Perceived Egregiousness and Boycott Intensity: Evidence from the BP Deepwater Horizon Oil Spill[†]

December 20, 2013

Zhongmin Wang (corresponding author)
Resources for the Future
1616 P St, NW
Washington, DC 20036
wang@rff.org
202-328-5036

Alvin Lee
School of Management and Marketing
Deakin University
Victoria 3125 Australia
a.lee@deakin.edu.au

Michael Polonsky
School of Management and Marketing
Deakin University
Victoria 3125 Australia
michael.polonsky@deakin.edu.au

Abstract: Consumer boycotts are responses to egregious acts, and John and Klein (2003) predict that boycott intensity increases with the level of perceived egregiousness. This paper provides the first test of this prediction by studying the changes in BP branded gasoline's market share in response to the 2010 Deepwater Horizon oil spill. Consumers' perceived egregiousness of the BP oil spill can be approximated by the reported severity of the oil spill, which increased over time, and by geographical region, as consumers in the states bordering the Gulf of Mexico likely perceived the oil spill as more egregious. Using a weekly panel data set of BP branded gasoline's volume share and price differentials in 256 large US counties before, during, and after the oil spill, we find strong evidence that boycott intensity increases with our proxies of perceived egregiousness. Our study also sheds light on consumers' specific motives to participate in boycotts.

Key words: boycott, perceived egregiousness, BP oil spill

[†] We thank Shefali Khanna and Xu Liu for excellent research assistance and participants at several conferences for helpful comments. We are grateful to the Center for Sustainable and Responsible Organization at Deakin University for financial support. Any remaining errors are ours only.

1. Introduction

A large proportion of consumers have reported participating in boycotts. For example, according to the World Values Survey conducted by the European Values Study Group and World Values Survey Association, 16% of the survey subjects in the United States in the 1982 wave indicated participation in a boycott, and 26% of the survey subjects in the 2000 wave reported participation.[1] Furthermore, in 2005, Global Market Insite polled 15,500 consumers in 17 countries, finding that 36% of consumers had boycotted at least one brand.[2]

Why do consumers boycott firms' products? Consumer boycotts are ultimately responses to egregious or socially irresponsible acts. In an article published in Management Science, John and Klein (2003, 1198) write, "[w]e think of the underlying cause of boycott activity as being some egregious act or behavior by a producer. We define a boycott as occurring when a number of people abstain from purchase of a product, at the same time, *as a result of the same egregious act or behavior,* …" (emphasis in original). In their formal mathematical model, a consumer boycotts a firm if the benefit from boycotting exceeds the cost of doing so. John and Klein (2003) posit that the benefit of boycotting increases with the level of perceived egregiousness of the triggering event, and their model predicts that the equilibrium level of boycott participation increases with consumers' perceived egregiousness.

John and Klein's theory has profound implications for the boycott literature. Consider the literature that studies the impact of boycotts on firms' stock price (e.g., Pruitt and Friedman 1986; Pruitt et al. 1988; Koku et al. 1997) or the literature that examines the effectiveness of boycotts in influencing firms' behavior (e.g., Friedman 1985, Garrett 1987, Friedman 1991, and King 2008). These two lines of literature do not measure the intensity of boycotts or control the egregiousness of the boycott-triggering events, but John and Klein's theory implies that it is necessary to do so when studying the casual impact of boycotts on the offending firms. A more egregious act leads to a stronger boycott, which, in turn, is more likely to have an impact on the offending firm. In addition, an egregious event can have a direct impact on the offending firm without going through the boycott mechanism. For example, the Deepwater Horizon oil spill in 2010 caused a dramatic decline in BP's stock price largely because of the enormous liabilities generated by the oil spill instead of the BP gasoline boycott.[3] Hence, whether a sample of boycotts, such as those considered in the above two lines of literature, has a significant impact on the offending firms depends critically on the intensity of the boycotts in the sample and the egregiousness of

[1] Data used to compute the statistics were downloaded from the website www.worldvaluessurvey.org.
[2] http://www.holmesreport.com/opinion-info/4471/More-Than-a-Third-of-Worlds-Consumers-Boycott-Brands.aspx (accessed September 12, 2013).
[3] BP's market capitalization decreased from about $190 billion on April 20, 2010, to about $95 billion by mid-June 2010 (Aldy 2011, 1805). See section 2.2 of this paper for discussions that suggest (1) BP's liabilities from the spill far outweigh the impact of the BP boycott and (2) the gasoline boycott has little financial impact on BP because BP does not own BP branded retail stations.

the boycott-triggering events. This may partly explain why, in the words of Baron (2001, 14), "the anecdotal and empirical evidence on the effect of boycotts on firms is sketchy and inconclusive."

Given the important implications of John and Klein's theory, it is imperative to empirically test the predictions of their model. In this paper, we ask a key question: Does boycott intensity at the market level increase with the level of perceived egregiousness of the triggering event? The evidence, to date, speaks only to the question of how perceived egregiousness affects individuals' decision to participate in boycotts. Klein et al. (2002, 2004) find that subjects in their surveys who perceive the triggering event as more egregious are more likely to boycott, and Balabanis (2013) finds that perceived egregiousness is the strongest determinant of individuals' boycott participation. These findings support the fundamental role of perceived egregiousness in determining individuals' boycott participation, but do not provide direct evidence on how perceived egregiousness affects boycott intensity at the market level. The lack of evidence on how perceived egregiousness affects boycott intensity at the market level results from the difficulty of observing variations both in perceived egregiousness and in boycott intensity.

To the best of our knowledge, this paper provides the first piece of evidence that market level boycott intensity increases with perceived egregiousness. We study the extent to which the 2010 Deepwater Horizon oil spill caused automobile drivers in the United States to boycott BP branded gasoline over time and across geographical regions. Our study takes advantage of the fact that consumers' perceived egregiousness of the BP oil spill can be approximated by the reported severity of the oil spill, which increased over time, and by geographical region, as consumers in the states along the Gulf coast likely perceived the oil spill as more egregious. We have access to a weekly panel data set of BP gasoline brand's volume share and price differentials in 256 large counties in 28 US states before, during, and after the oil spill. We measure the intensity of boycott participation by decreases in BP brand's market share. The results strongly indicate that drivers boycotted BP brand gasoline. More importantly, the timing and intensity patterns of the BP boycott are consistent with the changes in the reported severity of the oil spill, and the boycott effect is stronger in the states bordering the Gulf than in other states.

Examining the BP boycott also helps better understand consumers' specific motives to boycott, which is the subject of a growing literature (e.g., Kozinets and Handelman 1998, Sen et al. 2001, Klein et al. 2002 and 2004, Hoffmann and Müller 2009, Braunsberger and Buckler 2011, and Balabanis 2013). Boycotts are typically conceptualized as a collective effort with the instrumental purpose to stop the egregious act. John and Klein (2003) recognize that boycott participation, seen in this light, is a puzzle

because of the free-rider and small-agent problems[4], so they also formalize the idea that an individual may participate in a boycott for noninstrumental motives, such as to avoid guilt or keep her hands clean (Smith 1990), to vent her frustrations (Friedman 1991), to enhance self-esteem, or to punish the offending organization. We argue that the BP boycott lacks a clear instrumental purpose; it is focused on expressing anger and punishing BP. Yet, we find strong evidence for a boycott effect, providing some evidence that noninstrumental motives alone can be strong enough to generate significant boycotting behavior. Most of the previous findings on consumers' specific motives to boycott are based on instances with identifiable instrumental purposes.

