

Vertical Integration and Antitrust in Search Markets

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Abstract

This paper studies the integration of an upstream firm in the market for Internet search with downstream services. In 2011, Google integrated its comparison site for flight fares (Google Flights) and restaurant ratings (from a recent acquisition of Zagat) into Google's search results. I find that Google's integration of Google Flights led to a reduction in clicks to competing travel agencies for general searches. The acquisition of Zagat's restaurant ratings led to an increase in clicks, regardless of the content of the search term. The contrasting findings may be explained by the fact that Google Flights provides price information and therefore directly competes with other online travel agents while Google Zagat provides quality information, which may encourage more search on competing review sites.

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1 Introduction

The organization of production attracts the attention of economists and regulators across a broad range of industries. A rich theoretical literature illustrates that the economic consequences of a firm's boundaries are ambiguous. On one hand, if a firm provides both the upstream and downstream products, it may use dominance in one market to leverage market power in another market (Whinston, 1990; Carlton and Waldman, 2002). For instance, a vertically integrated firm may foreclose rivals by raising their costs. On the other hand, a vertically integrated firm may reduce transaction costs and improve efficiencies, which increase welfare. In fact, a growing theoretical literature suggests that under certain conditions, vertical integration could increase welfare and the use of rival products (Rochet and Tirole, 2008; Amelio and Jullien, 2012; Choi, 2010).

While the theoretical literature is rich, limited empirical evidence exists on how vertical integration affects economic outcomes (Lafontaine and Slade, 2007; Gil, 2015; Gil and Hartmann, 2009; Forman and Gron, 2009). This paper studies Internet search markets to understand the effect of vertical integration on competition. I examine Google's integration across different markets as an empirical test of the effects of vertical integration between an upstream market (search engines) and downstream markets (products and services).

When a user submits a keyword query to Google, Google returns a list of search results with links to products and services from other firms. In recent years, Google

has integrated its own products within its search results, which potentially compete with other products from listed firms. For instance, when an individual searches the keywords “airline tickets from Los Angeles to Boston,” Google returns a list of search results with links to online travel agencies such as Expedia and Orbitz as well as its own online travel site, Google Flights.

Search markets provide an excellent test case for studying the effects of vertical integration. The markets are highly concentrated; the three main search engines account for over 90 percent of searches, so a dominant firm may potentially leverage market power. Moreover, the relative ease of tying new downstream services to the upstream search market generates many potential experiments to study the effects of integration.

In recent years, regulators and policymakers have focused considerable attention on vertical integration of the search market (Stutz, 2011). Antitrust regulators in both the US as well as other countries have launched investigations into Google’s practices (Kendall et al., 2013). For instance, the Federal Trade Commission completed an 18-month investigation over allegations that Google was biasing its search results to favor products and services owned by Google. The European Union reopened a four-year antitrust investigation into Google’s search business. Furthermore, according to FairSearch (2012), “Google has become the focus of antitrust investigations around the world” including South Korea, Argentina, and Brazil.

This attention has generated a debate within the industry and among regulators

over the effects of vertical integration in Internet search markets. On one hand, supporters of Google's practices argue that such "search engine bias" is a beneficial consequence of search engines optimizing content for their users (Goldman, 2006). On the other hand, critics of Google's practices are concerned that Google may hurt rivals by "manipulating internet searches" (Reuters, 2013; Edelman, 2015). Given that the theoretical effects of vertical integration are ambiguous, the debate must be resolved empirically.

This paper empirically examines the entry of Google into two downstream markets: online travel and restaurant reviews. In 2011, Google integrated Google Flights (a price comparison site for plane tickets) within its search results alongside other online travel agents. In 2011, Google also acquired Zagat (a restaurant review firm) and began embedding Zagat restaurant ratings and reviews within its search results alongside other review sites.

I focus on the two industries of online travel and restaurant reviews because they encompass large and active segments of consumer search. Online searches for travel have risen dramatically as consumers move away from traditional travel agents towards booking their travel online; the online travel market for North America accounts for revenues of over \$200 billion in 2013 (Krasny, 2012; Trefis, 2015). Online reviews for restaurants have gained influence over consumers' decisions as well as the quantity and price of transactions (Jin and Leslie, 2003; Luca, 2011; Dai et al., 2014; Mayzlin et al., 2014). The National Restaurant Association finds that "over half (53 percent)

of 18- to 34-year olds report that online reviews factor into their dining decisions, as do 47 percent of frequent fullservice customers.”¹

I collect data on consumer behavior on three major search engines—Google, Yahoo!, and Bing—in the period before and after Google’s product integrations. To control for trends and seasonality among search engines and keyword searches, I examine how consumer behavior changes for keyword searches on flight fares and restaurant reviews on Google using consumers from Yahoo! and Bing as controls. In particular, I investigate how the number of clicks that sites receive changes before and after Google’s product integrations.

My results indicate that the effects of vertical integration are mixed. The integration of Google Flights led to a reduction in clicks to competing travel agencies for general flight searches. The acquisition of Zagat led to an increase in clicks, regardless of the specific content of the search term. The contrasting findings may be due to differences in the type of search; while Google Flights provides price information and therefore directly competes with other online travel agents, Google Zagat provides quality information, which may encourage further search on competing review websites.

My study is related to several streams of literature. First, my results link more broadly to the literature on information and technology markets; several studies examine how information may affect consumers’ decisions (Yang and Ghose, 2010; Chiou and Tucker, 2015; Lianos and Motchenkova, 2013). Second, my study also relates to

the literature on consumers' response to online advertising and sponsored search results. In particular, this study is complementary to concurrent work by Edelman and Lai (2015), which examines the incorporation of Google Flights and focuses on the interesting interplay between non-sponsored and sponsored listings. My study differs in that I focus on comparing entry by Google into two different product spaces of quality and pricing, and I examine several different search engines across these two industries. My work also relates to recent experimental evidence by Luca et al. (2015) on how consumers respond to changes in Google's displays that favor Google partners. By contrast, my paper focuses on a different question—how the addition of quality or pricing information for Google's tied products affects consumer search.

Finally, my result that clicks rise for restaurant keywords is consistent with the growing theoretical literature on antitrust in platform markets (Evans and Schmalensee, Evans and Schmalensee). User review sites are platforms that bring together two sides of a market—firms such as airlines or restaurants and consumers who seek these services. Choi (2010) builds a model to analyze the effects of tying in two-sided markets when consumers multi-home (i.e., visit more than one platform). His model illustrates the surprising result that tying may increase welfare if multi-homing is allowed, even in cases where welfare declines in the absence of multi-homing. This improvement in welfare occurs as tying induces more consumers to multi-home. My results suggest that consumers interested in quality may multi-home and visit multiple platforms, thereby mitigating the negative effects of vertical integration on other firms in the

market.

2 Institutional Setting

2.1 Google Flights and Google's Acquisition of Zagat

The development of Google Flights originates with Google's acquisition of ITA Software in 2010 for \$700 million. ITA Software provides data to online travel sites by using algorithms to "combine and parse multiple sets of flight information from airlines, including pricing and availability data, to create an up-to-date database that can be searched..." (Google, 2015). The acquisition was controversial and attracted attention from industry players and regulators. Competitors expressed concerns that the deal would reduce competition (Schoenberg, 2011). The Justice Department conducted an eight-month investigation and ultimately approved the deal, but it "imposed conditions limiting how Google could use the company's technology" (Miller, 2011). Once the deal was approved, Google began using the ITA technology to develop Google Flights, an online comparison of flight fares. In September 2011, Google Flights was launched, and in December 2011, Google began displaying Google Flights in its search results alongside competing travel agents (Google, 2011).

In September 2011, Google acquired Zagat, a company that reviews and rates restaurants by surveying consumers (Bosker, 2011). The acquisition reflects Google's attempt to provide more content for local searches and Google's "shift to become a content provider." Google combines factual information about a restaurant, such as

its hours and address, with information on reviews and ratings from Zagat. Upon acquiring Zagat, Google announced that users would immediately see the integration of Zagat content in Google searches (Ludwig, 2011). Prior to the acquisition, users could only access Zagat content through a subscription fee; in effect, Google's integration of Zagat ratings made the ratings as freely and widely available as other review sites such as Yelp.

Yahoo! and Bing also offer travel services that predate the integration of Google Flights into Google's search results in November 2011. Yahoo! Travel dates as far back as 1997, and it evolved into a "digital magazine" with general tips on planning travel and sightseeing destinations (Schaal, 2014); unlike Google Flights and other online travel agents, Yahoo! Travel was not focused on comparisons of flight fares. Eventually in 2016, Yahoo! closed Yahoo! Travel as part of a company-wide reorganization. Bing Travel debuted in June 2009 and included fare comparisons as well as a predictor for airline fares. In May 2011 prior to the integration of Google Flights into Google's search results in November, Bing formed a partnership with an online travel agent Kayak to incorporate Kayak's database and flight comparison tool (Sullivan, 2011). The partnership did not appear to alter how Bing displayed Bing Travel within its search results and instead affected the underlying database powering the price data.

