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Celebrity Endorsements, Firm Value, and Reputation Risk: Evidence from the Tiger Woods Scandal

Christopher R. Knittel
Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts 20142; and National Bureau of Economic Research, Cambridge, Massachusetts 02138, knittel@mit.edu

Victor Stango
Graduate School of Management, University of California, Davis, Davis, California 95616, vstango@ucdavis.edu

We estimate the stock market effects of the Tiger Woods scandal on his sponsors and sponsors' competitors. In the 10–15 trading days after the onset of the scandal, the full portfolio of sponsors lost more than 2% of market value, with losses concentrated among the core three sponsors: Electronic Arts, Nike, and PepsiCo (Gatorade). Sponsors' day-by-day losses correlate strongly with Google search intensity regarding the endorsement-related impact of the scandal, as well as with qualitative indicators of "endorsement-related news." At least some sponsors' losses were competitors' gains, suggesting that endorsement deals are partially a business-stealing strategy. However, competitors who were themselves celebrity endorsement intensive fared relatively worse than those who were not endorsement intensive, and that difference also correlates day by day with news/search intensity regarding the scandal. It appears that the scandal sent a negative marketwide signal about the reputation risk associated with celebrity endorsements.

Key words: celebrity endorsers; event studies; reputation risk
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1. Introduction

As of mid-2009, professional golfer Eldrick "Tiger" Woods earned roughly $100 million annually in endorsement income, an amount far greater than that earned by any other athlete. On November 27, 2009, Woods was involved in a car accident outside his home. Following the accident, a series of news reports about both the crash and Woods' personal life damaged his public reputation, and several sponsors either stopped featuring him or dropped him outright. In this paper we estimate the stock market effects of the scandal, for both the sponsor firms and their competitors. Some of those competitors are themselves "endorsement intensive" (but have no deal with Tiger Woods), whereas others have no celebrity endorsement deals.

Our empirics address several key questions about celebrity endorsements, firm value, and business strategy. Does firm value depend materially on investments in celebrity endorsements? If so, do sponsors' gains and losses from celebrity endorsements represent net market value creation/destruction, or business stealing from other firms? And, does the stock market reflect changing expectations about the "reputation risk" that firms take on by attaching their brands to celebrities? Previous work on celebrity sponsorship almost exclusively focuses on the first question rather than the latter two. And, most previous work focuses only on stock market effects, whereas we also bring to bear auxiliary data from Google Insights, allowing us to correlate endorsement-related news/search intensity with changes in firm value.

Our first empirical finding is that between the car accident and Woods' announcement 10 trading days later of an "indefinite leave" from golf, his sponsors' overall market value declined by over two percentage points. Narrower groups of "primary" firms with the biggest endorsement contracts, or that had made large complementary investments in the "Tiger brand," lost more in percentage terms. The losses grow further by 15 trading days after the accident.

We sharpen the empirics by showing a strong relationship between daily abnormal returns and several measures of endorsement-related news/search intensity during the scandal. For example, during the scandal, sponsors' losses are greater on days when the search term "Tiger Woods endorsement" is more popular on Google, a result that is statistically significant and economically substantive. For Woods' core three "Tiger brand" sponsors, Google search intensity explains over 30% of variation in abnormal returns during the 15 trading days after the onset of the scandal; the figure is lower but still significant for the full set of sponsors. The quantitative search intensity outperforms an author-defined variable denoting significant "endorsement-related news days."

We also estimate stock price changes for sponsors' competitors. We find that as sponsors lost market

value, competitors gained market value, as long as those competitors were themselves *not* heavily invested in celebrity endorsements. Sponsors' competitors with at least one celebrity endorsement deal experienced returns that are statistically significantly smaller than those experienced by competitors without any celebrity endorsement deals, and close to zero on net. The day-to-day pattern of competitors' abnormal returns correlates strongly with both sponsors' returns and with our auxiliary measures of news/search intensity; on days of high search interest in the term "Tiger Woods endorsement," nonendorsement-intensive competitors' gains are more positive, and more positive relative to endorsement-intensive competitors.

In the context of prior work linking stock market value to celebrity endorsements, our first result provides clear evidence that in this case, a celebrity endorsement substantively affected stock market value for sponsor firms. Previous evidence of links between endorsements and stock market value has been mixed, because nearly all of that work faces a harder identification problem: it uses initial endorsement announcements, which are likely to be at least partially anticipated by traders, to estimate gains in firm value.[1] The event we examine was by all accounts a complete surprise to the market, making it a near-ideal natural experiment from an event study perspective.

A corollary of our result is that endorsement deals carry substantial risk. Although we cannot compare the losses sustained by sponsors to their initial gains, the losses we estimate are large. That suggests taking a view of celebrity endorsement as a risky investment rather than a simple short-run cost-benefit trade-off—particularly if a firm plans to complement the endorsement deal with coinvestment in a new product or brand, as Nike did with its golf line, and as Electronic Arts and Gatorade did with their "Tiger-specific" products.

Our finding that sponsors' losses are competitors' gains is fairly novel in the context of previous work correlating endorsements with firm value. We are aware of one previous study (Mathur et al. 1997) examining competitors' returns after Michael Jordan's announced return to professional basketball, but that study finds "only very weak evidence" (p. 70) of a link between an endorser's behavior and competitors' stock market value.

Important corroborative evidence for these findings, albeit using a completely different method and data set, comes from a recent paper by Chung et al. (2013). That paper estimates a structural demand model of the golf ball industry and uses the Tiger Woods scandal to identify changes in demand. The authors find that demand for Nike golf balls shifts down following the scandal, significantly reducing Nike's flow of profits from selling golf balls. The empirics suggest both that total demand for golf balls fell (i.e., that there is a category effect) and that competitors of Nike experienced relative gains (i.e., that there is a business-stealing effect).

We view our incorporation of Google Insights search intensity into the empirics as promising for future work at the intersection of marketing and finance. A small but rapidly growing set of papers in finance establishes that Google search intensity is correlated with stock prices more generally (see, in particular, Da et al. 2011 and papers citing that work). A recent paper by Du and Kamakura (2012) shows that Google search intensity and other data allowing "quantitative trendspotting" explain new car sales. Our work complements that other work by linking of marketing-related search intensity to stock prices.

Finally, the difference in competitors' returns when we stratify by competitors' "endorsement intensity" is provocative evidence about how markets price reputation risk associated with celebrity endorsements. The relatively more negative returns for endorsement-intensive competitors suggests that the scandal changed marketwide perceptions of risk associated with investments in celebrity endorsement. We are not aware of any previous work examining this issue, and in the conclusion we discuss the implications of this finding in more detail.

An important caveat is that although our data display useful heterogeneity on some dimensions (the set of affected firms, their sponsorship intensity, and day-by-day events/returns following the scandal), we are still essentially examining a single event: one scandal involving one celebrity endorser and a particular set of sponsors. It would be unwise to extrapolate our findings to the larger population of celebrity endorsers or to other types of scandal. One would need to conduct a broader historical study of many past events to make more general statements about celebrity endorsements and firm value.

2. Celebrity Endorsements and Firm, Stock Market Value

Celebrity product endorsements, and endorsements by professional athletes in particular, are a critical element of brand strategy.[2] The key question from a firm's perspective, of course, is whether a celebrity endorsement generates value sufficient to offset its possibly considerable cost. Quantifying that benefit-cost trade-off is hard, and consequently, the

[1] Louie et al. (2001) is a notable exception. We discuss that work in the next section.

[2] See, for example, the many references in Ding et al. (2008) and an earlier survey by Erdogan (1999).

question of whether celebrity endorsements are value enhancing remains open.

Stock market event studies provide one window into measuring the returns associated with celebrity endorsements. A firm's stock price reflects expectations about the discounted value of future economic profits. If retaining a valuable endorser changes those expectations—say, by increasing expected future sales—then an announcement of celebrity endorsement should generate a "kick" in the stock price. Conversely, an adverse (reputation-damaging) event or the departure of a valuable endorser might move those expectations about future profits downward, which should result in a lower stock price. In addition to this level effect, establishing a link between brand value and an endorser's reputation creates risk. Investors should price that "reputation risk" as they would any other component of risk in a firm's stock, and they should also price changes in how markets perceive the risk of celebrity endorsements.

The stock market-based method does face empirical difficulties, most notably the anticipation problem. If, for example, a celebrity endorsement deal is widely anticipated long before its formal announcement, buyers and sellers of the sponsor's stock will have fully priced all of the gains associated with the deal well before the announcement itself, and the actual announcement will change neither expectations nor stock prices. That means that the empirically cleanest type of event to use for quantifying changes in firm value is a surprise, whether it is good or bad, because surprises by definition avoid the anticipation problem.

In the context of the identification issue on the front end, it is not surprising that previous studies attempting to link celebrity endorsements and corporate sponsorship to stock market value have found mixed evidence.[3] We are aware of one study examining announcements of "bad news" for celebrity endorsers (including athletes and entertainers); bad news is often, though not always, more of a surprise than announcements of endorsement/sponsorship deals, and therefore provides cleaner identification. In that paper, Louie et al. (2001) find that bad news with little "culpability" for the endorser (such as a career-ending injury) generates gains for sponsors, whereas bad news with more culpability (such as a DUI arrest) generates losses.[4] The scandal that we examine falls squarely in the second ("more culpability") class.