Only a small number of previous papers have measured boycott intensity by decreases in market sales (e.g., Ashenfelter et al. 2007, Chavis and Leslie 2009, Hong et al. 2011). These studies focus on whether an egregious act led to decreases in some products' market sales, not on the relationship between perceived egregiousness and boycott intensity.[5] In addition, due to data constraints, these studies generally use the number of related newspaper articles to identify ex ante the time period during which a boycott may have taken place. In this paper, we are able to use market share data to identify ex post the timing (e.g., the start, the peak, and the end) of the boycott because of the large number of cross-sectional units in our data set.

Our paper is of interest to a wide range of audiences. The BP oil spill is "by far the world's largest accidental release of oil into marine waters,"[6] and President Obama declared on June 15, 2010, that it is "the worst environmental disaster America has ever faced."[7] The oil spill caused many individuals, groups, Internet websites, and even newspaper editorials to call for or to call for not boycotting BP brand gasoline. Many newspaper articles reported anecdotal evidence that BP brand gasoline stations' sales were negatively affected by the oil spill. This paper is the first to provide rigorous empirical evidence on the impact of the oil spill on the sales of BP branded gasoline.

[4] The free rider problem refers to the observation that individuals can benefit from a successful boycott whether or not they participate. The small-agent problem refers to the observation that a single individual boycotter, similar to a single voter in an election, has a negligible impact on the boycott outcome.

[5] In their study of the boycott of French wine in the United States because of the French opposition to the Iraq war in early 2003, Chavis and Leslie (2009) examine whether political preferences affect boycott intensity. Their proxies for political preferences are cities (e.g., Boston versus Houston), which is similar in spirit to our geographical proxy for perceived egregiousness. Their data cover only four cities, and they find that political preferences did not affect boycott participation.

[6] See Campbell Robertson and Clifford Krauss, "Gulf Spill Is the Largest of Its Kind, Scientists Say," *The New York Times*, August 2, 2010.

[7] The White House, "Remarks by the President to the Nation on the BP Oil Spill," news release, June 15, 2010, http://www.whitehouse.gov/the-press-office/remarks-president-nation-bp-oil-spill (accessed September 12, 2013).

2. Conceptual Considerations

2.1 Perceived Egregiousness and Boycott Intensity

John and Klein's (2003) formal mathematical model of boycott participation uses the economic approach of cost and benefit analysis to assess whether people will participate in a boycott. The benefit from participating in a boycott includes (1) the utility gain from increasing the probability that the firm ceases the egregious act, (2) the utility gain from expressing anger or punishing the offending firm, and (3) the avoidance of the disutility associated with purchasing the product (due to guilt feelings or cognitive dissonance). John and Klein posit utility gains from boycotting increase as the perceived egregiousness of the socially irresponsible act increases. For example, if the perceived egregiousness is minor, then the utility gain from expressing anger or punishing the firm is small as well. A consumer's cost of boycotting is the utility loss a consumer experiences when she changes her consumption bundle from one with the boycotted product to one without. Given that an increase in perceived egregiousness increases the benefit from boycott participation, John and Klein's model predicts that an increase in perceived egregiousness tends to increase boycott participation.

The BP oil spill is a suitable setting for testing this prediction because the reported severity of the oil spill changed over time. Presumably, the perceived egregiousness of the BP oil spill can be approximated by the reported severity of the spill, which increased over time and can be measured by the official flow rate, the daily volume of oil leaking into the ocean. The Deepwater Horizon oil rig exploded on April 20, 2010, and the initial official daily flow rate was only 1,000 barrels up to April 27. The flow rate increased to 5,000 barrels the next day, to 12,000-19,000 barrels on May 27, to 25,000-30,000 barrels on June 10, and to 35,000–60,000 barrels on June 15 (Staff of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011). The oil leak was stopped on July 15 when the well was capped, though considerable uncertainties remained as to whether capping the well would force oil to create leaking paths in the rock until August 4 when "static kill" was declared a success.[8] The US federal government declared on September 19, 2010 that the BP well was "effectively dead" after a relief well was completed and the BP well was permanently sealed.

Perceived egregiousness of the BP oil spill may vary among individuals, but the average perceived egregiousness is expected to increase as the reported severity of the oil spill increases. Hence, we presume that the average perceived egregiousness of the BP oil spill is initially small, becomes larger over time, and peaks around the time when the oil leak was stopped. The perceived egregiousness of the oil spill after it was stopped may remain large, because of the continuing negative environmental effects, but the benefits of boycotting BP diminish as consumers' anger towards BP fades.

[8] Static kill is the procedure of pumping heavy drilling mud into the well to push oil and gas back into the reservoir.

The cost of boycotting BP is likely to be small because gasoline is a relatively homogeneous product available at many stations. Assuming that the cost of boycotting BP is essentially constant over time and that boycott intensity changes quickly with the average perceived egregiousness (as measured by the reported severity of the spill), John and Klein's model then predicts the following boycott participation patterns:

H1: *(a) Boycott intensity is weak or nonexistent initially, (b) becomes stronger as the reported severity of the spill increased, (c) peaks around the time when the oil spill was stopped, and (d) declines thereafter*.

Reasonably, consumers in the Gulf states may consider the oil spill more egregious than those in other states because the economy and environment in the Gulf region were most directly harmed by the oil spill (Aldy 2011, Barbier 2011, Lee and Blanchard 2012, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011). Thus, the logic of the John and Klein model predicts:

H2: *Boycott intensity in the Gulf states is stronger than that in other states*.

John and Klein (2003) do not model how firms respond to boycotts. Competition in retail gasoline markets can be characterized by standard economic models of price competition with differentiated products (e.g., Hastings 2004). In such a model,[9] a boycott can be modeled as a negative demand shock to the offending firm. In equilibrium, the negative demand shock causes the offending firm to cut its price. Because of strategic complementarity, rival firms cut their prices as well, but the size of their price cuts are smaller than that of the offending firm.[10] As a result of the boycott, the offending firm's price, relative to those of its rival firms, becomes smaller. The decrease in the offending firm's relative price is larger if the demand shock is larger. Therefore, if the oil spill causes consumers to

[9] Consider a simple model in which two firms, 1 and 2, compete over the price of a differentiated product. A firm's demand is decreasing in its own price and increasing in its competitor's price. Suppose firm 1 is the offending firm. One then can add an exogenous negative shock to firm 1's demand function to represent the boycott effect. In this setting, one can easily show that (1) firm 1's equilibrium response is to cut its price, (2) firm 2's response is to cut its price as well (because of strategic complementarity), and (3) firm 2's price cut is smaller than that of firm 1.

[10] The prediction that rival firms cut their prices results from the assumption that a boycott has no direct impact on their demand (it only has a direct negative impact on the offending firm's demand). If one assumes that a boycott has a direct and positive impact on rival firms' demand as well, then rival firms may not cut their prices in response to the boycott. Rival firms face the pressure of cutting price because of strategic complementarity, but they also have the incentive to increase price because of the positive demand shock. The sign of the rival firms' price changes depends on the parameters of the model. However, the prediction that offending firm's rice, relative to those of its rivals, becomes smaller continues to hold for reasonable parameters.

boycott BP branded gasoline and if the boycott effect is stronger in the Gulf states, then we have the following hypotheses:

H3: *(a) BP stations' relative retail price becomes smaller in response to the oil spill, and (b) the decrease in BP stations' relative price is smaller in the Gulf states than in other states.*

It is useful to note that on June 29, 2010, BP announced that it would offer price rebates to distributors of BP gasoline for some periods.[11] The price rebate was 2 cents per gallon along the Gulf Coast and 1 cent per gallon in the rest of the country. Price cuts are expected to attenuate the possible decreases in BP's market share due to boycotting behavior.