Prior to Google's acquisition of Zagat, Yahoo! and Bing did not acquire or integrate restaurant ratings into their search results. In June 2012, ten months after the

integration of Google Zagat, Bing formed a partnership with ratings website Yelp. Bing's partnership with Yelp affects Yahoo! as well, since in 2009, Microsoft and Yahoo! announced a deal in which Bing would power the Yahoo! search engine.²

In sum, it seems likely that the 4- and 6-month period of study around the policy change of Google Flights did not encompass significant changes by other search engines. The partnership of Yahoo! and Bing with Kayak predate the integration of Google Flights by several months, and the partnership of Yahoo! and Bing with Yelp occur almost one year after the integration of Google Zagat. In my robustness checks, I empirically examine the effects of these partnerships with Yahoo! and Bing as a comparison with the effects of Google's integrations.

2.2 Keyword Searches Online

When a consumer types in a keyword such as "airline tickets from los angeles to boston" in Google search, Google returns a list of search results with links to different websites. As seen in Figure 1, some of the links are from advertised sources ("paid links") while others are from non-advertised sources ("unpaid links"). The paid links are text ads that appear at the top and on the right of the webpage. Advertisers such as southwest.com bid for the text ads that appear in response to a consumer's keyword search, and when a user clicks on the paid link, the advertiser must pay the search engine. Google displays non-paid links below the paid links on the search results. The non-paid links are not sponsored by an advertiser.

As seen in Figure 1, the integration of Google Flights created a "Google link"

that appears below the paid links and above the non-paid links. The link to Google Flights lists pricing information for several airline tickets from Los Angeles to Boston by different airlines. By clicking on the link to Google Flights, the user is directed to the Google Flights site with further details and the option of conducting further searches for flights or clicking on booking links to airline sites.

The integration of Google Flights into Google's search results is controversial. On one hand, Google maintains that flight search results are "not influenced by any paid relationships" (Schaal, 2011). On the other hand, critics state that "Google stands as a gatekeeper for buying decisions" and that there are "conflicting demands of being both search-arbiter and market competitor" (Nicas, 2011).

<<COMP: Place Figure 1 about here>>

Similarly, the acquisition of Zagat by Google led to the incorporation of ratings from the Zagat Survey, also called "Zagat ratings," into Google's search results. The Zagat Survey collects and reports ratings of restaurants by diners. After Google acquired Zagat in September 2011, Zagat made its website freely accessible; before then, users had to subscribe in order to receive Zagat content. Figure 2 shows the two ways that Google incorporates Zagat ratings for a search on the keywords "burger near seattle." First, the Zagat rating for food is listed below each restaurant in the search result. Second, the righthand side of the webpage lists further information on the Zagat rating for a particular restaurant. A separate rating for three categories of food, decor, and service is provided as well as a brief excerpt of the Zagat review.

For instance, Google reports that Red Mill Burgers in Seattle has a rating of 24 for food, 11 for decor, and 15 for service.

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3 Data Description

My data derive from two main sources: Experian Hitwise and comScore. Both Experian Hitwise and comScore are considered among the top market research firms that aggregate and track consumer behavior online (Delo, 2011). From Experian Hitwise, I identify keyword searches on flight fares and restaurant reviews. From comScore, I collect information on the number of consumer clicks from keyword searches at three major search engines.

Experian Hitwise “develops proprietary software that Internet Service Providers (ISPs) use to analyze website logs created on their network” (Hitwise, 2011). Once the ISP aggregates the anonymous data, it provides the data to Hitwise. According to its website, Hitwise collects the usage data from a “geographically diverse range of ISP networks and opt-in panels, representing all types of Internet usage, including home, work, education and public access.” Currently, Hitwise has usage data from a sample of 25 million people worldwide. Hitwise is a highly-regarded data source for Internet market research (Delo, 2011). It implements a Categorization Model that associates each website with up to three industries and one country (Hitwise, 2011).³ For each category, Hitwise ranks a firm according to its share of overall traffic to the category.

ComScore tracks the online activity of a panel of more than 2 million users based in the US and aggregates the search patterns to the search-term level for resale to commercial clients. ComScore recruits its panel members through affiliate programs and partnering with third party application providers. Its Marketer User Guide emphasizes and discusses the representativeness of its sample to the general population. This source also has been used in several academic studies and noted as a “highly regarded proprietary [source] for information on the size and composition of media audiences” (Gentzkow and Shapiro, 2011; Montgomery et al., 2004; De Los Santos et al., 2012). The database reports the average click behavior of consumers following a keyword search on Google, Yahoo!, and Bing search engines. For each keyword search, comScore reports the monthly number of clicks received by a website either through a “paid” link or a “non-paid” link. “Paid clicks” refer to the clicks received by a paid link, and “non-paid clicks” refer to the clicks received by a non-paid link.

First, I use Experian Hitwise to identify keywords for the categories of websites that potentially compete with Google Flights or Google Zagat. For flight fares, Google Flights’ competitors include other travel agencies such as expedia.com and travelocity.com, so the relevant category is “Travel–Agencies.” For restaurant reviews, Zagat’s biggest competition will likely be from two sources: restaurant review sites such as restaurants.com and business directories such as yelp.com, so the relevant categories are “Food and Beverage–Restaurants and Catering” and “Business and Finance–Business Directories.” I retrieve the top ten websites under each of these categories

in Hitwise. Then for each of these websites, I identify the top 50 keywords related to flight fares and restaurant reviews that consumers used to navigate to the site. I remove brand names, geographic locations, and duplicate keywords to generate a unique list of keywords.⁴

Next I collect data from comScore on consumer clicks. For each keyword search, comScore reports the number of clicks on paid links (“paid clicks”) and non-paid links (“non-paid clicks”) as well as the total number of clicks on all links (“total clicks”) in a given month for each of the three search engines. I collect the data on total, paid, and non-paid clicks for all “broad” searches—any search phrases that contain the keywords of interest. The final sample contain websites with total clicks above comScore’s minimum reporting standard in all months.⁵

My analysis relies on using consumer behavior on Bing and Yahoo! as a control for consumer behavior on Google. I verify in Table 1 that the demographics across the three search engines are similar. As seen in the table, the gender breakdown of users across the three search engines is similar, with Google having a slightly larger fraction of male users. The age and income distributions of users are also similar across the three search engines and higher than the general US population.

<<COMP: Place Table 1 about here>>

I also investigate aggregate searches to the three search engines. Table 2 reports the total number of monthly searches for each of the three search engines. A concern is that search patterns may reflect changes in overall searches to the search engines

rather than a response to the product integrations. As seen in the table, during the months preceding and following the product integrations in September 2011 and December 2011, total searches to the search engines remained relatively stable.

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Tables 3 and 4 report the summary statistics of the datasets on keywords for flight fares and restaurants. As shown in the tables, advertising is more important for flight keywords than restaurant reviews; paid clicks account for approximately half of total clicks while most clicks for restaurant keywords originate from non-paid links. The market for flight keywords is relatively large with an average website receiving 26,000 clicks while the market for restaurant keywords is smaller with the average website receiving 10,000 clicks. Google accounts for 59% and 90% of all observations in the two samples; Google maintains the largest search volume in the US, so as expected, most clicks in the datasets originate from Google.

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4 Discussion of Theoretical Predictions

In this section, I discuss the relevant tradeoffs for consumers and firms when analyzing vertical integration. I also examine how the predictions from the theoretical literature apply to Internet search markets.

Theoretical models illustrate when vertical integration leads to negative or positive spillovers. Rival firms may experience negative spillovers if the integrated firm either

levers market power from the upstream market into the downstream market, forecloses rivals, or reduces transactions costs. The leverage of market power may easily occur in the online search market; Edelman (2015) argues that Google is the largest search engine in the US and therefore a gatekeeper of information. By integrating Google Flights or Google Zagat ratings into its search results, Google ties the upstream market of search to its downstream product market. In other words, Google users are also “forced” to “consume” Google Flights information. Critics have argued that foreclosure occurs because exclusive access to special fonts and additional webpage space has been limited to Google’s products. As seen in Figure 1, other competitors are restricted to 3-line text ads and unable to use the premium formatting of Google Flights. Finally, rivals may also experience negative spillovers if the newly integrated firm can reduce transaction costs for consumers. In particular, Google’s acquisition of ITA software provides flight information and fares quickly and nearly instantaneously and therefore dramatically reduces the time required for a search (Schaal, 2011).

Recent theoretical work illustrates that vertical integration may have positive spillovers in platform markets (Evans and Schmalensee, Evans and Schmalensee). Online sites for fare comparison and restaurant ratings are platforms or two-sided markets. Google Flights and other online travel agents bring together two sides of the market—consumers searching for flights and airlines selling those flight tickets. Google Zagat and other online ratings sites bring together two sides of the market—consumers searching for services such as restaurants and providers of the service,

restaurants.