Previous studies also may contain mixed findings for two other reasons. First, it is probably true that while some firms may capture rents when they sign celebrity endorsers, others may not. Some celebrities may command payments that completely offset any incremental profit generated for the sponsor firm. Second, some firms may simply overestimate the gains associated with an endorsement deal; by a winner's curse logic, those firms should in fact be the ones who sign celebrities more often.

An advantage in our case is that the scandal was a surprise. Before the accident, Tiger Woods was widely acknowledged to have the most valuable "brand" of any athlete in the world—a fact accruing from both his athletic success and his clean public image. Until 2009 he routinely placed in the top five of the Forbes "Celebrity 100" list of most influential celebrities worldwide. So our setting is certainly one in which stock prices might plausibly reveal the economic object of interest, because there is no evidence that the market anticipated any of the bad news associated with the scandal. The flipside of that, and a limitation of our approach, is that although our method can estimate by how much sponsors' expected future profits fall after the scandal, it cannot estimate the gain in expected future profits that firms initially experienced from the endorsement deal.

Another benefit associated with our example is that Tiger Woods endorses several products rather than just one. This allows us to estimate stock market effects across a wide set of otherwise unrelated firms, and gives us more statistical power than one would have if the estimates were confined to a single sponsor firm.[5]

We can further improve the power of our tests by examining how returns and information comove (or do not comove) during the time period of the scandal. Although the scandal was a surprise, news related to the scandal, and endorsement-related news in particular, disseminated gradually after the date of the accident, and did so in a way we can measure both quantitatively and qualitatively. As we discuss below, of the 15 trading days following the accident only three or four were days on which there

[3] Farrell et al. (2000) find that Tiger Woods' endorsement deal announcements generated stock market value for Nike, but not for American Express or Fortune (Titleist). Agrawal and Kamakura (1995), Mishra et al. (1997), Miyazaki and Morgan (2001), Pruitt et al. (2004), and Samitasa and Kenourgiosb (2008) find that endorsements/sponsorships generate positive stock market returns. Mathur et al. (1997) find that Michael Jordan's return to professional basketball generated positive returns for his sponsors and find that celebrity endorsements generate positive stock market returns for a wide set of celebrities. On the other hand, Fizel et al. (2008), Farrell and Frame (1997), Clark et al. (2009), Cornwell et al. (2001), and Ding et al. (2008) find weaker evidence, or even evidence of (in the case of Olympic sponsorships) negative returns following endorsement/sponsorship announcements.

[4] That paper also adds to an interesting set of studies asking how negative information about an endorser affects brand perception and firm value (see, e.g., Till and Shimp 1998).

[5] In this respect, our work follows that of Farrell et al. (2000) and Mathur et al. (1997).

was significant endorsement-related news; the other days were largely quiet. Our Google search intensity data, which we describe below, confirm this view by identifying clear peak periods of interest coinciding with the timing of endorsement-related news. The endorsement-related activity lags the onset of the broader scandal significantly; for example, Google searches for "Tiger Woods endorsement" did not take off until a few days after the accident, did not peak until 10 trading days after the accident, and experienced a third bump on December 14, 2009. Variation in news/search intensity during the scandal allows us to ask whether the pattern of stock price changes during the scandal matches the pattern of news/interest.

We augment the analysis by collecting data for a wide set of competitors to Tiger Woods' sponsors. These data allow us to estimate whether sponsors' losses after the scandal are competitors' gains. Whether that is true depends on substitutability between sponsors' products and competitors' products, and the extent to which celebrity endorsements create new demand, or merely steal business from competitors. Understanding whether celebrity endorsement is business stealing or pure value creation is important both conceptually and for business strategy, but there has been very little empirical work examining the question.[6]

Finally, the dramatic nature of this particular scandal—an extremely damaging set of events for the world's leading endorser—allows us to examine the general role of reputation risk in determining firm value for endorsement-intensive firms in general. Following the Tiger Woods scandal, the media devoted substantial attention to that risk; for example, a Google search for "celebrity reputation risk" yields stories largely written about Tiger Woods after the scandal. There is also evidence of a market response, by insurance companies offering protection against celebrity reputation risk; Belson and Sandomir (2010) stated the following:

> In the wake of the Tiger Woods scandal, insurers are being inundated with inquiries from corporations seeking to protect their investments, their brands and even their sales when their celebrity endorsers suffer public embarrassment . . . . In a new wrinkle, more companies are trying to insure against the potential loss of sales when an athlete product endorser is involved in a scandal.

Whether the scandal in fact changed market-level perceptions of reputation risk is, of course, an empirical question. We explore that question by estimating postscandal stock price changes for two subsets of sponsors' competitors: those who are themselves endorsement intensive and those who are not endorsement intensive. If the scandal sent a market-wide signal about reputation risk, one might expect that competitors with endorsement deals would fare relatively worse than competitors without endorsement deals.

3. Endorsement Deals of Tiger Woods and the Scandal

Prior to November 2009, Tiger Woods' annual endorsement income was estimated to be roughly $100 million, a figure roughly twice as large as that for any other athlete (Freedman 2009). We are able to identify seven publicly owned, domestically traded companies with which Tiger Woods had an endorsement or sponsorship deal as of November 27, 2009. We list those companies in Table A.1 in the appendix.[7] Although the details of most contracts are private, the five most valuable contracts were seemingly with Accenture, Gillette, Nike, PepsiCo (Gatorade), and Electronic Arts (EA).[8] In the empirical work below, we estimate some stock price effects for this subset of "primary" firms.

Some sponsors augment the endorsement relationship by making complementary coinvestments in product lines, brand name, or other assets, the value of which might also be tied to the endorser's reputation. There are three such firms in our sample. Nike has a considerable complementary investment in the Nike golf product line, which did not exist prior to the Tiger Woods endorsement contract. Electronic Arts sells the "EA Tiger Woods" line of video games, and recently launched a new "Tiger Woods Online" video game. Gatorade invested considerable resources in developing a "Tiger Focus" drink.

We draw this distinction because for firms with such coinvestments linked to the "Tiger brand," the link between reputation risk and firm value could go beyond the dollar value of the endorsement contract and its short-run effect on sales/profits. The Nike golf line, for example, is a brand with considerable asset value, accumulated via Nike's substantial up-front and ongoing investment in R&D, physical capital, and brand equity. For firms with such complementary investments, changes in stock prices will reflect changes in the value of those assets, as well as changes in direct sales associated with the endorsement deal. In the empirical work below

[6] As we previously noted, the exceptions are the work by Mathur et al. (1997), who find that competitors to Michael Jordan's sponsors experience "very weak" stock price changes after Jordan's return to professional basketball, and the work by Chung et al. (2013), who show that competitors of Nike gained golf ball sales after the scandal.

[7] See http://web.tigerwoods.com/sponsors/sponsors for a complete list. Some of the companies on that list are either privately held or traded on foreign exchanges; we do not track those companies.

[8] See Edwards (2009) for details.

Table 1 Chronology of Scandal- and Endorsement-Related News

Date	Trading day	Scandal-related news	Endorsement-related news
November 23, 2009		*National Enquirer* report: affair with Rachel Uchitel	
November 24, 2009			
November 25, 2009			
November 26, 2009			
November 27, 2009		Date of accident	
November 28, 2009[a]			
November 29, 2009[a]		Transcript of 911 call by neighbor released	
November 30, 2009	1		
December 1, 2009	2		
December 2, 2009	3	Jaimee Grubbs and Kalike Moquin named as mistresses; Woods issues first public statement admitting "transgressions"	
December 3, 2009	4		Nike and Gillette issue press releases confirming support for Woods
December 4, 2009	5		
December 5, 2009[a]		Jamie Jungers comes forward as mistress	
December 6, 2009[a]		Cori Rist and Mindy Lawton named as mistresses	
December 7, 2009	6	Holly Sampson named as mistress, bringing total to seven	
December 8, 2009	7	Woods' mother-in-law rushed to the hospital from Woods' home	Gatorade drops Tiger Woods–branded drink (after close of trading)
December 9, 2009	8		
December 10, 2009	9		
December 11, 2009	10	Woods announces he will take an "indefinite" leave from golf	Accenture removes Woods' image from its website
December 12, 2009[a]			Gillette announces that it is "limiting" Woods' role in marketing
December 13, 2009[a]			Accenture drops Woods
December 14, 2009	11		
December 15, 2009	12		
December 16, 2009	13		
December 17, 2009	14		
December 18, 2009	15		

Sources. Data from *ESPN.com* (2010), Ferran et al. (2009), Tate (2009), and *Socyberty.com* (2009).
Notes. AT&T dropped Woods on December 31, 2009. Gatorade dropped Woods on February 26, 2010.
[a]Weekend days (nontrading days).

we estimate stock price effects for the "Tiger brand" group of Nike, Electronic Arts, and Gatorade: the set of firms with substantial complementary investments associated with Tiger Woods.

3.1. Timeline of the Scandal

The scandal began with a car accident on the evening of November 27, 2009—a Friday, meaning that the first trading day after the release of "news" was Monday, November 30, 2009.[9] Following the night of the accident, several potentially reputation-damaging pieces of information emerged, primarily involving extramarital affairs. Events culminated 10 trading days later (December 11, 2009) with Tiger Woods' announcement of an "indefinite leave" from golf.[10] Table 1 summarizes these events day by day, starting one week before the scandal, and ending on December 18, 2009—15-trading days after the accident. Beyond the 15 trading-day horizon we lose statistical precision, so we confine ourselves to this window rather than some longer time period.