2.2 Specific Motives to Boycott BP Gasoline

Perceived egregiousness is the fundamental determinant of boycott participation, but what are consumers' specific motives to boycott the offending firms? A literature has studied the importance of instrumental versus noninstrumental motives for boycotting. In a survey study of consumers' motivations for participating in a boycott of Nestlé products, Klein et al. (2002, 363, 366) find that "instrumental motivations appear to predominate" and that subjects tend to "dismiss punishment, anger and concerns for other people as reasons for participation." On the other hand, by analyzing consumers' online comments, Kozinets and Handelman (1998) find that boycotters see their involvement not merely as part of a collective effort but also as an expression of their individuality or as a vehicle for moral self-realization. Similarly, Braunsberger and Buckler (2011) find that boycott pledgees express both instrumental and noninstrumental desires. The boycotts studied in these papers appear to have identifiable instrumental purposes. There are also papers that study boycotts without a clear instrumental purpose. For example, Smith and Li (2010) find that Chinese consumers continue to boycott Japanese goods because of atrocities during World War II. We argue below that the BP boycott lacks a clear instrumental purpose.

The typical purpose of an instrumental call for boycott is to force the firm to cease the egregious act. However, in the calls for boycotting BP branded gasoline there was never any discussion that boycotting the firm would help stop the spill or speed up BP's activities. Public Citizen was the main organization that urged consumers to boycott BP brand gasoline. Yet, in its May 14, 2010, press release, Public Citizen called for boycotting BP gasoline and emphasized consumer anger and punishment, not concrete goals: "BP must pay. A consumer boycott will deliver that message and give people a way to act

[11] Harry Weber, "AP News Break: BP Giving Financial Help to Stations," June 29, 2010. Available at http://www.boston.com/business/articles/2010/06/29/bp_floating_financial_lifeline_to_station_owners/ (accessed September 12, 2013)

on their anger. We are urging people to send a clear message to BP that its shoddy oversight of this project and its history of environmental and worker safety violations is unforgivable."[12] A "Boycott BP" Facebook page attracted more than 800,000 "likes" at one point. Yet, the creator of this website never mentioned specific goals for boycotting BP gasoline.

In fact, BP already had strong incentives to stop the spill because of the tremendous pressure from the US federal government and because of the enormous legal liabilities and potential criminal investigations. For example, an article on Knowledge @ Wharton in June 2010 reported the views of several academic scholars on the BP boycott and suggested that a BP boycott "is likely to be only a nuisance when compared to the outsized legal liability the company is facing from the Gulf spill."[13] In addition, "according to Wharton management professor Lawrence G. Hrebiniak, boycotts tend to be more successful when there is a clear connection between the act of boycotting and some desired outcome. 'It's not clear that if we boycott [BP] it solves the leak in the Gulf.' After all, Hrebiniak notes, BP is clearly aiming massive resources at stopping the spill, and a boycott doesn't make success in that arena any more likely."[14] Further, even the president of Public Citizen agrees that "BP's liability from the spill may be far greater than the impact of a boycott."[15]

There were many calls for not boycotting BP gasoline, and the arguments centered on whether boycotting BP would be an effective way to either punish BP or to keep one's hands clean (or to avoid guilty feelings)—not on whether boycotting may help stop the oil spill. For example, a May 31, 2010, Los Angeles Times editorial, "Boycott BP gas stations? That's the wrong target,"[16] presumes that people would boycott BP to express their anger or to punish BP, arguing, "[i]t's not surprising that people want to take action to express their despair … [but there] are far better and more effective outlets for public outrage." The editorial mentions two reasons why BP is the wrong target. First, the editorial asks, if people boycotted BP gasoline, where would they fill up? "[I]n the oil business," asserts the editorial, "nobody has clean hands." Second, it argues, "BP stations are independently owned, so a boycott hurts individual retailers more than London-based BP."

3. Data

Our data are provided by Oil Price Information Service (OPIS). OPIS collects gasoline price and quantity data from the transaction records of the Wright Express fleet cards. These price and quantity data

[12] "Public Citizen Urges Boycott of BP: BP Should Know That Its Irresponsibility Is Unacceptable; More Than 5,000 Have Already Signed Petition," http://www.citizen.org/pressroom/pressroomredirect.cfm?ID=3131
[13] "To Boycott or Not: The Consequences of a Protest," Knowledge @ Wharton, June 9, 2010, http://knowledge.wharton.upenn.edu/article.cfm?articleid=2515 (accessed September 12, 2013).
[14] Ibid.
[15] Ibid.
[16] http://articles.latimes.com/2010/may/31/opinion/la-ed-bp-20100531

are used by OPIS's clients, including gasoline retailers, to monitor retail gasoline markets. OPIS gasoline data have also been used in many academic studies (e.g., Taylor et al. 2010 and Busse et al. 2013). Wright Express states that upwards of 4 million drivers from more than 280,000 businesses (e.g., small businesses, large corporations, and government agencies) use the fleet cards, which are accepted at more than 90 percent of the retail fueling stations in the United States. Users of Wright Express cards may buy gasoline from any accepting stations.

We observe, by county, two weekly-frequency market outcome variables—BP brand's volume share and its price differential with competing brands—for 112 weeks, from January 2009 through February 2011. The price differential is defined as the average price of BP-branded gasoline in a county minus the average price of all competing brands in the same county. A week is defined as the seven days from Thursday through Wednesday. The Deepwater Horizon rig exploded on April 20, 2010, but the accident was not reported by major newspapers until April 22, 2010, a Thursday (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011, 129). We treat the seven days, from April 15 through April 21, as the week prior to the accident. Therefore, our sample covers 68 weeks prior to the accident and 44 weeks afterward.

Our analysis focuses on large counties, defined as those with at least 50 retail stations and at least 5 BP brand stations. The data for large counties are more reliable because such counties tend to have more Wright Express users. Our sample covers 256 such counties in 27 states and the District of Columbia. BP brand gasoline is sold in three of the five states bordering the Gulf of Mexico—Alabama, Florida, and Mississippi—and 44 sample counties are located in these three states.

Figures 1 and 2 present BP's weekly volume share and price differential with competing brands averaged over all sample counties during the entire sample period. The patterns shown in these two figures are simple averages without any controls. Figure 1 suggests that BP's volume share did not decrease in the first three post-spill weeks but then became quite volatile and considerably smaller than the pre-spill level for a considerable number of weeks. Subsequently, volume shares became less volatile and approached pre-spill levels. Figure 2 suggests that BP retail stations cut prices in some early post-spill weeks. The upward trend in BP's price differential starting in late October 2010 may be related to the expiration of the price rebates that BP offered to gasoline distributors.

The oil spill did not cause supply disruptions to BP refineries. In fact, gasoline sold at some BP-branded stations may not come from BP refineries.[17]

[17] Some stations "just get a spritz of BP additives right before it ends up at the service station." See Ron Lieber, "Punishing BP Is Harder Than Boycotting Stations," *The New York Times*, June 11, 2010.

