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

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ABSTRACT

Economics has long studied how consumers respond to the disclosure of information about firms. 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, as described in Roth (2007). The information in this case concerns the arrest of Jared Fogle, the 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 consistently fail to detect any effect of the Jared Fogle scandal on the probability of visiting a Subway restaurant. These results contrast with 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.

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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 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), 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), accounting fraud at Enron (Leuz and Schrand, 2009) and Arthur Andersen (Nelson et al., 2008), or lack of safety precautions by British Petroleum that led to a major oil spill at Deepwater Horizon (Barrage et al., 2020). These studies generally find that consumers and investors react negatively to such information disclosures about a firm's products, employees, or management, and that the sales, revenue, and stock prices of the company fall as a result.

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 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 intense distaste can affect markets just as much as prices and other incentives.² 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 (the buying of life insurance contracts of terminally ill patients), tradeable pollution permits, selling of human ova, and paid sex work. Roth notes, however, that repugnance is hard to predict, because similar transactions may be judged quite differently. We make the case below that the details of the scandal were likely to invoke repugnance in consumers. A contribution of this paper is that it represents an empirical test of the role of repugnance in consumer behavior and markets.

² For more discussion of repugnance in markets, with examples, see Healy and Krawiec (2017) and Ambuehl, Niederle, and Roth (2015).

The repugnance hypothesis is also consistent with other economic theories. For example, Bernheim and Rangel (2004) model consumption of an unhealthy good 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 note that billboards, advertising, and marketing can be cues (or counter-cues) to consumption. 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.

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, we conduct 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 use consumer surveys (rather than company reports or stock prices) to estimate the impact of information disclosure. Fourth, we estimate synthetic control models in which the units are firms rather than geographic areas. Fifth, we are one of the first to conduct the robustness checks for synthetic control models suggested by Ferman et al. (2020).

Jared Fogle as pitchman for Subway³

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 (e.g., in *Men's Health* magazine), bringing him to the attention of Subway corporate headquarters.

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 campaign began (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). In 2013, Subway scored the highest among restaurant brands in consumer perceptions, which was attributed to the relatable Jared ad campaign (Maze, 2015a). 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).

³ Information in this section is drawn from Herald-Times and IndyStar reports (2021) and Littlefield and Parker (2015).

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 Crimes⁴

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.

⁴ The following information is derived from newspaper stories of Jared Fogle's arrest: Larimer (2015a,b) and Harwell and Phillip (2015).

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 a man named Russell Taylor to direct this nonprofit. 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). The sentencing judge in the case said that "The level of perversion and lawlessness exhibited by Mr. Fogle is extreme" (Larimer, 2015b).

At the time, the scandal was predicted to decrease patronage of Subway. 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). 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 certain 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, 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 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 specific fast food restaurant chains in the past 30 days.⁵ 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 due to data issues; the number of visits is reported categorically and those categories change over time.⁶ This may not be a major disadvantage, as repugnance may be more likely to affect the extensive margin (whether one visits at all that month) rather than the intensive margin. 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.

The disclosure of information occurred in July 2015, and we examine data from January 2014 through December 2016. Thus, we examine 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

⁵ 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.

⁶ 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.

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.⁷ A strength of using the NCS is that it provides a large sample size and thus substantial statistical power to detect even modest effects.

Methods: Synthetic Control Models

Synthetic control models are based on the idea that, when the units of observation are a small number of entities (such as states, regions, or cities, 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; Abadie and Gardeazabal, 2003; Abadie, Diamond, and Hainmueller, 2010). 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.⁸ Synthetic control methods, sometimes called “comparative case studies” (Abadie et al., 2010; Cunningham, 2021) have been described as “arguably the most important innovation in the policy evaluation literature in the last 15 years” (Athey and Imbens, 2017, p. 9). Synthetic control models have been applied to estimate the effects of a wide range of shocks or treatments, including the Basque conflict in Spain (Abadie and Gardeazabal, 2003), a tobacco control program in California (Abadie et al., 2010), the Mariel boatlift (Peri and Yasenov, 2018), right-

⁷ The NCS surveys each individual in the household. We study adults (aged 18 years and older), but not youths because we do not have data for youths after 2013.

⁸ 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. We estimated DiD models in which the comparison firm was other sandwich restaurant chains contained in the Simmons NCS data (Blimpie, Panera/Au Bon Pain, Miami Subs, Quiznos, Schlotzsky’s), but the identifying assumption of parallel trends prior to treatment was violated. However, even if the results had been consistent with parallel trends, we still would have preferred a synthetic control model because of the ad hoc arbitrary nature of choosing one or more comparison firms for the DiD.

to-carry gun laws (Donohue et al., 2019) and legalized indoor prostitution in Rhode Island (Cunningham and Shah, 2018).

Unlike many applications of synthetic control models, in which the treated unit is a unit of geography - such as region (e.g. Abadie and Gardeazabal, 2003), state (e.g. Abadie et al., 2010; Cunningham and Shah, 2018; Donohue et al., 2019) or city (e.g. Peri and Yassenov, 2018) - 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 between zero and one, 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 important decision to be made is: what is the set of matching variables that one wants to be as similar as possible between the treated unit and synthetic control (Ferman, Pinto, and Possebom, 2020)? 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 additionally include four variables regarding the demographics of patrons of the chain in each pre-treatment wave: the proportion of the patrons in that time period that are female, white, have a high school degree, and have a household income under \$50,000. As robustness checks, we examine the sensitivity of results to using a range of matching variables (as recommended in Ferman, Pinto,

and Possebom, 2020) and to using a longer pre-treatment time period (which has the tradeoff of lowering the number of firms in the donor pool, because not all firms are included in every survey wave).

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 assess statistical significance, we use the randomization statistical inference of Fisher (1935). Specifically, 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.⁹ 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.

⁹ The randomization statistical inference of Fisher (1935) relies on the sharp null hypothesis: not only is the average effect of the treatment zero, but the treatment affects no unit whatsoever.

Robustness Checks and Extensions

In order to examine the sensitivity of our results, we conduct several robustness checks. First, we examine the sensitivity of the results to the set of matching variables. Ferman, Pinto, and Possebom (2020) suggest estimating synthetic control models with specific sets of matching variables, in order to demonstrate that researchers didn't cherry-pick a set of matching variables in order to engineer a specific result. The sets that they use in their paper are:

1. All pre-treatment outcome values
 - a. With no other covariates
 - b. With other covariates
2. The first three-fourths of the pre-treatment outcome values
 - a. With no other covariates
 - b. With other covariates
3. The first half of pre-treatment outcome values
 - a. With no other covariates
 - b. With other covariates
4. Odd period pre-treatment outcome values
 - a. With no other covariates
 - b. With other covariates
5. Even period pre-treatment outcome values
 - a. With no other covariates
 - b. With other covariates

We follow Ferman et al. (2020) and re-estimate our synthetic control models with each of these ten sets of matching variables.

The second extension is that we investigate the possibility of heterogeneity in how consumers responded to the disclosure of information about Jared. Numerous studies find that women are more likely than men to have been sexually assaulted. Among adolescents, being the victim of sexual assault by a peer was twice as likely among girls as boys (Young, Grey, and Boyd, 2009), and more generally, among those of all ages seeking counseling for sexual assault, women outnumber men 7:1 (Al-Asadi, 2021). Women also tend to have stronger negative reactions than

men to the sexual abuse of children (Wellman, 1993). Because women may respond more than men to the Jared Fogel scandal, we estimate models separately by gender.

We also estimate models separately for those who do and do not have children under the age of 18 in their household. For parents of minor children, the disclosure may be more salient, the scandal may be a more prominent attribute of Subway, or the disclosure may create a greater contrast between Subway and rival firms, any of which could lead to greater consumer response (Bordalo, Gennaioli, and Schleifer, 2022).

The third extension is that we use additional pre-disclosure time periods. In the main results, we will use data from 2013-2016 to study the impact of the mid-2015 disclosure. As an extension, we will use data from 2011-2016, and then from 2007-2016. There are advantages and disadvantages to expanding the number of pre-disclosure years. One advantage is the potential to better select donor units and their donor weights to better match the treated unit. (However, at some point, older data may not help and could hurt the match, if the units change over time in terms of characteristics not included in the matching variables.) Adding years to the dataset expands the number of consumers included in the analysis. In our main results based on 2013-16, the sample size is 78,903, whereas when we use data for 2011-16 the sample size is 145,933, and when we use data for 2007-16 the sample size is 238,032. However, a tradeoff of including additional years of pre-disclosure data is that it reduces the number of firms that we have in the donor pool, because there is less continuity of firms in every survey questionnaire over greater periods of time. In the main results (based on 2013-2016), we have data on 58 fast-food chains.

In contrast, when we use data for 2011-2016, we have data for 50 fast food chains, and when we use data for 2007-2016, we have data for 46 fast food chains.

In order to demonstrate that the information about the Jared scandal was widespread, we rely on two sources. First, we utilize the TV Archives database¹⁰ and plot the number of news stories related to the search term “Jared Fogle” over the study period. Second, we examine Google 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 zero TV news stories about Jared Fogle. However, when news of the scandal broke in July, there were 234 TV news stories, and when he pled guilty in August there were 271 more stories. The third peak in news stories coincides with his being sentenced to prison on November 19, 2015.

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,

¹⁰ The TV Archive database is part of the nonprofit Internet Archive that includes the Wayback Machine. For more information, see Internet Archive (2023).

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 third peak coincides with his sentencing in November 2015.

Both data sources are consistent with there being a sudden disclosure of information at the time of Jared Fogel’s arrest, and the brief time between his 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 for a relatively clean test of how consumers responded to the information disclosure (more so than if disclosure had occurred gradually over an extended period of time).