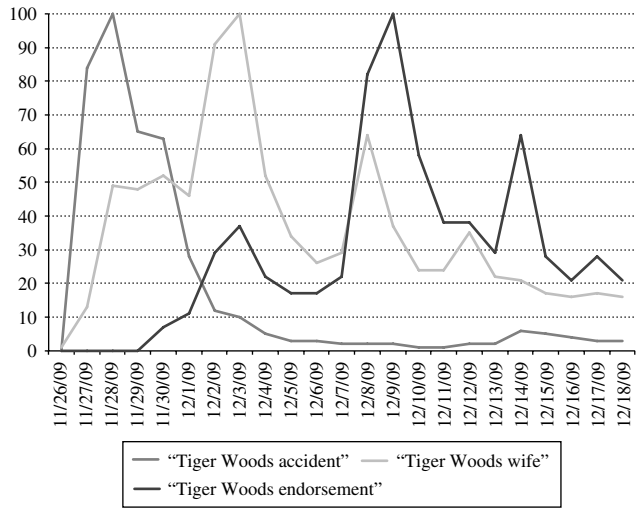
As illustrative evidence regarding the rise and decline of media interest in the story, we examine the results of Google Insights searches related to the scandal.[11] Previous work (e.g., Da et al. 2011 and follow-on studies) has shown that Google search intensity is correlated with stock price changes, implying that search intensity captures investor attention. Google's Insights data quantify Internet interest in a subject on a 100-point scale, as measured by the popularity of keyword searches. Data are normalized search by search, with 100 representing peak activity during the search period. To be clear, the scale is informative within a search rather than across searches: within a particular search "100" always implies twice as much search activity as "50," but the peak values of 100 across two different searches may represent different absolute levels of interest.

[9] For a timeline and some details about the allegations, see Tate (2009).

[10] One piece of scandal-related news predates the accident by four days: allegations of an affair leaked by the *National Enquirer* on November 23, 2009, in advance of its December 7 print issue. See Bacon and Busbee (2010) and elsewhere for references. We consider the possible effect of that early news in the empirical work below, and find that it does not appear relevant.

[11] One can find the search page at http://www.google.com/insights/search/.

Figure 1 Postaccident Search Intensity Related to Tiger Woods



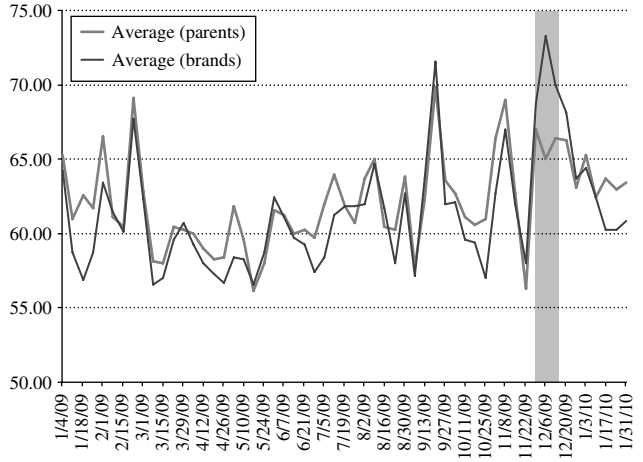
Notes. Search intensity is from http://www.google.com/insights/search/. Search intensity is normalized within each term, with peak volume at 100 and lower numbers representing percentage of peak volume. "Tiger Woods accident" and "Tiger Woods wife" are the top-ranked searches listed by Google Insights following an initial search for "Tiger Woods."

The most popular three-word search terms following the scandal were "Tiger Woods accident" and "Tiger Woods wife."[12] Figure 1 shows interest in these terms starting on November 26, 2009, and ending on December 18, 2009. Before then, interest in these topics was at zero according to Google Insights, suggesting that the preaccident *National Enquirer* allegation was not taken seriously. Interest in the "accident" search peaked on the day of the accident, then died out quickly. Interest in the "wife" search increased after the accident and peaked on December 2–3, the latter date being that on which Tiger Woods issued a statement admitting "transgressions." Interest in the "wife" search diminished until a resurgence on December 8, then fell again. By December 18, interest appears to have fully waned. Data over longer postscandal windows show no resurgence in interest over the next two years.

3.2. The Scandal and Sponsor Firms

Returning to Table 1, we also document endorsement-related news during the scandal. Endorsement-related announcements lag general news about the scandal; the first piece of endorsement-related news came on December 3, when Nike and Gillette issued press releases confirming support for Woods. On December 8, Gatorade announced cancellation of its Tiger Woods–branded sports drink; the announcement came late in the day, after the close of trading.[13] The next pieces of news, clustered on December 11 and over the following weekend, include Accenture dropping Woods, and Gillette announcing that it would "limit" Woods' role in marketing going forward. These pieces of information coincide with the announcement on December 11 of Woods' leave from golf. We do not extend the window of our analysis beyond December 18 because we have limited statistical power after then; however, it is perhaps worth noting that AT&T dropped Tiger Woods on December 31, 2009, and Gatorade dropped Woods on February 26, 2010.

Figure 2 Average Search Intensity for Sponsor Firms, January 2009 to January 2010



Notes. Search intensity is from http://www.google.com/insights/search/. Figure plots unweighted averages of search intensity for the seven sponsor brand/parent firms listed in Table A.1 in the appendix.

Figure 1 sheds light on the relative importance of these events by plotting Google search intensity for the term "Tiger Woods endorsement." That search term takes a value of zero until the day after the accident, and has its first spike on December 3—the Nike/Gillette press release day. Its peak is on December 8–9 following the Gatorade announcement, and interest remains high until after the announcement on December 13 that Accenture was dropping Woods. Although the correlation is not perfect, it is high—Google intensity corresponds closely to the pattern of endorsement-related announcements following the scandal.

As further suggestive evidence that the scandal mattered for sponsor firms, we show in Figure 2 the average Google search intensity for our seven sponsor firms between January 2009 and January 2010. We construct two averages. One average uses search intensity based on parent company name and the other uses search intensity based on the brand name endorsed

[12] We observe this by starting with a general search for "Tiger Woods." Given a general starting search, Google Insights shows a rank ordering of the most popular refined search terms associated with the general search.

[13] Whether cancellation was in the offing prior to the scandal is an open question (see Rovell 2009, Gilbert 2009).

by Tiger Woods (see Table A.1 in the appendix for details). This distinction matters only for two of the seven sponsors (Pepsi/Gatorade and Proctor and Gamble/Gillette). Also, we use "Electronic Arts" as the search term for both parent and brand, because a search for the Tiger Woods–themed golf video game ("Tiger Woods PGA Tour Golf") would spuriously capture broader searches for Tiger Woods.

The shaded area on the figure covers the two weeks of peak interest in the scandal. The brand-specific average peaks during that week, meaning that for our seven brands, this time period was, on average, the period of greatest worldwide Google search interest over the preceding year. Three of the seven brands in our sponsor group experience the peak (=100) of their 2009 search intensity during the two weeks of the scandal, and AT&T peaks during the week of December 31, when it announced dropping Woods.

The parent-specific pattern is similar, although there are three other time periods in which parent-level intensity exceeds that during the scandal. The first comes during February 22–28, and is driven by a 100 search intensity level for Accenture. That week coincides with the Accenture Match Play Championship, a golf tournament in which Tiger Woods played, and a key part of Accenture's Tiger Woods-related marketing activities. A second peak comes during November 8–14, and is driven by a 100 intensity value for Electronic Arts, which announced a substantial negative earnings report and layoffs during that week.[14] The third peak is during September 20–26 and driven by Gillette; we can find no corporate announcements by Gillette during that week, but the rock band U2 played a concert at Gillette Stadium in Foxborough, Massachusetts, which may have driven spurious interest in "Gillette" as a search term.

Looking at the gap between the parent-specific and brand-specific average lines is also informative. The averages move together quite closely for nearly all of 2009, but deviate by the greatest amount precisely at the peak of the scandal—when interest in the brands relative to the parents would have been highest, based on affiliation with Tiger Woods.

All of this evidence points to a substantive qualitative relationship between the events of the scandal, attention to endorsement values, and interest in sponsor firms. Google intensity correlates quite closely with endorsement-related news, Google intensity for our sponsor firms correlates quite closely with endorsement-related news, and prior work shows that search intensity is correlated with changes in firm value. Our empirical work examines these links more formally.

[14] The "minipeak" in February 1–7 is also EA-driven and coincides with another negative announcement.

4. Estimated Stock Market Effects of the Scandal

To estimate whether the scandal affected stock prices of Tiger Woods' sponsor firms and their competitors following November 27, 2009, we estimate an event study. Our method is standard in marketing, economics, and finance, and as we discuss in §2, has been employed previously in studies linking stock market value to celebrity endorsements.[15]

Our primary specification is

$$R_{it} = \alpha_i + \beta_i^m R_t^m + \sum_s \delta_s D_{st} + \epsilon_{it}, \tag{1}$$

where R_{it} is the return on shares of sponsor i at time t, R_t^m is the return on the Dow Jones value-weighted total market index at time t, δ_s is the abnormal return on day s after the accident, D_{st} is a dummy variable equal to 1 during day s after the accident, and ϵ_{it} is an error term.