Figure 1. BP's Weekly Volume Share

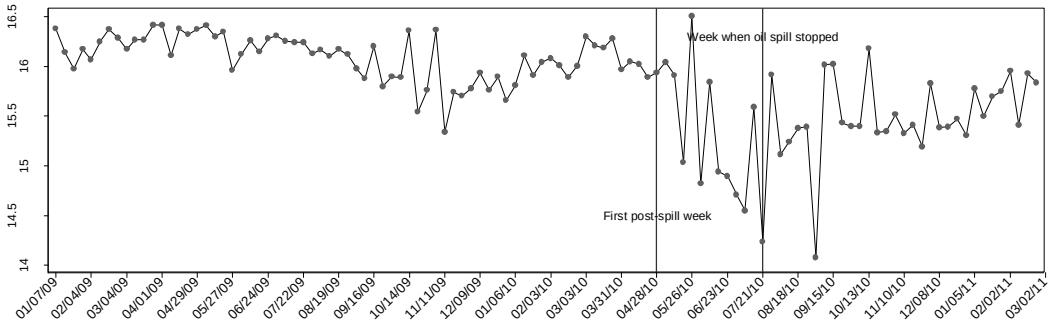
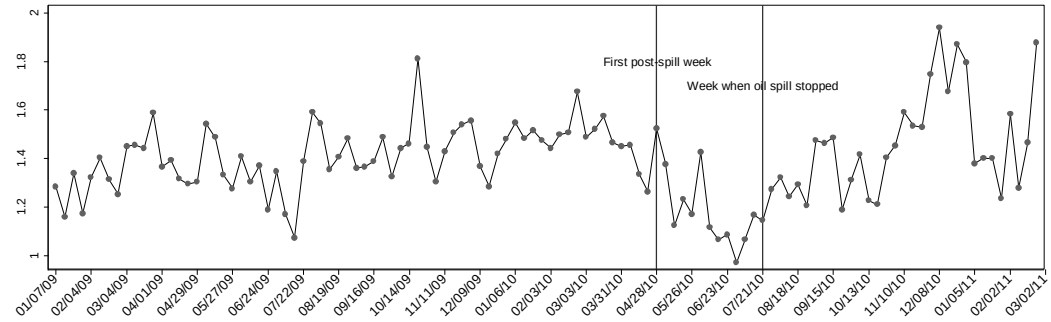


Figure 2. Weekly Price Differential between BP and Competing Brands



4. Econometric Model and Results

We use variations of the following model to study the impact of the oil spill on BP's volume share and price differential:

$$BP_{it} = c + flow_t + \alpha_i + T_{it} + T'_t + M_t + \varepsilon_{it}. \qquad (1)$$

The dependent variable BP_{it} is a measure of BP's market outcome in county i in week t; $flow_t$ is the official flow rate in week t divided by 1,000 (so that the unit is 1,000 barrels per day);[18] α_i is a county fixed effect, T_{it} is a county-specific time trend, T'_t is the overall time trend, $M_t$is a month dummy, and ε_{it} is the error term. The reported standard errors are those suggested by Davidson and MacKinnon (1993, 554–556), which are rather conservative. The random-effects estimates are essentially the same.

We use equation (1) to test hypothesis 1b (i.e., boycott intensity increases as the reported severity of the oil spill increased), where the dependent variable is BP's weekly volume share. When estimating

[18] Prior to the oil spill, the flow rate is, of course, zero. When a week corresponds to two different daily flow rates, we use the weighted average of the two daily flow rates, where the weights are the number of days during the week that correspond to a particular flow rate. If the flow rate for a particular day is a range (e.g., 12,000-19,000 barrels), we use the average (e.g., 15,500 barrels).

this specification, we restrict our sample to the pre-spill weeks and the first thirteen post-spill weeks because flow rate is no longer a good proxy of perceived egregiousness after the oil spill was stopped in week 13. Specification (1) in Table 1 reports the estimated results. The estimated coefficient for the flow rate variable is -0.025 and is highly statistically significant. This result implies that BP's market share decreases by 0.025% if the daily flow rate increases by 1,000 barrels, confirming that boycott intensity increases with the reported daily flow rate, our proxy for average perceived egregiousness.

To test hypothesis 2 (i.e., whether the boycott effect is stronger in the three Gulf states), we add into equation (1) a variable, $flow_t * Gulf$, that interacts the daily flow rate with a Gulf dummy variable ($Gulf$) indicating whether a county is in a state bordering the Gulf. Again, we restrict our sample to the pre-spill weeks and the first thirteen post-spill weeks. Specification (2) in Table 1 reports the estimated results. The estimated coefficient for the interaction term is -0.007 and is statistically significant, indicating that the marginal impact of the reported flow rate is stronger in the three Gulf states than in other states. This result implies that boycott intensity in the first thirteen post-spill weeks is stronger in the three Gulf states, thus confirming hypothesis 2.

Table 1: Volume Share and Price Differential Equations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Variables	Volume share	Volume share	Volume share	Price differential	Volume share	Volume share	Volume share
Flow rate	-0.025***	-0.024***				-0.025***	-0.024***
	(0.001)	(0.001)				(0.001)	(0.001)
Flow rate X Gulf		-0.007***					-0.007***
		(0.002)					(0.002)
Post spill			-0.587***	-0.221***	-0.598***		
			(0.050)	(0.036)	(0.050)		
Post spill X Gulf			-0.169**	-0.307***	-0.184**		
			(0.081)	(0.079)	(0.081)		
Price differential					-0.050***	-0.052***	-0.053***
					(0.011)	(0.011)	(0.011)
Trend	-0.037***	-0.035***	-0.035***	-0.010***	-0.035***	-0.038***	-0.036***
	(0.006)	(0.006)	(0.006)	(0.003)	(0.006)	(0.006)	(0.006)
Constant	22.035***	21.996***	21.977***	1.638***	22.059***	22.126***	22.085***
	(0.228)	(0.230)	(0.226)	(0.153)	(0.228)	(0.229)	(0.231)
Observations	20,817	20,817	20,817	20,817	20,817	20,817	20,817
R-squared	0.975	0.975	0.975	0.681	0.975	0.975	0.975
County-specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: FE = fixed effects. In parentheses are Davidson and MacKinnon (1993) robust standard errors.
*** p<0.01, ** p<0.05, * p<0.1.

A direct way of testing hypothesis 2 is to replace the flow rate variable in equation (1) with two variables: a post-spill dummy variable, $post_t$, that equals 1 for the first thirteen post-spill weeks and 0

otherwise, and an interaction term, $post_t * Gulf$, that interacts the post-spill dummy with the Gulf dummy. Specification (3) in Table 1 contains the estimated results. BP's volume share decreased by an estimated average of 0.59% in non-Gulf states and by 0.17% more in the three Gulf states. Because BP's average volume share was 16.11% before the spill, BP's sales quantity in the first thirteen post-spill weeks declined by an average of 3.7% (= 0.59%/16.11%) in the non-Gulf states and by 1.1% more in the three Gulf states.[19] These results are statistically significant and are in support of hypothesis 2.

Specification (4) in Table 1 tests hypothesis 3a (i.e., whether BP stations cut retail prices in the first thirteen post-spill weeks) and hypothesis 3b (i.e., whether BP stations' price decreases in the Gulf states are bigger than those in other states). The estimated results indicate that BP stations' relative retail prices in the first thirteen post-spill weeks decreased by an average of 0.22 cents per gallon in non-Gulf states and by an average of 0.31 cents per gallon more in the three Gulf states, thus confirming both parts of hypothesis 3.