Results of the Synthetic Control Model

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 0.537), McDonalds (weight of 0.400) and Jack in the Box (weight of 0.063) – see Table 1.¹¹ It is common in synthetic control models for only a small number of donor units to get positive weights; for example, in Abadie et al. (2003) only 2 of 16 Spanish regions, in Abadie et al. (2010) only 2 of 38 states, in Peri and Yassenov (2018) only 2 to 4 (depending on the model) of 43 cities, and in Cunningham and Shah (2018) only 3 of 42 states got positive weights.

¹¹ The restaurant chains receiving positive weights and thus representing the synthetic Subway as hamburger chains, and thus may be different than ones someone might choose as comparisons, such as other sandwich chains Quizno’s, Blimpies, or Panera. As noted above in footnote 8, using a control group of other sandwich chains violates the parallel trends assumption.

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 3a. (Figure 3b shows the same data as Figure 3a, but for a narrower range of the Y axis to make it easier to see smaller changes over time.) The fact that Subway has a very similar trend to the synthetic control, both before and for several waves after the Jared scandal, is consistent with consumer patronage not changing in response to the information disclosure. In fact, the largest difference between Subway and its synthetic control occurs in the final wave, which is a year after disclosure. We discuss later why this later difference is unlikely to be due to repugnance.

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 0.241, 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 13 untreated firms whose estimated effect in the placebo test were greater than that for the truly treated firm, Subway. Figure 4 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 5a and 5b plot the RMSPE gaps by survey wave for all 59 firms; Subway's line is in bold. Again, the vertical dotted line indicates the timing of the treatment (disclosure of the information about Jared). 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 5a, 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 5b). 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 to 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 no 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.

The point estimate of the effect of the Jared Fogel scandal on Subway patronage is 0.013 (see the column for RMSPE-post, in Table 4); in other words, that it lowered patronage by 1.3 percentage points. Figures 5a and 5b show that much of the deviation of Subway from synthetic Subway does not occur immediately after information disclosure, but instead a year later (wave 87). One

would expect any consumer response to occur immediately after disclosure; the news coverage was high immediately but tapered off over time (Figure 1). Moreover, one would expect consumers' reaction to the information (or to reminders via news stories) to be strongest immediately after disclosure. In terms of Kahneman (2013), repugnance is part of system 1, which is fast and emotional, rather than system 2, which is slower and more deliberative. Thus, it seems highly unlikely that repugnance would be absent for nine months after information disclosure only to appear a year later. Instead, it seems more likely that the greater deviation between Subway and synthetic Subway in the final wave (one year after disclosure) is noise. If we re-estimate the synthetic control model excluding that final wave, the point estimate is .0064 (less than half the initial point estimate), with a p value of 0.655.

Subway's Strategic Response

What we measure in our models is how consumers responded to not just the disclosure of information about Jared, but also any strategic responses made by Subway.¹² Subway, as a privately-held company, does not have to share information or hold public meetings, as a publicly-traded company would, and as a result it is difficult to ascertain the full extent of any strategic responses. However, to investigate this, we examined two data sources: their statements on social media, and their ad spending around the time of the disclosure.

Statements on Social Media

Appendix 9 contains the extent of Subway's social media statements around the time of the scandal. These are taken from Facebook, but very similar statements were released via Twitter

¹² Lawler and Skira (2022) examine firm strategic responses to an information shock; specifically, how Pfizer responded to the FDA's removal of a black box warning on its smoking cessation drug Chantix. They find that Pfizer responded to the removal by increasing its spending on television advertising for the drug and increasing its detailing payments to physicians.

(with only minor differences in wording). Subway made two brief statements on July 7, one of which announced that Subway and Jared had mutually agreed to suspend their relationship with Jared. On August 1, they made a similar statement in response to new disclosures. On August 18, they announced that Subway no longer had a relationship with Jared, which they reiterated the following day. In summary, Subway said very little beyond immediately indicating their shock and disagreement, and that they had ended their business relationship with Jared.

Subway Advertising Spending

As a privately-held company, there is little information about Subway's advertising strategy.¹³ To determine whether Subway sought to offset the Jared scandal with a barrage of advertising, we examine data from Kantar Media Ad\$ponder reports, which document the total annual spending on advertising, in millions of dollars, by Subway.¹⁴ Figure 7 depicts Subway's ad spending by year from 2012-2018, and, as a comparison, that of other fast food firms: McDonald's, Burger King, Wendy's, and Taco Bell. It shows that Subway's ad spending was declining from \$456 million in 2012 to \$261 million in 2018, and there was no noticeable spike in ad spending in 2015 in response to the Jared scandal.

Between the minimal public comment, and the lack of any increase in ad spending (in fact, it decreased from the prior year), we do not observe any evidence of a meaningful strategy by Subway to counter the information disclosure. We acknowledge that there may have been responses by Subway that we cannot observe but that meaningfully affected consumer demand

¹³ When Jared's crimes were disclosed in July 2015, his ads were pulled off the air; the company's next ad campaign was not released until December 2015, and featured actor Tony Hale (Peterson, 2015).

¹⁴ We thank Meghan Skira for kindly providing us with copies of the Kantar Ad\$pending reports.

and note that what we measure is the net effect of the information disclosure and any strategic responses by Subway.

Extensions

In order to gauge the robustness of the results and investigate the possibility of subgroup heterogeneity, we conducted the following extensions and robustness checks.

Extension 1: Sensitivity to Matching Variables

As a robustness check, we examined the sensitivity of the results to using the ten sets of matching variables as used in Ferman, Pinto, and Possebom (2020). Table 5 lists the p values associated with the RMSPE ratio for Subway in the randomization statistical inference that uses each of ten sets of matching variables enumerated in the Methods section. In no case is the estimated effect size for Subway statistically significant at the 5% level; the lowest p value out of the ten in Table 5 is .172. 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.

The wave-by-wave RMSPE for each of those ten specifications is graphed in Figure 6. In contrast to the earlier randomization statistical inference graphs (Figures 5a and 5b), which compared Subway to unaffected donor firms (i.e., placebo tests), every line in Figure 6 is an estimate for Subway, each estimated using a different set of matching variables in the synthetic control method. The bold line in Figure 6 corresponds to the results from our primary model. The graph indicates that our primary model is not an outlier and is in fact in roughly the middle of the

estimates from the ten specifications in Ferman et al. (2020). A few specifications show a drop in RMSPE after the Jared scandal, but those same specifications had poor fit prior to disclosure so their RMSPE ratios are not statistically significant either. In summary, the results and conclusions of this paper are not sensitive to the choice of matching variables in the synthetic control model.

Extension 2: Subgroup Heterogeneity

In order to investigate subgroup heterogeneity, we estimate the synthetic control model for several subgroups: 1) adults with children aged 18 or younger in their household; 2) adults without children in their household; 3) women; and 4) men. The results are shown in Appendices 4-7; each appendix includes the table of SC weights on donor firms, the graph of the match of Subway to the synthetic Subway in each wave, the histogram of the RMSPE ratio compared to those of donor firms (with the p value from randomization inference listed below it in a note), and the graph of the RMSPE by period.

For each of these subgroups, there is no detectable effect of the information disclosure on patronage of Subway. For adults with minor children in the household (Appendix 4), the probability of patronage drops slightly in the wave following disclosure, but then Subway patronage rises for one wave before falling back to pre-disclosure levels. The p value of 0.121 indicates that we cannot reject null hypothesis that the post-disclosure change in patronage was zero, and the wave-by-wave pattern of results (specifically, a one-period jump in patronage that occurs two waves after disclosure) is not consistent with repugnance decreasing consumer demand. Results are also not statistically significant for the other subgroups examined: adults

without minor children in the household (Appendix 5; $p=0.517$), women (Appendix 6; $p=0.759$), and men (Appendix 7; $p=0.207$).

Extension 3: Longer Pre-Disclosure Time Period

In the main results, we use data from 2013-2016 to study the impact of the mid-2015 disclosure. As an extension, Appendix 8 presents results for 2011-16, and Appendix 9 presents results for 2007-16. As with the subgroup analyses, each appendix includes the table of SC weights on donor firms, the graph of the match of Subway to the synthetic Subway in each wave, the histogram of the RMSPE ratio compared to those of donor firms (with the p value from randomization inference listed below it in a note), and the graph of the RMSPE by period. In both cases, extending the number of pre-disclosure periods does not alter the main result that there is little change in patronage post-disclosure, and that it is not statistically significant ($p=0.529$ when we use 2011-16, and $p=0.298$ when we use 2007-16).

Discussion

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 not meaningfully greater than the effects estimated from placebo tests of many untreated firms, and thus is not statistically significant. Moreover, the largest change in patronage post-disclosure occurs 4 waves (one year) later, which is inconsistent with repugnance; when that final wave is excluded, the point estimate drops by half (and is also statistically insignificant).

This paper makes several contributions to the literature. First, we examine how consumers responded to negative information specific to a firm, but which was not informative about the qualities of the product or the firm management. Second, we conduct an empirical test of whether repugnance affects markets (Roth, 2007) and whether such information could represent a counter-cue to consumption (Bernheim and Rangel, 2004). Third, we use consumer surveys (rather than company reports or stock prices) to estimate the impact of information disclosure. Fourth, we estimate synthetic control models in which the units are firms rather than geographic areas. Fifth, we are one of the first to conduct the robustness checks for synthetic control models suggested by Ferman et al. (2020).

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). The results are robust to varying the set of matching variables and pre-disclosure time periods, and we also fail to detect effects for relevant subgroups, such as adults with minor children in the household.

Subway's public comment after the scandal was minimal, and we do not observe an increase in ad spending during the year of the scandal (their ad spending continued its multi-year decline), so there is no evidence that the null result is due to strategic responses by Subway that increased consumer demand and offset the impact of the scandal. Of course, we acknowledge that there may have been strategic responses by Subway that we do not observe, and that what we measure is the net effect of the information disclosure and any such strategic responses by Subway.

