NBER WORKING PAPER SERIES

WINTERTIME FOR DECEPTIVE ADVERTISING?

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Working Paper 17829
http://www.nber.org/papers/w17829

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
February 2012

Thanks to Noah Glick, Meagan Herzog, Percy Lee, Benjamin Lo, and Boris Vabson for outstanding research assistance, and to James Feyrer, Thomas Hubbard, Christine Jolls, Chris Snyder, Michael Spence, Kip Viscusi, and seminar audiences at Dartmouth, the Utah Business Economics Conference, and the NBER Law and Economics Summer Institute meeting for comments. The views expressed in this paper are not necessarily those of our employer, which owns a small resort in our sample. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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JEL No. D82,D83,K29,L15

ABSTRACT

Casual empiricism suggests that deceptive advertising about product quality is prevalent, and several classes of theories explore its causes and consequences. We provide some unusually sharp empirical evidence on the extent, mechanics, and dynamics of deceptive advertising. Ski resorts self-report substantially more natural snowfall on weekends. Resorts that plausibly reap greater benefits from exaggerating do it more. Data on website visits suggests that consumers are appropriately skeptical of weekend reports. We find little evidence that competition restrains or encourages exaggeration. Near the end of our sample period, a new iPhone application feature makes it easier for skiers share information on ski conditions in real time. Exaggeration falls sharply, especially at resorts with better iPhone reception.

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"Jackson Hole/Teton Village DID NOT get 15" today…more like 0"

-Skier comment posted on SkiReport.com, 3/15/2009

Casual empiricism suggests that deceptive advertising about product quality is prevalent, and several classes of theories explore its causes and consequences.[1] Yet there is little sharp empirical evidence that speaks to such theories. This gap is due in part to formidable measurement challenges; in most settings, measuring deceptive advertising requires detailed, high-frequency information (on ads, product quality, and inventories) that is difficult to observe.

We test for deceptive advertising by examining a critical component of product quality at ski resorts: *new*, *natural* (or "fresh") snowfall in the past 24 hours. Ski resorts issue "snow reports" on their websites roughly once a day. These reports are also collected by aggregators and then rebroadcast over the Internet and via print and broadcast media. A skier wishing to ski on new, natural snow can use these snow reports to help decide whether and where to ski on a particular day. In principle, snow reports provide skiers with location-specific information on fresh snowfall that is not necessarily captured by third-party weather websites. We find confirming evidence, from resort website visits, that consumer demand responds to both resort- and government-reported snow.

The dynamics of customer acquisition by ski resorts suggest that the optimal (deceptive) advertising strategy may vary at high frequencies. Resorts only benefit from exaggerating

[1] Lazear (1995) models firms taking advantage of high consumer search costs by "baiting" consumers with a high quality good that is not actually in-stock, and then "switching" consumers to a lower quality good that is in-stock. In signal-jamming models (e.g., Holmstrom (1999)), agents engage in costly effort to upwardly bias signals of their quality, but rational recipients of these signals anticipate these efforts and no information is lost. Other models focus on deception more generally, with motivating examples from advertising; e.g., Ettinger and Jehiel (2010). See also footnote 10 below.

snow reports when skiers condition purchase decisions on them. The cost of exaggeration is angering or losing credibility with skiers, including those who have already pre-committed (e.g., as part of a multi-day vacation) but use the snow report to help plan their day. The pre-committed should represent a larger share of (potential) skiers on weekdays than on weekends, when many skiers are less constrained by work schedules and (we hypothesize) more likely to condition resort choice on snow conditions. So if there is deceptive advertising we should expect to see more of it designed to attract weekend skiers.

We test that hypothesis using data from 2004-2008, and find that resorts do indeed report 23 percent more new natural snow on Saturday and Sunday mornings (1.59 inches vs. 1.29 inches, p-value = 0.014). This "weekend effect" is substantial in absolute as well as percentage terms. New natural snow only falls during about 30% of the days in our sample, and our results also suggest that many resorts report accurately. Overall then, our results suggest that, when exaggerating, resorts *report* an inch or more of additional fresh snow on weekends.[2]

To be fair, it is not completely implausible that there might be a weekend effect in actual snow. There is a small literature in climatology that suggests that day of week effects in pollution affect precipitation and temperature, and thus may affect snowfall. The estimated effects are quite small (relative to the 23 percent difference in resort-reported snow we find) and of mixed sign.[3] Nevertheless, we control for government-reported snow in all of our key empirical specifications, and find that doing this cuts the weekend effect by one-quarter to

[2] In addition to reporting new natural snow, resorts also report other aspects of snow quantity and quality, such as base depth, number of trails open, and surface conditions (e.g., powder, packed powder). These other aspects can be influenced by manmade snow and hence we do not examine them.

[3] Cerveney and Balling (1998) find higher CO and O_3 levels and higher precipitation on Fridays and Saturdays. Effects are primarily in areas downwind of the U.S. Eastern seacoast. Forster and Solomon (2003) find that nighttime low temperatures are 0.2 to 0.4 degrees Celsius higher on weekends in the middle of the United States but are 0.1 to 0.2 degrees lower in the Southeast and Southwest (weekend effects in the Northeast and West, where most of our resorts are located, are smaller).

one-third but improves the precision of estimates, leaving them both statistically and economically significant.

Having found some evidence that deceptive advertising varies *within* resorts over time along with payoffs, we next explore whether deceptive advertising varies *across* resorts with plausibly different payoffs. Weekend effects in resort reporting are larger for resorts with more expert terrain and for those that do not offer a money back guarantee. This is consistent with expert skiers valuing fresh snow more highly, and with guarantees and deception being substitutes. We do not find any statistically significant differences in deceptive advertising across density of competition, population within 150 miles, or resort ownership type (government, privately held firm, or publicly-traded), although these null effects are imprecisely estimated.

Next we explore whether consumers (partly) pierce the veil of resort exaggeration, using daily data on resort website visits, by unique visitors residing within 150 miles of a given resort, before 10AM.[4] A resort snow report can drive traffic to its website because, as noted above, resort reports are rebroadcast by third-party aggregator websites and offline media outlets. Consumers exposed to a rebroadcast may then visit a resort website to get additional information on conditions, prices, services, and other aspects of trip planning.[5] So website visits are a useful, if incomplete, measure of consumer demand responses to resort snowfall reports. We find that, across all days, visits increase by more than 100% for each additional inch of government-reported snow, and by 61% for each additional inch of resort-reported snow. Visits do not respond differently to government-reported snow on weekends vs.

[4] We conducted this study without industry cooperation, and hence our data on resorts is limited to what we could gather from websites. Nearly all resorts are privately held so publicly available financial information on them is scarce, particularly at the daily frequency.

[5] Unfortunately we lack data on these within-site clicks that would enable us to observe what sorts of content site visitors peruse.

weekdays, but are sharply less responsive to resort-reported snow on weekends; in fact, our results suggest consumers only respond to additional resort-reported snow on weekdays. In all, the website visit results suggest that consumers are skeptical of resorts' weekend reports of fresh snowfall.

Why then do resorts exaggerate? Our evidence on website visits does not rule out that (some) resorts benefitted weakly from exaggerating fresh snowfall on weekends; e.g., there may have been a small increase in demand that we do not detect, offset by only a minimal cost of false advertising. If this was the case, then a perturbation, even a mild one, of the cost-benefit calculus could have large effects on the extent of deceptive advertising. And that is indeed what we find: ski resorts more or less stop exaggerating fresh snowfall after a technology shock reduces the cost of rapid information sharing between customers. In January 2009, *SkiReport.com* added a new feature to its popular iPhone application that makes it easier for skiers to post "first-hand reports" alongside the resort-provided reports. This feature sparked a sharp increase in the amount and timeliness of skier feedback on the accuracy of resort reports, with many first-hand reports filed from the chairlift or the lodge. But first-hand reports spike only at resorts with adequate coverage from AT&T's data network, and these covered resorts experience a disproportionate post-launch drop in exaggeration.

In all, our results suggest that deceptive advertising about product quality responds sharply to incentives (as they vary both within-resort, over-time, as is the case with both the weekend effect and the iPhone app launch, and as they vary across resorts with different characteristics). Consumers respond only weakly to exaggerated claims, and hence deception may have produced few benefits for the advertisers in equilibrium. This may help explain why a simple third-party technological innovation, that plausibly only slightly changed the cost-benefit calculus, dramatically reduced resort snow report exaggeration.

The latter finding adds to the literature on how customer feedback on product/service quality affects firm behavior and equilibrium.[6] It also complements prior work showing that third-party quality disclosure can change firm behavior.[7] Our finding of significant product quality exaggeration (in the pre-iPhone app equilibrium) builds on Jin and Kato (2006), who audit claims about the quality of baseball cards being auctioned on eBay and find evidence of exaggeration.[8] Jin and Kato's analysis focuses on the effect of deceptive claims on demand and auction prices, whereas our focus is more on the supply of deception and its response to a technology shock.