Because BP stations cut their retail prices, the boycott effect estimated from specification (3) in Table 1 is expected to be smaller than the actual boycott effect, the effect that we would observe if BP prices were held constant. Without the price cuts, the decreases in BP stations' quantity share due to consumer boycott are expected to be larger; BP stations' price cuts may prevent some consumers from switching to other brands and may even attract some consumers to BP brand. Because BP stations' price cuts are larger in the three Gulf states, the estimated difference in the boycott effect between Gulf states and non-Gulf states is attenuated as well. Even though it is an endogenous variable, we add price differential as an explanatory variable into specification (5) in Table 1. As expected, the coefficient for the price differential variable is negative and statistically significant; lower relative prices lead to higher volume shares. The coefficients for the post-spill dummy and the post-spill-Gulf interaction term are both slightly larger, but are not statistically different from the estimates in specification (3). Specifications (6) and (7) in Table 1 investigate whether adding the price differential as an explanatory variable affects the marginal effect of the daily flow rate on BP's volume share, and the results indicate that it does not.

To test the other three parts of hypothesis 1, we replace the flow rate variable in equation (1) with 44 post-spill weekly dummy variables (w_1, …, w_{44}, where $w_i = 1$ for the i^{th} week and 0 otherwise). By using weekly dummies instead of the flow rate, we obtain estimates of weekly boycott intensity (i.e., the weekly change in BP's market share from its average volume share prior to the spill). This approach allows us to identify the start, the peak, and the end of the boycott. Table 2 reports the regression results of this approach. Specification (1) in Table 2 confirms that BP's volume share did not decrease in the first three weeks, which is consistent with the relatively small reported scale of the spill early on, confirming part (a) of hypothesis 1.

[19] This is based on the assumption that the oil spill did not cause the total quantity of gasoline to change.

Table 2: Regressions with Weekly Dummies

	(1)		(2)		(3)	
	Volume Share		Price Differential		Volume Share	
Explanatory Variables	Coefficient	Std	Coefficient	Std	Coefficient	Std
Week 1	-0.119	(0.115)	0.100	(0.066)	-0.114	(0.115)
Week 2	0.001	(0.126)	-0.153**	(0.073)	-0.005	(0.126)
Week 3	-0.130	(0.116)	-0.409***	(0.088)	-0.147	(0.116)
Week 4	-1.001***	(0.114)	-0.303***	(0.081)	-1.014***	(0.114)
Week 5	0.478***	(0.121)	-0.368***	(0.092)	0.463***	(0.120)
Week 6	-1.170***	(0.107)	-0.012	(0.092)	-1.171***	(0.106)
Week 7	-0.143	(0.106)	-0.326***	(0.083)	-0.157	(0.106)
Week 8	-1.038***	(0.102)	-0.379***	(0.086)	-1.054***	(0.103)
Week 9	-1.081***	(0.096)	-0.360***	(0.081)	-1.096***	(0.096)
Week 10	-1.266***	(0.100)	-0.476***	(0.079)	-1.286***	(0.101)
Week 11	-1.473***	(0.092)	-0.371***	(0.080)	-1.488***	(0.092)
Week 12	-0.422***	(0.098)	-0.271***	(0.087)	-0.433***	(0.098)
Week 13	-1.778***	(0.092)	-0.297***	(0.085)	-1.791***	(0.091)
Week 14	-0.094	(0.094)	-0.169**	(0.085)	-0.101	(0.094)
Week 15	-0.815***	(0.091)	-0.247***	(0.078)	-0.826***	(0.091)
Week 16	-0.685***	(0.088)	-0.328***	(0.070)	-0.699***	(0.088)
Week 17	-0.541***	(0.094)	-0.281***	(0.084)	-0.553***	(0.094)
Week 18	-0.525***	(0.094)	-0.369***	(0.094)	-0.541***	(0.094)
Week 19	-1.660***	(0.099)	-0.032	(0.082)	-1.661***	(0.099)
Week 20	0.282***	(0.101)	-0.044	(0.082)	0.280***	(0.101)
Week 21	0.292***	(0.108)	-0.026	(0.086)	0.291***	(0.108)
Week 22	-0.298***	(0.093)	-0.323***	(0.076)	-0.311***	(0.093)
Week 23	-0.324***	(0.086)	-0.203***	(0.077)	-0.333***	(0.086)
Week 24	-0.274***	(0.090)	-0.247***	(0.086)	-0.284***	(0.090)
Week 25	0.508***	(0.100)	-0.439***	(0.088)	0.490***	(0.100)
Week 26	-0.333***	(0.085)	-0.455***	(0.070)	-0.352***	(0.085)
Week 27	-0.317***	(0.088)	-0.265***	(0.077)	-0.328***	(0.088)
Week 28	-0.060	(0.095)	-0.112	(0.073)	-0.065	(0.095)
Week 29	-0.241***	(0.091)	0.022	(0.091)	-0.240***	(0.091)
Week 30	-0.154*	(0.092)	-0.036	(0.080)	-0.156*	(0.092)
Week 31	-0.369***	(0.096)	-0.041	(0.082)	-0.371***	(0.096)
Week 32	0.234**	(0.105)	0.205***	(0.073)	0.243**	(0.105)
Week 33	-0.206**	(0.094)	0.396***	(0.085)	-0.189**	(0.094)
Week 34	-0.196**	(0.090)	0.128	(0.080)	-0.190**	(0.090)
Week 35	-0.114	(0.089)	0.323***	(0.079)	-0.100	(0.089)
Week 36	-0.275***	(0.098)	0.246***	(0.084)	-0.265***	(0.098)
Week 37	0.030	(0.108)	-0.176**	(0.083)	0.023	(0.108)
Week 38	-0.243**	(0.106)	-0.156**	(0.079)	-0.250**	(0.106)
Week 39	-0.042	(0.121)	-0.158*	(0.082)	-0.049	(0.121)
Week 40	0.014	(0.105)	-0.327***	(0.086)	-0.000	(0.105)
Week 41	0.150	(0.106)	-0.027	(0.083)	0.149	(0.106)
Week 42	-0.381***	(0.115)	-0.333***	(0.087)	-0.395***	(0.115)
Week 43	0.138	(0.106)	-0.146	(0.091)	0.131	(0.106)
Week 44	0.050	(0.106)	0.262***	(0.096)	0.061	(0.106)
Price Differential					-0.042***	(0.009)
Trend	-0.037***	(0.004)	-0.002	(0.002)	-0.037***	(0.004)

Constant	21.954***	(0.206)	1.389***	(0.136)	22.012***	(0.207)
County FE	Yes		Yes		Yes	
Month FE	Yes		Yes		Yes	
County-specific Time Trend	Yes		Yes		Yes	
Observations	28,784		28,784		28,784	
R-squared	0.974		0.673		0.974	

Notes*:* FE = fixed effects. In parentheses are Davidson and MacKinnon (1993) robust standard errors. *** p<0.01, ** p<0.05, * p<0.1.

The estimated boycott effect is the largest in the 13th week (July 15–21, 2010), which is consistent with the fact that the oil leak was stopped in this week, confirming part (c) of hypothesis 1. The absolute level of BP's volume share in that week was 1.78% smaller than the average pre-spill level. Because BP's average volume share was 16.11% before the spill, BP's sales quantity in the 13th week declined by about 11.05% (=1.78% /16.11%).