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 relevant 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).

Yet another relevant comparison is how consumers respond to 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%.

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 calorie information in

restaurants (e.g., Avery et al., 2023; Cantor et al., 2015; Elbel et al., 2009). The reason for the lack of a consumer response to the disclosure of information about Jared could be due in part to consumers perceiving that the information 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.

The absence of a detectable impact of the Jared scandal on patronage of Subway raises the question of whether Subway may have previously been overestimating the extent to which Jared was responsible for their increased sales. Recent research suggests that firms may routinely overestimate the value of advertising to their revenue or profit. Blake, Nosko, and Tadelis (2015) examine the effect of paid search ads for eBay and show that estimates from randomized experiments indicated that the return to paid search was actually a small fraction of what eBay believed based on non-experimental estimates. Likewise, Gordon et al. (2019) examine data from extremely large advertising RCTs conducted by Facebook and find that the observational methods often used in the advertising industry can greatly overestimate the return to advertising

as measured by RCTs. It may be that Subway, using methods other than RCTs, overestimated the impact of their Jared ad campaign.

In terms of methods, this paper demonstrates that consumer surveys can be used to estimate the effect of information disclosure 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 Jared Fogel scandal to the patronage of other restaurant chains. For example, instead of eating at Subway, patrons may have switched to eating at another 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. The possibility of spillovers between the treated unit and units in the donor pool is shared with other studies using SCM; for example, workers, jobs, and firms may move across the geographic units studied

in Abadie et al. (2003) and Peri and Yassenov (2018), and California's cigarette taxes studied in Abadie et al. (2010) may have led consumers to buy them in neighboring states.

Other limitations are that our data are repeated cross-sections rather than longitudinal, so we cannot observe how specific individuals changed behavior after the information disclosure. We are not able to examine the intensive margin of patronage, due to that being reported in only a few categories, and those change over time. 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.

Works Cited

- Abadie, A. (2021). Using Synthetic Controls: Feasibility, Data Requirements, and Methodological Aspects. *Journal of Economic Literature*, 59(2): 391-425.
- Abadie, Alberto, Alexis Diamond, and Jens Hainmueller. 2010. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association* 105 (490): 493-505.
- Abadie, Alberto, and Javier Gardeazabal. 2003. "The Economic Costs of Conflict: A Case Study of the Basque Country." *American Economic Review* 93 (1): 113-32.
- Akerlof, G. A. (1970). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, 84(3), 488-500.
- Ahluwalia, R., R. E. Burnkrant, and H. R. Unnava, "Consumer Response to Negative Publicity: The Moderating Role of Commitment," *Journal of Marketing Research* 37:2 (2000), 203-214. 10.1509/jmkr.37.2.203.18734
- Al-Asadi A. (2021.) Comparison Between Male and Female Survivors of Sexual Abuse and Assault in Relation to Age at Admission to Therapy, Age of Onset, and Age at Last Sexual Assault: Retrospective Observational Study. *JMIRx Med*;2(4):e23713
- Ambuehl, Sandro, Muriel Niederle, and Alvin E. Roth. 2015. "More Money, More Problems? Can High Pay Be Coercive and Repugnant?" *American Economic Review: Papers & Proceedings*, 105(5): 357-60.
- Andries, M., & Haddad, V. (2020). Information Aversion. *Journal of Political Economy*, 39.
- Arrow, K. J. (1963). Uncertainty and the Welfare Economics of Medical Care. *The American Economic Review*, 53(5), 941-973.
- Associated Press. (2015). Subway's Challenge: How to Erase Jared Fogle From Its Brand. NBC News, August 19. <https://www.nbcnews.com/business/business-news/subways-challenge-how-erase-jared-fogle-its-brand-n412531>
- Athey, Susan, and Guido W. Imbens. 2017a. "The State of Applied Econometrics: Causality and Policy Evaluation." *Journal of Economic Perspectives* 31 (2): 3-32.
- Avery, R. J., Cawley, J., Eddelbuettel J., Eisenberg, M., Mann, C., Mathios, A.D. Forthcoming, 2023. "Consumer Responses to Firms' Voluntary Disclosure of Information: Evidence from Calorie Labeling by Starbucks." *American Journal of Health Economics*, 9(1).
- Bachmann R., Ehrlich, G., Fan, Y., Ruzic, D., Leard, B. (2021). Firms and Collective Reputation: a Study of the Volkswagen Emissions Scandal. *NBER Working Paper* #26117.
- Bai, Jie, Ludovica Gazze, Yukun Wang. (2022). "Collective Reputation in Trade: Evidence from the Chinese Dairy Industry." *The Review of Economics and Statistics* 2022; doi: https://doi.org/10.1162/rest_a_01032
- Barrage, Lint, Eric Chyn, and Justine Hastings (2020), "Advertising and environmental stewardship: Evidence from the BP oil spill." *American Economic Journal: Economic Policy*, 12, 33-61.
- Bedard, K., & Kuhn, P. (2015). Micro-marketing healthier choices: Effects of personalized ordering suggestions on restaurant purchases. *Journal of Health Economics*, 39, 106-122. <https://doi.org/10.1016/j.jhealeco.2014.10.006>
- Bernheim, B.D. & Rangel A. (2004). Addiction and Cue-Triggered Decision Processes.

- American Economic Review*, 94(5): 1558-1590.
- Blake, Thomas, Chris Nosko, and Steven Tadelis. (2015). "Consumer Heterogeneity and Paid Search Effectiveness: A Large-Scale Field Experiment." *Econometrica*, 83(1): 155-174.
- Bollinger, B., Leslie, P., & Sorensen, A. (2011). Calorie Posting in Chain Restaurants. *American Economic Journal: Economic Policy*, 3(1), 91–128. <https://doi.org/10.1257/pol.3.1.91>
- Bordalo, Pedro, Nicola Gennaioli, Andrei Schleifer. (2022). "Salience." *Annual Review of Economics*, 14: 521-544.
- Cantor J, Torres A, Abrams C, Elbel B. Five Years Later: Awareness Of New York City's Calorie Labels Declined, With No Changes In Calories Purchased. *Health Aff* (Millwood). 2015 Nov;34(11):1893-900. doi: 10.1377/hlthaff.2015.0623. PMID: 26526247.
- Caulfield, K. (2019). Michael Jackson's Sales, Streaming Decline After 'Leaving Neverland' Broadcast. *Hollywood Reporter*, March 8. <https://www.hollywoodreporter.com/news/general-news/michael-jacksons-sales-streaming-decline-leaving-neverland-1193509/>
- Cawley, J., Susskind, A., & Willage, B. (2020). The Impact of Information Disclosure on Consumer Behavior: Evidence from a Randomized Field Experiment of Calorie Labels on Restaurant Menus. *Journal of Policy Analysis and Management*, 39(4), 1020–1042. <https://doi.org/10.1002/pam.22219>
- Chaney, P.K., Philipich, K.L., 2002. Shredded reputation: the cost of audit failure. *The Journal of Accounting Research* 40, 1221–1245
- Cunningham, Scott, and Manisha Shah. 2018. "Decriminalizing Indoor Prostitution: Implications for Sexual Violence and Public Health." *Review of Economic Studies* 85 (3): 1683–1715.
- Donohue, John J., Abhay Aneja, and Kyle D. Weber. 2019. "Right-to-Carry Laws and Violent Crime: A Comprehensive Assessment Using Panel Data and a State-Level Synthetic Control Analysis." *Journal of Empirical Legal Studies* 16 (2): 198–247.
- Dranove, D., Kessler, D., McClellan, M., & Satterthwaite, M. (2003). Is More Information Better? The Effects of "Report Cards" on Health Care Providers. *Journal of Political Economy*, 111(3), 555–588. <https://doi.org/10.1086/374180>
- Elbel B, Kersh R, Brescoll VL, Dixon LB. Calorie labeling and food choices: a first look at the effects on low-income people in New York City. *Health Aff* (Millwood). 2009;28(6): w1110–21. DOI: 10.1377/hlthaff.28.6.w1110.
- Evans, T. & Alesia, M. (2015.) Court documents reveal Jared Fogle's sordid secret life. *IndyStar*, August 19. <https://www.indystar.com/story/news/crime/2015/08/19/jared-fogle-subway-child-pornography-jared-foundation-indiana-university-diet-net-worth-family-us-district-court-southern-district--indiana/31929227/>
- Ferman, Bruno, Christine Pinto, and Vitor Possebom. 2020. "Cherry Picking with Synthetic Controls." *Journal of Policy Analysis & Management*, 39(2): 510-532.
- Fisher, R.A. (1935) *The Design of Experiments*. (8th ed., 1966) New York: Hafner Press.
- Freedman, Seth, Melissa Kearney, Mara Lederman; Product Recalls, Imperfect Information, and Spillover Effects: Lessons from the Consumer Response to the 2007 Toy Recalls. *The Review of Economics and Statistics* 2012; 94 (2): 499–516. doi: https://doi.org/10.1162/REST_a_00162
- Gordon, Brett R., Florian Zettelmeyer, Neha Bhargava and Dan Chapsky. (2019). "A Comparison of Approaches to Advertising Measurement: Evidence from Big Field Experiments at Facebook." *Marketing Science*, 38(2): 193-225.