The specification is a standard market model where the dependent variable is a sponsor's daily percentage return exclusive of dividends, from Wharton Research Data Services and the Center for Research in Stock Prices. The independent variables include a value-weighted total market return. The model allows for sponsor-specific daily mean returns (alphas) and correlations with market/competitor returns (betas). Our estimation window begins three months before the accident date and extends to December 18, 2009. Event date "zero" is November 27, and November 30, 2009, is the first trading day after the event date.

Our model yields estimates of daily abnormal returns, δ_s, which are deviations of actual returns on the days after the scandal from those predicted by the model. We weight observations by market capitalization, effectively estimating the abnormal returns that one would earn by holding a value-weighted portfolio of Tiger Woods' sponsors.[16] We also estimate cumulative abnormal returns (CARs)—which are running sums of the daily abnormal returns—starting on November 30. The CARs estimate sponsors' total loss over a multiday window starting on event date one, relative to the market returns. In the results below we report abnormal returns and CARs for windows extending up to 15 trading days after the event date.

When examining the effect of a single event on multiple firms, it is important to adjust the estimated standard errors for the contemporaneous correlation of sponsor-specific errors on the same day. We use

[15] See, for example, MacKinlay (1997) for a survey.

[16] Estimating a value-weighted return is more informative than estimating an equally weighted return, because total dollar gains or losses for shareholders depend on the value-weighted average return. We use daily market capitalization to construct the weights. Results are identical if we use weights as of the event date or averaged over the month prior to the event date.

the procedure in Salinger (1992) for calculating standard errors on the cumulative abnormal returns. The procedure involves making a simple transformation to the data matrix that yields correct standard errors. We also omit observations for the week preceding November 30, 2009. Including them does not change the results, and we find no evidence of preevent abnormal returns.

In some cases we are interested in examining abnormal returns that vary across firms within the same day. We estimate those using the more flexible specification:

$$R_{it} = \alpha_i + \beta_i^m R_t^m + \sum_{is} \delta_{is} D_{st} + \epsilon_{it}. \quad (2)$$

This more flexible specification allows us to conduct nonparametric sign and rank tests regarding the postevent abnormal returns δ_{is}. In both tests the null hypothesis is that postevent abnormal returns are centered on zero, which is what one would expect if the postevent period contains no systematic news about firm value. Rejecting the null suggests that some (either positive or negative) information affected sponsor firms' returns. In these models we also correct for contemporaneous correlation of errors across sponsor firms.

Given that we also collect data on competitors' returns, it would be possible to estimate specifications including both the market return and a value-weighted portfolio of competitors' returns. This is sometimes done because it can control more completely for confounding industry-specific contemporaneous influences on sponsors' stock prices. Including competitors' returns is less correct, on the other hand, if the scandal itself affected competitors' returns. We indeed find that to be the case, in results presented below. We therefore present here only results relative to the market (i.e., the abnormal returns estimated from Equation (1)). We do show the results relative to the market as well as competitors' returns in a working paper (available from the authors upon request).

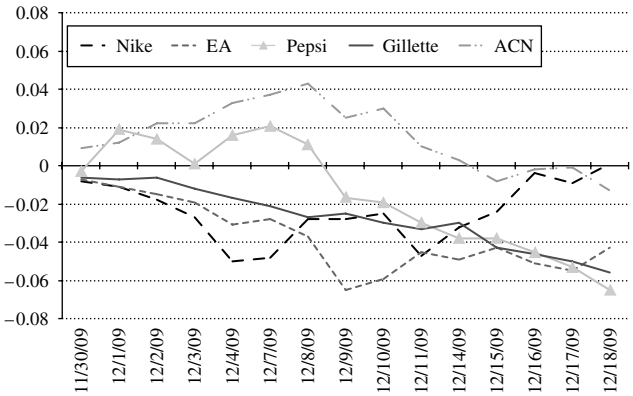
4.1. Primary Results

Table 2 shows estimates of cumulative abnormal returns and daily abnormal returns for all sponsors, for the primary group only (Nike, Gatorade, Electronic Arts, Accenture, and Gillette) and for the Tiger brand group (Nike, Gatorade, and Electronic Arts). The first three columns show CARs. In every model the point estimates are fairly flat and not statistically significant until eight trading days after the accident, after which the CARs turn sharply negative and remain so until the end of our 15-day event window. By and large the estimates are statistically significant, particularly later in the event window and for the primary and Tiger brand subsamples. The point estimates for the smaller subgroups are also larger (more negative). Referring to the first three columns, in the primary subsample the 10- (15-)day CAR shows a loss of 3.0% (5.3%), and in the Tiger brand subsample the 10- (15-)day CAR shows a loss of 3.4% (5.8%).

The second three columns of Table 2 show average daily abnormal returns, and below those the results of the sign and rank tests. One can see that the largest negative returns occur in two clusters, 3–4 and 8–9 trading days after the onset of the scandal, corresponding to December 2–3 and December 9–10, respectively. The bottom four rows use the firm-specific daily abnormal returns δ_{is} (not shown in the table) to conduct both sign and rank tests over 10- and 15-day windows. The null hypothesis in these tests is that returns are centered on zero, and the alternative (one-tailed) hypothesis in each test is that the returns are centered on a negative value, indicating the systematic release of negative information affecting all firms. The sign test uses only information about the sign (positive or negative) of each coefficient, and the rank test uses information about both signs and magnitudes. For the full sponsor group, the p-values for both sign tests are below 0.10. Results for the subsamples are more significant. For the primary and Tiger brand both sign test p-values are below 0.05. The pattern for the rank tests is similar. In all, these results provide strong evidence that abnormal returns after the scandal are systematically negative, particularly for the primary/three groups.

Figure 3 provides graphical detail on the firm-level patterns of losses over time for the primary group. We do not show CARs for the full set of firms because the CAR for TLC Vision is extremely large and negative, reducing the viewing scale of CARs for all other firms. The large negative CAR for TLC Vision almost certainly foreshadows its bankruptcy declaration on December 21, 2009. For our weighted average CARs in the full sample this does not matter much because

Figure 3 Cumulative Abnormal Returns for Individual Sponsor Firms



Note. Cumulative abnormal returns are from sponsor-by-sponsor event studies based on specification in Equation (2).

Table 2 Cumulative and Daily Abnormal Returns for Sponsor Firms

Abnormal returns:	Cumulative			Daily		
Days after event	All firms	Primary	Tiger brand	All firms	Primary	Tiger brand
1	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004
	(0.004)	(0.004)	(0.006)	(0.004)	(0.005)	(0.006)
2	0.001	0.001	0.012	0.005	0.006	**0.016****
	(0.005)	(0.006)	(0.009)	(0.004)	(0.005)	(**0.006**)
3	0.003	0.001	0.007	0.002	−0.001	−0.005
	(0.007)	(0.008)	(0.011)	(0.004)	(0.005)	(0.006)
4	0.001	−0.007	−0.004	−0.002	**−0.008***	**−0.011***
	(0.008)	(0.009)	(0.013)	(0.004)	(**0.005**)	(**0.006**)
5	0.003	−0.005	0.004	0.001	0.001	0.008
	(0.009)	(0.010)	(0.014)	(0.004)	(0.005)	(0.006)
6	0.007	−0.006	0.008	0.004	−0.000	0.004
	(0.010)	(0.011)	(0.016)	(0.004)	(0.005)	(0.006)
7	0.000	−0.011	0.000	**−0.007***	−0.006	−0.008
	(0.010)	(0.012)	(0.017)	(**0.004**)	(0.005)	(0.006)
8	−0.008	−0.022	−0.027	**−0.008****	**−0.011****	**−0.027*****
	(0.011)	(0.013)	(0.018)	(**0.004**)	(**0.005**)	(**0.006**)
9	−0.007	**−0.024***	−0.027	0.000	−0.002	−0.000
	(0.012)	(**0.014**)	(0.020)	(0.004)	(0.005)	(0.006)
10	−0.009	**−0.030****	−0.034	−0.001	−0.006	−0.007
	(0.013)	(**0.015**)	(0.021)	(0.004)	(0.005)	(0.006)
11	−0.010	**−0.031***	**−0.040***	−0.001	−0.001	−0.006
	(0.014)	(**0.016**)	(**0.022**)	(0.004)	(0.005)	(0.006)
12	−0.019	**−0.039****	−0.038	**−0.009****	−0.007	0.002
	(0.014)	(**0.017**)	(0.023)	(**0.004**)	(0.005)	(0.006)
13	−0.023	**−0.042****	**−0.044***	−0.003	−0.003	−0.006
	(0.015)	(**0.018**)	(**0.024**)	(0.004)	(0.005)	(0.006)
14	**−0.028***	**−0.047****	**−0.051****	−0.005	−0.005	−0.007
	(**0.016**)	(**0.019**)	(**0.025**)	(0.004)	(0.005)	(0.006)
15	**−0.032***	**−0.053*****	**−0.058****	−0.004	−0.007	−0.006
	(**0.016**)	(**0.019**)	(**0.027**)	(0.004)	(0.005)	(0.006)
Observations	605	435	261	605	435	261
R-squared	0.291	0.314	0.336	0.291	0.314	0.336
10-day sign test *p*-value		n/a		0.06	0.03	0.01
15-day sign test *p*-value				0.03	0.01	0.01
10-day rank test *p*-value				0.14	0.02	0.00
15-day rank test *p*-value				0.04	0.01	0.02

Notes. Coefficients are cumulative abnormal returns or daily abonormal returns (ARs) weighted by firm value (market capitalization). The first three columns show cumulative abnormal returns. The second three columns show daily abnormal returns. All coefficients are from the market model in Equation (1). Event date is November 27, 2009. The estimation window begins three months before event date and ends one week before event date. Standard errors are adjusted for contemporaneous correlation across firms. "All firms" include all listed in Table 1. "Primary" includes Nike, EA, Accenture, PepsiCo (Gatorade) and P&G (Gillette). "Tiger Brand" includes Nike, EA and PepsiCo. Numbers in parentheses are standard errors. Shaded cells indicate negative values. Sign and rank tests *p*-values use the full set of firm-day-specific abnormal returns, estimated using the model in Equation (2). For the sign and rank tests the null hypothesis is that returns are centered on zero. Coefficients in bold are statistically significant at the 10% level or better.