Although our findings provide unusually sharp evidence on the nature and dynamics of deceptive advertising, our setup can only identify a subset of the behaviors of interest for modeling and policy analysis. As noted above, we lack any data directly related to resort profit functions, and hence cannot measure the demand responses to snow reports with depth or precision. This prevents us from sharply testing across the models discussed at the outset or measuring the welfare implications of (changes in) advertising practices. Moreover, as with any study of a single industry, the external validity of our findings to other markets is uncertain.

Our findings nevertheless have potentially broad applicability, as the market for skiers does not seem uniquely suited to deceptively advertising. There are many other markets where

[6] This literature has focused to a great extent on eBay; see, e.g., Cabral and Hortascu (2010) and cites therein. See also Hubbard (2002) on auto repair and Luca (2011) on restaurants.

[7] See, e.g., Sauer and Leffler (1990); Dranove and Jin (2010). Beales et al (1981) provide an overview of legal limitations on deceptive advertising. Jolls and Sunstein (2006) discuss behavioral motives for government regulation of advertising.

[8] See also Ellison and Ellison (2009) for evidence of firm practices that "frustrate consumer search or make it less damaging to firms" in the Pricewatch shopping engine for computer parts.

search and switching costs loom large.[9] And many of the other conditions that contribute to deception in theory do *not* seem to prevail in our setting. Ski area customers get immediate and visceral feedback on the accuracy of snow reports. The potential for repeat play and learning is high.[10] And the entry and exit rates of ski areas are low: there are few if any “fly-by-night” players with incentives to commit outright fraud. So we speculate that there are many other markets where conditions are ripe for deceptive advertising that varies sharply with advertiser incentives.

The paper proceeds as follows. Section II details our data on snowfall and on resort characteristics. Section III details our identification strategy and results. Section IV concludes.

II. Snowfall and Resort Data

Our data for measuring product quality and its reporting consists of resort-provided snow reports, government snow data, and resort characteristics.

We collect resort-provided reports from the websites of two popular aggregators: *SkiReport.com* and *OnTheSnow.com*. These websites do not supply archives of ski reports and thus we are forced to assemble our data from different sources. From February 15, 2008 until the end of our sample in May 2009, we collected snow reports once per day from *SkiReport.com*.[11] We collected snow reports from earlier time periods from two private Internet archives. Since these archives had better coverage of *OnTheSnow.com*, we used

[9] In our setting, on a one-shot basis, driving times are substantial even between “neighboring” resorts. On a longer-term basis, some consumers may find it costly to coordinate with peers on alternative destinations or to learn how to navigate the terrain and ancillary services (parking, rentals, dining, lodging) of a new mountain.
[10] The immediate feedback stands in contrast to the examples (e.g., tobacco use, investment advice) that motivate Glaeser and Ujelyi (2010) and Kartik et al (2007). The visceral feedback (and high stakes) contrasts with the “low involvement situations” (e.g.,. voting, cheap products) that can make consumers susceptible to persuasion in Mullainathan et al (2008).
[11] Since we circulated the first draft of this paper in mid-2009, both *Skireport.com* and Mountain News Corporation, the owner of *Onthesnow.com,* have been purchased by Vail Resorts. Skireport.com now redirects to Onthesnow.com.

archived reports from this website. In the data collected from Internet archives, we are limited to collecting data for days on which the relevant web page was archived. We collect snow reports from archived pages that summarize all reports from a given state or province, so an entire state's data is either archived or not on a given day. The frequency of data collection in these archives increases over time. In the 2004-5 and 2005-6 seasons, snow reports are available for only about 10 percent of resort-days between December and March. This ratio rises to 30 percent in the 2006-7 season and 65 percent in the 2007-8 season.

The archiving process is Internet-wide, so it seems reasonable to assume that the archiving of data for a resort should be exogenous to actual or reported snow. We test this assumption in three ways. First, we test whether reports were more likely to be archived on certain days of the week, and find that weekends account for almost exactly two sevenths of our resort reports (28.4%, p-value of difference from 2/7 = 0.945). Second, we simply examine the timing of the reports, finding that in one of our archives it increased from once every ten days, to once every five days, to once every three days, to essentially every day. Archiving frequencies were higher for states with more resorts (e.g., Colorado vs. Missouri), suggesting that the archiving of a page containing a state's snow reports responded to that webpage's popularity, but the regular sampling frequencies suggested that this response was not happening at high enough frequency to contribute to a weekend effect. Third, we test whether the availability of a report is correlated with an interaction of government-reported snow (which we can measure on days when resort-reported snow is missing from the archives) and a weekend indicator variable, and find no evidence that it is (results discussed below, and reported in Table 5).

We compare the resort reports of new snowfall to government data from two sources: actual reported snowfall from nearby government weather stations, and estimated snowfall from the Snow Data Assimilation System (SNODAS), a U.S. National Weather Service model that provides estimated snowfall from satellite, ground station, and airborne weather data collection.[12] SNODAS data are available for any point in the continental United States on a 30-arc-second grid.[13] We take the largest of the 25 SNODAS estimates from the 5x5 grid surrounding the main resort mountain as the estimate of actual snowfall that we match to the resort snow report.[14]

For the government weather stations, we match each resort with to up to 20 National Oceanographic and Atmospheric Administration (NOAA) or National Operational Hydrologic Remote Sensing Center (NOHRSC) weather stations within 100 miles horizontally and at elevations within 1000 feet of the resort summit.[15] We match each resort snow report to mean reported snow from the surrounding stations that meet these criteria.

In matching the resort and government snow data, we match time periods as closely as possible. Resorts can issue and update snow reports on aggregator websites at any time, but they usually issue a report early in the morning local time.[16] This report is timed to capture as

[12] SNODAS data are described and available at http://nsidc.org/data/g02158.html.

[13] Thirty arc seconds are roughly 930 meters North-South and 660 meters East-West (at 45 degrees latitude).

[14] We collect data on the latitude and longitude of resort mountains primarily from the U.S. Geological Survey, and supplement this data with hand-collected information from Google Maps.

[15] NOAA station data is described at http://www.ncdc.noaa.gov/oa/climate/ghcn-daily/. NOHRSC station data is described at http://www.nohrsc.noaa.gov/nsa/reports.html. We match weather stations using a loss function of the distance in miles plus 0.1 times the difference between summit and station elevation in feet. The average matched station is 26 miles away and 160 feet below the summit for Eastern resorts and 52 miles away and 280 feet below the summit for Western resorts. Twenty-eight out of 437 resorts do not have matching weather stations due to the elevation restriction (19 of these are in Western Canada).

[16] Our data collection methods will usually capture the last snow report issued on a given day (midnight-to-midnight local time), rather than the first. In data collected from Internet archives, we can determine the date and time of a snow report from a timestamp. In the data we collect ourselves, we collect snow reports at midnight Eastern time, so these reports will be the last issued on a given calendar day. If a resort receives snowfall during the day and updates its snow report, it is possible that the same snowfall will appear in the snow report for two consecutive days. For instance, if a resort received snow on Saturday morning between 8 AM and noon, it may issue an updated snow report at noon Saturday that includes this snow, as well as a regular snow report Sunday morning at 6 AM that includes the snow. To the extent resorts issue more updated snow reports on weekends, this may lead to more double counting of weekend snow and may contribute to our result. In practice, however, updated snow reports are quite rare. Of the 1504 times our third-party archives captured the same resort twice on

much overnight snowfall as possible while still being available in time to affect that day's skier purchasing decisions. Saturday's snow report issued at 7 AM local time would therefore reflect snowfall from 7 AM Friday to 7 AM Saturday, and so we attempt to match the Saturday resort report with SNODAS and government data from this time period. NOHRSC reports typically cover a 24-hour period beginning at 7 AM local time, so this matches the timing of resort reports well. NOAA stations aggregate their data into 24-hour periods beginning at midnight Coordinated Universal Time (UTC), which corresponds to 7 PM Eastern Standard Time (EST) and 4 PM Pacific Standard Time (PST) in winter months. Since NOHRSC reports provide a better match with the timing of the resort reports, we match with NOAA reports only if matched NOHRSC stations are not available. SNODAS aggregates its data into 24-hour periods that begin at 6 AM (UTC), or 1 AM EST and 10 PM PST. Our analysis accounts for this asynchronicity.