- Handel, B. R., & Kolstad, J. T. (2015). Health Insurance for “Humans”: Information Frictions, Plan Choice, and Consumer Welfare. *American Economic Review*, 105(8), 2449–2500. <https://doi.org/10.1257/aer.20131126>
- Harwell, D., & Phillip, A. (2015). Ex-‘Subway guy’ Jared Fogle to plead guilty to child porn, underage sex. *Washington Post*, August 19.
- Healy, Kieran and Kimberly D. Krawiec. 2017. “Repugnance Management and Transactions in the Body.” *American Economic Review: Papers & Proceedings*, 107(5): 86-90.
- Herald-Times and IndyStar reports (2021). “‘Subway Jared’: A look at Jared Fogle's time in Bloomington and his criminal case.” Herald-Times. <https://www.heraldtimesonline.com/story/news/crime/2021/11/02/jared-fogle-subway-jared-timeline-career-and-downfall/6253368001/>
- Heath C & Heath D. (2007). *Made to Stick: Why Some Ideas Survive and Others Die*. (Random House: New York).
- Internet Archive (2023). Internet Archive TV News. <https://archive.org/details/tv> Accessed February 3, 2023.
- Jarrell, G. and Peltzman, S. (1985) The impact of product recalls on the wealth of sellers, *Journal of Political Economy*, 93, 512–36. doi:10.1086/261313
- Jin, G.Z. & Leslie, P. (2003). The Effect of Information on Product Quality: Evidence from Restaurant Hygiene Grade Cards. *Quarterly Journal of Economics*, 118(2): 409-451.
- Jovanovic, Boyan. 2021. "Product Recalls and Firm Reputation." *American Economic Journal: Microeconomics*, 13 (3): 404-42.
- Kahneman, Daniel. (2013). *Thinking, Fast and Slow*. Farrar, Straus and Giroux: New York.
- Karpoff, Jonathan M., John R. Lott, Jr., and Eric W. Wehrly. 2005. “The Reputational Penalties for Environmental Violations: Empirical Evidence.” *Journal of Law and Economics* 48 (2): 653–75.
- Kolstad, J. T. (2013). Information and Quality When Motivation Is Intrinsic: Evidence from Surgeon Report Cards. *American Economic Review*, 103(7), 2875–2910
- Larimer, S. (2015a). Ex-director of Jared Fogle’s foundation agrees to guilty plea in child exploitation case. *Washington Post*, September 1.
- Larimer, S. (2015b). Jared Fogle, ex-Subway spokesman, gets 15 years in prison for child porn, sex crimes. *Washington Post*, November 19.
- Lawler EC, Skira MM. (2022). “Information shocks and pharmaceutical firms' marketing efforts: Evidence from the Chantix black box warning removal.” *J Health Econ*. 81: 102557.
- Leuz, C. & Schrand, C. (2009). Disclosure and the Cost of Capital: Evidence from Firms' Responses to the Enron Shock. *NBER Working Paper* #14897.
- Littlefield, Christina and Ryan Parker. (2015). “The Subway guy: How Jared Fogle went from overweight student to cultural icon.” *Los Angeles Times*, July 7. <https://www.latimes.com/business/la-fi-jared-fogle-subway-20150707-htmstory.html>
- Masunaga, Samantha. 2015. “Jared who? How Subway will reposition its brand after child porn scandal.” *Los Angeles Times*, August 19. <https://www.latimes.com/business/la-fi-jared-subway-marketing-20150819-story.html>
- Maze, J. (2015a). Analysis: Subway reaches crossroads as spokesman crisis unfolds. *Nation’s Restaurant News*, July 8. <https://www.nrn.com/quick-service/analysis-subway-reaches-crossroads-spokesman-crisis-unfolds>
- Maze, J. (2015b). Subway breaks relationship with former spokesman Jared Fogle. *Nation’s Restaurant News*, August 19. <https://www.nrn.com/news/subway-breaks-relationship>

[former-spokesman-jared-fogle](#)

- Maze, J. (2015c). Report: Jared Fogle investigation hurt Subway's reputation. *Nation's Restaurant News*, October 1. <https://www.nrn.com/marketing/report-jared-fogle-investigation-hurt-subway-s-reputation>
- Murray, R. (2013). Subway commercial spokesman Jared Fogle marks 15 years of turkey subs and keeping the weight off. *New York Daily News*, June 9. <https://www.nydailynews.com/life-style/health/jared-subway-guy-marks-15-years-turkey-subs-article-1.1365511>
- Nelson, K. K., Price, R. A. and Rountree, B. R. (2008) The market reaction to Arthur Andersen's role in the Enron scandal: loss of reputation or confounding effects?, *Journal of Accounting and Economics*, 46, 279–93. doi:10.1016/j.jacceco.2008.09.001
- Pauly, M. V. (1968). The Economics of Moral Hazard: Comment. *The American Economic Review*, 58(3), 531–537.
- Peri, Giovanni, and Vasil Yassenov. 2018. "The Labor Market Effects of a Refugee Wave: Synthetic Control Method Meets the Mariel Boatlift." *Journal of Human Resources* doi: 10.3368/jhr.54.2.0217.8561R1.
- Peterson, Hayley. 2015. "Subway just launched its first new ad campaign since the Jared Fogle nightmare." *Business Insider*, December 19. <https://www.businessinsider.com/subways-first-ad-campaign-since-jared-fogle-nightmare-2015-12>
- Roth, Alvin, E. 2007. "Repugnance as a Constraint on Markets." *Journal of Economic Perspectives*, 21 (3): 37-58.
- Spence, M. (1973). Job Market Signaling. *Quarterly Journal of Economics*, 87(3), 355–374.
- Stigler, G. (1961). The Economics of Information | *Journal of Political Economy*: Vol 69, No 3. *Journal of Political Economy*, 69(3), 213–225.
- Wellman MM. (1993.) Child sexual abuse and gender differences: attitudes and prevalence. *Child Abuse Negl.* Jul-Aug;17(4):539-47. doi: 10.1016/0145-2134(93)90028-4. PMID: 8402256.
- Wisdom, J., Downs, J. S., & Loewenstein, G. (2010). Promoting Healthy Choices: Information versus Convenience. *American Economic Journal: Applied Economics*, 2(2), 164–178. <https://doi.org/10.1257/app.2.2.164>
- Young, Amy, Melissa Grey, and Carol Boyd. (2009). Adolescents' Experiences of Sexual Assault by Peers: Prevalence and Nature of Victimization Occurring Within and Outside of School. *Journal of youth and adolescence*. 38. 1072-83.

Table 1. Synthetic Control Restaurant Chains and Weights

Restaurant Chain	Synthetic Control Weight
Jack in the Box	0.537
McDonalds	0.400
Whataburger	0.063

Notes: Data: Simmons National Consumer Survey. Underlying N=78,903. The donor pool consists of 58 fast food restaurants, which are listed in the rows of Table 4. Dependent variable: patronage of that restaurant chain in the past 30 days. Matching variables listed in the rows of Table 2.

Table 2. Predictor Balance for Synthetic Subway

Matching Variable	Subway (Treated)	Synthetic Subway (Control)
Patronage - Wave 76	.263	.260
Patronage - Wave 77	.265	.255
Patronage - Wave 78	.270	.270
Patronage - Wave 79	.261	.260
Patronage - Wave 80	.245	.254
Patronage - Wave 81	.237	.241
Proportion Female	.565	.550
Proportion White	.755	.721
Proportion with a HS Diploma	.280	.293
Proportion with a HH Income <\$50k	.343	.373

Notes: Data: Simmons National Consumer Survey. Waves 76-81 cover all of 2014 and the first half of 2015. Underlying N=78,903. The donor pool consists of 58 fast food restaurants, which are listed in the rows of Table 4. Dependent variable: patronage of that restaurant chain in the past 30 days.

Table 3. Subway v. Synthetic Subway Patronage

Wave	Subway	Synthetic Subway
76	.264	.260
77	.265	.255
78	.270	.270
79	.261	.260
80	.245	.254
81	.237	.241
82	.247	.249
83	.252	.247
84	.246	.251
85	.249	.239
86	.243	.245
87	.237	.260

Notes: Data: Simmons NCS 2014-2016, with four waves per calendar year. N= 78,903. Wave 83 partially treated. Weights for synthetic control of Subway. Y: patronage of that restaurant chain in the past 30 days.

Table 4. RMSPE Table

Firm	RMSPE – Pre	RMSPE – Post	RMSPE Ratio	Rank	Percentile Rank
Krispy Kreme	0.001	0.009	7.873	1	0.017
Chick-fil-A	0.006	0.030	5.081	2	0.034
KFC	0.002	0.007	4.352	3	0.052
Whataburger	0.003	0.013	4.224	4	0.069
Schlotsky's	0.001	0.004	3.765	5	0.086
Cici's	0.003	0.011	3.731	6	0.103
Little Caesar's	0.001	0.004	3.422	7	0.121
Carl's Jr.	0.001	0.004	3.340	8	0.138
El Pollo Loco	0.002	0.005	2.934	9	0.155
Popeye's	0.002	0.006	2.914	10	0.172
Jack-in-the-Box	0.004	0.012	2.806	11	0.190
Panda Express	0.004	0.010	2.547	12	0.207
Pizza Hut	0.005	0.012	2.449	13	0.224
Subway	0.005	0.013	2.407	14	0.241
Papa John's	0.002	0.005	2.387	15	0.259
Boston Market	0.003	0.006	2.387	16	0.276
Five Guys	0.004	0.010	2.381	17	0.293
Captain D's	0.001	0.002	2.224	18	0.310
Del Taco	0.002	0.004	2.167	19	0.328
Bojangles	0.001	0.003	1.974	20	0.345
In-and-Out	0.005	0.010	1.928	21	0.362
Little Caesar's	0.001	0.002	1.902	22	0.379
Baskin Robbins	0.002	0.004	1.804	23	0.397
Qdoba	0.001	0.002	1.803	24	0.414
Domino's	0.002	0.003	1.682	25	0.431
Taco Bell	0.004	0.007	1.666	26	0.448
Quizno's	0.003	0.004	1.628	27	0.466
Steak n Shake	0.002	0.004	1.621	28	0.483
Jimmy Johns	0.003	0.005	1.614	29	0.500
Hardee's	0.003	0.005	1.609	30	0.517
Cold Stone Creamery	0.001	0.001	1.558	31	0.534
Long John Silver's	0.003	0.005	1.514	32	0.552
Firehouse Subs	0.003	0.004	1.510	33	0.569
Starbucks	0.006	0.009	1.469	34	0.586
Donato's	0.001	0.001	1.468	35	0.603
Blimpie's	0.001	0.001	1.341	36	0.621
Dunkin Donuts	0.007	0.009	1.328	37	0.638
Panera	0.006	0.008	1.276	38	0.655
Zaxby's	0.001	0.002	1.250	39	0.672
Chipotle	0.007	0.009	1.243	40	0.690
Burger King	0.006	0.007	1.207	41	0.707
Sbarro	0.001	0.002	1.161	42	0.724