In markets with multiple platforms, consumers have a choice to single-home and participate in only one platform or to multi-home and use multiple platforms. The ability of consumers to multi-home affects the welfare consequences of vertical integration. Choi (2010) demonstrates that tying leads to an increase in welfare if consumers multi-home and visit multiple platforms. In other words, after the vertical integration of one platform, the use of a rival's platform may increase. This result is striking as welfare may increase even in cases where welfare would decline in the absence of multi-homing.

Multi-homing is also likely to occur in online environments (Athey et al., 2016). Consumers can easily switch between websites; online travel agents and online review sites often offer their platform services for free or for a nominal fee. Furthermore, multi-homing is also likely to occur for users that are engaged most deeply in search.

Other explanations exist for positive spillovers in the short-term. With the debut of a new service, consumers may explore the new platform in the short-term. For instance, consumers that search more intensively for price by using the keywords "cheap" may increase their use of a new platform in the initial period after its introduction. These consumers may use the initial period to determine whether the new platform provides additional, better, or cheaper results compared to existing platforms.

Overall, the prior literature suggests several predictions. First, negative or positive

spillovers to rivals may occur when a firm vertically integrates. Second, consumers searching for information on price may behave differently than consumers searching for information on quality or horizontal attributes of a service. For instance, Google Flights provides pricing information and is therefore a direct competitor of online travel agents, so negative spillovers may exist for other rivals. On the other hand, Google Zagat provides quality and attribute information, which may encourage consumers to multi-home and visit multiple platforms. Finally, differences in keywords could be correlated with the propensity for consumers to visit multiple platforms either to explore new services or to multi-home and collect more information. For instance, consumers searching under the keyword “cheap” for flight fares may be more likely to visit multiple platforms or explore new services.

5 Results and Discussion

I use the theoretical predictions from the prior section to inform the empirical analysis in this section. I separately analyze Google Flights and Google Zagat as the effects are likely to differ between search for pricing versus quality. I also include additional controls for keywords such as “cheap” that could measure a consumer’s intensity of search. Furthermore, I conduct a series of robustness checks to distinguish between the theories of short-term and long-term effects.

5.1 Google Flights

As a preliminary analysis, I examine the number of clicks to websites from travel keywords across the major search engines before and after Google's integration of Google Flights. Figure 3 depicts the total, paid, and non-paid clicks for Google compared to other search engines during this period. The figure indicates that seasonal trends are important in searches for the travel industry. As expected, clicks increase towards the end of the year from October and November 2011 to December 2011 and January 2012. In the regression analysis to follow, I control for both keyword and search engine fixed effects to verify that clicks from Google fall relative to the seasonal trend in the control groups of Yahoo! and Bing.

As discussed in the prior section on theoretical predictions, consumer search behavior may also vary by the intensity of search—as measured by the use of keywords such as “cheap.” Consequently, I examine the corresponding graphs for flight searches that contain the keyword “cheap” in Figure 4. These figures graph the average number of total, paid, and non-paid clicks to a website from Google and other search engines (Yahoo! and Bing) before and after Google's integration of Google Flights. Consistent with industry observation, clicks increase as the end of the year approaches due to seasonality in the travel industry. However, the figures reveal a discontinuous and disproportionately large increase in total clicks for Google relative to the other search engines after the integration of Google Flights. The figures suggest that the policy change had positive spillovers for keyword searches containing the word

“cheap.”

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To formally examine the change in click behavior before and after the integration of Google products, I regress the logarithm of the number of clicks to website i from keyword k on search engine j in month t :

$$\log(\text{clicks}_{ijkt}) = \beta_0 + \beta_1 \text{Post}_t \times \text{Google}_j + \gamma_i + \alpha_j + \delta_k + \rho_t + \epsilon_{ijkt} \quad (1)$$

where Post is a dummy variable that equals one in the months after the integration of Google Flights, and Google is a dummy variable that equals one for searches conducted on the Google search engine. The parameters γ , α , δ , and ρ are fixed effects at the levels of the website, search engine, keyword, and month.⁶ I cluster all standard errors at the website-level to account for correlations in click behavior at the same website over time, and I examine the period two months before and after the product integration.

The coefficient of interest β_1 compares consumer click behavior on Google before and after the integration of Google Flights with consumer click behavior on Yahoo! and Bing. The identification of the coefficient arises from comparing clicks to a site from a given keyword search in Google before and after the product integration to the same keyword search in Yahoo! and Bing. Fixed effects for keywords control for seasonal trends in search volume and clicking behavior for certain keywords. I also control for the differences in the levels of clicks across websites and search engines

through fixed effects for websites and search engines. Moreover, I control for general trends in search behavior across all three search engines through monthly dummies that capture seasonality in the travel.

I interpret the coefficient β_1 as the “ratio-of-ratios” (Mullahy, 1999) due to the semi-log specification and the discrete values of the variable $Post \times Google$. I calculate the effect of the integration of a Google product on clicks as:

$$\frac{\left\{ \frac{E[clicks|Google=1,Post=1]}{E[clicks|Google=1,Post=0]} \right\}}{\left\{ \frac{E[clicks|Google=0,Post=1]}{E[clicks|Google=0,Post=0]} \right\}} = exp(\beta_1) \quad (2)$$

The fraction in the numerator of Equation (2) calculates the expected number of clicks to a website from searches on Google before and after the integration of Google Flights to search results. The fraction in the denominator compares the expected number of clicks to the control search engines before and after the integration of the Google product.⁷ Consequently, Equation (2) reflects the ratio of the two ratios and simplifies to $exp(\beta_1)$. This expression captures how clicks from Google fall relative to clicks from other search engines after the integration of the Google product. If the expression in Equation (2) is less than one, then the “interaction” between site clicks and Google’s product integration is negative. In other words, clicks to sites from Google decrease compared to clicks from other search engines after the product integration. If this expression is equal to one, then no interaction effect exists. If this expression is greater than one, then the interaction is positive; clicks from Google increase compared to other search engines after the product integration.⁸

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Table 5 reports the results of the regression for Google Flights. Columns (1)-(3) indicate that the main effect $Google \times Post$ is not statistically significant. Columns (4)-(6) incorporate additional interactions with the dummy variable $Cheap$ that equals one if the keyword phrase contains the word “cheap,” since search patterns may differ by a consumer’s price sensitivity.

The results reveal that the integration of Google Flights had two effects that work in opposite directions. For general searches on flight fares, total, paid, and non-paid clicks fell relative to other search engines after the integration of Google Flights to the search results. Using the ratio-of-ratios interpretation, after the integration of Google Flights, total clicks declined by 32% relative to other search engines.⁹ Non-paid clicks declined even further by 58% while paid clicks declined by 37%.¹⁰ However, for searches that contained the word “cheap,” total, paid, and non-paid clicks increased after the integration of Google Flights to Google’s search results. Total clicks increased by 21%.¹¹

5.2 Google Restaurant Ratings

I perform a similar analysis for Google’s integration of Zagat ratings. Figure 5 graphs the average number of total, paid, and non-paid clicks to a website from restaurant searches on Google and other search engines (Yahoo! and Bing) before and after Google’s integration of Zagat. The figures reveal a discontinuous increase in total and non-paid clicks for Google relative to the other search engines. This figure suggests

positive spillovers for restaurant searches after the policy change.

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I perform a similar regression analysis using restaurant keywords for the period before and after Google's acquisition of Zagat in September 2011. To examine the relationship between clicks and the integration of Zagat ratings on Google, I estimate Equation (1) using data before and after Google's integration of Zagat restaurant ratings.

Table 6 reports the results from the regression for Google's entry into restaurant reviews. After the acquisition of Zagat by Google, total clicks to other sites almost double relative to other search engines.¹² The increase in total clicks arises primarily from the increase in non-paid clicks.¹³ The change in paid clicks is not precisely estimated.

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5.3 Implications of the Findings

The results suggest that the effects of Google's vertical integration depend upon whether firms compete in pricing or quality information. For general searches on flight fares, Google Flights directly competes with online travel agents, so clicks to other sites fall after the incorporation of Google Flights into Google's search results. By providing pricing information, Google provides a direct substitute to other online travel agents. The results suggest that users with general fare searches click on the Google link instead of the non-paid links below or the other paid links above.

As discussed in Edelman (2015), the decline in clicks to other sites may occur if “Google accentuates the effects of tying through premium formatting.” Figure 1 reveals how additional space beyond the three-line text limit for paid links is devoted to Google Flights.

The results also indicate that after Google’s integration of Zagat ratings, clicks to other sites increased. The incorporation of Zagat ratings within Google’s results provides information on product quality for the various restaurants listed within the search results, and this additional information may encourage consumers to visit other sites as well. For instance, Google provides the overall Zagat rating as well as snippets from reviews by Zagat as seen on the righthand-side of Figure 2.