Table 1 provides statistics on the distribution of our resort and snowfall observations across region and time period. We include resorts in the U.S. and Canada in our sample. We distinguish between Eastern and Western resorts, defining Eastern as states and provinces that are entirely east of the Continental Divide. Eastern mountains have lower elevations, and we are able to match more Eastern mountains to government weather stations that are within 1000 feet of summit elevation. SNODAS forecasts are not available in Canada, but are available for essentially all U.S. resorts. As mentioned above, the frequency of resort snow reports increases later in the sample, from about 12-13 reports per resort*year in 2004-5 and 2005-6, to 39 in 2006-7, to 70-75 in 2007-8 and 2008-9. Our analysis of the weekend effect

one day, on only 62 times (4.5 percent) had the resort report been updated, and these instances were not disproportionately on weekends or weekdays.

will focus on the 2004-8 seasons, and we will use the 2008-9 season to measure how the weekend effect changed following the introduction of the iPhone application.

Table 2, Panel A describes some additional characteristics on the resorts in our sample. Eastern and Western resorts differ on many of these characteristics, and so we report separate summary statistics for each group. Western resorts classify a larger share of their terrain as Expert (double black diamond), Advanced (black diamond) or, Intermediate (blue square), whereas Eastern resorts have a higher share of Beginner (green circle) terrain. Eastern mountains have lower base and summit elevations and vertical drops that are 60 percent smaller. Eastern resorts have roughly similar numbers of lifts, but less than half as many runs and one-ninth as many skiable acres. Eastern resorts have greater proximity to skiers who might be most influenced by snow reports in deciding whether and where to make a day- or weekend-trip (as measured by the population living in postal codes within 150 miles of the resort using U.S. and Canadian census data). Eastern resorts also face more competitors (as measured by the number of non-co-owned resorts within 50 miles).

Table 2, Panel B provides summary statistics for resort snow reports and snowfall data from government weather stations and SNODAS. Average reported snowfall from resort reports is 23 percent higher on weekends than during the week (1.59 vs. 1.29 inches, p-value of difference = 0.025). Resorts are 14 percent more likely to report at least some snow on weekend days (32.3 vs. 28.3 percent, p-value 0.016) and report 8 percent more snow conditional on reporting a positive amount (p-value 0.222).[17] Resorts report more snow than is reported in government weather data on both weekdays and weekends, although this could be the result of resort being located on specific mountains that receive more snow than

[17] The p-values given, like the standard errors in the regressions that follow, allow for clustering of error terms within days and resorts.

neighboring locations.[18] There is also more snow on weekends in government weather data, but the differences are smaller and statistically insignificant (p-values 0.316 and 0.184 in Table 2 Panel B, more below in Table 3).

III. Results

In this section, identify a weekend effect in resort snow reports, examine the cross-sectional determinants of that weekend effect, explore how consumer web site visits respond to snow reports, and estimate how the weekend effect changed with the introduction of an iPhone application that made it easier for skiers to post first-hand reports on snow conditions.

Our starting point for testing for weekend effects is the OLS specification:

$$s_{rt} = \beta * w_t + a_w + n_r + e_{rt} \qquad (1)$$

where s_{rt} is natural new (or "fresh") snowfall reported by resort r on day t, w_t is an indicator variable for whether t is a weekend day, a_w is a fixed effect for a specific calendar week (Wednesday-Tuesday), n_r is a fixed effect for a resort, and e_{rt} is an error term. The fixed effects control for any bias arising from the proportion of snow reports on weekends varying between more and less snowy weeks of the year (e.g., if resorts were open only on weekends at the beginning and end of the season) or between more and less snowy resorts. Point estimates actually change very little when these fixed effects are dropped (Appendix Table 1), so these potential omitted variable biases do not appear important in practice. But the fixed effects do improve the efficiency of estimation by absorbing variation that would otherwise be

[18] Although the SNODAS model estimates snowfall for precise locations, it does so partly by interpolating between government weather stations. Thus strategic ski resort location decisions might exploit mountain-by-mountain variation in snowfall that SNODAS does not fully capture.

captured by the error term. Appendix Table 1 also shows that the results are qualitatively similar if we use Tobit instead of OLS.[19]

Since actual and reported snowfall may be correlated across resorts on the same day, we allow for clustering within day when calculating our standard errors. Since snow reports may be serially correlated, we also allow for clustering within resorts, using the two-dimensional clustering procedure in Petersen (2009). Allowing for clustering within days does meaningfully affect standard errors, while clustering within resort has essentially no effect.

Table 3 presents estimates of day of the week effects, and of weekend effects for various definitions of weekend (Sat-Sun, Fri-Sun), over the 2004-2008 seasons. In resort-reported snow (column 1), we find that the largest day of the week effects are for Saturday, Sunday, Friday, and Monday. Regardless of our definition of weekend, we find that resorts report 0.20-0.25 more inches of new natural snow on weekends

In contrast, we do not find statistically significant evidence of a weekend effect in weather station or SNODAS data (columns 2-4). Point estimates of a weekend effect are positive for the sample of days for which we have a resort report, with magnitudes between 0.06 and 0.10 inches, or between 23 and 43 percent of the weekend effect in resort-reported snow. In contrast to the weekend effects in resort reports, the weekend effects in government reports are far from statistically significant (p-values range from 0.22 to 0.53), and they are not present to any meaningful extent when we examine the full sample of resort*days from the 2004-2008 seasons. In our tests below, we will control for government-reported snow when testing for weekend effects.

[19] We also estimate specifications with resort*week fixed effects. This reduces degrees of freedom by about a third and increases the standard errors accordingly. The weekend effect point estimate is not statistically (or economically) significantly different from the specifications in Table 3, and the additional fixed effects are not collectively significant. See Appendix Table 1 for details..

Table 4 examines the effect of controlling for government weather data on our estimated weekend effects over the 2004-2008 seasons.[20] The first column presents our result from Table 3, Column 1 (Specification 2) for reference. Column 2 restricts the sample to resort-days with a good match to government weather stations. Column 3 restricts the sample to resort-days with a good match to SNODAS. Columns 4-7 add controls for various functional forms of weather station snowfall: Column 4 includes same-day weather station snowfall and restricts its coefficient to be 1 (a difference-in-difference approach); Column 5 removes the coefficient restriction but continues to impose linearity (see below for more flexible fuctional forms); Column 6 restricts the sample to observations with data for prior and next-day weather station snowfall; Column 7 adds controls for these leads and lags (longer leads and lags do not have statistically significant coefficients). Regardless of specification, adding these weather station controls reduces both the standard error and the point estimate on the weekend effect but leaves it economically and statistically significant. When we control for SNODAS estimates by differencing (Column 8), we use a weighted average of current and next-day reported snowfall, where the weights are derived from the overlaps of time periods with a 7am-7am local time window in the resort's time zone. This yields weights that are fairly similar to the coefficients estimated in Column 9. Regardless of the approach, controlling for SNODAS instead of weather station estimates of snowfall produces weekend effect estimates between the unconditional (Column 3) and weather station (Column 4-7) specifications. In subsequent analysis, we focus on the specifications using differences between resort-reported and weather station or SNODAS snowfall estimates (Columns 4 and 8).

[20] Appendix Table 2 presents estimates of the weekend effect for various sub-periods (by year, by month, and by holiday vs. non-holiday). We do not have sufficient power to draw any firm inferences.

Figure 1 provides a more flexible analysis of the relationship between resort and weather station-reported snow. We sort days into categories based on resort-reported snow and plot the average of weather station snowfall for both weekdays (blue, dashed, top line) and weekends (red, solid, bottom line). The figure suggests that weekend exaggeration is largest for resort reports in the 6-12 inch range. This suggests that the weekend effect is increasing in the amount of actual snowfall, at least up to a "bliss point" of 10-12 inches. Formal tests of this hypothesis do not reject a model with a constant weekend effect, however. Figures using SNODAS estimates or a weighted average of weather station snow from days t+1, t, and t-1 (using weights from Table 4, Column 7) yield similar results.

Table 5 examines whether our results are affected by either selective reporting by resorts or by the selection of reports captured in our archives. Selective reporting could be due to (possibly also deceptive) practices by resorts or aggregators that are subtly different than reporting more snow than has actually fallen. For example, resorts with no new snow might prefer to leave up a stale report rather than report no new snow, and the optimality of this strategy might vary over the week (Columns 4-6). Similarly, we might be concerned that archiving was related to interest in a webpage, and thus might be related to snow in a way that varied over the week (Columns 1-3). In practice we find some evidence that reporting and archiving frequencies are very slightly higher when there is more actual snow (Columns 2, 5, and 8). But these effect sizes are tiny (compared to the dependent variable mean in the last row), and they disappear once we include our usual set of fixed effects for weeks and resorts

(Columns 3, 6, and 9).[21] More importantly, there is no evidence that selectivity differs on weekends (this key result is shown in the "Gov snow*Weekend" row).