Checkers	0.002	0.002	1.093	43	0.741
Wingstop	0.002	0.002	1.056	44	0.759
Arby's	0.007	0.008	1.052	45	0.776
Sonic	0.005	0.005	0.997	46	0.793
McDonald's	0.242	0.235	0.974	47	0.810
A&W	0.003	0.003	0.953	48	0.828
White Castle	0.002	0.002	0.950	49	0.845
Jamba Juice	0.003	0.002	0.906	50	0.862
Church's Chicken	0.003	0.003	0.900	51	0.879
Dairy Queen	0.015	0.013	0.868	52	0.897
Mazzio's	0.001	0.001	0.848	53	0.914
Au Bon Pain	0.002	0.001	0.774	54	0.931
Caribou Coffee	0.002	0.001	0.722	55	0.948
Wendy's	0.008	0.005	0.702	56	0.966
Rally's	0.001	0.001	0.694	57	0.983
Einstein Bros Bagels	0.002	0.001	0.685	58	1.000
Tim Horton's	0.002	0.002	0.618	59	1.017

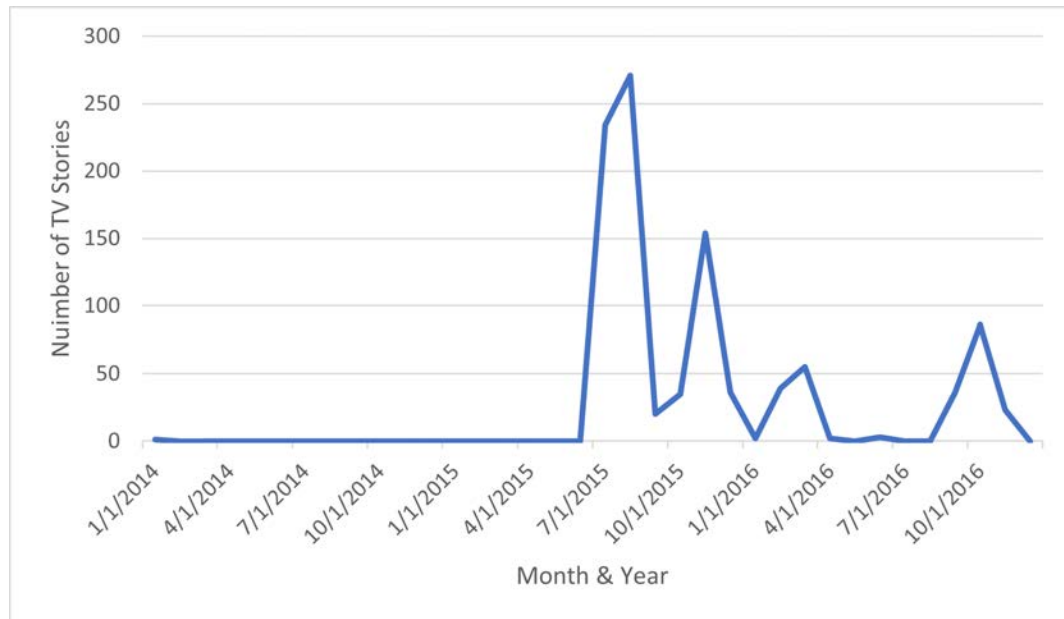
Notes: Data: Simmons NCS 2014-2016, with four waves per calendar year. N= 78,903.

Table 5: Robustness Check for Different Sets of Matching Variables

Specification	(1a)	(1b)	(2a)	(2b)	(3a)
P-Value	.293	.241	.414	.328	.241
Specification	(3b)	(4a)	(4b)	(5a)	(5b)
P-Value	.172	.293	.241	.621	.517

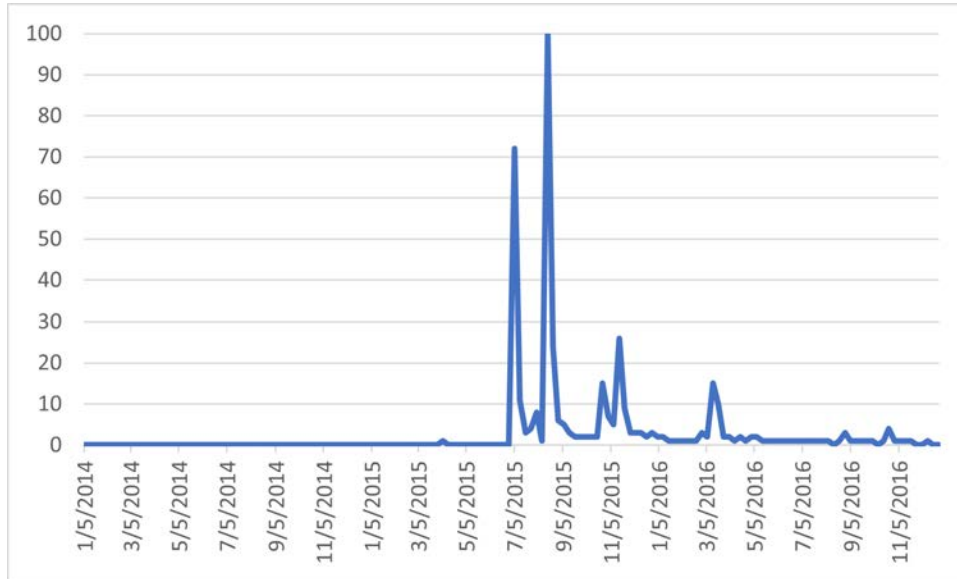
Notes: specifications of matching variables are as defined as in Ferman et al. (2020). Listed are the p values of the Subway RMSPE ratio in the randomization statistical inference using that set of matching variables.

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.

Figure 3a and 3b. Subway vs. Synthetic Subway Patronage

Figure 3a: with Y axis (Percent of Respondents Patronizing in the Past 30 Days) ranging from 0 to 0.3

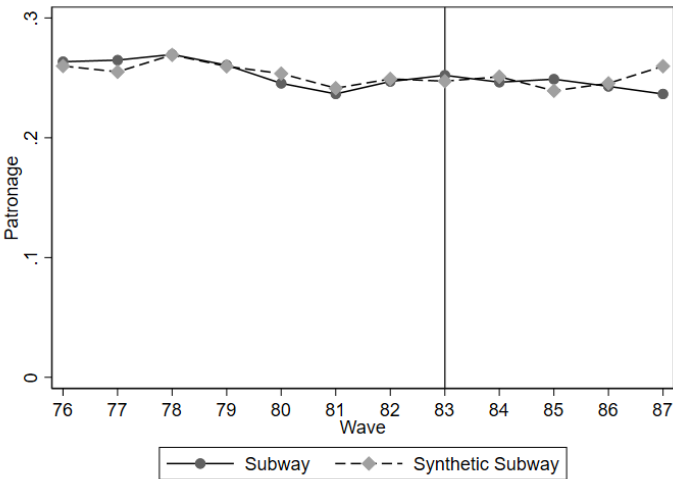


Figure 3b: with Y axis (Percent of Respondents Patronizing in the Past 30 Days) ranging from 0.2 to 0.3

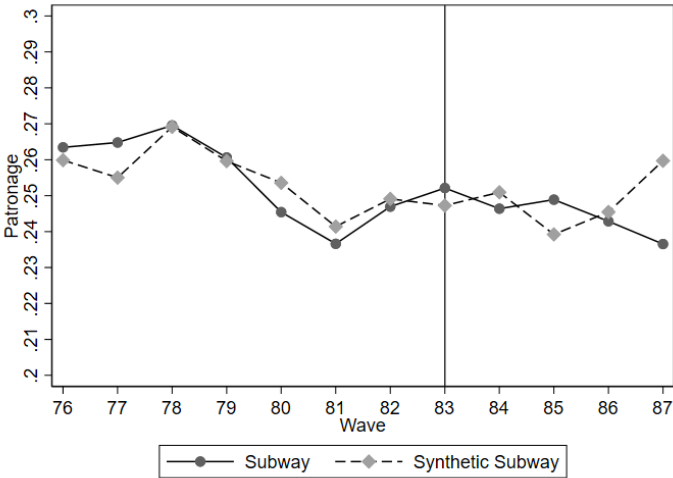
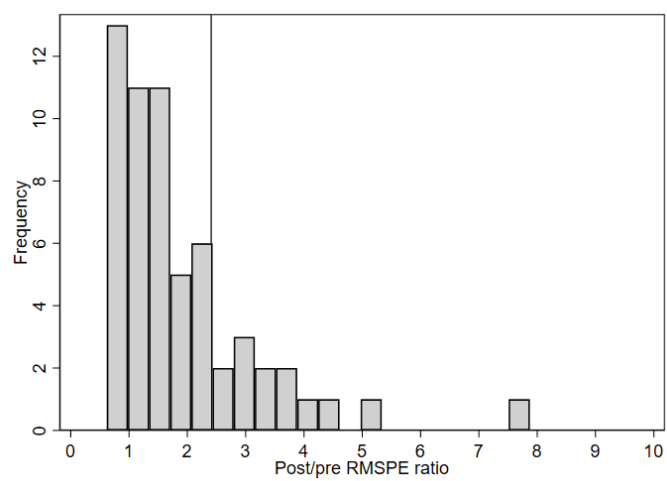