The estimated coefficients (in absolute value) on and before week 13 exhibit an upward trend; the correlation coefficient between the estimated weekly boycott intensity (in absolute value) and the daily flow rate during the first thirteen post-spill weeks is 0.70, with a standard error of 0.0075. The upward trend in boycott intensity, again, confirms part (b) of hypothesis 1.

The estimated coefficients (in absolute value) after week 13 (when the oil spill was stopped) exhibit a downward trend, confirming part (d) of hypothesis 1. The boycott effect stayed over 0.5% consecutively from week 15 through week 19, the first few post-spill weeks, and never reached similar levels afterwards. Toward the end of our sample, most estimated coefficients are no longer statistically significant, suggesting that the boycott effect had become very weak or nonexistent by the end of our sample period.

We do not have a good explanation for why the coefficients for weeks 5, 20, 21, 25, and 32 are positive and statistically significant, though a plausible explanation is that they result from the strong volatility in BP's volume share starting from the fourth post-spill week.

Specification (2) in Table 2 investigates whether BP stations cut retail prices in each of the 44 post-spill weeks. The estimated coefficients from week 2 through week 27 are all negative, and the overwhelming majority of these coefficients are statistically significant at the 1 percent level or higher. The largest coefficient, in absolute value, is 0.476 cents per gallon in week 10. The estimated coefficients from week 28 on are no longer uniformly negative. These results indicate that BP stations reacted to the oil spill rather quickly, even though the magnitude of price cuts was not very large. Recall that BP announced at the end of week 10 that it would offer BP distributors a price support of 2 cents per gallon in the Gulf states and 1 cent in other states. The price support announcement did not lead BP retail stations to cut their prices further. Specification (3) in Table 2 is the same as specification (1) in Table 2 except for the price differential term. The coefficient for the price differential terms is negative and

statistically significant, but, similar to our findings in Table 1, the rest of the coefficients are not statistically different from those in specification (1) in Table 2.

We also test whether the boycott effect is larger in the three Gulf states in each of the post-spill weeks by adding 44 additional interaction variables, each of which interacts a weekly dummy variable with the Gulf dummy. Specification (1) of Table 3 (in the Appendix) presents the regression results. Almost all of the interaction terms are negative, but only the interaction term for weeks 7, 8, 14, 16, and 23 are statistically significant at the 5% or higher. In specification (2) of Table 3, we test whether BP stations cut prices more in each of the 44 post-spill weeks by adding 44 interaction terms. All of the interaction terms on and before week 17 have a negative coefficient, but the interaction terms after that week are no longer uniformly negative. Only three interaction terms (for weeks 11, 12, and 13) are statistically significant at the 5 percent level or higher, and four more terms (for weeks 4, 8, 9, and 14) are statistically significant at the 10 percent level. Since BP announced on the last day of week 10 that it would offer BP distributors a price support of 2 cents per gallon in the Gulf states and 1 cent per gallon in other states, the more aggressive price cuts by BP stations in the Gulf states in weeks 11-14 are expected. Specification (3) of Table 3 is the same as specification (1) except for the price differential term. While the price differential term has a negative and statistically significant coefficient, the rest of the coefficients in specification (3) are very close to those in specification (1) of the same table.

5. Conclusion

Does boycott intensity increase with the level of perceived egregiousness of the triggering event? In this paper, we provide the first piece of evidence toward answering this important question. The BP oil spill makes it possible to observe variations, over time and across geographical area, in perceived egregiousness and in boycott intensity. The empirical results indicate that the intensity of the BP boycott changes roughly in tandem with the reported severity of the oil spill and is stronger in the three states bordering the Gulf than in other states.

The insight that boycott intensity is increasing in perceived egregiousness suggests that firms' best defense against large-scale consumer boycotts is to adopt measures to avoid the occurrence of events that may be perceived as egregious. This insight also suggests that boycotts that target highly egregious offenses are more likely to appear successful in forcing the offending organizations to make concessions, and that groups seeking to successfully organize boycotts may need to focus their attention on those offenses that are perceived to be highly egregious. By presenting evidence that perceived egregiousness affects boycott intensity, we also wish to highlight the need for researchers to measure and consider the intensity of boycotts and the egregiousness of the triggering events when studying boycotts' impact on the offending firms. The enormous legal liabilities caused by the BP oil spill also highlight that boycotts are

not the only reason why firms need to adopt socially responsible measures—a boycott-triggering event may damage a firm far beyond the impact of the boycott itself.

Our study also sheds lights on consumers' specific motives to boycott. Because the BP oil spill lacks a clear instrumental purpose, our results suggest that noninstrumental motives alone can be strong enough to prompt boycotting behavior. However, we also find that the boycott effect died out quickly once the oil spill stopped, suggesting that noninstrumental firm-specific boycotts, unlike some societal boycotts (e.g., some Chinese consumers' boycott of Japanese goods), do not last long. Our finding is consistent with Ettenson et al.'s (2006, 6) conclusion that "even in high-profile, company-specific boycotts, drops in sales—although sometimes substantial—are typically short-lived."

In this paper, we do not attempt to separately estimate the effect of the news media or the effect of boycott advocates/opponents. We recognize that the news media play an important role in generating boycotting behavior because they provide oil spill-related information to consumers and because many calls for or against boycotting BP come directly from members of the news media. Had the BP oil spill taken place at a time when the Internet and cable TV news channels were not available, the intensity of the BP boycott, we suspect, would have been weaker. In this paper, we take the existence of the news media as given. We recognize that the debates on whether to boycott BP and the associated media coverage are largely endogenous results of the oil spill: they would not exist if the oil spill did not happen or if the egregiousness of the oil spill were minor. Our identification of the effect of perceived egregiousness on boycott intensity relies on the fact that calls for and calls against boycotting BP cannot generate the three full sets of predictions we tested empirically in this paper, especially the hypotheses regarding the timing of the boycott peak and the difference in boycott intensity between Gulf states and other states.

References

Aldy, Joseph. 2011. "Real-Time Economic Analysis and Policy Development During the BP Deepwater Horizon Oil Spill." *Vanderbilt Law Review* 64(6): 1795-1817.

Ashenfelter, Orley, Stephen Ciccarella, and Howard J. Shatz. 2007. "French Wine and the US Boycott of 2003: Does Politics Really Affect Commerce?" *Journal of Wine Economics* 2(1): 55–74.

Balabanis, George. 2013. "Surrogate Boycotts against Multinational Corporations: Consumers' Choice of Boycotts Targets," *British Journal of Management* 24: 515-531.

Barbier, Edward B. 2011. "Coastal Westland Restoration and the Deepwater Horizon Oil Spill," *Vanderbilt Law Review* 64(6): 1821-1849.

Baron, David P. 2001. "Private Politics, Corporate Social Responsibility, and Integrated Strategy," *Journal of Economics and Management Strategy* 10(1): 7-45.

Braunsberger, Karin and Brian Buckler. 2011. "What Motivates Consumers to Participate in Boycotts: Lessons from the Ongoing Canadian Seafood Boycott," *Journal of Business Research* 64: 96-102.

Busse, Meghan R., Christopher R. Knittel, and Florian Zettelmeyer. "Are Consumers Myopic? Evidence from New and Used Car Purchases," *American Economic Review* 103(1): 220-256.