Next we estimate cross-resort differences in weekend effects. Figure 2 plots the distribution of resort-level weekend effect estimates, with the resort count on the y-axis. The blue line (with the larger mass near zero) comes from a Bayesian posterior mixed (random coefficients) model; the red line comes from a noisier model that interacts the weekend indicator with resort fixed effects.[22] Both models suggest that the modal weekend effect is close to zero, and that a substantial number of resorts (perhaps 10 to 15 percent) exaggerate by 0.5 inches or more on the weekends.

Table 6 tests whether the weekend effect is larger for resorts with characteristics that proxy for payoffs to exaggeration. (We report specifications that difference resort-reported and weather station snowfall; results are similar if we control for snowfall or difference with SNODAS instead). We find that resorts with expert terrain report 0.24 inches more fresh snow on weekdays (bottom panel) and an *additional* 0.17 extra inches of fresh snow on weekends (top panel).[23] The main (weekday) effect could be due to resorts with expert terrain being especially well located, but the interaction (weekend) effect suggests that resorts with more expert terrain exaggerate their snowfall more on weekends because fresh snow is especially appealing to expert skiers. We also find some evidence of larger weekend effects for resorts

[21] In particular, it is the inclusion of resort fixed effects that causes the relationship between snow and both reporting and archiving frequencies to disappear, suggesting that this relationship reflects snowier resorts reporting more frequently and snowier states being archived more frequently.

[22] We estimate the mixed model using the Generalized Linear Latent and Mixed Model (GLLAMM) procedure described in Rabe-Hesketh et al (2004). Both the GLLAMM model and the fixed effects model reject the null hypothesis of a constant weekend effect across resorts (with a p-value less than 0.0001 in both cases).

[23] We also estimate specifications that interact the share of terrain that is Intermediate, Advanced, and Expert with the weekend indicator (with Beginner terrain as the omitted category). These regressions find slightly positive but insignificant coefficients for Intermediate and Advanced terrain, and a positive and significant coefficient for Expert terrain. A regression including an indicator variable for any Expert terrain and a continuous variable for the share of Expert terrain suggests that the weekend effect is mostly associated with the former. This is consistent with resorts needing Expert terrain to be in expert skiers' choice sets, but with the exact amount being less important (or imprecisely measured).

that do not offer money-back guarantees (i.e., the interactions between weekend and no guarantee are positive and significant). In contrast, we do not find a significant relationship between weekend effects and the number of neighboring (competing) resorts, or the number of people living within 150 miles driving distance from the resort, although our estimates here are quite noisy.[24] Likewise, the differences in the weekend effect between resorts with different types of owners (publicly traded, private, or government), and between West vs. East, are insignificant and imprecisely estimated.

Next we explore whether consumers pierce the veil of resort exaggeration, using data on resort website visits collected from a sample of internet users.[25] We measure visits by counting unique website visitors from IP addresses within 150 miles of a given resort, before 10AM. A resort snow report can drive traffic to its website because, as noted above, resort reports are rebroadcast by third-party aggregator websites and offline media outlets. Consumers exposed to a rebroadcast may then visit a resort website to get additional information on conditions, prices, services, and other aspects of trip planning.[26] So website visits are a useful, if incomplete, measure of consumer demand responses to resort snowfall reports.

Table 7, Column 1 reports Poisson regressions showing that, across all resort-days in this website visit sample (January 2007-May 2008, excluding the non-ski-season months June-Oct 2007), visits increase by more than 100% for each additional inch of government-reported snow, and by 61% for each additional inch of resort-reported snow. Visits do not respond

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[24] We define two resorts as competitors if they are within 50 miles (as the crow flies), are not under common ownership, and either both or neither have expert terrain. Permuting the definition does not change the results.

[25] We conducted this study without industry cooperation, and hence we do not have access to demand data from the resorts themselves. Nearly all resorts are privately held so publicly available financial information on them is scarce, particularly at the daily frequency.

[26] Unfortunately we lack data on these within-site clicks that would enable us to observe what sorts of content site visitors peruse.

differently to government-reported snow on weekends, but are sharply less responsive to resort-reported snow on weekends (the Resort snow*Weekend row in the table); in fact, our results suggest that consumers only respond to additional resort-reported snow on weekdays. The next four columns of Table 7 explore whether visits respond for resorts with characteristics associated with larger weekend effects in Table 6: Expert terrain (Column 2, vs. no Expert terrain in Column 3) and No Guarantee (Column 4, vs. Column 5). We do not find strong evidence that skiers discount weekend reports by these resorts more strongly; i.e., we do not find significant differences in the Resort snow*Weekend coefficients in Column 2 vs. Column 3, or in Column 4 vs. Column 5. In all, the website visit results suggest that consumers are skeptical of resorts' weekend reports of fresh snowfall but may not completely pierce the veil on the nature and extent of weekend exaggeration.

Finally, we examine the effect of a change to the information environment on exaggeration. On January 8, 2009, *SkiReport.com* introduced a feature in its popular iPhone application that allows users to file "first-hand" reports. These reports are then posted below the resort's official snow report (Figure 3). Although users previously had the ability to file first-hand reports on the SkiReport.com website, the iPhone application made it much easier to do so from the phone (as opposed to a computer), and hence file in real time (e.g., from the chair lift).[27] The volume of first-hand reports increased dramatically following the feature launch (Figure 4).

In addition to the time shock (pre- vs. post- iPhone application launch), we also exploit cross-sectional differences in iPhone coverage to identify resorts that were plausibly more or less affected by the new "app". Coverage maps from AT&T (the sole network provider for the

[27] Even if first-hand reports are not always *posted* to the aggregator site in real-time, the threat of negative feedback being posted *eventually* could raise the cost of exaggeration and hence provide a deterrent.

iPhone in the United States during our sample period) do not account well for topography, so we classify a resort as covered (and hence more-affected) if it was the subject of 10 or more first-hand reports after January 8, 2009 that did *not* mention snow quality.[28] This low threshold for measuring coverage minimizes concerns about endogeneity, and allows for the possibility that the mere threat of negative first-hand reports might be sufficient to deter resort exaggeration in equilibrium (although there are in fact many skier reports questioning the veracity of resort reports).

Table 8 presents estimates of how the iPhone application affected resort reporting.. As in Table 6, the dependent variable measures the difference between resort-reported and weather station snow. Table 8, Columns 5 and 6, present the key result here: iPhone coverage*post-app launch*weekend is strongly negative (-0.266 or -0.221, depending on control variable specification), and significant. I.e., these results suggest that resorts with iPhone reception basically stopped exaggerating weekend snowfall after the app launched. Columns 2, 4, and 6 suggest that this is not an artifact of seasonality in weekend effects (that varies with coverage): the point estimates on (weekend)*(post-Jan 8 in any season) are negative and insignificant, as are the point estimates on (weekend)*(coverage)*(post-Jan 8 in any season).

The results on the other variables shown in Table 8 are interesting in their own right but do not affect the main inference that the iPhone app greatly curbed exaggeration at resorts with better reception (relative to resorts with no or worse coverage). The significant and positive results on weekend*Post-launch suggest that resorts generally received relatively much fresh snow (relative to government reports) post-January 8th during the 2008-2009 season (and/or that resorts exaggerated more during the week than in previous time periods).

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[28] Most reports are indeed about something other than fresh snowfall (e.g., food, socializing, other aspects of trail access or conditions). See e.g., Figure 3.

The significant and positive results on coverage*post-launch suggest that whatever was happening (more microclimate snow and/or more weekday exaggeration) was stronger at resorts with good iPhone reception. The nearly significant and positive results on weekend*coverage suggest that covered resorts tended to have larger initial weekend effects.

IV. Conclusion

We provide some unusually sharp empirical evidence on the extent, mechanics, and dynamics of deceptive advertising.

Ski resorts self-report significantly and substantially more natural snowfall on weekends; there is no significant weekend effect in government snowfall data gleaned from three different sources. There is some evidence that resorts with greater benefits from exaggerating- those with expert terrain and without money-back guarantees-- do it more. The evidence on whether competition restrains or encourages exaggeration is inconclusive. Data on resort website visits suggest that consumer demand responds strongly to snow reports (both resort- and government-issued), that skiers were quite skeptical of resort reports on weekend, but that they did not fully pierce the veil on the nature and extent of resort exaggeration. Near the end of our sample period, we observe a shock to the information environment: a new iPhone application feature makes it easier for skiers to comment on resort ski conditions in real time. Exaggeration of weekend fresh snowfall by resorts with better iPhone reception falls sharply.

In all, the results suggest that deceptive advertising about product quality varies sharply with incentives, both within resorts (over time, at high-frequencies), and across resorts. They also suggest that consumers responded only weakly to exaggerated claims, and hence that advertisers reaped few benefits from deception in equilibrium. This may help explain why a simple technology shock (the launch of the iPhone app) seems to have changed the equilibrium by dramatically reducing weekend exaggeration at resorts with better iPhone reception.