*Significance at 10%; **significance at 5%; ***significance at 1% (or better).

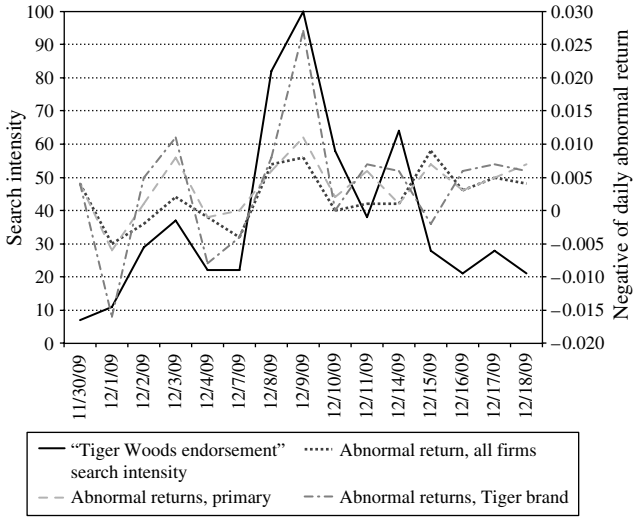
TLC Vision's weight in the portfolio is trivially small, but it is worth noting. If one weights the portfolio equally, the CARs for portfolios including TLC Vision become more negative after the scandal.

4.2. Endorsement-Related News, Search Intensity, and Abnormal Returns

We now tie the day-by-day pattern of abnormal returns summarized in Table 2 to the patterns of news/search behavior we documented in Table 1 and Figure 1. This analysis corroborates the view that our estimated abnormal returns are related to the Tiger Woods scandal, rather than some other factor(s).

We first approach the question graphically. Figure 4 plots the Google Insights index for "Tiger Woods endorsement" over trading days 1–15 in the event window. On the same axis we also plot the negative of average abnormal returns for sponsor firms over the event window, using our standard groupings of sponsors; each point on the figure corresponds to one coefficient from the first three columns of Table 2. Plotting the negative of abnormal returns makes easier the visual comparison between higher (more positive)

Figure 4 "Tiger Woods Endorsement" Search Intensity and Daily Abnormal Returns



Notes. Search intensity is from http://www.google.com/insights/search/, as in Table 1. Abnormal returns are plotted as the negative of coefficients from Table 2.

search intensity and larger (more negative) abnormal returns for sponsor firms.[17] The figure shows a strong link between Google search intensity and daily abnormal returns. Search intensity peaks on December 9, and that is the day with the largest (negative) abnormal return for any group of firms. Day-by-day movements up/down in search intensity also correlate with abnormal returns.

We next undertake a more formal statistical analysis linking endorsement-related news/search intensity to the magnitude of abnormal returns. The model for this analysis is

$$\hat{\delta}_{is} = \alpha + \beta\, News_s + \epsilon_{is}, \tag{3}$$

where $\hat{\delta}_{is}$ is the estimated abnormal return on shares of firm i on event date s from Equation (1), $News_s$ is a time-varying measure of news/search intensity, and ϵ_{is} is an error term.

With seven firms and 15 trading days during the event window, we have a total of 105 observations for these regressions when all sponsor firms are included, and 75/45 observations for the primary/Tiger brand subsamples.

To fully explore the relationship between search/news intensity and abnormal returns, we use three different measures of news/search intensity. The first is the level of search intensity for "Tiger Woods endorsement" from Google Insights, as shown in Figures 1 and 3, rescaled to be between 0 and 1 (rather than between 1 and 100). This takes on a minimum value of 0.07 (on November 30) and a maximum value of 1.00 (on December 9). Our second measure of search intensity is a 0/1 indicator set to 1 on the days with a Google Insights score above 25; those days are December 2, 3, 8–11, 14, 15, and 17 of 2009.[18] Finally, we include a qualitative indicator, self-defined, equal to 1 on the "endorsement-related news days" identified in Table 1: December 3, 8, 9, and 14.[19]

Table 3 Sponsors' Abnormal Returns and News/Search Intensity

	All firms	Primary	Tiger brand
Dependent variable: Firm-level daily abnormal return			
"Tiger Woods endorsement" search intensity	**−0.007*** (**0.003**)	**−0.007*** (**0.004**)	**−0.024***** (**0.006**)
Constant	0.001 (0.001)	−0.001 (0.002)	**0.006*** (**0.003**)
R-squared	0.048	0.056	0.306
"Tiger Woods endorsement" search intensity > 25	**−0.004*** (**0.002**)	**−0.004*** (**0.002**)	**−0.010**** (**0.003**)
Postaccident dummy	0.000 (0.001)	−0.001 (0.001)	0.002 (0.002)
R-squared	0.046	0.057	0.182
Endorsement-related news day	−0.001 (0.002)	−0.004 (0.002)	**−0.012***** (**0.003**)
Postaccident dummy	−0.002 (0.001)	**−0.002*** (**0.001**)	−0.000 (0.002)
R-squared	0.006	0.042	0.228
Observations	105	75	45

Notes. Coefficients are from model (3) in the text, modeling the relationship between firm-level daily abnormal returns during the period November 30–December 18 and three different measures of endorsement-related news intensity. The first set of rows use the level of "Tiger Woods endorsement" search intensity on a [0, 1] scale to measure endorsement-related news. The second set of rows use an indicator equal to 1 if "Tiger Woods endorsement" intensity exceeds 0.25, and 0 otherwise. The third set of rows use indicator variables equal to 1 on December 3, December 9, December 11, and December 14; see Table 1 for details. Numbers in parentheses are standard errors. Coefficients in bold are statistically significant at the 10% level or better.

*Significance at 10%; **significance at 5%; ***significance at 1% (or better).

Table 3 presents results from these models. With every specification of news/search intensity, the coefficients show more negative abnormal returns on days of greater news/search intensity. The effects are larger for the Tiger brand firms than for the sample

[17] Specifying the relationship this way maintains the assumption that all news during the event window had a negative effect. We have also constructed, but do not present here, a figure correlating search intensity with the absolute value of returns; that assumes that search intensity could lead to large abnormal returns in either direction. That figure looks quite similar, because most of the largest daily returns are negative.

[18] We have also tried other cutoffs such as 0.50 or 0.75, or sets of indicators based on quartile cutoffs; the results are qualitatively similar. We present results using the 0.25 cutoff here because it is generous relative to the other two measures in the table in terms of classifying "high" intensity, and therefore provides a useful comparison to those narrower measures.

[19] We classify both December 8 and 9 as "news days" because the Gatorade announcement occurred after close of trading on the December 8. December 14 is the first trading day after the series of announcements on December 12 and 13.

as a whole. In the first set of rows, the point estimates imply negative abnormal returns of 0.7%–2.6% on days with search intensity equal to 1.00, relative to days with search intensity equal to 0.00. The second set of rows show negative abnormal returns of 0.4%–1.0% on days with search intensity greater than 0.25. And finally, the coefficients in the last set of rows imply negative abnormal returns of 0.2%–1.4%.

Two important patterns emerge in these results. First, the correlation between news/search intensity is much stronger for the Tiger brand firms than for the other firms in the set of sponsors—note the significantly higher R-squared terms in the last column of results. This is what one would expect if the results reflect the downside of the scandal and the Tiger brand firms had more at stake. Second, and perhaps more important, our objectively measured search intensity variable (the Google Insights measure) significantly outperforms our qualitative and subjectively defined "news day" measure, in terms of fitting the pattern of abnormal returns. This is a promising result in the context of event studies that attempt to explain abnormal returns, because the Google Insights–based variable avoids issues related to researcher-defined measures of which days after an event are "important."

As a robustness check, we show in Table A.3 in the appendix the results of similar models that use other search terms related to the scandal. The first two sets of rows use the search intensity for the "Tiger Woods accident" search, and the second sets of rows use the "Tiger Woods wife" search.[20] We show two specifications for each alternative search measure: one including the "Tiger Woods endorsement" search intensity (from Table 3) and one omitting that variable.