Chavis, Larry, and Phillip Leslie. 2009. "Consumer Boycotts: The Impact of the Iraq War on French Wine Sales in the US," *Quantitative Marketing and Economics* 7: 37–67.

Davidson, Russell, and James G. MacKinnon. 1993. *Estimation and Inference in Econometrics*. New York: Oxford University Press.

Ettenson, Richard, N. Craig Smith, Jill Klein and Andrew John. 2006. "Rethinking Consumer Boycotts: Recent Events Provide Five Key Lessons for the Post-9/11 Era," *MIT Sloan Management Review* 47(4): 6-7.

Friedman, Monroe. 1985. "Consumer Boycotts in the United States, 1970–1980: Contemporary Events in Historical Perspective." *Journal of Consumer Affairs* 19: 96–117.

Friedman, Monroe. 1991. "Consumer Boycotts: A Conceptual Framework and Research Agenda," *Journal of Social Issues* 47(1): 149–168.

Garrett, Dennis. 1987. "The Effectiveness of Marketing Policy Boycotts: Environmental Opposition to Marketing," *The Journal of Marketing* 51(2): 46-57.

Hastings, Justine S. 2004. "Vertical Relationships and Competition in Retail Gasoline Markets: Empirical Evidence from Contract Changes in Southern California," *American Economic Review* 94(1): 317-327.

Hong, Canhui, Wei-Min Hu, James E. Prieger, and Dongming Zhu. 2011. "French Automobiles and the Chinese Boycotts of 2008: Politics Really Does Affect Commerce," *The B.E. Journal of Economic Analysis & Policy* 11(1) (Topics): Article 26.

Hoffmann, Stefan, and Stefan Muller. 2009. "Consumer Boycotts due to Factory Relocation," *Journal of Business Research* 62: 239-247.

John, Andrew, and Jill Klein. 2003. "The Boycott Puzzle: Consumer Motivations for Purchase Sacrifice," *Management Science* 49(9): 1196–1209.

King, Brayden G. 2008. "A Political Mediation Model of Corporate Response to Social Movement Activism." *Administrative Science Quarterly* 53: 395-421.

Klein, Jill, N. Craig Smith, and Andrew John. 2002. "Exploring Motivation for Participation in a Consumer Boycott," *Advances in Consumer Research* 29: 363-369.

Klein, Jill, N. Craig Smith, and Andrew John. 2004. "Why We Boycott: Consumer Motivations for Boycott Participation," *The Journal of Marketing* 68(3): 92–109.

Koku, Paul Sergius, Aigbe Akhigbe, and Thomas M. Springer. 1997. "The Financial Impact of Boycotts and Threats of Boycotts," *Journal of Business Research* 40: 15–20.

Kozinets, Robert V., and Jay Handelman. 1998. "Ensouling Consumption: A Netnographic Exploration of the Meaning of Boycotting Behavior," *Advances in Consumer Research* 25: 475–480.

Lee, Matthew R. and Troy C. Blanchard. 2012. "Community Attachment and Negative Affective States in the Context of the BP Deepwater Horizon Disaster," *American Behavioral Scientist* 56(1): 24-47.

National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. 2011. *Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling.* Report to the President. http://www.oilspillcommission.gov/ (accessed September 12, 2013).

Pruitt, Stephen W., and Monroe Friedman. 1986. "Determining the Effectiveness of Consumer Boycotts: A Stock Price Analysis of Their Impact on Corporate Targets," *Journal of Consumer Policy* 9: 375–387.

Pruitt, Stephen W., K. C. John Wei, and Richard E. White. 1988. "The Impact of Union-Sponsored Boycotts on the Stock Prices of Target Firms," *Journal of Labor Research* 9(3): 285–289.

Sen, Sankar, Zeynep Gurhan-Canli, and Vicki Morwitz. 2001. "Withholding Consumption: A Social Dilemma Perspective on Consumer Boycotts," *Journal of Consumer Research* 28: 399–417.

Smith, N. Craig. 1990. *Morality and the Market: Consumer Pressure for Corporate Accountability*. London: Routledge.

Smith, Malcolm, and Qianpin Li. 2010. "The role of occupation in an integrated boycott model: A cross-regional study in China," *Journal of Global Marketing* 23(2): 109-126.

Staff of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. 2011. "The Amount and Fate of the Oil," Staff working paper no. 3. http://www.oilspillcommission.gov/resources#staff-working-papers (accessed September 12, 2013).

Taylor, Christopher T., Nicholas Kreisle, and Paul R. Zimmerman. 2010. "Vertical Relationship and Competition in Retail Gasoline Markets: Comment," *American Economic Review* 100(3): 1269–1276.

Appendix

Table 3. Regressions Using Weekly Interaction Terms to Test Whether Gulf States Differ from Other States

	(1) Volume Share		(2) Price Differential		(3) Volume Share	
Variables	Coefficient	Std	Coefficient	Std	Coefficient	Std
Week 1	-0.152	(0.131)	0.111	(0.072)	-0.148	(0.131)
Week 2	-0.015	(0.144)	-0.148*	(0.078)	-0.022	(0.144)
Week 3	-0.132	(0.131)	-0.358***	(0.091)	-0.147	(0.130)
Week 4	-0.999***	(0.130)	-0.232***	(0.081)	-1.009***	(0.130)
Week 5	0.541***	(0.136)	-0.353***	(0.094)	0.526***	(0.136)
Week 6	-1.142***	(0.120)	0.037	(0.089)	-1.141***	(0.119)
Week 7	-0.027	(0.116)	-0.277***	(0.090)	-0.039	(0.115)
Week 8	-0.948***	(0.112)	-0.323***	(0.094)	-0.961***	(0.112)