Although our setting may be unusual with its high-frequency variation in product quality, we speculate that our findings are broadly applicable. They relate to many classes of models on signaling, deception, obfuscation, and search costs. Search and information costs loom large in many other markets where product availability and pricing vary at high frequencies. Some of these markets presumably have conditions that are even more ripe for deceptive advertising than ours, with, for example, purchase decisions that are lower-stakes, have quality realizations with longer lags, or embed fewer opportunities for repeat play and learning.

A particularly important direction for future research is to combine evidence on the nature and dynamics of deceptive advertising with richer evidence on consumer responses. This is critical for examining whether and how consumers pierce the veil of deception, and for measuring the welfare effects of deceptive advertising and innovations that amplify or discourage it.

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Table 1. Descriptive Statistics: Resorts and Reports by Region and Year

	Ski resorts			Daily snow reports		
	Total	w/Weather Station	w/SNODAS	All	w/Weather Station	w/SNODAS
Region						
Eastern U.S.	232	227	195	38,683	34,092	18,808
Western U.S.	135	131	125	34,339	26,895	21,112
Eastern Canada	41	41	0	5,640	4,088	0
Western Canada	29	10	0	6,148	1,254	0
Total	437	409	320	84,810	66,329	39,920
Season						
2004-5	354	223	268	4,054	1,544	2,829
2005-6	363	310	277	4,807	2,566	3,714
2006-7	393	359	299	15,376	12,812	11,354
2007-8	429	399	315	32,165	26,197	22,023
2008-9	405	373	0	28,408	23,210	0
Total	437	409	320	84,810	66,329	39,920

We define Eastern resorts as those located in states and provinces that are entirely east of the Continental Divide.

Table 2. Descriptive Statistics: Resort and Snow (Report) Characteristics

	All resorts (437)		Eastern resorts (273)		Western resorts (164)	
Panel A. Resort characteristics	Mean	SD	Mean	SD	Mean	SD
Terrain type (%)						
Beginner	27	11	29	11	22	10
Intermediate	41	12	41	12	42	11
Advanced	25	13	25	12	26	13
Expert	7	11	5	9	10	15
% with any expert terrain	42		40		46	
Base elevation	3132	2946	1157	901	6419	2111
Summit elevation	4373	3580	1922	1178	8455	2266
Vertical drop	1242	1004	764	620	2036	1019
Lifts	7.8	5.1	7.1	3.7	8.8	6.7
Runs	41	35	29	24	63	42
Acres	671	1114	155	168	1461	1438
LN(Population within 150 mile radius)	15.5	1.2	16.1	1.0	14.6	1.0
Competing resorts within 50 miles	5.9	4.8	6.3	5	5.2	4.3
% Offering money-back guarantee	3.9		4.8		2.4	
% with iPhone coverage	66.8		65.2		69.5	
Type of ownership (%)						
Publicly traded	3.2		1.8		5.5	
Private	89.9		91.6		87.2	
Government	6.9		6.6		7.3	

Panel B. Natural Snowfall	Resort-reported		Weather station		SNODAS	
% of days with snowfall in range	Weekday	Weekend	Weekday	Weekend	Weekday	Weekend
0"	71.7	67.7	51.2	49.0	50.3	46.5
0.01 to 0.49			14.2	14.7	15.1	14.9
0.50 to 1.49	6.7	7.7	14.1	14.8	11.3	12.7
1.50 to 2.49	5.2	5.7	6.9	6.8	5.9	6.6
2.50 to 3.49	3.4	4.1	4.3	3.9	4.2	4.3
3.50 to 4.49	3.1	3.4	2.6	2.8	2.9	3.0
4.50 to 5.49	1.9	2.0	1.8	2.3	2.8	3.3
5.50 or more	8.0	9.4	5.0	5.8	7.5	8.7
Mean snowfall	1.29	1.59	1.05	1.15	1.17	1.32
SD snowfall	3.16	4.13	2.27	2.38	2.11	2.20
Observations	40,398	16,004	34,065	13,676	28,308	11,612
% on weekend	28.4%		28.6%		29.1%	
P-value (H0: % weekend = 2/7)	0.94		0.978		0.845	

States and provinces that are entirely east of the Continental Divide are considered Eastern. Resorts are considered to have iPhone coverage if they received 10 or more iPhone first-hand reports about subjects other than snow quality. P-values reported are for a test of the null hypothesis that the proportion of snow reports on a weekend day (Saturday or Sunday) is 2/7. These tests allow for clustering of observations on days. Data in Panel B is for the 2004-8 seasons.

Table 3. Day of week effects in reported snowfall, 2004-2008

Dependent variable: Inches of new natural snowfall reported

	Resorts	Weather stations		SNODAS
		All	w/Resort report	w/Resort report
	(1)	(2)	(3)	(4)
Specification 1. Day of week indicator variables (Sunday omitted)				
Monday	-0.145	0.074	0.147	-0.005
	(0.166)	(0.056)	(0.157)	(0.144)
Tuesday	-0.389***	0.016	-0.264**	-0.092
	(0.149)	(0.054)	(0.121)	(0.154)
Wednesday	-0.231	0.032	-0.048	0.0439
	(0.162)	(0.055)	(0.152)	(0.160)
Thursday	-0.388**	0.001	-0.237*	0.128
	(0.165)	(0.052)	(0.137)	(0.168)
Friday	-0.131	0.043	0.000	0.101
	(0.156)	(0.051)	(0.144)	(0.165)
Saturday	-0.006	0.007	-0.027	0.242
	(0.161)	(0.055)	(0.139)	(0.157)
F-test p-value	0.0550	0.2413	0.136	0.356
R^2	0.123	0.0403	0.166	0.133
Specification 2. Two-day weekend indicator variable (Sat&Sun)				
Weekend	0.246**	-0.029	0.057	0.096
	(0.099)	(0.033)	(0.090)	(0.092)
R^2	0.123	0.0403	0.163	0.131
Specification 3. Three-day weekend indicator variable (Fri-Sun)				
Weekend	0.238***	-0.014	0.086	0.102
	(0.089)	(0.030)	(0.084)	(0.083)
R^2	0.123	0.0401	0.163	0.131
Observations	56,402	231,952	47,741	39,920
Unique days	752	1,026	709	707

OLS with fixed effects for weeks (Wed-Tues) and resort. Column 2 includes every weather station reading taken from October-May from a station that is matched with a ski resort, regardless of whether a resort report is available for that day or not. Standard errors allow for clustering within both day and resort.

Table 4. Weekend effect regressions 2004-2008, controlling for actual snowfall per government data

Dependent variable: Inches of new natural snowfall reported by resort

Dependent variable	Resort			Resort, controlling for weather station snow				Resort, controlling for SNODAS	
Observations include		w/Station data	w/SNODAS	w/Station data (t+1, t, t-1)				w/SNODAS (t+1, t, t-1)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Weekend (Sat&Sun)	0.246**	0.203**	0.242**	0.146**	0.164***	0.131**	0.125**	0.173*	0.183**
	(0.099)	(0.099)	(0.117)	(0.060)	(0.062)	(0.062)	(0.059)	(0.093)	(0.089)
Gov (t+1)							0.053**	.25 to .375	0.359***
							(0.024)		(0.025)
Gov (t)				1	0.684***	0.736***	0.672***	.625 to .75	0.621***
					(0.047)	(0.051)	(0.048)		(0.029)
Gov (t-1)							0.180***		0.104***
							(0.025)		(0.020)
Observations	56,402	47,741	39,920	47,741	47,741	43,119	43,119	39,920	39,920
Unique days	752	692	707	692	692	692	692	707	707
R^2	0.123	0.117	0.141	0.093	0.294	0.303	0.317	0.084	0.351

OLS with fixed effects for weeks (Wed-Tues) and resort. Columns 4 constrains the coefficient on current-day snow to be one; column 7 constrains the coefficients on current and future-day SNODAS snow to sum to one, with the proportions determined by the number of hours in the 7AM-to-7AM local time window that overlap with the SNODAS observation window in question (weights are 0.75 on t and 0.25 on t+1 for the Eastern time zone; and 0.625 and 0.375 respectively for the Pacific time zone). Columns 2-9 are restricted to observations with either weather station or SNODAS data for days t-1 to t+1. Standard errors allow for clustering within both day and resort.