Figure 4. Plotted RMSPE Ratio Histogram



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

Figures 5a and 5b. RMSPE Gaps by Wave, All 59 Firms

Figure 5a: RMSPE Gaps by Wave, Including McDonald's (Top Line)

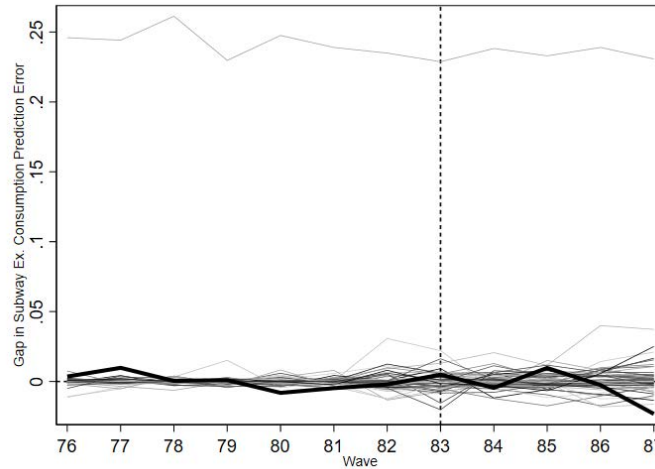
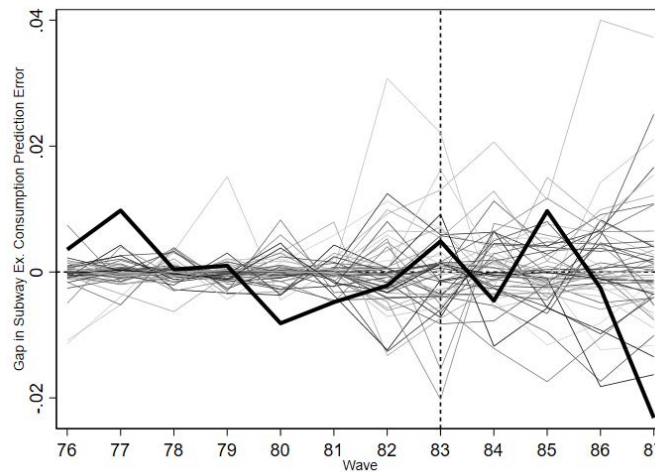
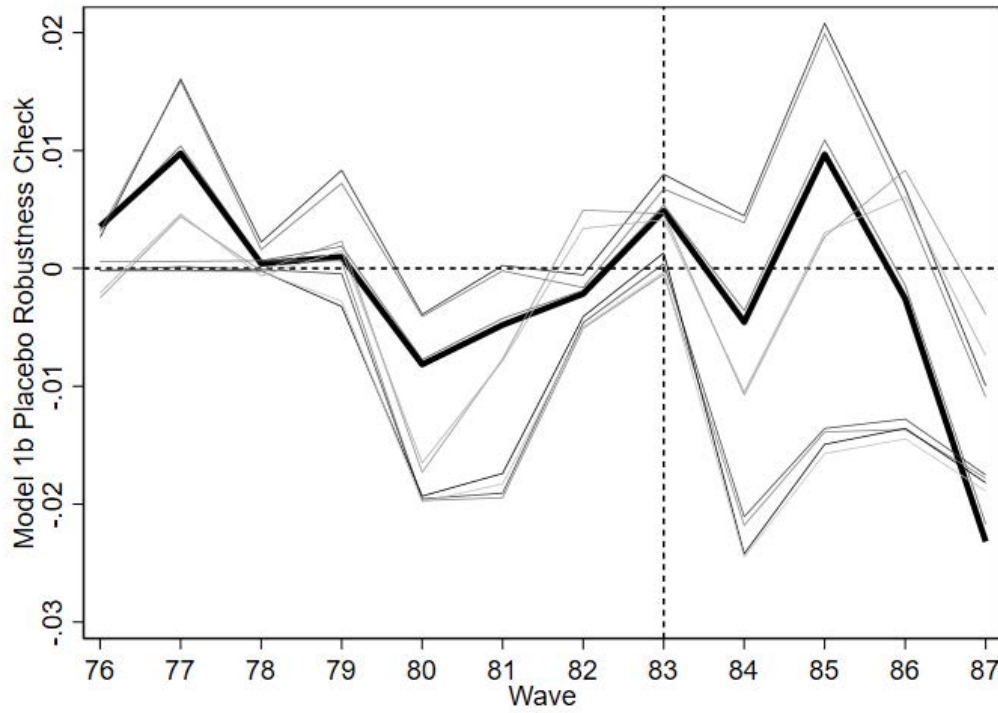


Figure 5b: RMSPE Gaps by Wave, Excluding McDonald's



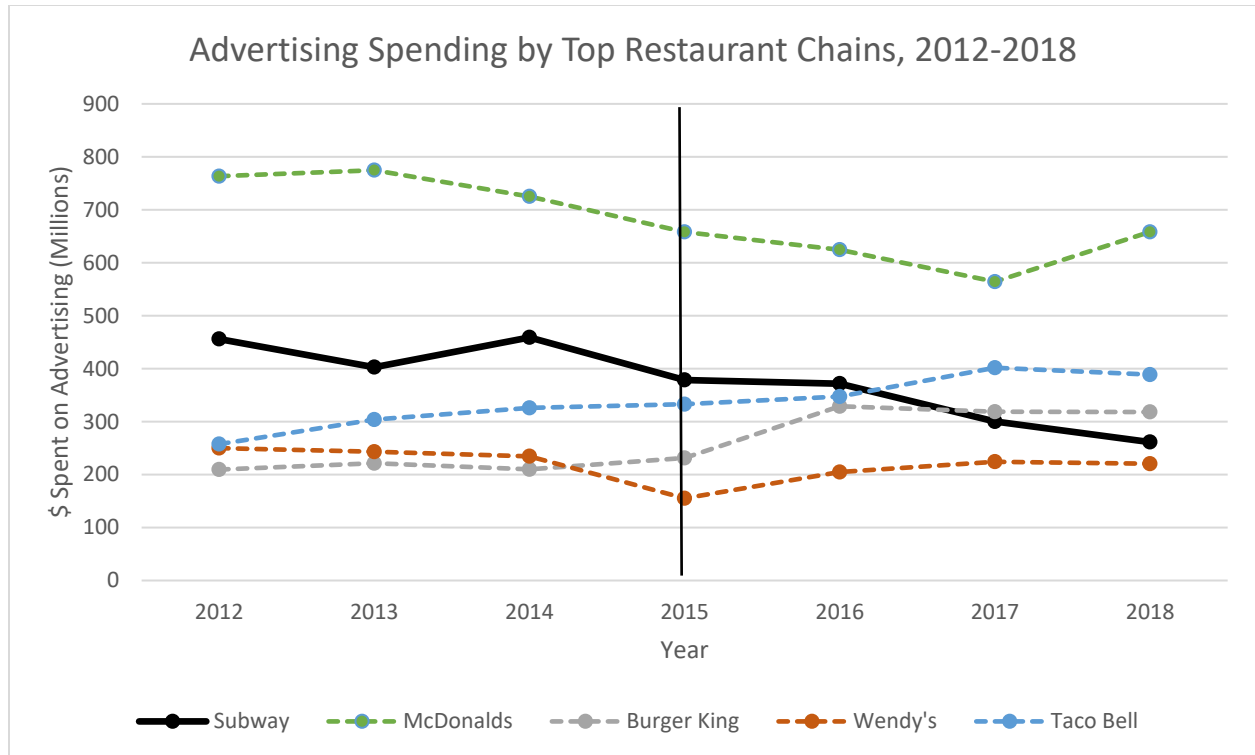
Notes: The bold line corresponds to Subway, and the lighter lines correspond to the other 38 fast food chains. McDonald's consistently has the highest error in every wave because it has by far the highest percentage of respondents who report patronizing it in the past 30 days, so it is difficult to construct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

Figure 6: RMSPE Gaps by Wave, for Subway with Different Matching Variables



Notes: Each line represents a different estimate for Subway, using the different specifications of matching variables in Ferman et al. (2020). The bold line corresponds to our primary model.

Figure 7: Subway Advertising, 2012-2018



Source: Kantar Media AdSpender reports, 2012-18. The vertical line indicates the year of the Jared Fogel scandal (2015).

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.

Appendix 3: Subway Statements on Social Media July – August 2015



Subway

July 7, 2015 · 🌐



We are shocked about the news and believe it is related to prior investigation of a former Jared Foundation employee. We are very concerned and will be monitoring the situation closely. We don't have any more details at this point.



1.4K

625 comments 187 shares



Subway

July 7, 2015 · 🌐



We are shocked about the news and believe it is related to prior investigation of a former Jared Foundation employee. We are very concerned and will be monitoring the situation closely. We don't have any more details at this point.



1.4K

625 comments 187 shares



Subway

July 7, 2015 · 🌐



We are shocked about the news and believe it is related to prior investigation of a former Jared Foundation employee. We are very concerned and will be monitoring the situation closely. We don't have any more details at this point.



1.4K

625 comments 187 shares



Subway

July 7, 2015 · 🌐



We are shocked about the news and believe it is related to prior investigation of a former Jared Foundation employee. We are very concerned and will be monitoring the situation closely. We don't have any more details at this point.