The results show quite clearly that whereas endorsement-related search intensity correlates quite strongly with sponsors' abnormal returns, nonendorsement-related but still scandal-related search intensity is unrelated to the pattern of abnormal returns. The more general scandal-related search terms are closer to zero in point terms, and never statistically significant. Furthermore, their inclusion leaves the magnitude and significance of the endorsement-related coefficient unchanged. This provides further evidence that our findings reflect something specific to the endorsement-related effect of the scandal.

4.3. Competitor Returns and Endorsement Intensity

In this section, we examine returns for our sponsors' competitors. For each of the seven firms in our sponsor sample we collect daily return data for 10 competitors, meaning that we examine returns for as many as 70 competitors in the work below. Some competitors move in or out of the sample during the estimation window, are not traded on a U.S. exchange, or are one of our sponsors, meaning that we do not always have data for all 70 firms. The competitor portfolio includes the first 10 firms listed by Google Finance as "competitors" of the sponsor—meaning the sponsor's parent company.[21] Table A.1 in the appendix lists competitors for each sponsor; we include only competitors traded on U.S. stock exchanges.

Our analysis of competitors' returns focuses on two questions. First, we ask whether the scandal appears to generate abnormal returns for competitors. One might imagine that losses for sponsor firms could be gains for rivals of sponsors, if celebrity endorsements lead to business stealing and that business stealing reverses after a scandal. Alternatively, it is possible that losses for sponsors would not affect competitors' returns, if celebrity endorsements simply create new value in a market (perhaps relative to other markets, perhaps not). It might even be possible that one firm's losses could spill over to all competitors in a "category," although this is perhaps more plausible for some products (e.g., golf balls) than for others (e.g., sports drinks).

A second question is whether those competitors who are themselves endorsement intensive, meaning that they also use celebrity endorsements as part of their marketing efforts, fared differently from those competitors with no links to celebrities. The purpose of the second test, as we previously note, is to test for broader impacts of the Tiger Woods scandal. Given the prominence of Tiger Woods as an endorser and his arguably impeccable reputation prior to the scandal, it is possible that the scandal sent a negative marketwide signal about risk associated with *any* endorsement deal. We classify a competitor as endorsement intensive if a Google search for "(competitor name) celebrity endorsement" over a window 2000–2009 reveals that the competitor had at least one celebrity endorsement deal during our event window (listed on the first page of Google's results). Table A.1 in the appendix lists our competitors and whether we classify them as endorsement intensive. This is probably conservative, in the sense that relatively few of these firms are as endorsement intensive as the large firms that Tiger Woods endorses. We have confirmed that our sponsor firms are classified as endorsement intensive using this method.

[20] We have also estimated the model using the more general "Tiger Woods" search, which tracks, "Tiger Woods wife" quite closely and yields similar results.

[21] We have estimated the model using the first five or three competitors, and also using the Yahoo! Finance competitor list. Varying the specification of competitors' returns has no effect on the results, nor does weighting competitors' returns equally.

Table 4 Cumulative Abnormal Returns for Competitors, by Endorsement Intensity

Days after event	Not endorsement intensive			Endorsement intensive			Difference		
	All firms	Primary	Tiger brand	All firms	Primary	Tiger brand	All firms	Primary	Tiger brand
1	**−0.003***	−0.002	**−0.009*****	−0.000	−0.000	−0.000	0.003	0.002	0.009
	(**0.002**)	(0.002)	(**0.003**)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.006)
2	−0.001	**0.004***	−0.006	**0.008***	**0.008***	**0.011****	**0.009****	0.004	**0.017****
	(0.002)	(**0.003**)	(0.005)	(**0.004**)	(**0.004**)	(**0.005**)	(**0.004**)	(0.005)	(**0.008**)
3	−0.001	**0.006***	−0.009	−0.002	−0.002	0.002	−0.000	−0.008	0.011
	(0.003)	(**0.003**)	(0.006)	(0.006)	(0.006)	(0.007)	(0.005)	(0.006)	(0.010)
4	0.004	**0.011*****	−0.006	−0.001	−0.001	0.000	−0.004	−0.011	0.007
	(0.003)	(**0.004**)	(0.007)	(0.006)	(0.006)	(0.008)	(0.006)	(0.007)	(0.012)
5	−0.000	**0.011*****	0.001	−0.001	−0.001	−0.001	0.001	−0.010	−0.002
	(0.004)	(**0.004**)	(0.007)	(0.007)	(0.007)	(0.009)	(0.007)	(0.008)	(0.013)
6	−0.002	0.007	0.005	−0.007	−0.007	−0.005	−0.002	−0.012	−0.008
	(0.004)	(0.004)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.014)
7	−0.001	0.004	0.002	−0.011	−0.011	−0.009	−0.007	−0.013	−0.009
	(0.005)	(0.005)	(0.009)	(0.009)	(0.009)	(0.010)	(0.008)	(0.009)	(0.016)
8	0.008	0.008	0.006	−0.008	−0.008	−0.009	−0.012	−0.013	−0.013
	(0.005)	(0.005)	(0.010)	(0.009)	(0.009)	(0.011)	(0.009)	(0.010)	(0.017)
9	**0.012****	**0.017*****	**0.022****	−0.007	−0.007	−0.006	−0.015	**−0.021***	−0.027
	(**0.005**)	(**0.006**)	(**0.010**)	(0.010)	(0.010)	(0.012)	(0.010)	(**0.011**)	(0.018)
10	**0.011****	**0.019*****	**0.026****	−0.010	−0.010	−0.007	**−0.017***	**−0.026****	**−0.032***
	(**0.006**)	(**0.006**)	(**0.011**)	(0.011)	(0.011)	(0.013)	(**0.010**)	(**0.011**)	(**0.019**)
11	**0.011***	**0.021*****	**0.021***	−0.009	−0.009	−0.007	−0.016	**−0.026****	−0.026
	(**0.006**)	(**0.006**)	(**0.012**)	(0.011)	(0.011)	(0.013)	(0.011)	(**0.012**)	(0.020)
12	0.006	**0.019*****	**0.027****	−0.008	−0.008	−0.009	−0.010	**−0.023***	−0.034
	(0.006)	(**0.007**)	(**0.012**)	(0.012)	(0.012)	(0.014)	(0.011)	(**0.012**)	(0.021)
13	0.006	**0.019*****	**0.029****	−0.009	−0.009	−0.013	−0.010	**−0.024***	**−0.040***
	(0.007)	(**0.007**)	(**0.013**)	(0.012)	(0.012)	(0.015)	(0.012)	(**0.013**)	(**0.022**)
14	0.003	**0.016****	**0.028****	**−0.022***	**−0.022***	**−0.029***	−0.019	**−0.033****	**−0.054****
	(0.007)	(**0.007**)	(**0.013**)	(**0.013**)	(**0.013**)	(**0.015**)	(0.013)	(**0.014**)	(**0.023**)
15	0.009	**0.024*****	0.022	−0.008	−0.008	−0.017	−0.010	**−0.026***	−0.036
	(0.007)	(**0.008**)	(0.014)	(0.013)	(0.013)	(0.016)	(0.013)	(**0.014**)	(0.024)
Observations	3,355	2,328	1,106	869	869	632	4,224	3,197	1,738
R-squared	0.327	0.370	0.470	0.327	0.327	0.271	0.330	0.34	0.33

Notes. Coefficients are cumulative abnormal returns weighted by firm value. "Competitors" are the first 10 firms listed by Google Finance for each sponsor firm; see Table A.1. "All firms," "primary," and "Tiger brand" include competitors of each group. "Endorsement intensive" firms are those for which a Google search of "(company name) endorsement deals" yields one or more hits describing an endorsement deal during the event window. "Difference" columns show differences between endorsement-intensive and nonintensive competitors. Event date is November 27, 2009. Estimation window begins three months before event date, and ends one week before event date. Standard errors are adjusted for contemporaneous correlation across firms. Numbers in parentheses are standard errors. Coefficients in bold are statistically significant at the 10% level or better.

*Significance at 10%; **significance at 5%; ***significance at 1% (or better).

The endorsement intensity searches were conducted on various days during April 2010.[22]

The model for this analysis is the standard market model, as in Equation (1), but with competitors' returns as the dependent variable. We weight the returns by competitor value (market capitalization). We estimate competitors' returns for all competitors, as well as competitors to the primary/Tiger brand groups.

Table 4 shows 10-day CARs for the competitor sample. The first three columns show returns for competitors who are not endorsement intensive. Competitors' CARs are positive and rise as sponsors' returns fall—with the greatest changes occurring by day 10. This pattern dovetails with the gradual onset of negative CARs for sponsors and with the timing of endorsement-related news, corroborating the view that competitors' gains are sponsors' losses. The point estimates grow in size as we restrict the sample to competitors of the primary and Tiger brand groups, which is also consistent with the pattern of sponsors' losses.[23]

The more interesting results are those in the next six columns, which show that endorsement-intensive

[22] We experimented with several ways of classifying endorsement intensity, with little variation in the qualitative results.

[23] The difference in sponsors' abnormal returns when measured relative to competitors need not equal competitors' abnormal returns. The net difference depends both on the level of competitors' returns, and on the correlation between sponsors' and competitors' returns.

competitors fared significantly worse than nonintensive competitors. The middle three columns show that after event day two nonintensive competitors' returns turn negative, and are statistically significantly negative on day 14. More important, the difference between returns for endorsement-intensive and nonintensive competitors is economically meaningful and statistically significant, at least for the primary/three subsamples. For the primary subsample the CARs are significant at 10% or 5% on all days after trading day 8 (December 9, 2009), and range from -2.1% to -3.3% in point terms, meaning that endorsement-intensive competitors lost roughly 2%–3% of value relative to their nonintensive competitors. The point estimates are larger for Tiger brand competitors but less significant statistically, reflecting the smaller sample size.