Table 5. Tests for selection biases in resort snow reports
Dependent variable: = 1 if observation is archived and/or resort issued snow report

	Was state*day page archived?			Did resort issue a fresh report? (conditional on page being archived)			Is report in dataset? (page archived & resort issued report)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Weekend (Sat or Sun)	-0.0099	-0.0180	-0.0389	0.0068	0.0044	0.0116	-0.0020	-0.0106	-0.0132
	(0.0320)	(0.0327)	(0.0663)	(0.0091)	(0.0104)	(0.0421)	(0.0285)	(0.0289)	(0.0532)
Gov snow (NOHRSC/NOAA)		0.0079*	-0.0048		0.0040***	-0.0095		0.0066*	-0.0052
		(0.0042)	(0.0108)		(0.0016)	(0.0070)		(0.0037)	(0.0088)
Gov snow*Weekend		0.0095	0.0063		0.0032	0.0163		0.0101	0.0116
		(0.0074)	(0.0195)		(0.0031)	(0.0129)		(0.0062)	(0.0150)
Fixed effects									
Week (Wed-Tues)?			yes			yes			yes
State or resort?			state			resort			resort
Observations	20,603	19,886	19,841	59,737	57,488	54,105	154,556	152,307	149,515
Dependent variable mean		0.42			0.86			0.37	

The table reports marginal effects from probit regressions predicting whether a state's page was archived on a given day, and whether a resort snow report is available for a specific day (conditional on the page being archived and unconditional). The sample includes every day in the 2004-2008 seasons (October 1 to May 31) for every resort between the resort's opening and closing date (as determined by the first and last day a resort snow report is issued). Since the variation in the regressions in the first three columns is at the state*day level, they include one data point for each state*day, but observations are weighted by the number of resorts in the state. Actual snow is measured using the average snowfall reported by the NOAA stations matched to the state's resorts. Standard errors adjust for clustering within day.

Table 6. Variation in weekend effects by resort characteristics, 2004-8 seasons
Dependent variable: Resort - NOHRSC/NOAA snow

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Weekend (Sat&Sun)	0.146**	0.061	-0.012	-0.093	-0.103	-0.062	-0.088
	(0.058)	(0.068)	(0.082)	(0.089)	(0.097)	(0.105)	(0.089)
Interaction effects with weekend							
Expert terrain > 0		0.169**	0.170**	0.171**	0.173**	0.173**	0.168**
		(0.075)	(0.074)	(0.074)	(0.073)	(0.074)	(0.072)
West			0.140	0.139	0.162	0.138	0.135
			(0.150)	(0.150)	(0.189)	(0.150)	(0.151)
No money back guarantee				0.196***	0.191***	0.193***	0.194***
				(0.073)	(0.070)	(0.072)	(0.072)
1/(1+number of competitors within 50 miles)					0.019		
					(0.065)		
Ln(Population within 150 miles), normalized						-0.084	
						(0.150)	
Publicly traded owner							0.064
							(0.217)
Government owner							-0.051
							(0.116)
Main effects							
Expert terrain > 0		0.240***	0.235***	0.236***	0.232***	0.238***	0.234***
		(0.039)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
West			0.540***	0.540***	0.499***	0.538***	0.537***
			(0.082)	(0.082)	(0.103)	(0.082)	(0.082)
No money back guarantee				0.039	0.049	0.037	0.038
				(0.033)	(0.033)	(0.033)	(0.033)
1/(1+number of competitors within 50 miles)					-0.035		
					(0.034)		
Ln(Population within 150 miles), normalized						-0.095	
						(0.070)	
Publicly traded owner							0.067
							(0.122)
Government owner							-0.001
							(0.055)
Observations	47,741	47,741	47,741	47,741	47,741	47,741	47,741
Unique days	692	692	692	692	692	692	692
R^2	0.310	0.316	0.326	0.327	0.327	0.327	0.333

OLS with fixed effects for weeks (Wed-Tues) and resort. Standard errors allow for clustering within both day and resort. Two resorts are considered competitors if they are within 50 miles, are not under common ownership, and either both or neither have expert terrain. Sample size drops in the last two columns because we were not able to find data for many resorts on guarantees and ownership.

Table 7. Snow reports and resort-web site visitors

Dependent variable: Unique resort web site visitors (residing within 150 miles, before 10 AM local time)

	Full sample	Expert terrain?		Money back guarantee	
		Yes	No	No	Yes
	(1)	(2)	(3)	(4)	(5)
Resort-reported snow	0.028***	0.033***	0.018	0.035***	0.029**
	(0.008)	(0.007)	(0.016)	(0.011)	(0.012)
Resort snow*Weekend	-0.027***	-0.029*	-0.020	-0.032**	-0.018
	(0.012)	(0.018)	(0.019)	(0.014)	(0.016)
Gov snow (NOHRSC/NOAA)	0.059**	0.061***	0.058***	0.063***	0.042***
	(0.014)	(0.019)	(0.022)	(0.020)	(0.016)
Gov snow*Weekend	0.008	-0.006	0.019	0.003	0.011
	(0.020)	(0.035)	(0.031)	(0.030)	(0.030)
Weekend	0.234***	0.228**	0.246***	0.155	0.309***
	(0.072)	(0.097)	(0.095)	(0.106)	(0.106)
Observations	35,320	16,560	18,760	31,800	3,520
Dep var mean	0.046	0.054	0.040	0.054	0.029

Table 8. First-hand reporting (via iPhones) and the weekend effect
Dependent variable: Resort - NOHRSC/NOAA snow

Time period	2004-08 seasons	2004-08 seasons	2004-08 seasons	2004-08 seasons	2004-09 seasons	2004-09 seasons
	(1)	(2)	(3)	(4)	(5)	(6)
Weekend (Sat&Sun)	0.146**	0.257**	0.062	0.137	0.039	0.050
	(0.058)	(0.101)	(0.077)	(0.126)	(0.073)	(0.126)
Interaction effects with weekend						
Post-Jan8 (1/8 or later in any season)		-0.166		-0.108		-0.018
		(0.123)		(0.156)		(0.157)
Post-launch (1/8/2009 or later)					0.237**	0.244*
					(0.120)	(0.131)
iPhone coverage at resort			0.107	0.152	0.120*	0.195
			(0.070)	(0.134)	(0.066)	(0.124)
iPhone coverage*post-Jan8				-0.072		-0.119
				(0.155)		(0.147)
iPhone coverage*post-launch					-0.266***	-0.221**
					(0.094)	(0.101)
Main effects						
iPhone coverage*post-Jan8				0.133*		0.100
				(0.080)		(0.079)
iPhone coverage*post-launch					0.226***	0.190***
					(0.061)	(0.066)
Observations	47,741	47,741	47,741	47,741	72,569	72,569
Unique days	692	692	692	692	813	813
R^2	0.093	0.093	0.093	0.093	0.091	0.091

OLS regressions with fixed effects for week (Wed-Tues) and resort. To keep week fixed effects and the post-launch and post-Jan 8 variables synchronized, Post-Jan 8/Launch refers to weeks (Wed-Tues) beginning after January 7. The main effects for post-Jan 8 and post-launch are therefore absorbed by the week fixed effects, and the main effect for iPhone coverage at resort is absorbed by the resort fixed effect. Standard errors allow for clustering within both day and resort. We classify a resort as covered if it was the subject of 10 or more first-hand reports after January 8, 2009 that did not mention snow quality.

Appendix Table 1. Alternative specifications for 2004-2008 -- fixed effects and tobit

Dependent variable: Inches of new natural snowfall reported by resort

	(1)	(2)	(3)	(4)	(5)	(6)
Specifications without actual snow controls	Table 4, Col 1	No FEs	Resort FEs	Week FEs	Resort*week FEs	Tobit
Weekend (Sat&Sun)	0.246**	0.297**	0.277**	0.274***	0.230*	0.994**
	(0.099)	(0.133)	(0.134)	(0.100)	(0.135)	(0.397)
Constant	1.229***	1.297***	1.302***	1.303***	1.316***	-5.063***
	(0.077)	(0.0665)	(0.0665)	(0.0491)	(0.0598)	(0.335)
Ln(Sigma)						8.341***
						(0.301)
Observations	56,402	56,402	56,402	56,402	56,402	56,402
Unique days	755	755	755	755	755	755
R^2	0.123	0.001	0.064	0.060	0.453	N/A
Resort-reported - weather station snow	Table 4, Col 4	No FEs	Resort FEs	Week FEs	Resort*week FEs	Tobit
Weekend (Sat&Sun)	0.146**	0.146*	0.136*	0.155**	0.137*	0.694**
	(0.060)	(0.082)	(0.079)	(0.062)	(0.076)	(0.276)
Constant	0.403***	0.377***	0.337***	0.403***	0.333***	-6.033***
	(0.0476)	(0.0455)	(0.0497)	(0.0476)	(0.0781)	(0.367)
Ln(Sigma)						6.976***
						(0.304)
Observations	47,741	47,741	47,741	47,741	47,741	47,741
Unique days	692	692	692	692	692	692
R^2	0.093	0.000	0.070	0.025	0.425	N/A
Resort-reported - SNODAS snow	Table 4, Col 8	No FEs	Resort FEs	Week FEs	Resort*week FEs	Tobit
Weekend (Sat&Sun)	0.173*	0.189*	0.180	0.185**	0.154	0.692**
	(0.085)	(0.114)	(0.112)	(0.093)	(0.131)	(0.323)
Constant	-0.034	-0.0239	-0.0249	0.0343	0.0843	-6.941***
	(0.050)	(0.0431)	(0.0462)	(0.0533)	(0.0862)	(0.343)
Ln(Sigma)						6.866***
						(0.229)
Observations	39,920	39,920	39,920	39,920	39,920	39,920
Unique days	707	707	707	707	707	707
R^2	0.3434	0.2859	0.323	0.3075	0.5848	N/A

Note: Regressions are estimated by OLS or Tobit and include the indicated fixed effects. Standard errors allow for clustering within both date and resort. Week fixed effects are for Wednesday-Tuesday weeks (to include a weekend and the immediately surrounding weekdays). Tobit models control for rather than difference weather station and SNODAS snow.