As discussed earlier, the increase in traffic to other platforms is consistent with two explanations. First, Choi (2010) develops a model that demonstrates how usage of rival platforms can increase after vertical integration. Under this model, consumers multi-home and visit several platforms, so the integration of one platform leads to a rise in visits for all platforms in the market. This model “highlights the importance of explicitly considering the role of multi-homing in the antitrust analysis of network industries.” For instance, if consumers who search for quality multi-home, then the model explains why visits to other sites would increase for searches on product quality. In fact, recent empirical work in online markets also suggests positive spillovers between online content (Athey and Mobius, 2012; Chiou and Tucker, 2012); in online media, the integration of content has been shown to lead consumers to seek out

further information.

Second, in the short-term, positive spillovers may exist if consumers test out new platforms in order to compare their services to existing platforms. For instance, consumers that search more intensively for price by using the keywords “cheap” may increase their use of a new platform in the initial period as they compare fares across platforms to determine whether the new platform provides additional, better, or cheaper results. In the subsequent section of robustness checks, I will test for differences between short-term and long-term effects for the product integrations.

To assess the implications of these results, I examine whether firms and consumers may be better or worse off after the integration of products and which consumers are most likely to be affected. I consider suggestive evidence from industry anecdotes and prior empirical studies to discuss possible changes in welfare.

First, industry facts suggest that Google may have a large effect on rival firms, since webpages may depend a lot upon referrals from Google. Clicks from Google are likely to be important for rival firms given Google’s role as a gatekeeper—Google accounts for 70% of all searches in the US. Anecdotal evidence suggests that webpages consider Google an important gateway for their service. For instance, industry players have expressed frustration with potential bottlenecks; Rob Krolik, CFO of Yelp, has stated that “consumers are fighting through [Google’s] content to get to ours.”

Second, consumers may be better off with the use of Google services in lieu of or in conjunction with other sites. For instance, Google Flights may improve consumer

welfare by providing an innovative advance with its price alerts and the speed by which it displays results (Strutner, 2015; Kugel, 2014). Like other major online travel agencies such as Expedia and Travelocity, Google Travel also does not include fares for low-cost airlines such as Southwest, therefore any gain in consumer welfare will occur for consumers of major airline carriers such as Delta, American, and United Airlines. Currently these airlines account for almost half of the domestic airline market share (Statista, 2015) and cover a large segment of consumers, so the magnitude of the changes in consumer welfare may be large. Anecdotal evidence from the industry suggests that “different flight search engines tend to retrieve the exact same prices and options” (Tuttle, 2014). Any reduction in prices from using Google Flights will likely come from using Google Flights’ trip planning tools to identify routes and dates with potentially lower prices.

For Google Zagat, prior empirical evidence shows that quality disclosure improves health outcomes and affects restaurant revenues (Jin and Leslie, 2003). While Zagat does not explicitly rate hygiene, the component scores of food, decor, and service quality are correlated with hygiene quality (Jin and Leslie, 2009). Furthermore, previous work finds that restaurants included in the Zagat restaurant guide tend to be the more expensive restaurants. National Restaurant Association surveys indicate that fine-dining restaurants are “most likely” to engage in resources devoted to marketing towards travelers and tourists.¹⁴ Consequently, independent information from review platforms may be even more important for consumers whose knowledge of

local restaurants may be limited.

The indirect evidence suggests that the two product integrations could plausibly benefit consumers. First, the switch from other online travel agents to Google Flights may improve a consumer's itinerary, search costs, and final fare. Of course, this does not rule out the possibility of consumer harm if the decline in clicks leads to exit by other online travel agents and results in less innovation in the industry in the long-term. Second, the use of Google Zagat along with other online review platforms may improve a consumer's health and information set.

6 Robustness Checks

In the prior section, I establish that clicks to other sites decline for general searches on flight fares and increase for keywords containing the word "cheap" after the integration of Google Flights to Google's search results. I also find that clicks to other sites rise for searches related to restaurants after the incorporation of Google's Zagat ratings on restaurant quality. In this section, I explore further robustness checks for these results.

6.1 Types of Rivals

To examine how different types of rivals are affected by the integration of Google Flights into search results, I stratify my analysis by the type of website. For each website in the sample, I identify whether the site is an online travel agent (that books airline tickets) or a travel guide (that provides information on a particular destina-

tion). Since Google Flights provides a direct substitute for information provided by online travel agents, I would expect a decrease in clicks for online travel agents for general searches on flight fares. Travel guides often provide more descriptive information about destinations for users planning the details of their trip instead of fare information and therefore may not compete as directly with Google Flights.

Table 7 reports the results for online travel agents and travel guides. As expected, online travel agents experience a decrease in clicks for general searches and an increase in clicks for searches containing the word “cheap” after the integration of Google Flights. The coefficients for total and non-paid clicks are negative and statistically significant. The coefficient for paid clicks is also negative, but not statistically significant (p-value of 0.11). Travel guides are generally unaffected in total clicks.

<<COMP: Place Table 7 about here>>

To examine how the integration of Google’s Zagat ratings affects different websites, I run the analysis separately for review sites. I examine the effect on sites that compete directly with Zagat ratings. If consumers multi-home and visit multiple review sites, then we would expect the integration of Zagat ratings on Google to lead to an increase in navigation to other review platforms.

Table 8 reports the results of the regressions. As expected, the integration of Google’s Zagat ratings to the search results leads to an increase in total and non-paid clicks to other review sites.

<<COMP: Place Table 8 about here>>

6.2 Advertising over Time

Since websites decide whether to submit a bid for a keyword advertisement, the decline in paid clicks observed for Google Flights could reflect websites' advertising decisions. For instance, advertisers may not advertise or may switch part of their advertising budget from Google to Yahoo! or Bing during the time of the policy change.

To investigate this further, I collect data on the number of ads that appeared for each keyword in my sample. I measure the number of ads by the number of websites that receive paid clicks above the minimum reporting threshold. I focus on advertising for Google Flights, since advertising accounts for a large fraction of total clicks (approximately half) in this industry. The results in Table 5 indicate a large response in paid clicks to the integration of Google Flights, so I test the extent to which changes in advertising may account for this response.¹⁵

Figure 6 graphs the average number of ads for flight searches on each search engine by month. As seen in the figure, the number of ads is relatively stable across the three search engines in October and November 2011 prior to the integration of Google Flights; I do not find evidence of a negative pre-trend that may explain the decline in paid clicks after the integration of Google Flights. Immediately after the integration of Google Flights in December 2011 and January 2012, the number of ads does not sharply decline. In the short-term, the sharp reduction in paid clicks does not appear to be driven by a sharp decline in ads. This is suggestive that advertisers may not have anticipated the integration of Google Flights and did not immediately

switch their advertising to other search engines.

Second, I collect additional data beyond my initial time frame to examine long-term effects in advertising. We would expect advertisers to respond in the long-term to this decline in paid clicks. I compute the number of ads for February and March 2012 in Figure 6. In the long-term, the number of ads did decline for Google, as we may expect. It seems likely in equilibrium that some advertisers may switch advertising to other search engines.

Overall, the figure suggests that the short-term decline in paid clicks for Google Flights is not driven by a decline in the number of ads. In the long-term, advertisers may adjust their advertising.

<<COMP: Place Figure 6 about here>>

6.3 Short- vs. Long-term Effects

The effects of the policy change may differ in the short-term versus the long-term. In the short-term, consumers may explore new platforms in order to compare them to existing platforms. In the long-term, firms may respond by changing their advertising decisions.

To test these hypotheses, I collect additional data for the months following my sample and perform an analysis where I allow for a long-term effect of the policy change. For flight keywords, I run a similar regression as Equation (1) and include data from February and March 2012. The variable *Post* continues to equal one for months after the product integration, and the variable *Longterm* equals one for

February and March 2012 and captures the additional change in clicks in the long-term. For restaurant keywords, I include data from November and December 2011 to capture long-term effects.

Table 9 reports the results of the regressions. In Columns (1)-(3), I observe lower total clicks in the short-term with no incremental shift in the long-term for general searches on flights. The effect on paid clicks is negative with a p-value of 0.145. However, for searches with keyword “cheap,” in the short-term users click more on other sites, but in the long-term this positive spillover dissipates. I do not observe a persistent long-term effect for “cheap” keywords. This is consistent with consumers exploring a new service; price-sensitive consumers may be more interested in comparing fares from a new platform with existing platforms.

In Columns (4)-(6), I observe that the increase in clicks in the short-run does not dissipate in the long-term for restaurants searches. No incremental effect exists in the long-term. Given that advertising is not as important for restaurant keywords, the patterns are not likely to be driven by changes in advertising decisions. The patterns are also not likely to be driven by exploration of a new services, as the increase in clicks to other sites is persistent over time.