The relative gains for competitors without endorsement deals suggest the losses for sponsor firms were at least in part gains for competitors—in other words, that celebrity endorsements transfer value across firms. But the fact that being endorsement intensive was treated more harshly in the market suggests a second effect—that the scandal sent a negative marketwide signal, as suggested by Belson and Sandomir (2010), about the possible downside of celebrity endorsements. For endorsement-intensive competitors, the net effect of the business-stealing effect (a gain) and the reputation risk effect (a loss) appears to be nearly a wash. If we pool all competitors, the average CARs for the pooled group are close to (and not significantly different from) zero.

To confirm that our findings for competitors are endorsement related, we estimate a series of regressions mirroring those in Table 3, estimating the link between competitors' abnormal returns and measures of news/search intensity. We allow the relationships to differ for endorsement-intensive and nonintensive competitors by including an interaction term.

Table 5 shows the results of these models. The broad pattern is of a positive and statistically significant relationship between endorsement-related news/search intensity and abnormal returns for the baseline set of nonintensive competitors, and a relationship for endorsement-intensive competitors that is significantly less positive and close to zero on net. The effects estimated in this table are generally smaller than those estimated for sponsors. In short, competitors' returns during the scandal are greatest precisely when sponsors' losses are greatest, unless the competitors themselves are endorsement intensive.

In the top rows, the all and Tiger brand coefficients show a positive and significant relationship between the continuously measured "Tiger Woods endorsement" search intensity variable and abnormal returns for nonintensive competitors. Those coefficients are also positive and significant for all groups using the discrete "intensity > 0.25" variable. They are smaller and less significant using our qualitative self-defined "news days" variable. The pattern for the interaction terms is similar, in terms of size and significance. The interaction terms measure the difference between returns for nonintensive and endorsement-intensive competitors—the sum of the two coefficients measures the net effect on endorsement-intensive competitors. We also observe, as we did with sponsors' abnormal returns, that the quantitative intensity measures from Google Insights correlate more strongly with abnormal returns than does our self-defined "endorsement-related news day" variable.

Although we do not report the results, we have estimated a model that pools all sponsors and competitors and estimates overall (value-weighted) effects on the "category portfolio." These models show negative, small (less than 1%) and borderline statistically significant effects overall. In other words, the net effect on

Table 5 Competitors' Abnormal Returns and News/Search Intensity

	All firms	Primary	Tiger brand
Dependent variable: competitors' daily abnormal return			
"Tiger Woods endorsement" search intensity	**0.010***** (**0.002**)	**0.006**** (**0.002**)	**0.007**** (**0.002**)
"Tiger Woods endorsement" search intensity × Endorsement-intensive competitor	**−0.009***** (**0.002**)	**−0.007***** (**0.002**)	**−0.006**** (**0.002**)
Constant	0.001 (0.001)	**0.002***** (**0.001**)	−0.001 (0.001)
R-squared	0.049	0.028	0.027
"Tiger Woods endorsement" search intensity > 25	**0.006***** (**0.001**)	**0.006***** (**0.001**)	**0.005***** (**0.001**)
"Tiger Woods endorsement" search intensity > 25 × Endorsement-intensive competitor	**−0.006***** (**0.001**)	**−0.006***** (**0.001**)	**−0.005***** (**0.001**)
Constant	0.001 (0.001)	**0.002*** (**0.001**)	**−0.002*** (**0.001**)
R-squared	0.068	0.073	0.055
Endorsement-related news day	**0.004***** (**0.001**)	**0.003*** (**0.001**)	0.001 (0.002)
Endorsement-related news day × Endorsement-intensive competitor	**−0.005**** (**0.002**)	**−0.004*** (**0.002**)	**−0.004*** (**0.002**)
Constant	**0.003***** (**0.000**)	**0.003***** (**0.000**)	−0.000 (0.001)
R-squared	0.019	0.011	0.015
Observations	775	589	347

Notes. Coefficients are from the model of the relationship between competitors' firm-level daily abnormal returns during the period November 30–December 18 and three different measures of endorsement-related news intensity. Interaction terms test for differential responses across endorsement-intensive and nonintensive competitors (see Table A.1). The first set of rows use the level of "Tiger Woods endorsement" search intensity (on a [0, 1] scale) to measure endorsementrelated news. The second set of rows use an indicator equal to 1 if "Tiger Woods endorsement" intensity exceeds 0.25, and 0 otherwise. The third set of rows use indicator variables equal to 1 on December 3, December 9, December 11, and December 14; see Table 1 for details. Numbers in parentheses are standard errors. Coefficients in bold are statistically significant at the 10% level or better.

*Significance at 10%; **significance at 5%; ***significance at 1% (or better).

this entire set of firms is a small and weakly significant loss in value, with significant "within-category" transfers from sponsor firms to nonintensive competitors of sponsor firms. These results are broadly consistent with the results in Chung et al. (2013) from the golf ball market.

4.4. Robustness Checks and Caveats

Although we do not present them here, we have conducted a variety of robustness checks. We have estimated the models using a variety of estimation windows, with little effect on the results.[24] We have estimated models that include the preevent week, or drop up to a month's worth of preevent data. We have varied the weighting scheme (using time-invariant market capitalization weights, for example). We have also varied the reference index for the market return, using in some specifications the NASDAQ, in others the S&P 500, and in others the index on which the company's stock is traded. These modifications to the specification do not change the results.

Another robustness issue arises because PepsiCo announced a negative earnings revision on December 9, 2009, and one might worry that the announcement contaminates our results. In unreported specifications (which we show in an earlier working paper version), we break our "Tiger brand" subsample of EA, Nike, and PepsiCo into two groups: PepsiCo and the other two firms. The abnormal return for PepsiCo on December 9 is indeed negative and significant, but so are abnormal returns for the other two firms, and the point estimates are very close. Although one cannot rule out a negative stock price effect of the announcement for PepsiCo, the pattern of results is consistent with the release on December 9 of bad news common to Nike, EA, and PepsiCo.

To further explore whether our event window contains substantive events for sponsor firms other than the scandal, we have examined Googles news headlines for the event period, again using Google Insights. Two firms, EA and TLC Vision, have no headlines. Three firms, Gillette, Nike, and Accenture, have one headline, all having to do with Tiger Woods and endorsements. PepsiCo has one headline, discussed above. AT&T has one headline, on December 18, 2009, mentioning its improved wireless service in Rochester, New York. It does not appear that this was a period during which our set of sponsor firms experienced other substantive events affecting firm value.

A final point concerns interpretation of the results. Ideally, one would want to interpret any abnormal returns as measuring percentage changes in the expected value of future economic profits. In our case that is hard, if not impossible, for a few reasons. Most of our sponsor firms are large multiproduct firms, for which Tiger Woods endorses only a single product; Nike produces many products outside its golf line, for example. Nike's stock price, of course, reflects expectations about its profits from all business lines. So, the percentage change in profits will be weighted by the shares of economic profits flowing from "Tiger-related" products and "non-Tiger-related" products. One could proxy for those shares using dollar values of sales—Nike golf, for example, represents roughly 10% of annual sales for Nike—but there is no guarantee that shares of *expected future profit* correspond to shares of *current dollar sales*. Another complicating factor is that if the scandal sent a market-wide signal about celebrity reputation risk, then even the non-Tiger-related business lines might suffer. That would be particularly true for a company like Nike, which is one of the most celebrity endorsement-intensive firms in the world. For these reasons, our results should be taken as indicating the direction and overall dollar value (percentage change times market capitalization) of abnormal returns, not as indicating percentage changes in Tiger-related economic profit.

5. Discussion and Conclusion

The Tiger Woods scandal provides a unique opportunity to understand more about the relationship between stock market value and celebrity endorsements. Our first result confirms a direct dimension of that link: the market value of Tiger Woods' sponsors fell substantively after the scandal broke, relative to the market values of firms without such endorsement deals. That finding is informative in the context of the mixed evidence from previous work.

Beyond that, we shed light on some previously understudied aspects of the endorsement/stock price relationship. Firms with substantial coinvestments in new products linked to the "Tiger brand" suffered greater declines in value, presumably reflecting declines in the asset values or brand equity associated with those products. We do not estimate whether our results reflect long-run declines in value, due to the limited statistical power of longer-run tests, but we have no evidence over as long as one month after the scandal of any reversion in prices. The efficient markets hypothesis would suggest that markets should immediately price the downside of scandals correctly on average; of course, that need not have been the case in this specific instance. Further work using more data from a broader set of scandals might be able to shed light on whether there is any systematic underreaction or overreaction to celebrity scandals.[25]

[24] See Table A.2 in the appendix.

[25] We know of no work on that particular question, although previous work (see, e.g., Bernard and Thomas 1989 and follow-on work) has shown that markets might underreact to other value-changing events such as earnings announcements.

