.S. percentages are based on adults aged 20 years or older.

Appendix Table 2. Descriptive Statistics

| Variable | Mean | SD |
|-----------------------------------|--------|---------|
| Subway Patronage | 0.251 | (0.434) |
| Jack-in-the-Box Patronage | 0.100 | (0.300) |
| McDonalds Patronage | 0.516 | (0.450) |
| Whataburger Patronage | 0.075 | (0.263) |
| % Female | 0.565 | (0.496) |
| % Age 18-30 | 0.150 | (0.357) |
| % Age 30-40 | 0.143 | (0.350) |
| % Age 40-50 | 0.163 | (0.369) |
| % Age 50-60 | 0.206 | (0.405) |
| % Age 60-70 | 0.187 | (0.390) |
| % Age 70 Plus | 0.150 | (0.357) |
| % White | 0.744 | (0.436) |
| % Black | 0.093 | (0.290) |
| % Asian | 0.035 | (0.184) |
| % Other Race | 0.128 | (0.334) |
| % Hispanic | 0.295 | (0.456) |
| % Less than HS Grad | 0.132 | (0.338) |
| % HS Grad | 0.272 | (0.445) |
| % <1 Year of College | 0.068 | (0.253) |
| % 1 Full Year of College | 0.061 | (0.240) |
| % 2 Full Years of College | 0.103 | (0.304) |
| % 3 Full Years of College | 0.049 | (0.217) |
| % College Graduate | 0.174 | (0.379) |
| % Some Graduate School | 0.028 | (0.166) |
| % Graduate School Degree | 0.112 | (0.315) |
| % Married | 0.582 | (0.493) |
| % Single | 0.224 | (0.417) |
| % Divorced, Separated, or Widowed | 0.194 | (0.395) |
| % HH Income: \$0-\$29,999 | 0.178 | (0.382) |
| % HH Income: \$30,000-\$49,999 | 0.171 | (0.376) |
| % HH Income: \$50,000-\$74,999 | 0.177 | (0.381) |
| % HH Income: \$75,000-\$149,999 | 0.297 | (0.457) |
| % HH Income: \$150,000+ | 0.178 | (0.383) |
| % in Northeast Region | 0.187 | (0.390) |
| % in Midwest Region | 0.218 | (0.413) |
| % in South Region | 0.397 | (0.489) |
| % in West Region | 0.199 | (0.399) |
| <i>N</i> | 78,903 | |

Note: This table is unique to the person-wave level. Data: Simmons National Consumer Survey, 2014-2016.