<<COMP: Place Table 9 about here>>

6.4 Rankings and Non-paid Clicks

The integration of Google’s products into search results may affect websites differently, depending upon their position or ranking on the search results page. Prior research

has shown that consumer click behavior can vary depending upon a link's position on the search results page (Baye et al., 2016; Glick et al., 2014; Ghose et al., 2014). In particular, the integration of the Google link pushed the non-paid links further down the search results page as seen in Figure 1.

For flight searches, I use variation in the presence of ads as a proxy for the ranking of non-paid links. Note that approximately half of clicks occur on paid links, and significant advertising exists for flight keywords.¹⁶ Since more ads will push the non-paid links further down the search results, the position of the non-paid links is directly correlated with the number of ads.

Then I estimate how the policy change interacted with the position of the link. I employ a triple-difference estimator where I interact the effect of the policy change with the number of ads that were displayed for each keyword. I would expect the integration of Google Flights to have a stronger effect for non-paid links that were previously at the top of the page when few ads were shown. That is, non-paid links closer to the top of the page would have a stronger spillover from the policy change due to the salience of its position. Similarly, I would expect a weaker spillover for a link located further down the search results page.

Table 10 reports the results of the triple-difference regression. As expected, for general flight searches, sites that appeared on keywords with fewer ads experienced a stronger decline in non-paid clicks. The positive coefficient on $Post \times Google \times NumberofAds$ indicates that sites for keywords with fewer ads experienced a larger

decline in non-paid clicks; these non-paid links were likely higher up on the search results before the integration of Google Flights. For flight searches containing the keyword “cheap,” sites for keywords with fewer ads experience a stronger increase in non-paid clicks. If consumers are visiting other sites immediately after the integration of Google Flights, the sites most likely to benefit are those located higher up on the search result page.

<<COMP: Place Table 10 about here>>

6.5 Falsification Checks

I perform a series of falsification checks in this section to test for pre-existing trends and placebo effects. First, I test for pre-existing trends in the months leading up to the product integration. The concern is that the observed results may reflect underlying trends in consumer search behavior during the period of analysis. I run a regression similar to Equation (1) using data from the months prior to the policy change.¹⁷

Table 11 reports the results from the falsification checks. Columns (1)-(3) report the falsifications checks for flight keywords. The sample contains the months prior to the policy, and the variable *FakePost* is a dummy variable that equals one for the second half of the time period. I do not observe a pre-existing trend of clicks on sites from flight keywords on Google relative to other search engines. Columns (4)-(6) report the results from the falsification checks for restaurant review keywords. I also do not observe a trend in clicks on Google relative to other search engines in the months prior to the incorporation of Zagat’s restaurant ratings within Google’s

search results.

<<COMP: Place Table 11 about here>>

Second, I construct two placebo tests to rule out the alternative explanation that other changes in flight and restaurant searches can account for the results. I identify categories that share similar underlying trends in searches and clicks to the two industries of travel and restaurants, but are unaffected by the policy change. As a placebo test for Google Flights, I use keyword searches on “car rentals.” Car rentals are likely to share similar underlying trends on travel searches as flights. Car rentals are not directly affected by the integration of Google Flights as Google Flights only reports prices for airline tickets and not car rentals. Columns (1)-(3) of Table 12 report the results for the difference-in-difference analysis on the placebo group of searches for car rentals. Reassuringly, I do not find evidence of an effect for the placebo group of car rentals after the integration of Google Flights into search results.

As a placebo test for Google Zagat, I use keyword searches on food-related health searches. Consumer searches and interest in food-related health categories and food-related dining may be correlated. Food-related health searches are unlikely to be directly affected by Google Zagat as Google Zagat reports information on food-service establishments. I perform an analogous construction of my dataset for the placebo group; I identify the top 10 websites from the Hitwise category of “Food & Health” and obtain the top keywords related to food.¹⁸ Columns (4)-(6) of Table 12 report the results for the difference-in-difference analysis on the placebo group of food-related

health searches. I do not find evidence of an effect for the placebo group after the integration of Zagat into Google's search results.

<<COMP: Place Table 12 about here>>

6.6 Partnerships with Yahoo! and Bing

The analysis so far compares integration by Google into two downstream services (Google Flights and Google Zagat). I find that vertical integration by Google may have differing consequences on its rivals based upon the information and purpose of the integrated product. Given that Google is a dominant search engine in the market with 75% of the global market share of Internet search, I consider what happens when a similar integration occurs for other search engines, Yahoo! and Bing.¹⁹

I investigate restaurant and travel products by the competing search engines, Yahoo! and Bing. As discussed earlier, Bing formed a partnership with the online travel agent Kayak in March 2011 to incorporate Kayak's database into its search results. Bing's partnership with Kayak also affects Yahoo!, since in 2009, Microsoft and Yahoo! announced a deal in which Bing would power the Yahoo! search engine.²⁰ According to Bing's blog, the partnership would "give customers access to a larger set of flight itineraries" (Bing, 2011). As the blog suggests, this experiment is slightly different than Google's integration of Google Flights because Bing may not have changed how its travel service was displayed and integrated into search results. More likely the partnership with Kayak changed the set of flight results delivered to consumers. To the extent that a change in the content of Bing Travel may have

affected consumer search, I perform an analysis on this additional experiment.

I collect additional data to span the months January to April 2011, preceding and following Kayak's partnership with Bing and Yahoo!. Columns (1)-(3) of Table 13 report the results of a difference-in-differences analysis similar to Equation 1. In this experiment, Bing and Yahoo! form the treatment group while Google serves as the control group. The variable *Post* equals one for the months after the Kayak partnership, and the variable *BingYahoo!* equals one if the keyword search originated on Bing or Yahoo! The coefficient estimates are not precisely estimated. One potential explanation for the lack of a finding is that the partnership with Kayak did not alter how flight content was integrated into Bing's search results and thus did not alter consumers' search patterns.

For restaurant reviews, Yelp formed a partnership with Bing and Yahoo! in June 2012, ten months after the integration of Google Zagat (McCue, 2012). As mentioned previously, Bing's partnership with Yelp affects Yahoo! as well, since in 2009, Microsoft and Yahoo! announced a deal in which Bing would power the Yahoo! search engine (BBC, 2009). As in Figure 7, Bing displayed Yelp ratings below the links and to the right of the page. This formatting is similar to Google Zagat without the special color used by Google for Google Flights.

I collect additional data for this period April to July 2012, two months before and after Yelp's partnership with Bing and Yahoo!. I perform a similar analysis of the effect of Bing and Yahoo's partnership with Yelp where Google is now the control

group, and Bing and Yahoo! are the treatment groups. Columns (4)-(6) of Table 13 report the results of the difference-in-differences analysis similar to Equation (1). The variable *Post* equals one for the months after the Yelp partnership, and the variable *BingYahoo!* equals one if the keyword search originated on Bing or Yahoo! The table reveals that the coefficient estimates are not precisely estimated. This may be expected if the effect of the partnership is too small to estimate precisely.

In summary, after identifying and estimating two further experiments as well as collecting data for the time periods before and after my sample, I do not find strong evidence of an effect for other search engines.

<<COMP: Place Figure 7 about here>>

<<COMP: Place Table 13 about here>>

7 Conclusion

This study examines the entry of Google, a dominant search engine in the market for Internet search, into downstream products of online travel and restaurant reviews. In 2011, Google embedded Google Flights within its search results, so users would receive its information on airline fares based upon their search queries. Google also acquired Zagat and embedded the restaurant ratings and reviews into its search results.

This study directly relates to vertical integration and how dominance in an upstream market (Internet search) can be levered into a downstream market (products and services). Since the theoretical effects of vertical integration are ambiguous, I empirically examine whether integration of Google's downstream services leads to

positive or negative spillovers. Google serves as a prominent test case, as Google expands its products and search offerings over the next several years.

I find that Google's entry into downstream products may either decrease or increase traffic to other sites in the market, depending upon whether the good provides pricing or quality information. After the integration of Google Flights, clicks to other websites declined for general searches on travel keyword on Google relative to other search engines. In contrast, when Zagat ratings were incorporated into Google search results, clicks to other sites increased, as Zagat ratings provided restaurant quality information and reviews. My results indicate that consumers interested in quality will multi-home and visit other platforms, thereby mitigating the negative effects of vertical integration on competitors.

Given Google's large role in the economy and how little is known about its product expansion, this study provides the first exploration into Google's effects in other markets. The main focus of this study is on consumer search and information. A future area of work would be to examine other industries where substitution across online and offline products and webrooming are likely to occur (Halzack, 2015).

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Notes

¹“Fullservice” restaurants refer to restaurants with fine dining and table service. National Restaurant Association, “Online Reviews: The New Word of Mouth,” 2013, <http://www.restaurant.org/Downloads/PDFs/onlinereviews1.pdf>

²“Microsoft and Yahoo Seal Web Deal,” BBC, July 29, 2009

³Hitwise groups “potential and perceived competitors” in a category, and categories are intended to give a “broad picture of the marketplace” (Hitwise, 2009).