Week 9	-1.019***	(0.104)	-0.294***	(0.086)	-1.032***	(0.104)
Week 10	-1.196***	(0.105)	-0.435***	(0.086)	-1.214***	(0.106)
Week 11	-1.447***	(0.103)	-0.292***	(0.086)	-1.460***	(0.103)
Week 12	-0.357***	(0.109)	-0.173*	(0.094)	-0.364***	(0.109)
Week 13	-1.771***	(0.101)	-0.237**	(0.094)	-1.781***	(0.101)
Week 14	-0.012	(0.102)	-0.102	(0.091)	-0.016	(0.102)
Week 15	-0.786***	(0.099)	-0.209**	(0.083)	-0.795***	(0.099)
Week 16	-0.600***	(0.095)	-0.301***	(0.076)	-0.613***	(0.095)
Week 17	-0.478***	(0.104)	-0.230**	(0.092)	-0.488***	(0.104)
Week 18	-0.480***	(0.102)	-0.407***	(0.098)	-0.498***	(0.102)
Week 19	-1.704***	(0.111)	-0.026	(0.085)	-1.705***	(0.111)
Week 20	0.339***	(0.112)	-0.060	(0.088)	0.336***	(0.112)
Week 21	0.339***	(0.121)	-0.019	(0.096)	0.339***	(0.121)
Week 22	-0.269***	(0.104)	-0.334***	(0.082)	-0.283***	(0.104)
Week 23	-0.255***	(0.092)	-0.231***	(0.082)	-0.265***	(0.092)
Week 24	-0.261***	(0.097)	-0.226**	(0.089)	-0.270***	(0.097)
Week 25	0.520***	(0.108)	-0.386***	(0.088)	0.503***	(0.108)
Week 26	-0.345***	(0.093)	-0.421***	(0.071)	-0.363***	(0.093)
Week 27	-0.308***	(0.095)	-0.275***	(0.078)	-0.320***	(0.095)
Week 28	-0.029	(0.104)	-0.153**	(0.075)	-0.036	(0.104)
Week 29	-0.263***	(0.099)	0.052	(0.099)	-0.261***	(0.099)
Week 30	-0.173*	(0.101)	-0.021	(0.087)	-0.174*	(0.101)
Week 31	-0.426***	(0.101)	-0.062	(0.084)	-0.428***	(0.101)
Week 32	0.186	(0.117)	0.233***	(0.079)	0.196*	(0.117)
Week 33	-0.229**	(0.104)	0.392***	(0.089)	-0.212**	(0.104)
Week 34	-0.215**	(0.097)	0.132	(0.082)	-0.209**	(0.097)
Week 35	-0.075	(0.095)	0.326***	(0.085)	-0.061	(0.095)
Week 36	-0.291***	(0.110)	0.223**	(0.089)	-0.282**	(0.110)
Week 37	0.063	(0.121)	-0.227**	(0.091)	0.053	(0.122)
Week 38	-0.302**	(0.118)	-0.196**	(0.085)	-0.311***	(0.118)
Week 39	-0.076	(0.137)	-0.147	(0.090)	-0.083	(0.136)
Week 40	-0.060	(0.115)	-0.332***	(0.090)	-0.074	(0.115)
Week 41	0.109	(0.119)	-0.023	(0.090)	0.108	(0.119)
Week 42	-0.456***	(0.129)	-0.325***	(0.094)	-0.470***	(0.129)
Week 43	0.100	(0.118)	-0.098	(0.097)	0.096	(0.118)
Week 44	0.013	(0.118)	0.329***	(0.104)	0.028	(0.118)
Week 1 X Gulf Region	0.196	(0.231)	-0.068	(0.179)	0.193	(0.231)
Week 2 X Gulf Region	0.098	(0.237)	-0.030	(0.167)	0.097	(0.235)
Week 3 X Gulf Region	0.009	(0.235)	-0.297	(0.244)	-0.004	(0.234)
Week 4 X Gulf Region	-0.011	(0.209)	-0.413*	(0.236)	-0.028	(0.208)
Week 5 X Gulf Region	-0.369	(0.245)	-0.086	(0.272)	-0.373	(0.244)
Week 6 X Gulf Region	-0.163	(0.208)	-0.284	(0.314)	-0.175	(0.209)
Week 7 X Gulf Region	-0.675***	(0.235)	-0.281	(0.193)	-0.687***	(0.233)
Week 8 X Gulf Region	-0.526**	(0.219)	-0.325*	(0.193)	-0.540**	(0.218)
Week 9 X Gulf Region	-0.362*	(0.208)	-0.388*	(0.206)	-0.379*	(0.207)
Week 10 X Gulf Region	-0.409	(0.263)	-0.241	(0.176)	-0.419	(0.261)
Week 11 X Gulf Region	-0.150	(0.192)	-0.459**	(0.194)	-0.169	(0.192)
Week 12 X Gulf Region	-0.383*	(0.217)	-0.568***	(0.206)	-0.407*	(0.215)
Week 13 X Gulf Region	-0.042	(0.203)	-0.347**	(0.175)	-0.057	(0.202)
Week 14 X Gulf Region	-0.480**	(0.224)	-0.397*	(0.203)	-0.497**	(0.224)

Week 15 X Gulf Region	-0.175	(0.212)	-0.226	(0.201)	-0.184	(0.211)
Week 16 X Gulf Region	-0.496**	(0.207)	-0.156	(0.164)	-0.503**	(0.208)
Week 17 X Gulf Region	-0.368*	(0.207)	-0.295	(0.193)	-0.381*	(0.207)
Week 18 X Gulf Region	-0.263	(0.227)	0.219	(0.276)	-0.253	(0.226)
Week 19 X Gulf Region	0.258	(0.187)	-0.036	(0.237)	0.256	(0.188)
Week 20 X Gulf Region	-0.332	(0.204)	0.093	(0.202)	-0.328	(0.205)
Week 21 X Gulf Region	-0.278	(0.228)	-0.037	(0.179)	-0.279	(0.230)
Week 22 X Gulf Region	-0.167	(0.181)	0.062	(0.178)	-0.164	(0.181)
Week 23 X Gulf Region	-0.401**	(0.199)	0.165	(0.199)	-0.394**	(0.200)
Week 24 X Gulf Region	-0.077	(0.209)	-0.119	(0.245)	-0.082	(0.210)
Week 25 X Gulf Region	-0.067	(0.239)	-0.306	(0.281)	-0.080	(0.241)
Week 26 X Gulf Region	0.068	(0.173)	-0.199	(0.193)	0.060	(0.173)
Week 27 X Gulf Region	-0.050	(0.201)	0.061	(0.229)	-0.047	(0.200)
Week 28 X Gulf Region	-0.179	(0.217)	0.243	(0.202)	-0.169	(0.218)
Week 29 X Gulf Region	0.125	(0.204)	-0.172	(0.223)	0.117	(0.205)
Week 30 X Gulf Region	0.110	(0.201)	-0.084	(0.196)	0.106	(0.202)
Week 31 X Gulf Region	0.331	(0.256)	0.122	(0.237)	0.336	(0.256)
Week 32 X Gulf Region	0.282	(0.243)	-0.164	(0.184)	0.275	(0.243)
Week 33 X Gulf Region	0.135	(0.213)	0.023	(0.247)	0.136	(0.215)
Week 34 X Gulf Region	0.112	(0.228)	-0.026	(0.248)	0.111	(0.229)
Week 35 X Gulf Region	-0.225	(0.238)	-0.019	(0.217)	-0.226	(0.238)
Week 36 X Gulf Region	0.092	(0.213)	0.130	(0.229)	0.098	(0.213)
Week 37 X Gulf Region	-0.190	(0.235)	0.300	(0.196)	-0.177	(0.236)
Week 38 X Gulf Region	0.345	(0.235)	0.229	(0.198)	0.355	(0.235)
Week 39 X Gulf Region	0.201	(0.260)	-0.065	(0.199)	0.198	(0.260)
Week 40 X Gulf Region	0.429*	(0.246)	0.027	(0.244)	0.430*	(0.247)
Week 41 X Gulf Region	0.238	(0.215)	-0.022	(0.201)	0.238	(0.214)
Week 42 X Gulf Region	0.439*	(0.241)	-0.045	(0.210)	0.437*	(0.242)
Week 43 X Gulf Region	0.221	(0.235)	-0.277	(0.247)	0.209	(0.235)
Week 44 X Gulf Region	0.211	(0.240)	-0.391	(0.236)	0.195	(0.240)
Price Differential					-0.043***	(0.009)
Trend X Gulf	-0.088***	(0.005)	0.007	(0.005)	-0.087***	(0.005)
Trend	0.051***	(0.002)	-0.008*	(0.004)	0.050***	(0.002)
Constant	21.972***	(0.203)	1.378***	(0.138)	22.032***	(0.203)
Observations	28,784		28,784		28,784	
R-squared	0.974		0.674		0.974	
County-specific Time Trend	Yes		Yes		Yes	
County FE	Yes		Yes		Yes	
Month FE	Yes		Yes		Yes	

Notes: FE = fixed effects. In parentheses are Davidson and MacKinnon (1993) robust standard errors. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.