1.4K

625 comments 187 shares



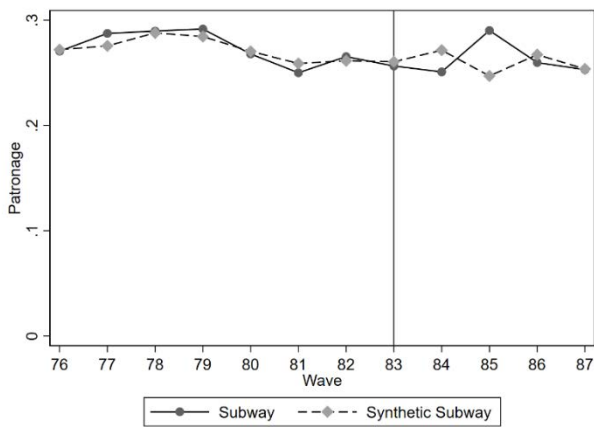
Source: Subway account on Facebook. Similar posts, with minor changes in wording, were posted on the company's Twitter account.

Appendix 4: Subgroup analysis: Adults With Children in the Household

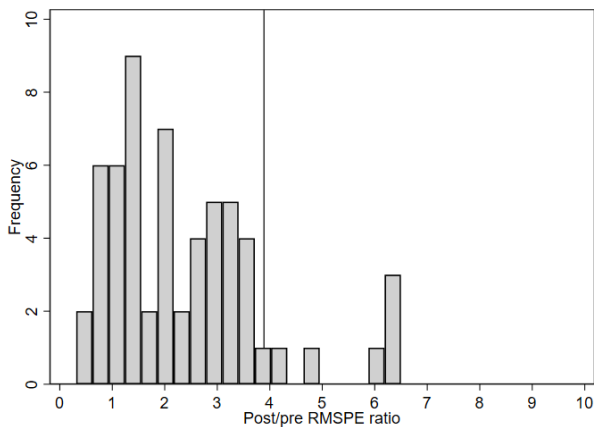
Appendix Table 4a: Synthetic Control Restaurant Chains and Weights

Firm	Weight
McDonald's	0.356
Whataburger	0.270
Little Caesar's	0.138
Sonic	0.125
Cici's	0.112

Appendix Figure 4a: Subway vs. Synthetic Subway Patronage

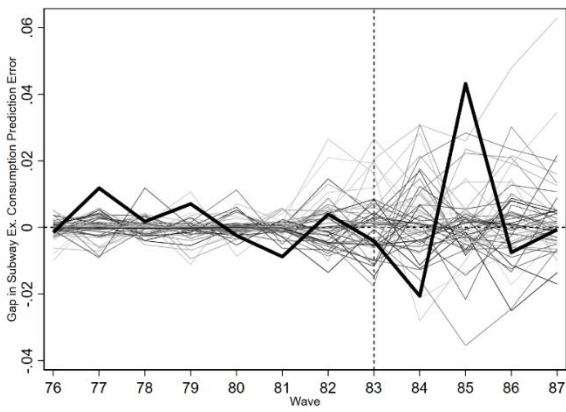


Appendix Figure 4b. Plotted RMSPE Ratio Histogram



Note: P value from Fisher randomized statistical inference: $p=0.121$

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



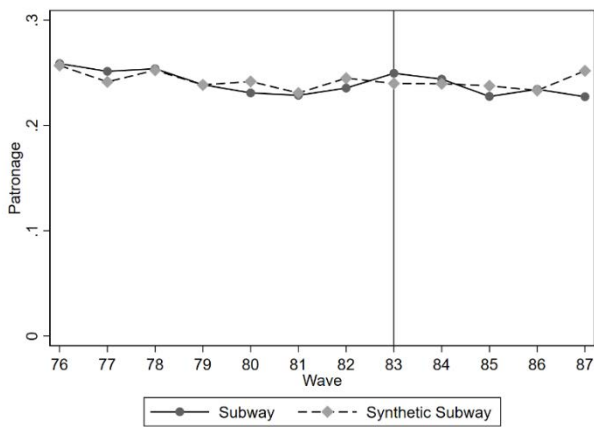
Note: excludes McDonald's (which has the greatest prediction error) to improve visibility.

Appendix 5: Subgroup analysis: Adults Without Children in the Household

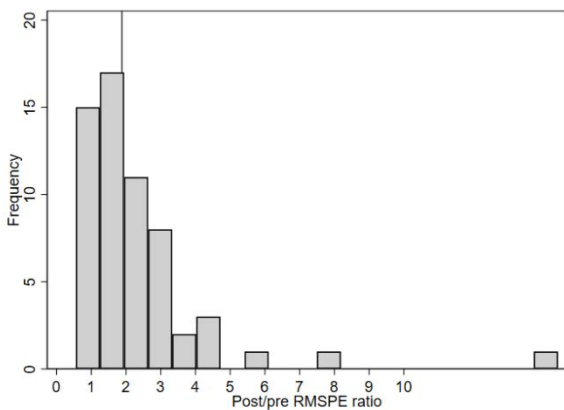
Appendix Table 5a: Synthetic Control Restaurant Chains and Weights

Firm	Weight
Jack in the Box	0.565
McDonald's	0.383
Wendy's	0.053

Appendix Figure 5a: Subway vs. Synthetic Subway Patronage

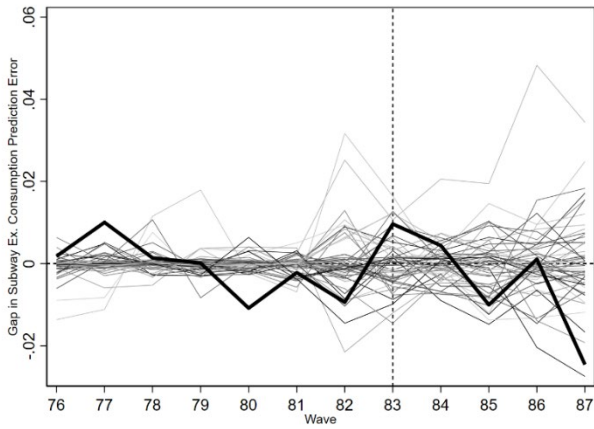


Appendix Figure 5b. Plotted RMSPE Ratio Histogram



Note: P value from Fisher randomized statistical inference: $p=0.517$

Appendix Figure 5c: RMSPE Gaps by Wave, Excluding McDonald's



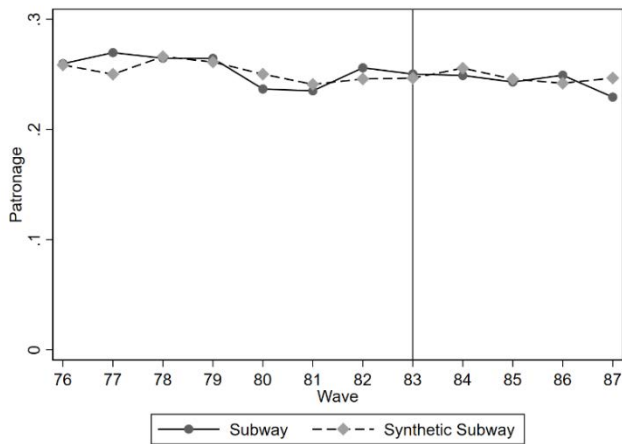
Note: excludes McDonald's (which has the greatest prediction error) to improve visibility.

Appendix 6: Subgroup analysis: Women

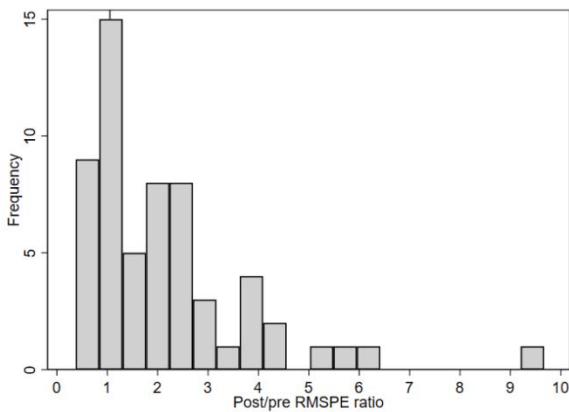
Appendix Table 6a: Synthetic Control Restaurant Chains and Weights

Firm	Weight
Cici's	0.339
McDonald's	0.289
Burger King	0.226
Wendy's	0.146

Appendix Figure 6a: Subway vs. Synthetic Subway Patronage

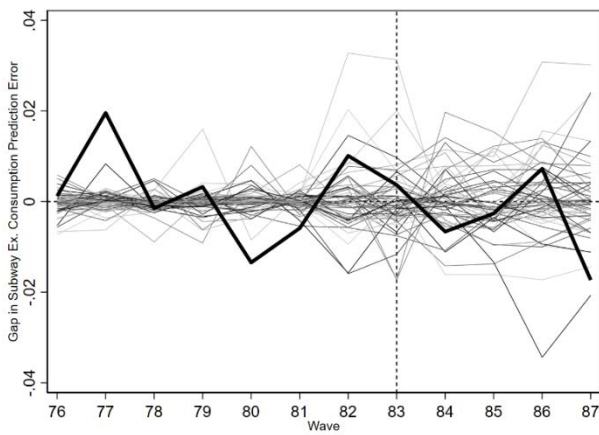


Appendix Figure 6b. Plotted RMSPE Ratio Histogram



Note: P value from Fisher randomized statistical inference: $p=0.759$

Appendix Figure 6c: RMSPE Gaps by Wave, Excluding McDonald's



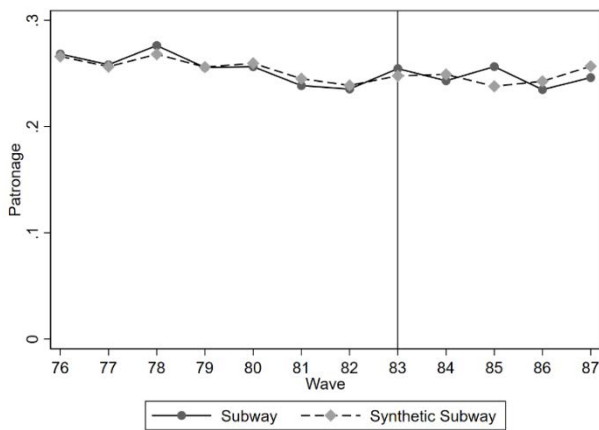
Note: excludes McDonald's (which has the greatest prediction error) to improve visibility.