⁴The keywords related to airfare or prices of flights are: airfare, airline tickets, airplane tickets, cheap airfare, cheap airline tickets, cheap flights, cheap plane tickets, last minute flights, and plane tickets. The keywords related to restaurant reviews are: best restaurants, chinese restaurant, italian restaurant, japanese restaurant, menus, mexican restaurant, restaurant guide, restaurant menu, and romantic restaurants

⁵Since a vast set of combinations of search terms and websites exist, comScore imposes some selection criteria for inclusion into its database. ComScore only collects data on specific phrases that arise from queries by at least two different panel members. Under its minimum reporting standards, comScore does not record the number of clicks for websites that receive clicks from fewer than three unique users (Chiou and Tucker, 2010). My results are robust to an alternative definition where unreported paid and non-paid clicks are assumed to be 0.

⁶Regressions with interactions of fixed effects by keyword and month lead to qualitatively similar results.

⁷This calculation avoids the “retransformation bias” for estimating the number of clicks from the semi-log regression, and the expression offers a natural interpretation for the estimated coefficients directly (Mullahy, 1999).

⁸This interpretation is equivalent to a traditional difference-in-differences setup where a positive coefficient on the interaction term ($\exp(\beta_1) > 1$) implies a positive effect on the treatment group; a zero coefficient ($\exp(\beta_1) = 1$) implies no effect. Note that this interpretation assumes that the variances of the error terms for the treatment and control groups are equal; allowing for the variances to differ leads to similar qualitative results.

⁹Since $\exp(-0.380) = 0.68$, clicks were 68% of their previous levels, and therefore clicks declined by 32%.

¹⁰Since $\exp(-0.858) = 0.42$, non-paid clicks were 42% of their previous levels, and therefore non-paid clicks declined by 58%. Since $\exp(-0.457) = 0.63$, paid clicks were 63% of their previous levels, and therefore paid clicks declined by 37%.

¹¹The net effect of the integration of Google Flights for keyword phrases containing the word “cheap” is $-0.380 + 0.573 = 0.193$, and $\exp(0.193) = 1.21$.

¹²Since $\exp(0.661) = 1.94$, clicks are 94% higher compared to the previous level, and therefore clicks increase by 94%.

¹³Since $\exp(0.652) = 1.91$, clicks are almost twice as high compared to the previous level.

¹⁴National Restaurant Association, “2014 Restaurant Industry Forecast,” 2014, <https://www.restaurant.org/Downloads/PDFs/News-Research/research/RestaurantIndustryForecast2014.pdf>.

¹⁵ By contrast, very little advertising occurs for restaurant ratings, and unpaid clicks account for the response to the product integration as in Table 6.

¹⁶Restaurant searches have limited advertising and few paid links.

¹⁷For Google Flights, I use the months in the pre-period of my analysis to avoid confounding the results with the debut of Google Hotels in September 2011. For Google Zagat, I use the four months

prior to the policy change.

¹⁸I collect data on searches for “calorie counter,” “foods that are hard to digest,” and “belly fat.”

¹⁹URL accessed November 2016 at <https://www.netmarketshare.com/search-engine-market-share.aspx?qprid=4&qpcustomd=0>.

²⁰“Microsoft and Yahoo Seal Web Deal,” BBC, July 29, 2009.

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Figure 1: Screen shot of flight search on Google

The screenshot shows a Google search for "airline tickets from los angeles to boston". The results are categorized into three groups by blue brackets on the left:

- Paid links:**
 - Southwest - Official Site - southwest.com
 - Los Angeles To Boston - Low Fares Available on All Flights
 - Flights to Boston - jetblue.com
- Google link:**
 - Flights from Los Angeles, CA (LAX) to Boston, MA (BOS) - Sponsored

Origin	Destination	Class	Airline	Duration	Price
Los Angeles, CA (LAX)	Boston, MA (BOS)	Nonstop	American	5h 30m	from \$287
			Virgin America	5h 30m	from \$287
			US Airways	5h 30m	from \$287
			JetBlue	5h 30m	from \$317
			Alaska	5h 30m	from \$399
			United	5h 35m	from \$412
			Delta	5h 35m	from \$503
		Connecting	United	5h 35m+	from \$299
			Delta	7h 20m+	from \$305
			Other airlines	7h 15m+	from \$405
- Non-paid link:**
 - Cheap Flights from Los Angeles to Boston from \$271 - KAYAK

On the right side of the page, there are several advertisements (Ads) for American Airlines, farecompare.com, Expedia, and edreams.net.

Source: Accessed September 16, 2015. The screenshot has been excerpted to fit the page.

Figure 2: Screen shot of restaurant search on Google

The screenshot shows a Google search for "burger near seattle" with approximately 3,110 results. The search results are organized into a list of restaurant entries. Each entry includes the restaurant name, website link, a brief description or review snippet, and the address. A detailed view for "Red Mill Burgers" is expanded on the right, showing a map, photos, a Zagat rating table, and a menu.

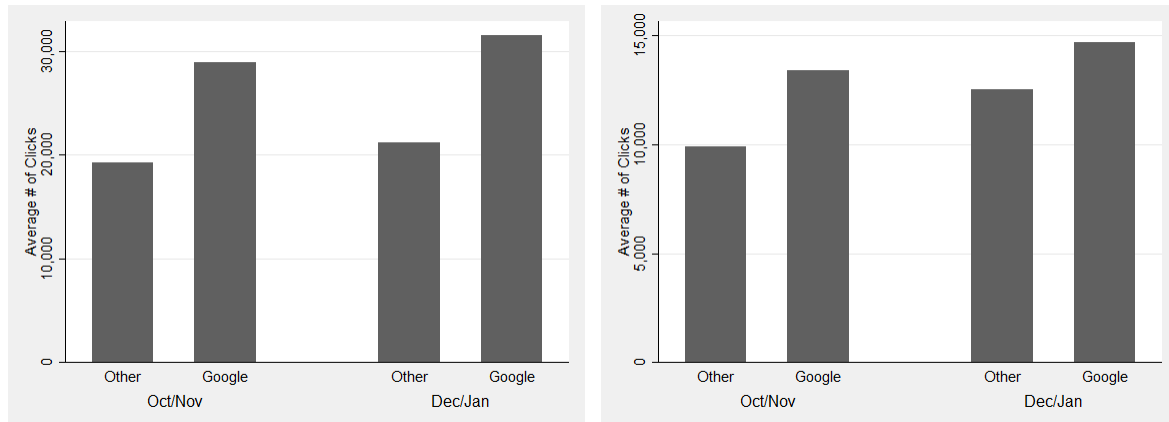
ZAGAT	FOOD	DECOR	SERVICE	Reviews
24	24	11	15	306 Google reviews

Red Mill Burgers
 Offering some of the most "amazing" burgers in town "greasy hands down", fans say this "old-fashioned" duo in Phinney Ridge and Interbay completes the "perfect meal" with "onion rings that taste like onions" pl...

At a glance: onion rings · man vs food · deluxe with cheese · the beef patty · verde
Prices: \$\$\$\$
Hours: Mon Closed
 Tue-Sat 11am-9pm
 Sun 12-8pm
Transit: Phinney Ave N & N 67th St
Menu: zagat.com · redmillburgers.com · viewmenu.com
More reviews: yahoo.com (119), urbanspoon.com (83)

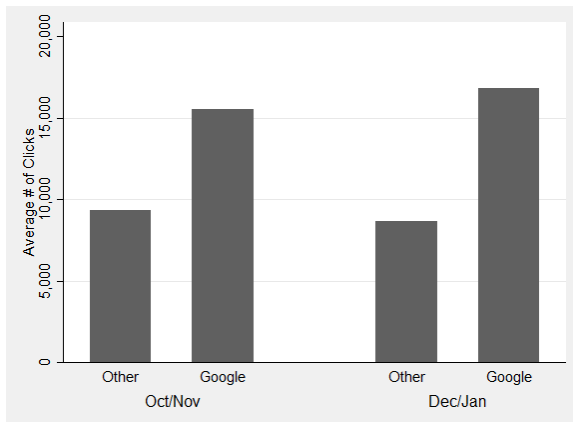
Source: Original figure and arrows from searchengineland.com, "Google Places is Over, Company Makes Google Plus the Center of Gravity for Local Search," May 30, 2012

Figure 3: Seasonal changes in clicks for Google and other search engines for searches on flight fare that do not contain the keyword “cheap”