We also relate novel auxiliary data from Google Insights to abnormal returns during the scandal. The level of interest in the search term "Tiger Woods endorsement" explains nearly 40% of the variation across firms and days in abnormal returns following the scandal, and does so in an intuitive way. The search intensity variable significantly outperforms our own qualitative measure of which days were endorsement newsworthy, suggesting promising avenues for future research.

Our estimates of competitors' gains represent new evidence regarding how far-reaching the stock market effects of celebrity endorsements can be. Competitors to sponsor firms measurably gained value after the scandal, relative to the rest of the market. That finding has implications for business strategy, in that competitors' endorsement deals are one more factor affecting firm value, and can transfer value across firms.

Finally, we find compelling evidence that how competitors fared during the scandal depended on whether they also had celebrity endorsers; this result is confirmed by the postevent relationship between competitors' abnormal returns and endorsement-related news/search intensity. Along with the anecdotal evidence regarding how the scandal altered perceptions of celebrity endorsement reputation risk, this evidence suggests a regime change in how equity markets priced reputation risk. Whether that regime change persists is an open question, but if insurance companies indeed start offering "reputation risk insurance" then that view will have passed a convincing market test.

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Appendix

Table A.1 Sponsors, Competitors, and "Endorsement Intensity"

Panel A

Sponsor	Parent company	Endorsement value (/yr.)	Market cap
Nike	Nike	$20–$30 million	$32 billion
Gatorade	PepsiCo	$20 million	$95 billion
Accenture	Accenture	$20 million	$26 billion
Gillette	Procter and Gamble	$15 million	$179 billion
Tiger Woods PGA Tour Golf	Electronic Arts	$8 million	$5.76 billion
AT&T	AT&T	n/a	$165 billion
TLC Laser Eye Centers	TLC Vision	n/a	$4.04 million

Panel B

PROCTER & GAMBLE CO	NIKE INC	PEPSICO INC
Church & Dwight Co., Inc.	Deckers Outdoor Corp.	The Coca-Cola Company[a]
The Clorox Company	Crocs, Inc.	Coca-Cola Enterprises (bottler)
Colgate-Palmolive Company	Skechers USA, Inc.[a]	Hansen Natural Corporation
Johnson & Johnson	K-Swiss, Inc.[a]	Jones Soda Co. (USA)
CCA Industries, Inc.	Steven Madden, Ltd.	Cott Corporation (USA)
Kimberly-Clark Corporation	Heelys, Inc.	Dr Pepper Snapple Group[a]
Energizer Holdings, Inc.	LaCrosse Footwear, Inc.	National Beverage Corp.
Zep, Inc.	The Global Housing Group[b]	Reed's, Inc.
PC Group, Inc.	Adidas AG (ADR)[b]	Celsius Holdings, Inc.[b]
The Stephan Co.[b]	Puma AG Rudolf Dassler[b]	Fomento Economico Mexi[b]
TLC VISION CORP	**ACCENTURE LTD BERMUDA**	**ELECTRONIC ARTS INC**
LCA-Vision, Inc.	Microsoft Corporation[a]	THQ, Inc.
Hanger Orthopedic Grou	Hewlett-Packard Company[a]	Microsoft Corporation[a]
U.S. Physical Therapy,	Intl. Business Machine	Activision Blizzard, Inc.[a]
NovaMed, Inc.	Genpact Limited	Take-Two Interactive Software[a]
UCI Medical Affiliates[b]	Oracle Corporation	The Walt Disney Company
Pacific Health Care Or[b]	Infosys Tech., Ltd. (ADR)	KONAMI CORPORATION (ADR)
Clinica de Marly S.A.[b]	Hewitt Associates, Inc.	Sony Corporation (ADR)
SHL TeleMedicine, Ltd.[b]	Dell, Inc.	Majesco Entertainment Co.
Feelgood Svenska AB[b]	Towers Watson & Co	Time Warner, Inc.
European Lifecare Group[b]	Accenture Plc (Germany)[b]	Nintendo Co., Ltd. (ADR)[b]

Table A.1 (Continued)

Panel B
AT&T INC
Verizon Communications
Sprint Nextel Corporation
Qwest Communications I
CenturyTel, Inc.
Apple, Inc.
General Communication,
Cbeyond, Inc.
Cincinnati Bell, Inc.
Intl. Business Machine
Deutsche Telekom AG (ADR)[a,b]

Notes. We include all sponsors for which we can obtain stock price data. Market cap values are as of mid-December 2009. AT&T's relationship with Woods involves sponsoring a golf tournament and charity events, in exchange for product placement (e.g., on Tiger Woods' golf bag). Each underlined heading in panel B is for one of the sponsors listed in Table I. The next 10 rows under each heading show the first 10 firms listed, in order, by Google Finance under "competitors." Competitors are measured relative to the parent company.

[a]These competitors are classified as "endorsement intensive," meaning that a Google search for the company name followed by "endorsement deals" yields at least one mention of a celebrity endorsement contract.

[b]These competitors are not listed on U.S. stock exchanges.

Table A.2 Robustness to Alternative Estimation Windows and Indexes

Days after event	Two-month estimation window	One-month estimation window	Nasdaq as reference index	S&P as reference index	"Home" index as reference index
1	−0.004	−0.005	−0.004	−0.004	−0.004
	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
2	0.002	−0.002	0.001	0.001	0.001
	(0.006)	(0.005)	(0.006)	(0.006)	(0.006)
3	0.002	−0.004	−0.000	0.002	0.002
	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)
4	−0.005	−0.011	−0.010	−0.006	−0.006
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)
5	−0.004	−0.011	−0.011	−0.004	−0.005
	(0.009)	(0.009)	(0.010)	(0.010)	(0.010)
6	−0.004	−0.012	−0.010	−0.003	−0.003
	(0.010)	(0.010)	(0.012)	(0.011)	(0.011)
7	−0.009	−0.016	−0.017	−0.008	−0.008
	(0.011)	(0.011)	(0.013)	(0.012)	(0.012)
8	−0.019	−0.028**	−0.029**	−0.019	−0.019
	(0.012)	(0.012)	(0.014)	(0.013)	(0.013)
9	−0.021	−0.032**	−0.030**	−0.022	−0.022
	(0.013)	(0.013)	(0.014)	(0.014)	(0.014)
10	−0.027*	−0.039***	−0.033**	−0.027*	−0.028*
	(0.014)	(0.014)	(0.015)	(0.015)	(0.015)
11	−0.028*	−0.042***	−0.035**	−0.028*	−0.028*
	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)
12	−0.035**	−0.049***	−0.042**	−0.034**	−0.035**
	(0.016)	(0.016)	(0.017)	(0.017)	(0.017)
13	−0.038**	−0.053***	−0.046**	−0.037**	−0.037**
	(0.017)	(0.017)	(0.018)	(0.017)	(0.017)
14	−0.042**	−0.057***	−0.050***	−0.041**	−0.041**
	(0.017)	(0.018)	(0.019)	(0.018)	(0.018)
15	−0.048***	−0.065***	−0.062***	−0.048**	−0.048**
	(0.018)	(0.018)	(0.020)	(0.019)	(0.019)
Observations	340	230	440	440	440
R-squared	0.394	0.540	0.294	0.330	0.332

Notes. Coefficients are cumulative abnormal returns for the "Big Five." Event date is November 27, 2009. Standard errors are adjusted for contemporaneous correlation across firms.

*Significance at 10%; **significance at 5%; ***significance at 1% (or better).

Table A.3 Abnormal Returns and Alternative Measures of Search Intensity

	All firms	Primary	Tiger brand
Dependent variable: Sponsors' daily abnormal return			
"Tiger Woods endorsement" search intensity	−**0.008*** (**0.003**)	−0.007 (0.004)	−**0.026***** (**0.006**)
"Tiger Woods accident" search intensity	−0.003 (0.006)	0.000 (0.007)	−0.007 (0.010)
Constant	0.001 (0.002)	−0.001 (0.002)	**0.007*** (**0.003**)
R-squared	0.050	0.056	0.314
"Tiger Woods accident" search intensity	0.003 (0.005)	0.006 (0.006)	0.012 (0.011)
Constant	−**0.002*** (**0.001**)	−**0.004***** (**0.001**)	−**0.005*** (**0.002**)
R-squared	0.003	0.012	0.029
"Tiger Woods endorsement" search intensity	−**0.007*** (**0.003**)	−**0.007*** (**0.004**)	−**0.024***** (**0.006**)
"Tiger Woods wife" search intensity	0.004 (0.003)	0.001 (0.004)	−0.002 (0.006)
Constant	−0.001 (0.002)	−0.001 (0.002)	0.006 (0.003)
R-squared	0.062	0.057	0.308
"Tiger Woods wife" search intensity	0.003 (0.003)	0.001 (0.004)	−0.002 (0.007)
Constant	−**0.003*** (**0.001**)	−**0.004*** (**0.002**)	−0.003 (0.003)
R-squared	0.013	0.001	0.003
Observations	105	75	45

Notes. Coefficients are from model (3) in the text, modeling the relationship between firm-level daily abnormal returns during the period November 30–December 18 and alternative measures of endorsement-related news intensity. Measures are the level of "Tiger Woods accident," "Tiger Woods wife," and "Tiger Woods endorsement" search intensity on a [0, 1] scale from Figure 1. Numbers in parentheses are standard errors. Coefficients in bold are statistically significant at the 10% level or better.

*Significance at 10%; **significance at 5%; ***significance at 1% (or better).

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