Appendix 7: Subgroup analysis: Men

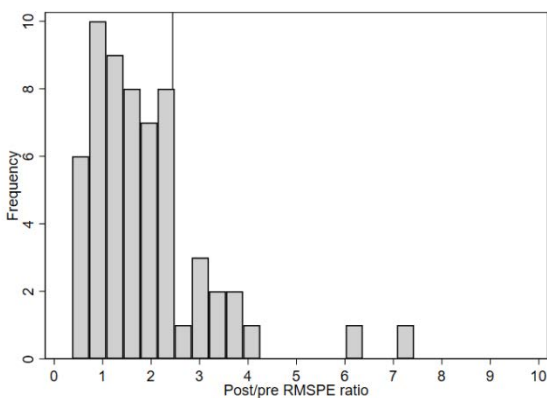
Appendix Table 7a: Synthetic Control Restaurant Chains and Weights

Firm	Weight
Taco Bell	0.459
McDonald's	0.235
Jack in the Box	0.225
Pizza Hut	0.081

Appendix Figure 7a: Subway vs. Synthetic Subway Patronage

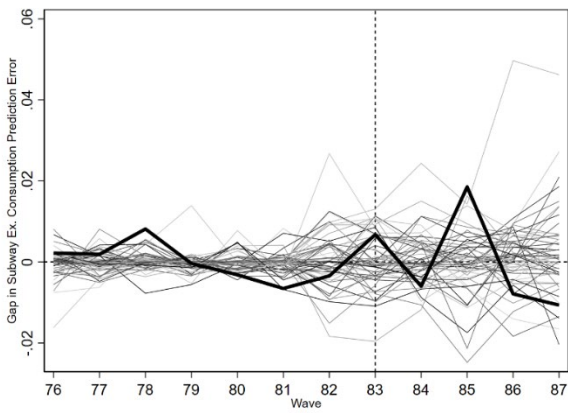


Appendix Figure 7b. Plotted RMSPE Ratio Histogram



Note: P value from Fisher randomized statistical inference: $p=0.207$

Appendix Figure 7c: RMSPE Gaps by Wave, Excluding McDonald's



Note: excludes McDonald's (which has the greatest prediction error) to improve visibility.

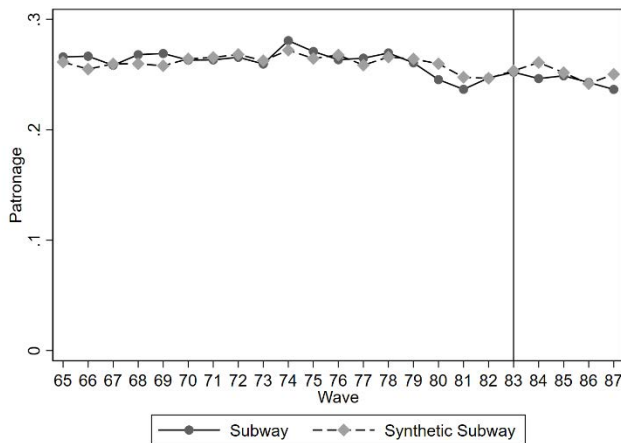
Appendix 8: Longer Pre-Disclosure Time Period, 2011-2016

In this appendix, we present results for synthetic control models estimated using a longer pre-disclosure time period. In the main results, we use data from 2013-2016 to study the impact of the mid-2015 disclosure. In this appendix we present results based on data from 2011-2016. In the main results, we have data on 58 fast-food chains. In this appendix, because we use additional years, only 50 fast food chains appear in all years of the data and thus can be used in the synthetic control model. The main results are based on the patronage data on 78,903 respondents. In this appendix, which uses additional years, the results are based on patronage data for 145,933 respondents.

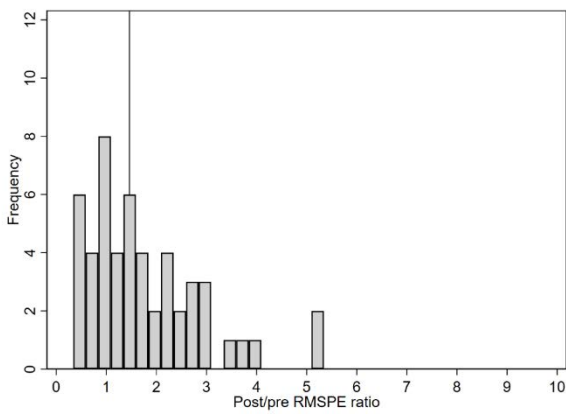
Appendix Table 8a: Synthetic Control Restaurant Chains and Weights

Firm	Weight
Burger King	0.354
Pizza Hut	0.289
McDonalds	0.206
Jack in the Box	0.088
Sonic	0.051
Wendy's	0.011

Appendix Figure 8a: Subway vs. Synthetic Subway Patronage

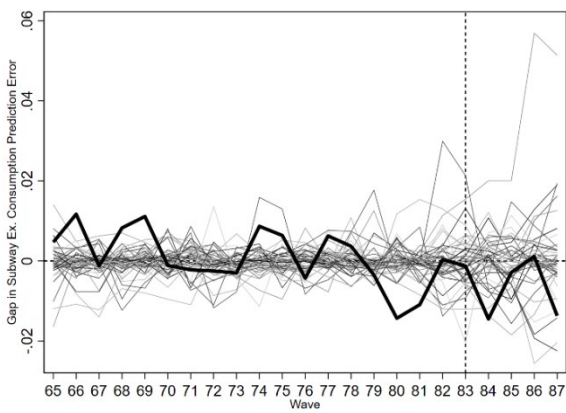


Appendix Figure 8b. Plotted RMSPE Ratio Histogram



Note: P value from Fisher randomized statistical inference: $p=0.529$

Appendix Figure 8c: RMSPE Gaps by Wave, Excluding McDonald's



Note: excludes McDonald's (which has the greatest prediction error) to improve visibility.

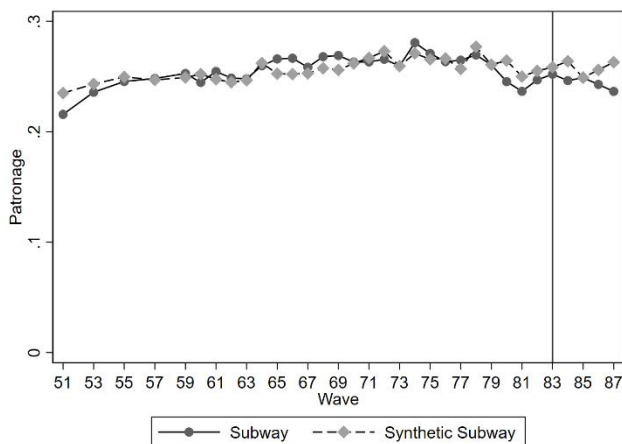
Appendix 9: Longer Pre-Disclosure Time Period, 2007-2016

In this appendix, we present results for synthetic control models estimated using a longer pre-disclosure time period. In the main results, we use data from 2013-2016 to study the impact of the mid-2015 disclosure. In this appendix we present results based on data from 2007-2016. In the main results, we have data on 58 fast-food chains. In this appendix, because we use additional years, only 46 fast food chains appear in all years of the data and thus can be used in the synthetic control model. The main results are based on the patronage data on 78,903 respondents. In this appendix, which uses additional years, the results are based on patronage data for 238,032 respondents.

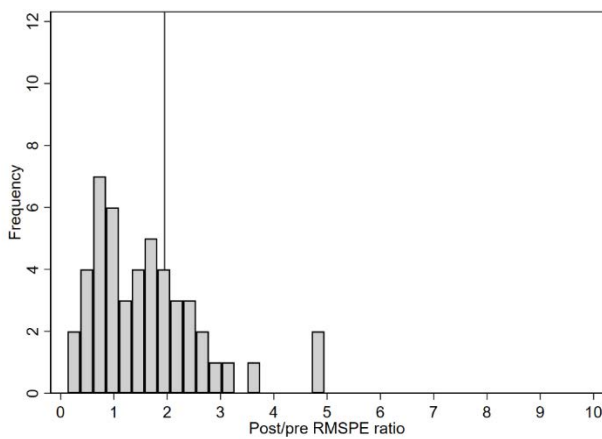
Appendix Table 9a: Synthetic Control Restaurant Chains and Weights

Firm	Weight
Taco Bell	0.419
McDonald's	0.279
Panda Express	0.173
Jack in the Box	0.129

Appendix Figure 9a: Subway vs. Synthetic Subway Patronage

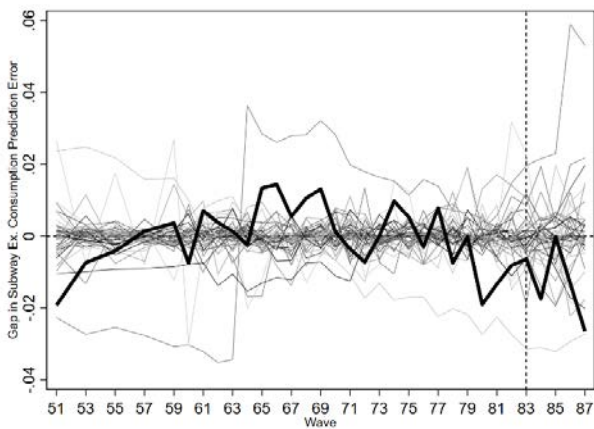


Appendix Figure 9b. Plotted RMSPE Ratio Histogram



Note: P value from Fisher randomized statistical inference: $p=0.298$

Appendix Figure 9c: RMSPE Gaps by Wave, Excluding McDonald's



Note: excludes McDonald's (which has the greatest prediction error) to improve visibility.