Appendix Table 2. Weekend effect estimates for sub-periods, 2004-2008

Dependent variable: Inches of new natural snowfall reported by resort

	No weather controls			Resort - weather station			Resort - SNODAS		
	Obs.	Coef.	SE	Obs.	Coef.	SE	Obs.	Coef.	SE
All observations	56,402	0.246**	(0.097)	47,741	0.146**	(0.058)	39,920	0.173*	(0.088)
2004-5 Season	4,054	0.152	(0.410)	2,218	0.772*	(0.393)	2,829	0.107	(0.331)
2005-6 Season	4,807	0.571	(0.367)	3,463	0.327	(0.277)	3,714	0.223	(0.280)
2006-7 Season	15,376	0.248	(0.184)	13,518	-0.034	(0.090)	11,354	0.210*	(0.111)
2007-8 Season	32,165	0.219*	(0.130)	28,542	0.152**	(0.076)	22,023	0.157	(0.133)
November	2,581	0.591	(0.357)	1,811	0.347	(0.351)	2,051	0.147	(0.306)
December	10,271	-0.029	(0.194)	8,720	0.111	(0.125)	7,140	0.182	(0.159)
January	12,247	0.521*	(0.290)	10,611	0.368**	(0.143)	8,495	0.479	(0.296)
February	11,932	0.088	(0.201)	10,304	0.159	(0.142)	9,137	-0.037	(0.200)
March	14,653	0.372*	(0.190)	12,623	0.032	(0.121)	9,704	0.157	(0.131)
April and May	4,718	-0.054	(0.207)	3,672	-0.032	(0.164)	3,393	0.044	(0.168)
Christmas holiday	3,683	-0.056	(0.277)	3,157	-0.047	(0.224)	1,746	-0.298	(0.202)
President's day week	2,395	0.509	(0.301)	2,119	0.307*	(0.167)	1,841	0.019	(0.207)
Other periods	50,324	0.254**	(0.106)	42,465	0.132**	(0.062)	36,333	0.189**	(0.094)
West	28,880	0.385**	(0.172)	21,686	0.281***	(0.108)	21,112	0.332**	(0.141)
East	27,522	0.092	(0.126)	26,055	0.041	(0.057)	18,808	0.003	(0.105)
U.S.	49,215	0.234**	(0.106)	44,318	0.168***	(0.058)			
Canada	7,187	0.315**	(0.130)	3,423	-0.212	(0.216)			

This table repeats the specifications in Table 4 (columns 1, 4, and 8) for subsamples of the data.

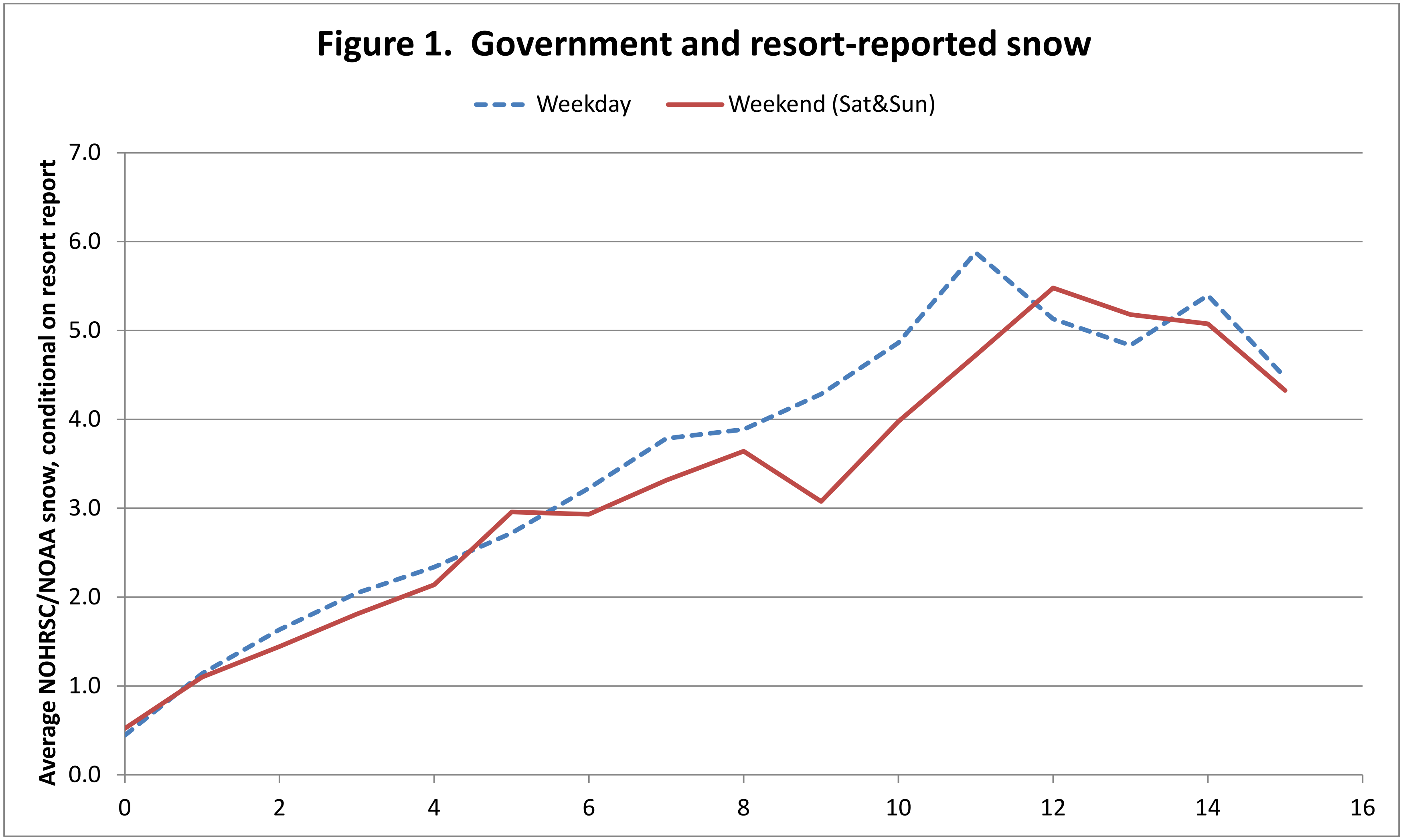
Figure 1. Government and resort-reported snow
Weekday
Weekend (Sat&Sun)
Average NOHRSC/NOAA snow, conditional on resort report
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
0
2
4
6
8
10
12
14
16