(a) # Total clicks

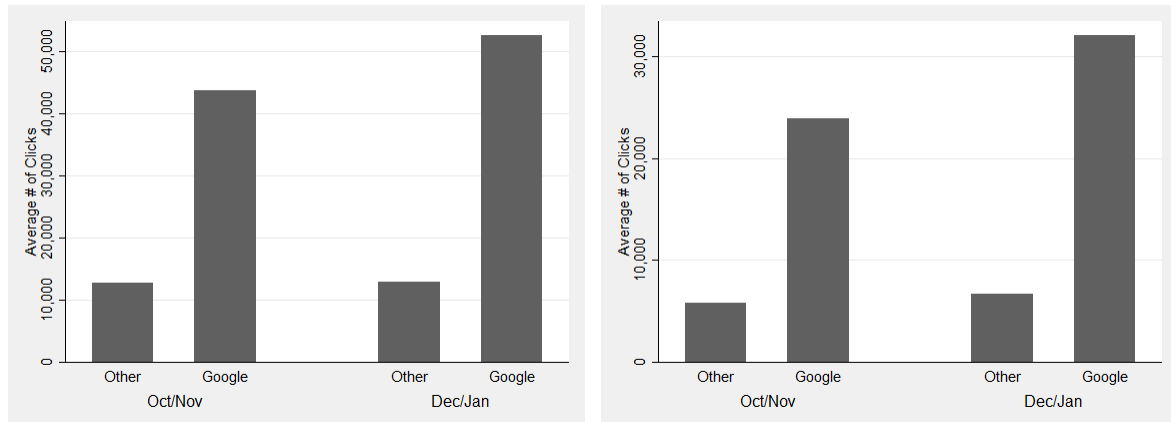
(b) # Paid clicks



(c) # Non-paid clicks

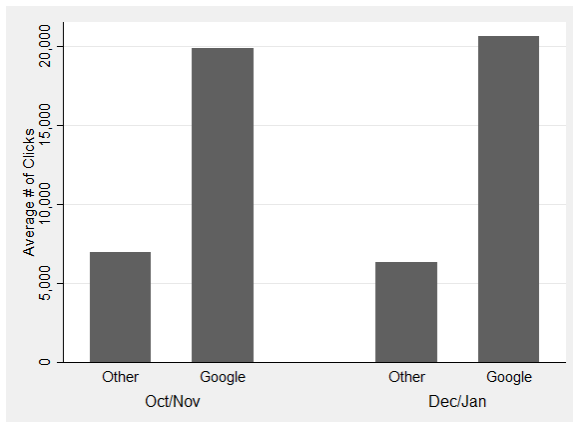
Note: The label “Google” refers to Google, and the label “Other” refers to the other search engines, Yahoo! and Bing. The time period covers October 2011 to January 2012—the two months before and after the integration of Google Flights into Google’s search results.

Figure 4: Total and paid clicks discontinuously increase on Google relative to other search engines for searches on flight fares that contain the keyword “cheap”



(a) # Total clicks

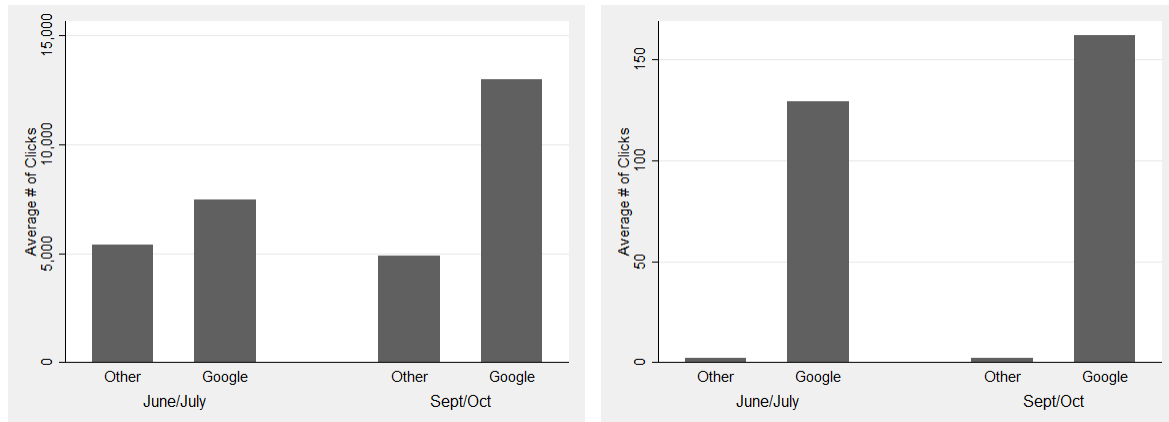
(b) # Paid clicks



(c) # Non-paid clicks

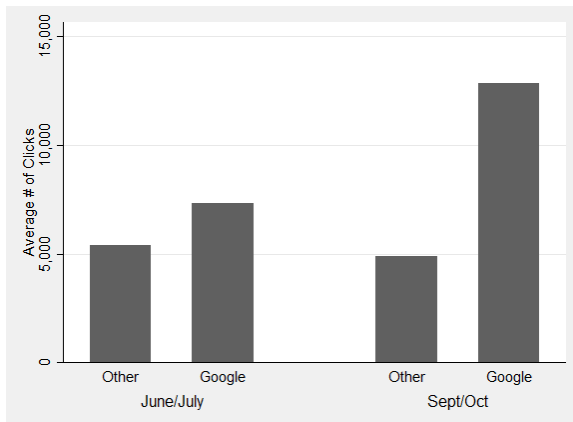
Note: The label “Google” refers to Google, and the label “Other” refers to the other search engines, Yahoo! and Bing. The time period covers October 2011 to January 2012—the two months before and after the integration of Google Flights into Google’s search results.

Figure 5: Clicks discontinuously increase on Google relative to other search engines after integration of Google Zagat restaurant ratings



(a) # Total clicks

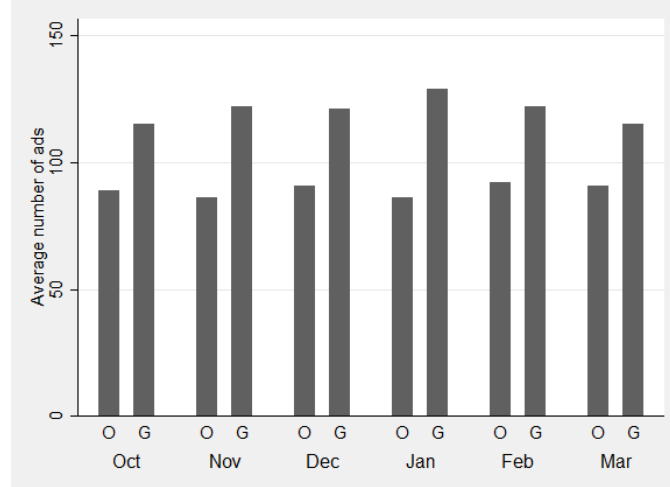
(b) # Paid clicks



(c) # Non-paid clicks

Note: The label “Google” refers to Google, and the label “Other” refers to the other search engines, Yahoo! and Bing. The time period covers June 2011 to October 2011—the two months before and after the integration of Google Zagat restaurant ratings into Google’s search results.

Figure 6: The number of ads on Google and other search engines



Note: The label “G” refers to Google, and the label “O” refers to the other search engines, Yahoo! and Bing. The time period covers October 2011 to March 2012.

Figure 7: Screen shot of Yelp restaurant ratings integrated into Bing search results

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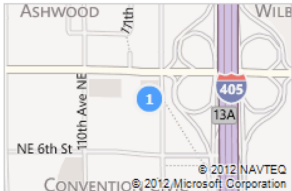
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Source: Original figure from *workinghomeguide.com*, "Bing Partners with Yelp to Serve More Local Information," June 14, 2012.

Table 1: Demographics of users are similar Google, Yahoo!, and Bing

Measure	Google	Yahoo!	Bing
Male	51.68	49.56	50.63
Age 18-24	16.57	16.35	14.91
Age 25-34	21.00	22.34	21.28
Age 35-44	21.10	21.23	19.16
Age 45-54	20.13	19.53	20.17
Age 55+	21.19	20.55	24.48
Income <30k	20.10	22.13	21.60
Income 30-60k	28.95	31.66	30.98
Income 60-100k	27.69	25.53	26.60
Income 100-150k	14.44	13.42	12.94
Income >150k	8.84	7.26	7.89

Source: Hitwise

Notes: This table reports the fraction of users within each demographic category. Statistics are reported for users of Google, Yahoo!, and Bing for August 2011.

Table 2: Number of searches on Google, Yahoo!, and Bing are relatively stable

Month	Google	Yahoo!	Bing
July 2011	11.2	2.8	2.5
August 2011	11.1	2.8	2.5
September 2011	11.2	2.6	2.5
October 2011	11.9	2.7	2.7
November 2011	11.7	2.7	2.7
December 2011	12.0	2.7	2.6
January 2012	11.8	2.7	2.5

Source: ComScore Press Releases. Number of searches are measured in billions.