Figure 2. Distribution of resort-level estimates of weekend effects

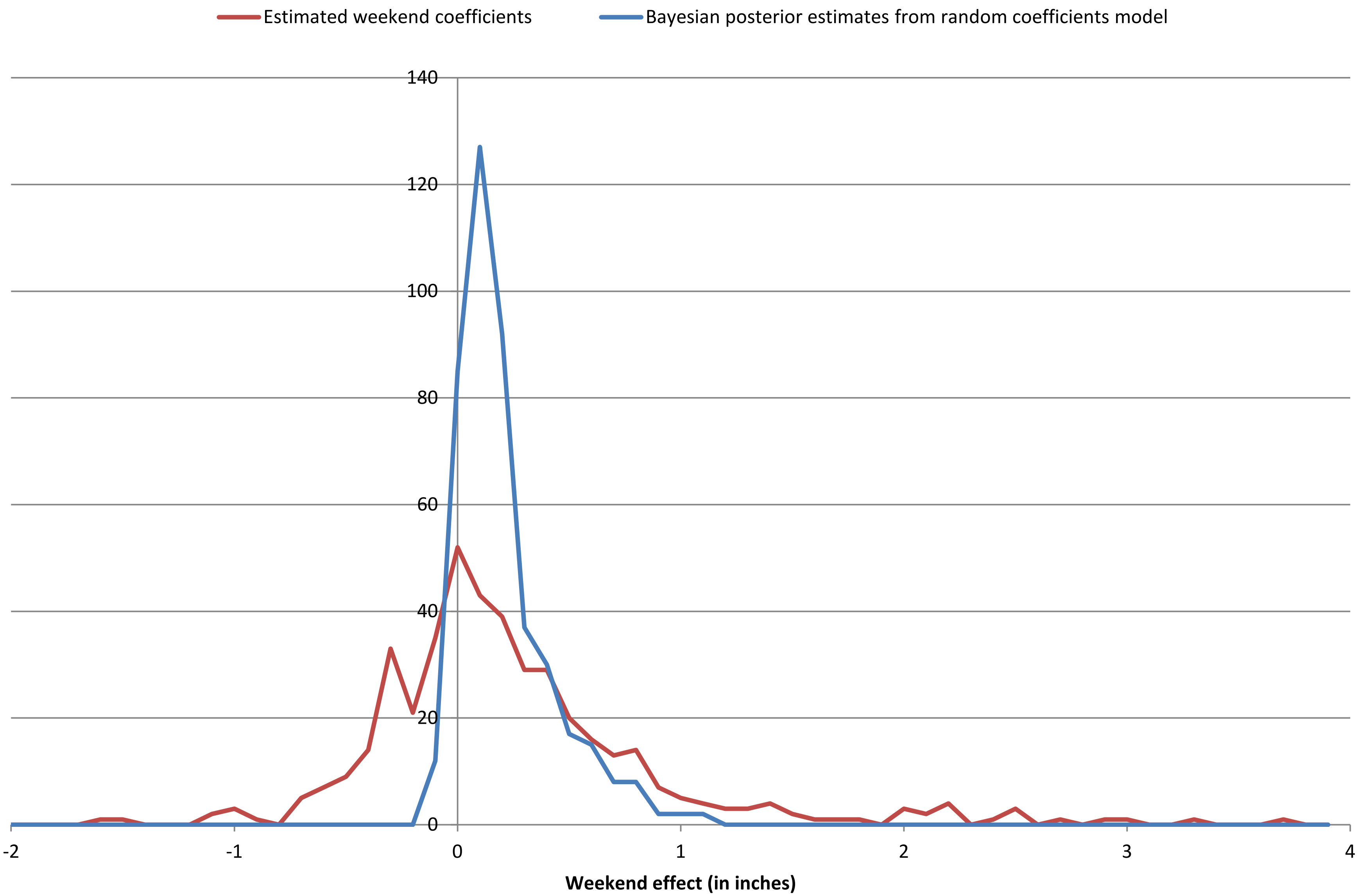

Figure 3. Example of first-hand reports

SkiReport.com YOUR SKI AND RIDE POWDER GUIDE sponsored by SPYDER

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Home California Mammoth Ski Report

Search: GO

Jump to: Mammoth

Mammoth Ski Report

Mammoth

- Ski Report
- Ski Cams
- Weather
- Road Conditions
- Mountain Stats
- Trail Map
- Google Map
- Photo Gallery
- Area Profile
- Ticket Prices
- Lodging
- « California

Base	82-145 in | 208-368 cm
24 Hour Snowfall	No new snow
Last Snowfall	Apr 25 - 4 in | 10 cm
Previous Snowfall	Apr 15 - 1 in | 3 cm
Surface	Spring Conditions
Secondary Surface	Variable Conditions
Lifts Open	7 of 29
Trails Open	65 of 150
Percent Open	35%
Fri Weather	Rain likely, mainly after 11am. Cloudy, with a high near 55. Southwest wind between 5 and 15 mph. Chance of precipitation is 70%. (Weather Forecast)
Nearby Ski Areas	June, Sierra Summit, Badger Pass
Report Time	4/30/09 8:34 AM PST

Mammoth ski report provided by SnoCountry Mountain Reports

SkiReport.com now on the iPhone!

First-Hand Ski Reports

April 20th - iPhone Report
How's the conditions for this wknd

April 20th - iPhone Report
Went this past weekend. Awesome weather, good snow, just a little too hard packed in the morning, but gets loose as the day goes on. A bit slushy in the afternoon but can't complain, I'm from So Cal, I'm used to it. Still very worth the 6 hour drive.

April 20th - iPhone Report
They'll be closing some areas but the season is going to last till memorial day from what I read a few weeks ago. Heading up this weekend :)

April 20th - iPhone Report
What is Mammoth like this week- is it still worth it for spring skiing?

April 18th - iPhone Report
It was alot of fun runs are kind of ice in the morning but alot of fun you should go up

View All First-Hand Reports (393)

Post First-Hand Ski Report

Publish your personal ski report of Mammoth

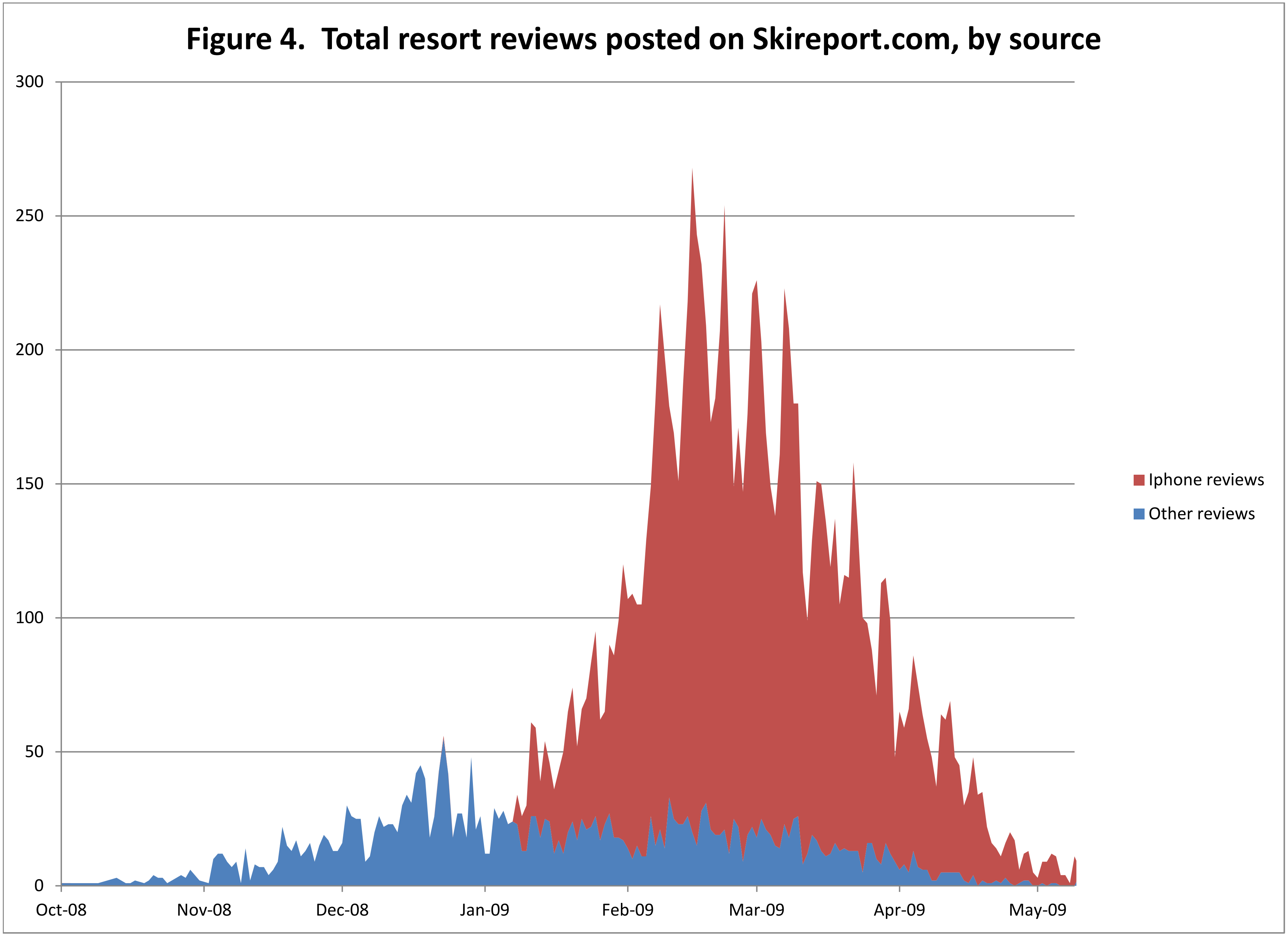
Figure 4. Total resort reviews posted on Skireport.com, by source
300
250
200
150
100
50
0
Oct-08
Nov-08
Dec-08
Jan-09
Feb-09
Mar-09
Apr-09
May-09
Iphone reviews
Other reviews