Table 3: Summary statistics for Google Flights

	Mean	Std Dev	Min	Max
Total Clicks	25624.1	60013.9	415	897758
Paid Clicks	13946.3	53874.7	2	885220
Non-Paid Clicks	11678.7	28043.8	2	307617
Google	0.59	0.49	0	1
Observations	820			

Notes: Each observation represents a website and keyword combination from a given search engine during a particular month. The data includes searches on three main search engines (Google, Yahoo!, and Live) and spans the period from October 2011 to January 2012—before and after the integration of Google Flights.

Table 4: Summary statistics for Google Zagat restaurant ratings

	Mean	Std Dev	Min	Max
Total Clicks	10568.1	10913.0	405	57335
Paid Clicks	107.2	555.6	2	7292
Non-Paid Clicks	10462.7	10922.9	2	57335
Google	0.90	0.30	0	1
Observations	236			

Notes: Each observation represents a website and keyword combination from a given search engine during a particular month. The data includes searches on three main search engines (Google, Yahoo!, and Live) and spans the period from July 2011 to October 2011—before and after the integration of Zagat ratings to Google.

Table 5: Traffic falls to other sites for general searches on flight fares, but rises for searches containing keyword “cheap” after the integration of Google Flights

	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Paid	Non-paid	Total	Paid	Non-paid
Post × Google	-0.127	-0.144	0.228	-0.380*	-0.858*	-0.457*
	(0.152)	(0.292)	(0.275)	(0.192)	(0.438)	(0.226)
Post × Google × Cheap				0.573***	1.624***	1.591***
				(0.199)	(0.582)	(0.517)
Post × Cheap				-0.208	-0.639	-0.887**
				(0.199)	(0.399)	(0.417)
Google × Cheap				0.435*	0.0930	-0.333
				(0.216)	(0.486)	(0.300)
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	820	820	820	820	820	820
R-Squared	0.494	0.604	0.632	0.512	0.610	0.637

Notes: Robust standard errors clustered at website level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the logarithm of clicks.

Table 6: Traffic to other sites rises after integration of Zagat restaurant ratings to

Google's search results

	(1)	(2)	(3)
	Total	Paid	Non-paid
Post \times Google	0.651**	0.0427	0.717***
	(0.239)	(0.241)	(0.238)
Month Fixed Effects	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes
Observations	236	236	236
R-Squared	0.410	0.566	0.455

Notes: Robust standard errors clustered at website level. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The dependent variable is the logarithm of clicks.

Table 7: Traffic falls to online travel agents and travel guides after the integration of Google Flights for general searches on flight fares

	Online travel agents		Travel guides			
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Paid	Non-paid	Total	Paid	Non-paid
Post \times Google	-0.478** (0.204)	-0.929 (0.551)	-0.557** (0.241)	0.246 (1.028)	1.010 (0.553)	-1.218*** (0.270)
Post \times Google \times Cheap	0.627*** (0.203)	1.629** (0.657)	1.513*** (0.508)	-0.608 (0.881)	1.231 (3.539)	2.751 (3.841)
Post \times Cheap	-0.347 (0.203)	-0.632* (0.350)	-0.878** (0.336)	0.988 (0.784)	-1.069 (3.540)	-1.622 (3.672)
Google \times Cheap	0.529** (0.238)	-0.203 (0.540)	-0.272 (0.307)	1.251* (0.568)	2.066** (0.545)	-0.241 (0.872)
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	588	588	588	100	100	100
R-Squared	0.482	0.556	0.525	0.621	0.862	0.732

Notes: Robust standard errors clustered at website level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the logarithm of clicks.

Table 8: Traffic rises for review sites after the integration of Zagat restaurant ratings to Google's search results

	(1)	(2)	(3)
	Total	Paid	Non-paid
Post \times Google	0.951**	0.588	0.934**
	(0.334)	(0.500)	(0.330)
Month Fixed Effects	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes
Observations	92	92	92
R-Squared	0.387	0.657	0.402

Notes: Robust standard errors clustered at website level. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The dependent variable is the logarithm of clicks.

Table 9: Long-term effect after integration of Google Flights and Google Zagat restaurant ratings

	Flights			Restaurants		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Paid	Non-paid	Total	Paid	Non-paid
Post × Google	-0.429** (0.170)	-0.524 (0.354)	-0.668*** (0.231)	0.480** (0.216)	-0.499 (0.467)	0.589*** (0.211)
Long-term × Google	0.0945 (0.153)	-0.307 (0.241)	0.328 (0.247)	-0.0966 (0.388)	-0.375 (0.281)	-0.0635 (0.391)
Post × Google × Cheap	0.660*** (0.206)	1.324*** (0.491)	1.662*** (0.410)			
Long-term × Google × Cheap	-0.698*** (0.187)	-0.891** (0.419)	-1.107** (0.465)			
Post × Cheap	-0.307 (0.204)	-0.715** (0.305)	-0.989*** (0.341)			
Google × Cheap	0.359** (0.178)	0.0619 (0.517)	-0.174 (0.314)			
Long-term × Cheap	0.240 (0.155)	0.162 (0.344)	0.458 (0.342)			
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1556	1556	1556	475	475	475
R-Squared	0.491	0.601	0.603	0.303	0.467	0.341

Notes: Robust standard errors clustered at website level. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The dependent variable is the logarithm of clicks.

Table 10: How the number of ads affected non-paid clicks after integration of Google

Flights

	(1)
Post \times Google	-1.963** (0.854)
Post \times Google \times Number of ads	0.0972** (0.0417)
Post \times Google \times Cheap	4.624*** (1.309)
Post \times Google \times Cheap \times Number of ads	-0.209** (0.0807)
Post \times Number of ads	-0.0591 (0.0356)
Post \times Number of ads	0.0246 (0.0336)
Post \times Cheap	-3.397*** (1.065)
Google \times Cheap	-0.815 (0.880)
Cheap \times Number of ads	-0.147 (0.141)
Month Fixed Effects	Yes
Website Fixed Effects	Yes
Keyword Fixed Effects	Yes
Search Engine Fixed Effects	Yes
Observations	1128
R-Squared	0.622

Notes: Robust standard errors clustered at website level. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The dependent variable is the logarithm of clicks.

Table 11: No evidence of a pre-trend before integration of Google Flights or Zagat's restaurant ratings to Google's search results

	Flights			Restaurants		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Paid	Non-paid	Total	Paid	Non-paid
FakePost × Google	0.298 (0.212)	0.492 (0.414)	0.0305 (0.395)	-0.514 (0.488)	-0.108 (0.224)	-0.498 (0.487)
FakePost × Google × Cheap	-0.256 (0.266)	-0.0495 (0.559)	-0.124 (0.522)			
FakePost × Cheap	0.217 (0.227)	0.175 (0.523)	0.416 (0.439)			
Google × Cheap	0.391* (0.210)	-0.302 (0.550)	0.301 (0.425)			
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	546	546	546	200	200	200
R-Squared	0.582	0.640	0.655	0.342	0.536	0.351

Notes: Robust standard errors clustered at website level. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The dependent variable is the logarithm of clicks. The falsification check examines the months prior to the integration of Google Flights or Google Zagat ratings and creates a fake “post variable” that equals one for the second half of this time period.

Table 12: Traffic is unaffected for searches on placebo groups of car rentals and food-related health

	Car rentals			Food-related health		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Paid	Non-paid	Total	Paid	Non-paid
Post × Google	-0.0142 (0.136)	-0.293 (0.267)	0.254 (0.366)	0.115 (0.232)	-0.157 (0.215)	0.307 (0.346)
Post × Google × Cheap	-0.0975 (0.225)	-0.614 (0.557)	2.484 (2.018)			
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	710	710	710	168	168	168
R-Squared	0.579	0.743	0.582	0.535	0.895	0.748

Notes: The placebo group for Google Flights is “car rentals,” and the placebo group for Google Zagat restaurant ratings is “food-related health.” Robust standard errors clustered at website level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the logarithm of clicks.

Table 13: Partnerships of Bing and Yahoo! with Kayak and Yelp

	Kayak			Yelp		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Paid	Non-paid	Total	Paid	Non-paid
Post \times Bing Yahoo!	-0.00626 (0.155)	0.241 (0.528)	0.283 (0.261)	-0.308 (0.271)	0.115 (0.0953)	-0.319 (0.272)
Post \times Bing Yahoo! \times Cheap	-0.0293 (0.170)	0.0846 (0.471)	-0.226 (0.268)			
Post \times Cheap	0.0781 (0.127)	-0.0457 (0.309)	0.162 (0.251)			
Bing Yahoo! \times Cheap	-0.642** (0.250)	-1.133** (0.476)	-0.488 (0.322)			
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Website Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Keyword Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Search Engine Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	976	976	976	208	208	208
R-Squared	0.570	0.631	0.688	0.408	0.272	0.407

Notes: Bing and Yahoo! partnered with Kayak for online travel results in March 2011, and Bing and Yahoo! partnered with Yelp for online restaurant reviews in June 2012. Robust standard errors clustered at website level. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$. The dependent variable is the logarithm of clicks.